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Three Essays on Overconfidence

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DEDICATION

To Fan, Yifei

Shopping with you is the happiest time I have ever had in the past five years!

ABSTRACT OF THE DISSERTATION

Three Essays on Overconfidence

by

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This dissertation consists of three essays examining the effects of overconfidence on decision making. In the first study, I explore the role of board network centrality in mitigating the effects of CEO overconfidence on acquisition decisions. From the perspective of information processing, I argue that more centrally connected boards can guide overconfident CEOs' attention toward more valuable information, thereby constraining their over-optimism in decision-making. Moreover, I propose that female board representation improves information processing and in turn, strengthens the effect of board networks. I test and confirm my arguments in the context of corporate acquisition. My analysis of 2160 firms from 2002 to 2018 in the context of corporate acquisition supports the proposed two-way and three-way interactions. In the additional analysis, I explored an exogenous variable to proxy for the change of board network centrality and demonstrated the validity of my main results.

In the second study, I explore how overconfidence influence CEO decision-making during acquisition waves. Overconfident CEOs are frequently criticized for making value-

destroying corporate acquisitions in which they excessively acquire and overpay. I argue that overconfident CEOs often create value and deliver better performance in the acquisition waves given that the motivation and the requirement for action speed for acquisitions that occur in waves are different from those in other acquisition contexts. Specifically, I hypothesize and find that overconfident CEOs are more likely to capture preemption opportunities by acting earlier in acquisition waves, and such rapid moves enable overconfident CEOs to seize high-quality targets or targets with cospecialized assets with lower costs, leading to better acquisition performance. In addition, I find that in acquisition waves, organizational acquisition experience hampers value-add because it reduces overconfident CEO action speed, and associated returns to acquisitions. Contributions to the CEO overconfidence and acquisitions literatures are discussed.

Researchers in the area of entrepreneurship have explored how overconfidence influences the decision-making of entrepreneurs and the outcome of ventures. However, the overconfidence of venture capitalists, who are critical participants in entrepreneurship, is rarely discussed. To fill in the gap, in the third study, I explore how overconfidence influences venture capitalists' investment decisions and their nurturing of portfolio companies. I argue and find that after experiencing success, venture capitalists tend to attribute the credits to their own abilities and foster overconfidence, which leads to inferior investment decisions and poor investment performances. To further identify the mechanisms behind these dynamics, I explore whether venture capitalists will change their investment strategies after experiencing success, and I find that after experiencing extraordinarily higher IPO performances in its previous funds, venture capitalists were

more likely to invest in private companies beyond their own expertise in their current funds. Furthermore, I find that the level of overconfidence is stronger if a venture capitalist is just a free rider but succeeds and is weaker if the venture capitalist has more investment experience. In the private company level analysis, I explore how the percentage of overconfident venture capitalists within lead VCs in a syndicate influences the fate of the private company. I defined a private company as a missed target if the private company could have the opportunities of being acquired, but it forwent the acquisition, and failed to go IPO, either. I find that a private company backed by a syndicate with a higher percentage of overconfident lead venture capitalists is more likely to be a missed target. This paper contributes to the area of entrepreneurship by extending the study of overconfidence from entrepreneurs to venture capitalists.

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Overview

Overconfidence refers to the general belief that individuals have knowledge and abilities superior to their peers', which leads them to overestimate the likelihood that desirable outcomes will occur (Griffin and Varey, 1996). According to DeBondt and Thaler (1995), "Perhaps the most robust finding in the psychology of judgment is that people are overconfident." Overconfidence has many manifestations, which include the illusion of superior knowledge and ability to the averages (above-average effect) (Alicke, 1985; Svenson, 1981; Taylor and Brown, 1988), an inflated perception of control and chances of success (overestimation) (Langer, 1975; Presson and Benassi, 1996), and excessive certainty about the accuracy of beliefs and underestimation of the volatility of random events (miscalibration) (Alpert and Raiffa, 1982; Lichtenstein, Fischoff, and Phillips, 1977; Ronis and Yates, 1987). Specifically, these biases make overconfident individuals reluctant to invest in information production and excessively rely on their private information (Bernardo and Welch, 2001; Goel and Thakor, 2008). The biases in their information processing manifests itself as follows. First, overconfident individuals tend to interpret information too narrowly and have an inflated subjective probability of a particular outcome (Gampbell, Goodie, and Foster, 2004). Second, in decision-making, overconfident individuals over-rely on the strength (e.g., the size of an effect) rather than the weight (e.g., the size of the sample) of the evidence (Griffin and Tversky, 1992), and value an idea without adequately assessing it (Slovic and Lichtenstein, 1971). Third, when making predictions or forecasts, overconfident individuals are drawn to perspectives that are "friendly" to them instead of looking for disconfirming evidence (Klayman and Ha,

1987). Accordingly, due to insufficient assessment of the manner in which events can unfold (Sniezek, Paese, and Switzer III, 1990), overconfident individuals often make decisions quickly and optimistically.

CEO Overconfidence

Scholars in entrepreneurship and finance find that overconfidence exist ubiquitously among entrepreneurs and CEOs. Based on the biased information processing mentioned above, overconfident CEOs tend to overestimate the probabilities of their desired outcomes (overestimation) (Griffin and Varey, 1996; Hayward, Shepherd, and Pollock, 2006) and underestimate the volatility of outcomes (miscalibration) (Ben-David, Graham, and Harvey, 2013; Moore and Healy, 2008), which leads to value-destroying decisions. Research has shown overconfident CEOs undertake more acquisitions (Malmendier and Tate, 2008) and pay higher bid premiums in takeover transactions (Hayward and Hambrick, 1997). They also hesitate less in the face of investment opportunities (Gervais, Heaton, and Odean, 2011) and invest more in capital expenditures and research and development (Ben-David, Graham, and Harvey, 2013; Campbell et al., 2011; Malmendier and Tate, 2005). Overconfident CEOs prefer debt to equity in external financing because they often believe that capital markets undervalue their firm's risky securities (Heaton, 2002; Malmendier, Tate, and Yan, 2011). They also tend to "borrow" from the future to manage earnings because they expect future earnings will be sufficient to cover reversals (Schrand and Zechman, 2012). In addition, they are more likely to ignore poor performance feedback (Schumacher, Keck, and Tang, 2020) and increase stock crash risk (Kim, Wang, and Zhang, 2016).

Research also indicates that overconfident managers are more likely to be promoted to CEOs under value-maximizing corporate governance (Goel and Thakor, 2008), and a large proportion of CEOs in firms share traits of overconfidence. For instance, Malmendier and Tate (2005) showed that, out of a sample of 1,200 CEOs between 1980 and 1994, 895 (74.6 %) were considered overconfident by the market. In Campbell and coauthors' (2011) large sample of 3,352 CEOs between 1992 and 2006, 34.1% were classified as overconfident. The prevalence of managerial overconfidence makes it urgent for both practitioners and scholars to consider ways to mitigate its effects.

Venture Capitalist Overconfidence

I believe that overconfidence also exists among venture capitalists for three reasons. First, venture capitalists may inherit overconfidence from their previous entrepreneurship experience. Venture capitalists are often referred to as "entrepreneurs behind the scenes", as many of them are, or once were successful entrepreneurs, CEOs, or top executives in corporations. For example, Neil Shen, who is the Chairman of Sequoia Capital, China and is also considered as the most successful venture capitalist in China, founded two public companies successfully before his VC career. If they are overconfident when they are CEOs, it is reasonable to believe that they will bring overconfidence to their VC career. Second, the process of VC backed entrepreneurship is more likely to induce self-attribution bias, which is one common source of overconfidence. The success of a venture is the result of the joint efforts of entrepreneurs and the syndicate of VCs behind, which makes the attribution of credits ambiguous and causes self-attribution bias. Individuals subject to self-attribution bias tend to over-attribute their roles in success and over-attribute external

factors or bad luck to failures (Hayward, Shepherd, and Griffin, 2006; Hilary and Menzly, 2006). The enormous returns of a successful venture (via IPO) will make individual venture capitalist subject to self-attribution bias so that he may believe that it is his insights and management capabilities that lead to the success of the venture, even if he may just be a free rider. Third, the highly uncertain environment of entrepreneurship is quite likely to develop overconfidence. Predictions tend to be overconfident when the target outcome is rare, when the evidence available is only weakly diagnostic, and/or when predictions are made with high confidence (Lichtenstein et al. 1982, Vallone et al. 1990). Ventures routinely fail (Hayward, Shepherd, and Griffin, 2006), and VCs write off 75.3% of their investments on average (Ljungqvist et al., 2005). The highly uncertain environment of entrepreneurship provides limited and noisy information to venture capitalists for their decision making, which develops their overconfidence.

Chapter 1 Mitigating the Effects of CEO Overconfidence: Role of Board Network Centrality

1.1 Introduction

I explore corporate governance mechanisms to mitigate the effects of CEO overconfidence. Overconfident CEOs overestimate their ability and knowledge (Alicke, 1985; Svenson, 1981; Taylor and Brown, 1988), which makes them reluctant to invest in information production and more prone to excessively rely on private information (Goel and Thakor, 2008). Restricted information processing, in turn, makes them more vulnerable to overestimating the probabilities of desired firm outcomes (Griffin and Varey, 1996; Hayward, Shepherd, and Pollock, 2006), underestimating the volatility of outcomes (Ben-David, Graham, and Harvey, 2013; Moore and Healy, 2008), and valuing an idea without adequately assessing it (Slovic and Lichtenstein, 1971), which leads to behavioral distortions in decision-making. Hambrick and Mason (1984) argued that CEOs' areas of attention were limited, posing constraints on their perceptions and interpretations of information. Therefore, broadening the breadth of attention is a feasible way to promote information processing and better decisions. According to the attention-based view (ABV) (Ocasio, 1997), decision-makers' actions depend on their focus of attention, which in turn depends on the firm's rules, resources, and social relationships. In this vein, I propose that leveraging firm resources, social connections, and governance mechanisms may guide CEO attention toward more information, which may mitigate the effects of CEO overconfidence on decision-making.

A well-suited board of directors is critical during a CEO's decision-making process. The knowledge and expertise brought by the board may influence CEO decision-making

by fostering attention (e.g., Asad et al., 2023). The professional networks formed by interlocked directors may guide CEO attention toward information, knowledge, and resources (Ocasio, 1997). Boards that stay in more central positions in the networks have better access to a wealth of knowledge and information on industries, markets, and regulations (Mizruchi, 1996; Mol, 2001). By incorporating this perspective with ABV, I theorize that more centrally connected boards could promote CEOs' information processing and constrain their optimistic beliefs in decision-making.

I test my arguments in the context of corporate acquisition, which has been widely used in research on the value-destroying decisions of overconfident CEOs. Overconfident CEOs overestimate synergies and underestimate the likelihood of failure (Hayward and Hambrick, 1997; Malmendier and Tate, 2008; Roll, 1986), which produces an excessive willingness to acquire other firms. Accordingly, research indicates that overconfident CEOs are associated with higher acquisition intensity than other CEOs (Malmendier and Tate, 2008). I argue that more centrally connected boards could guide overconfident CEOs' attention toward more information during the acquisition process so that overconfident CEOs may revise their optimistic estimates about the outcomes of acquisitions and reduce their intention to pursue acquisitions. By analyzing S&P 1500 firms from 2002 to 2018, I find that board network centrality mitigates the positive relationship between CEO overconfidence and acquisition intensity.

Furthermore, I investigate whether the mitigating effect of board network centrality is stronger if the board has a more deliberate decision-making process. Greater female board representation leads to more exhaustive evaluations of information and slows down the

pace of decision-making (Chen, Crossland, and Huang, 2016), increasing the likelihood that relevant information brought in through board networks is processed and analyzed properly and systematically (Judge and Miller, 1991; Mintzberg, Raisinghani, and Theoret, 1976). I anticipate that this will further lessen the tendency of overconfident CEOs to overestimate the synergies from potential targets (Pavicevic and Keil, 2021). Consistent with my expectation, I find that the mitigating effect of board network centrality on the positive relationship between CEO overconfidence and acquisition intensity is stronger for boards with greater female representation.

A series of additional analyses were conducted to demonstrate the robustness of my findings. First, employing an alternative measure of CEO overconfidence (Malmendier and Tate, 2008) yielded consistent results. Second, I tested my predictions in the context of capital expenditures, and all my results still hold. Third, the possible endogeneity concern of board network centrality was addressed. Given that unobserved CEO level and firm level factors may influence the board network centrality, I explored a variable to measure the number of boards that are indirectly connected to the focal board. Since the changes of indirect connections are beyond the focal firm's control but may influence the centrality of the focal board in the network, they can be regarded as exogenous. By examining the moderating role of the changes of indirect connections, I demonstrated the robustness and validity of my main results.

My study makes significant contributions to the study of CEO overconfidence. First, I strive to provide a more comprehensive picture about the relationship between CEO overconfidence and corporate decisions, by examining the moderating effect of board of

directors. Scholars in both management and finance have documented a number of negative consequences of CEO overconfidence (e.g., Guo, Crossland, and Luo; 2015; Hayward and Hambrick, 1997; Kim, Wang, and Zhang, 2016; Malmendier and Tate, 2005, 2008; Schrand and Zechman, 2012; Schumacher, Keck, and Tang, 2020). However, questions about how to manage the governance environments to mitigate the effects of CEO overconfidence are rarely explored. One exception is Pavićević and Keil (2021), who discussed debiasing the acquisition decisions of overconfident CEOs through slowing down the pre-acquisition process. However, I conducted additional analyses and show that my predictions are applicable in more contexts (e.g., capital expenditure). My study thereby complements Pavićević and Keil (2021) and responds to the call for research on the boundary effects of CEO overconfidence (Heavey, Simsek, Fox, and Hersel, 2022).

Second, this research also contributes to the literature on corporate governance by unveiling the role of interlocked directors with respect to overconfident CEOs decision-making. Thus far, researchers have not reached an agreement on the net economic results of interlocked directors in corporate governance. On the one hand, interlocked directors may serve on multiple board seats, and therefore, devote limited attention to each firm, which leads to less effective monitoring (Fich and Shivdasani, 2006). Accordingly, interlocked directors are found to be associated with increased CEO private benefits (Sauerwald, Lin, and Peng, 2016) and decreased firm value (Core, Holthasen, and Larcker, 1999; Fich and Shivdasani, 2006). However, research also indicates that interlocked directors helped reduce uncertainty and improve firm performance through bringing information to the focal firms (Larcker, So, and Wang, 2013; Martin, Gozubuyuk, and

Becerra, 2013). I propose a new channel through which interlocked directors can contribute to corporate decision-making by mitigating the effects of CEO overconfidence.

1.2 Theory and Hypothesis

1.2.1 CEO Overconfidence

Overconfidence has many manifestations, which include the illusion of superior knowledge and ability to the averages (above-average effect) (Alicke, 1985; Svenson, 1981; Taylor and Brown, 1988), an inflated perception of control and chances of success (overestimation) (Langer, 1975; Presson and Benassi, 1996), and excessive certainty about the accuracy of beliefs and underestimation of the volatility of random events (miscalibration) (Alpert and Raiffa, 1982; Lichtenstein, Fischoff, and Phillips, 1977; Ronis and Yates, 1987). Specifically, these biases make overconfident individuals reluctant to invest in information production and excessively rely on their private information (Bernardo and Welch, 2001; Goel and Thakor, 2008). The biases in their information processing manifests itself as follows. First, overconfident individuals tend to interpret information too narrowly and have an inflated subjective probability of a particular outcome (Gampbell, Goodie, and Foster, 2004). Second, in decision-making, overconfident individuals over-rely on the strength (e.g., the size of an effect) rather than the weight (e.g., the size of the sample) of the evidence (Griffin and Tversky, 1992), and value an idea without adequately assessing it (Slovic and Lichtenstein, 1971). Third, when making predictions or forecasts, overconfident individuals are drawn to perspectives that are "friendly" to them instead of looking for disconfirming evidence (Klayman and Ha, 1987). Accordingly, due to insufficient assessment of the manner in which events can

unfold (Sniezek, Paese, and Switzer III, 1990), overconfident individuals often make decisions quickly and optimistically.

Based on this biased information processing, overconfident CEOs tend to overestimate the probabilities of their desired outcomes (overestimation) (Griffin and Varey, 1996; Hayward, Shepherd, and Pollock, 2006) and underestimate the volatility of outcomes (miscalibration) (Ben-David, Graham, and Harvey, 2013; Moore and Healy, 2008), which leads to value-destroying decisions. Research has shown overconfident CEOs undertake more acquisitions (Malmendier and Tate, 2008) and pay higher bid premiums in takeover transactions (Hayward and Hambrick, 1997). They also hesitate less in the face of investment opportunities (Gervais, Heaton, and Odean, 2011) and invest more in capital expenditures and research and development (Ben-David, Graham, and Harvey, 2013; Campbell et al., 2011; Malmendier and Tate, 2005). Overconfident CEOs prefer debt to equity in external financing because they often believe that capital markets undervalue their firm's risky securities (Heaton, 2002; Malmendier, Tate, and Yan, 2011). They also tend to "borrow" from the future to manage earnings because they expect future earnings will be sufficient to cover reversals (Schrand and Zechman, 2012). In addition, they are more likely to ignore poor performance feedback (Schumacher, Keck, and Tang, 2020) and increase stock crash risk (Kim, Wang, and Zhang, 2016).

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(74.6 %) were considered overconfident by the market. In Campbell and coauthors' (2011) large sample of 3,352 CEOs between 1992 and 2006, 34.1% were classified as overconfident. The prevalence of managerial overconfidence makes it urgent for both practitioners and scholars to consider ways to mitigate its effects.

1.2.2 Board Network Centrality

I argue that overconfident CEOs' restricted information processing can be moderated by guiding their attention toward more information. Ocasio (1997) defined attention as a procedure of information processing that "encompasses noticing, encoding, interpreting, and focusing time and effort on a variety of issues and answers" (Ocasio, 1997, p189). Research shows that broader attention enables CEOs to be more responsive to new information and identify new opportunities, which promotes information processing and benefits decision-making (Hambrick and Mason, 1984; Kapan, 2011; Shepherd, Mcmullen, and Ocasio, 2017). Therefore, restricted information processing, caused by the cognitive bias of overconfidence (Bloomfield, Libby, and Nelson, 1999; Goel and Thakor, 2008), can be compensated by a greater breadth of attention. This is particularly useful when the cognitive bias of overconfidence prevents CEOs from investing in information production and makes them rely excessively on private information (Bernardo and Welch, 2001; Goel and Thakor, 2008).

Building on the Carnegie School perspective (March and Simon, 1958; Simon, 1947), as well as theory of information processing (Laberge, 1995), the ABV theory assumes that "(a) what decision-makers do depend on what issues and answers they focus their attention on; (b) what issues and answers decision-makers focus on, and what they do, depend on

the particular context or situation they find themselves in; (c) what particular context or situation decision-makers find themselves in, and how they attend to it depend on how the firm's rules, resources, and social relationships regulate and control the distribution and allocation of issues, answers, and decision-makers into specific activities, communications, and procedures" (Ocasio, 1997, p188). Therefore, one way to moderate overconfident CEOs' restricted information processing is to exploit firm resources, social connections, and governance mechanisms to guide CEO attention towards a broader focus and more information.

Board networks are formed by interlocked directors who serve on multiple boards. Research indicates that firms are especially likely to be influenced by the practice of other firms which their directors have interlocked connections (Burt, 1987; Davis, 1991; Fiss and Zajac, 2004; Haunschild and Beckman, 1998). These directors may bring information on other firms' decision-making processes to the focal boards (Galaskiewicz and Wasserman, 1989; Westphal, Seidel, and Stewart, 2001). Sitting on multiple boards may also enrich directors' knowledge about industry and market trend (Larcker, So, and Wang, 2013), which can be beneficial for them to advise focal CEOs. A more centrally connected board, which has more connections to other boards through interlocked directors, may have better and easier access to these knowledge and information, which builds up comparative advantages in strategic decision-making (Mizurich, 1996; Mol, 2001).

I explore whether a more centrally connected board can mitigate the effects of CEO overconfidence. Executive attention is limited and scarce, and CEOs cannot observe all aspects of the firms and their environment. Restricted attention poses a sharp limitation on

CEOs' perceptions and receptions of information and knowledge (Hambrick and Mason, 1984). This bias in information processing is likely to be even more severe for overconfident CEOs. Based on ABV, board networks shape firm social resources and the environment in which CEOs present themselves, thereby guiding CEO attention. In particular, boards that stay in the more central positions in the network may guide CEO attention toward more information about the activities of other firms through their networks (Martin, Gözübüyük, and Becerra, 2015). As such, the attention of overconfident CEOs could be guided to their peer firms, which leads them to search for and compare information across firms. Although overconfident CEOs have biased justifications for their own actions, such biased justifications do not exist when judging others (Schumacher, Keck, and Tang, 2020). By focusing on the decisions of their peers, overconfident CEOs can learn from the value-destroying decisions of peer firms, thus compensating for their unwillingness to learn from past mistakes (Schumacher, Keck, and Tang, 2020). Guided by better-connected and informed directors and constantly receiving new information, overconfident CEOs gradually adjust their beliefs and revise their optimistic estimates, which consequently leads to higher quality decisions.

I summarize my logic as follows. Overconfident CEOs overestimate their ability and knowledge relative to the average (Moore and Healy, 2008), which makes them reluctant to invest in information production and excessively rely on private information (Goel and Thakor, 2008). This restricted information processing causes them to overestimate the probabilities of their desired outcomes (Griffin and Varey, 1996; Hayward, Shepherd, and Pollock, 2006) and underestimate the volatility of outcomes (More and Healy, 2008). Board

networks shape firms' social resources and the context in which CEOs find themselves and guide CEO attention. Therefore, I argue that more centrally connected boards can guide overconfident CEOs' attention towards more information, which could promote their information processing and constrain their optimistic beliefs in decision-making.

1.2.3 Baseline Hypothesis

I apply and test my arguments within the context of corporate acquisition. Although some acquisitions are beneficial to firms through synergies from resource combinations, the average returns to acquisitions are non-positive. Research indicates that acquisitions are more likely to destroy the value of acquiring firms (Chatterjee, 1992; Haleblian, Devers, McNamara, and Carpenter, 2009; King, Dalton, Daily, and Covin, 2004), as many acquisitions are conducted without sufficient due diligence (Puranam, Powell, and Singh, 2006). Therefore, acquisitions are highly uncertain and likely to be harmful in the long term.

An overconfident CEO may believe that he/she can control the outcomes of acquisitions. Cognitive biases of overconfidence make the CEO unwilling to gather information about acquisitions or focus only on information that can justify the acquisition decisions, which can lead to overestimating synergies and underestimating the likelihood of failure (Hayward and Hambrick, 1997; Malmendier and Tate, 2008; Roll, 1986). These biases can produce an excessive willingness to acquire other firms (Malmendier and Tate, 2008). Therefore, I hypothesize as follows:

> ***Baseline hypothesis*:** Overconfident CEOs are associated with higher acquisition intensity than non-overconfident CEOs.

1.2.4 Moderating Role of Board Network Centrality

Overconfident individuals tend to attribute favorable outcomes to their own decisions or outcomes, but unfavorable outcomes to external, unforeseeable factors or bad luck (Kahneman and Tversky, 2000). Such self-attribution bias incurred by overconfidence is manifested through two mechanisms. First, high levels of overconfidence increase ego involvement-the situation where a task or event is perceived to be a potential threat to self-esteem (Utman and Harkins, 2010), which makes overconfident people unwilling to acknowledge their mistakes. Second, when faced with unambiguous evidence that prior decision-makings were actually ill-conceived, overconfident individuals are likely to experience cognitive dissonance (Festinger, 1957), which leads to psychological discomfort (Elliot and Devine, 1994). Accordingly, research indicates that overconfident CEOs tend to ignore corrective feedback (Guo, Crossland, and Luo, 2015) and are less willing to admit failures (Schumacher, Keck, and Tang, 2020). For example, overconfident CEOs consistently undertake more acquisitions, even though their acquisition performances are always lower than other CEOs (Malmendier and Tate, 2008).

Nevertheless, acquisition decision-making of overconfident CEOs may be affected by the experience of other firms brought by interlocked directors. Especially, the value-destroying decisions of other firms could be good lessons for overconfident CEOs to learn from. CEO decision-making is significantly influenced by directors' exposure to related decisions at other firms (Boeker, 1997; Geletkanycz and Hambrick, 1997; Wezel, Cattani, and Pennings, 2006). Exposure to related decisions at other firms enables directors to learn about what practices are normal and appropriate (Davis, 1991; Galaskiewicz and

Wasserman, 1989; Haunschild, 1993). More centrally connected boards, whose directors have more exposure to acquisition decisions in other firms, may guide the attention of overconfident CEOs toward more information related to acquisitions.

First, interlocked directors can provide more information about how other firms evaluate similar acquisition targets, thereby allowing focal CEOs to better understand the value and synthetic gains associated with potential targets and be more exhaustive in their evaluations (Cai and Sevilir, 2012). Such information can help CEOs to avoid large loss acquisitions (Field and Mkrtchyan, 2017). For example, through attending other firms' board meetings, interlocked directors may understand how the latent events, such as the redeployment of resources, cultural conflicts, or employee turnover, can change the value of target firms (Buouo and Bowditch, 1985; Capron, 1999). Directors may bring such information to overconfident CEOs' attention, which makes CEOs re-evaluate the synergies from the potential targets and forgo the acquisitions if they consider the synergies not high enough. Second, witnessing the target integration processes in other firms, interlocked directors may help overconfident CEOs to anticipate the long-term consequences of current acquisitions. For example, Field and Mkrtchyan (2017) found that firms with board of directors that were more experienced in acquisitions had greater improvements in total productivity and operating performance. By considering the potential obstructions during the integration, overconfident CEOs may give up the current acquisitions. Third, even if the interlocked directors do not experience acquisitions in other firms, they can still bring information on the industry and market trends to CEOs (Larcker, So, and Wang, 2013). CEOs are unlikely to possess general knowledge and expertise in

acquisitions in all industries (McDonald, Westphal, and Graebner, 2008). Industry knowledge brought by board networks contributes to identifying promising acquisitions and avoiding problematic ones. For example, McDonald, Westphal, and Graebner (2008) found that a firm's acquisition performance was better if its directors had experience with the same product market.

By studying other firms' failed acquisitions, overconfident CEOs may re-evaluate the outcomes of their intended acquisitions and be less likely to proceed with the acquisitions that are seemingly promising, but actually value-destroying. Overall, more centrally connected boards could guide overconfident CEOs' attention towards more information during the acquisition process, which makes overconfident CEOs realize the risks associated with their potential acquisition targets, and therefore, be more cautious and prudent when they are faced with acquisition opportunities. Therefore, I formulate my first hypothesis:

> ***Hypothesis 1***. Board network centrality mitigates the positive relationship between CEO overconfidence and acquisition intensity such that the positive relationship becomes weaker (less positive) as the board network centrality increases.

1.2.5 Female Board Representation

In this section, I explore whether better information processing in the board will strengthen the mitigating effect of board networks. Research indicates that greater female board representation will lead to more thorough and comprehensive deliberations, which result in more exhaustive evaluations of information (Chen, Crossland, and Huang, 2016). Therefore, greater female board representation may slow down the CEO decision-making

process, which makes board networks more effective in mitigating the consequences of CEO overconfidence on decision-making.

Prior studies have examined the different implications of male versus female leadership, and mixed-gender boards versus all-male boards (e.g., Hillman, Cannella, and Harris, 2002). Compared with all-male boards, boards with greater female representation are associated with more competitive interactions (Hogg, 2006). The decision-making processes within such boards are characterized as contentious, thorough, and comprehensive, rather than acquiescence, rapid consensus, or groupthink (Hogg and Terry, 2000). Specifically, the presence of female team members is likely to alter the behavior of their male peers and typically leads males to behave in a more caring, generous, and helpful manner to other team members of both genders (Dufwenberg and Muren, 2006; van Vugt and Iredale, 2013; Williams and Polman, 2015). Male directors engage in their duties more diligently and miss fewer meetings when there are also female directors on the same board (Adams and Ferreira, 2009). Although men in all-male teams interrupt more often and exhibit less encouragement of others to voice their opinions than do women in all-female teams, men display similar levels of interruption and encouragement as do their female peers in mixed-gender teams (Keck and Tang 2018). Such interpersonally sensitive behavior is, in turn, likely to create a psychologically safe interaction climate in which members feel that they can take interpersonal risks—by speaking up when noticing problems, providing constructive criticism, asking for help and advice, and/or proposing novel perspectives on the task—without concerns about being criticized, disliked, or even

punished for doing so (Bradley, Klotz, Postlethwaite, and Brown, 2012; Chan, Liu, Keck, and Tang, 2023; Edmondson, 1999; Edmondson and Lei, 2014).

Overconfident CEOs tend to reach acquisition decisions rapidly (Pavicevic and Keil, 2021). Based on the above discussion, greater board female representation slows down the pace of decision-making, which increase the likelihood that relevant information brought in through board networks is processed and analyzed properly and systematically (Judge and Miller, 1991; Mintzberg, Raisinghani, and Theoret, 1976). This will further reduce the tendency of overconfident CEOs to overestimate the synergies from potential targets (Pavicevic and Keil, 2021). Therefore, I formulate my third hypothesis as follows:

> ***Hypothesis 2.*** There is a three-way interaction between CEO overconfidence, board network centrality, and female board representation on a firm's acquisition intensity. The mitigating effect of board network centrality on the positive relationship between CEO overconfidence and acquisition intensity is stronger for boards with greater female representation.

1.3 Research Method

1.3.1 Sample and Data Selection

The data for this study was gathered from multiple sources. I first identified CEOs of S&P 1500 firms for the period 2002 to 2018 from the ExecuComp database[1]. I excluded financial services industries (SIC codes start from 6) since firms in these industries have

[1] The boards were assumed to have stronger monitoring effects after the passage of Sarbanes-Oxley (SOX) in 2002. Therefore, I started the data in 2002 to exclude the influence of SOX.

different asset structures and acquisition strategies. Then, I merged CEO data with director data from the BoardEx database and deleted several observations that contained missing values, which resulted in a total of 23,286 firm-year observations. I then used the Securities and Data Corporation (SDC) database to collect information on all firms' acquisition transactions over this sample period. This procedure resulted in a total of 10454 acquisitions undertaken by 2160 firms. I obtained option data from the ExecuComp to construct an option-based measure of CEO overconfidence (Campbell et al., 2011; Malmendier and Tate, 2008). Data about financial performance, stock market performance, as well as other control variables were collected from the Compustat and the CRSP databases.

1.3.2 Variables and Measurements

Dependent Variable

Acquisition Intensity. Following Chen, Crossland, and Huang (2016), I operationalized Acquisition Intensity as the logarithm of one plus the number of acquisitions in a given year. In my sample, the number of acquisitions in a firm-year ranged from 0 to 17.

Independent Variables

CEO Overconfidence. Following Malmendier and Tate (2005) and Campbell et al. (2011), CEOs' stock-option holding and exercising decisions were used to measure the level of overconfidence. Although developed more than 15 years ago, this option-based measure is still "the most common approach to measuring CEO overconfidence" (Malmendier and Tate, 2015, p40). Kaplan, Sørensen, and Zakolyukina (2022) used

detailed assessments of CEO personalities to show that the option-based measure was significantly related to several specific characteristics representing overconfidence, which justifies the accuracy of this measure. The basic idea is that under-diversified and risk-averse CEOs should exercise their in-the-money options early. If a CEO persistently delayed the exercise of their in-the-money options, then I inferred that the CEO was overconfident in his ability to keep the company's stock price rising and wanted to profit from the expected price increases by holding the options.

Specifically, the realizable value per option was calculated as the total realizable value of the exercisable options (ExecuComp variable: OPT_UNEX_EXER_EST_VAL), divided by the number of exercisable options (ExecuComp variable: OPT_UNEX_ EXER_NUM). I then subtracted the per-option realizable value from the stock price at the fiscal year-end (ExecuComp variable: PRCCF) to obtain an estimate of the average exercise price of the options. The average percent value of in-the-money options equals the per-option realizable value divided by the estimated average exercise price. If a CEO had an average value of in-the-money options of more than 67%[2] in a certain year, I assumed that they had exhibited overconfident behavior in that year. To be classified as an overconfident CEO, the CEO must exhibit such overconfident behavior at least twice during the sample period. The overconfidence classification was assigned, however,

[2] Hall and Murphy (2002) created the 67% threshold, which corresponded to a risk aversion of three in a constant relative risk-aversion utility specification. Malmendier and Tate (2005) adopted Hall and Murphy (2002)'s 67% threshold when creating the option-based overconfidence measure.

beginning with the first time that the CEO exhibited behavior to the end of the sample period (Malmendier and Tate, 2005). I defined CEO Overconfidence as a binary variable that equaled to 1 if a CEO was classified as overconfident and 0 otherwise.

Moderators

Board Network Centrality. Several centrality conceptions in social network analysis literature capture different aspects of social and economic networks. I used Degree and Eigenvector to measure the number of connections that a board had with other boards. The intuition is that the more connections a board had, the more centrality it was located within its network, and the more comprehensive information it would provide. Additionally, I used the 2-Step Reach to count the number of connections that were two steps away from the focal board. This measure is similar to Degree but under the assumption that indirect connections also matter. To compute the centrality measures, I constructed an adjacency matrix X for each year, which was an N by N matrix with N representing the number of boards in a given year. In an X for a certain year, each cell took a value of one if two boards shared at least one director in that year.

Degree is the most intuitive and straightforward centrality measure. It counts the number of other unique boards that the focal board was connected with. Given the adjacency matrix X, Degree for board i is:

$$Degree\ (i) = \sum_j X\ ij \quad (1)$$

which is the sum of the row or column of the adjacency matrix. The networks consisted of boards that were connected to each other by sharing at least one director. Thus, Degree

measures the total number of boards with which the focal board shared directors in one year. Technically, Degree does not provide complete information related to the position of a board in the network, as it uses a vector of the adjacency matrix and does not cover the full information about the structure of the network. However, it is indeed a good proxy for a board's capacity to provide comprehensive information to its CEO, as the higher the number of connections, the greater the information flow (Bajo, Chemmanur, Simonyan, and Theranian, 2016).

Another widely used measure of network centrality is Eigenvector (Bajo, Chemmanur, Simonyan, and Tehranian, 2016). The Eigenvector not only considers the number of connections but also weighs each connection by the connection's centrality. In other words, being connected to more central boards generates a higher Eigenvector score than being connected to more peripheral boards. A higher Eigenvector score for the focal board indicates that the board could be able to provide more comprehensive information, as the information came from other boards that were more central and informed. Formally, the Eigenvector for a board *i* is calculated as the following equation, where λ is a constant represented by the biggest eigenvalue of the adjacency matrix *X*.

$$Eigenvector(i) = \sum_{j=1}^{N} XijEigenvalue(j) \quad (2)$$

2-Step Reach centrality is a particular form of k-Step Reach centrality, which is the number of distinct agents within *k* steps of a given agent. Therefore, 2-Step Reach counts the number of boards that could be arrived at directly or indirectly through other boards

that were one step away. With the consideration of indirect connections, 2-Step Reach is an intuitive measure of a board's ability to receive information flows within its network.

For each annual volume of the BoardEx data from 2002 to 2018, I constructed the entire board networks and calculated each of the three centrality measures for every firm. Then, to reduce the influence of extreme values and facilitate the explanation of regression results, for each year, I sorted firms into quintiles based on the three centrality measures: Degree, Eigenvector and 2-Step Reach, where the highest (lowest) values of centrality equal a value of five (one) (Larcker, So, and Wang, 2013). I used Eigenvector for the main test and used Degree and 2-Step Reach for the robust tests.

Female Board Representation. Following Chen, Crossland, and Huang (2016), I operationalized Female Board Representation as the number of female directors in a given firm-year divided by total number of directors. For the ease of interpretation, I de-meaned this variable in the regression.

Control Variables

Several factors at the CEO, governance, and firm level were included in the model to control for their effects the likelihood of acquisitions. At the CEO-level, I included CEO Duality (a binary variable indicating that the CEO was also the board chair), CEO Age (measured as the logarithm form of a CEO's age), CEO Bonus to Salary (measured by dividing a CEO's salary by his bonus), CEO Shares (measured as the logarithm form of a CEO's share percentage), CEO Vested Option (measured by dividing a CEO's number of unexercised exercisable options by common shares outstanding), and Female CEO (as a

binary variable indicating that the CEO in a given firm-year was a female), all of which could influence corporate acquisitions (Malmendier and Tate, 2005, 2008). At governance-level, I included Board Independence (measured as the ratio of independent directors), Board Size (measured as the logarithm form of the number of directors), and Busy Board (a binary variable indicating that 50% or more of the board's independent directors held three or more directorships (Fich and Shivdasani, 2007)).

At the firm level, I controlled firm size, performance, and leverage, all of which influence could acquisition intensity (Malmendier and Tate, 2008). Specifically, I included Total Assets (measured as the logarithm of a firm's total assets), R&D Spending (measured by dividing a firm's R&D spending by its total sales), ROA (measured by dividing a firm's net income by its total assets), Free Cash Flow (measured by dividing a firm's operation cash flow by its total assets), Market to Book Ratio (measured by dividing a firm's market value by its book value of assets), as well as Leverage Ratio (measured by dividing a firm's total debts by its total equity). I also included firm fixed effects and year fixed effects in all models.

1.3.3 Analysis

STATA 16.0 was used to conduct my statistical analysis. Following prior studies (Malmendier and Tate, 2008; Schumacher, Keck, and Tang, 2020), I used panel data analysis (*xtreg* with *fe* option) to conduct regression analysis. The unit of observations in the above dataset is firm-year. I control for the firm and year fixed effects, which helps to account for unobserved time-invariant factors and mitigate endogeneity issues. The standard errors were clustered at the firm level to account for the nonindependence of the

observations. To ensure that my results are not driven by outliers, I "winsorized" all variables at 1% level. I conducted additional robustness analysis, including operationalizing the dependent variable by using count form and using the Poisson model for the regression.

1.4 Empirical Results

Table 1 presents the summary statistics and correlations of the variables. Overall, the correlations among variables are low. To further exclude the possibility of multicollinearity among valuables, I calculated variance inflation factors (VIF) to detect the presence of any multicollinearity. The average VIF for all variables is 1.46, and the VIFs for individual variables range from 1.03 to 2.69, which are below the rule-of-thumb cutoff of 10 (Neter, Wasserman, and Kutner, 1985). Therefore, multicollinearity was not a concern in my statistical analysis.

Table 1 Summary Statistics and Correlation Matrix, 2002 to 2008

Summary Statistics and Correlation Matrix, 2002 to 2018

		Mean	SD	1	2	3	4	5	6	7	8	9	10
1	Acquisition Intensity (Ln)	0.45	1.05	1									
2	CEO Overconfidence	0.48	0.50	0.042	1								
3	Board Network Centrality	3.99	1.17	0.043	-0.076	1							
4	Female Boardroom Representation	0.13	0.11	0.001	-0.094	0.312	1						
5	CEO Duality	0.63	0.48	0.028	0.141	0.006	-0.026	1					
6	CEO Age (Ln)	4.02	0.13	-0.023	0.119	-0.013	0.024	0.177	1				
7	CEO Bonus to Salary Ratio	0.36	0.77	0.059	0.065	-0.016	-0.066	0.152	0.016	1			
8	CEO Shares (Ln)	-0.93	1.91	-0.031	0.190	-0.306	-0.201	0.086	0.160	-0.007	1		
9	CEO Vested Option	6.94	9.52	-0.016	0.248	-0.154	-0.160	0.098	0.007	0.080	0.212	1	
10	Female CEO	0.04	0.18	-0.029	-0.041	0.053	0.259	-0.041	-0.045	-0.036	-0.044	-0.021	1
11	Board Independence	0.59	0.13	-0.024	-0.053	0.116	0.127	-0.144	0.005	-0.163	0.036	-0.002	0.040
12	Board Size (Ln)	2.36	0.31	0.070	-0.038	0.458	0.262	0.208	0.046	0.148	-0.373	-0.189	-0.009
13	Busy Board	0.02	0.13	0.011	0.001	0.081	0.020	0.016	-0.013	0.023	-0.027	0.007	0.005
14	Total Assets (Ln)	7.49	1.63	0.119	-0.076	0.501	0.331	0.100	0.107	0.082	-0.421	-0.332	0.015
15	R&D Spending	0.06	0.12	0.006	0.050	-0.069	-0.118	-0.092	-0.096	-0.040	-0.020	0.169	-0.024
16	ROA	0.05	0.10	0.077	0.158	0.014	0.060	0.055	0.033	0.095	-0.026	-0.078	0.009
17	Free Cash Flow	0.12	0.17	0.073	0.077	0.044	0.033	0.024	0.016	0.068	-0.099	-0.123	-0.001
18	Market to Book Ratio	1.66	1.62	0.035	0.225	-0.098	-0.044	-0.038	-0.078	0.034	0.049	0.044	-0.004
19	Debts to Assets Ratio	0.68	1.70	0.005	-0.030	0.094	0.075	-0.016	-0.001	-0.005	-0.052	-0.049	0.005

		11	12	13	14	15	16	17	18	19
11	Board Independence	1								
12	Board Size (Ln)	-0.297	1							
13	Busy Board	-0.088	0.016	1						
14	Total Assets	-0.080	0.654	0.043	1					
15	R&D Spending	-0.019	-0.145	0.031	-0.239	1				
16	ROA	-0.055	0.099	-0.005	0.063	-0.299	1			
17	Free Cash Flow	-0.041	0.116	-0.012	0.224	-0.313	0.591	1		
18	Market to Book Ratio	-0.073	-0.117	0.025	-0.281	0.327	0.390	0.158	1	
19	Debts to Assets Ratio	0.033	0.098	-0.003	0.178	-0.086	-0.057	0.038	-0.132	1

Note: 23286 observations. Correlations ≥0.01 or ≤−0.01 are significant at the 0.05 level.

Table 2 presents the results of testing Baseline Hypothesis and Hypothesis 1. Model 1 only contains control variables. In Model 2, I tested the Baseline Hypothesis, which proposes that CEO overconfidence increases acquisition intensity. In support of this hypothesis, as well as prior research (Malmendier and Tate, 2008), the coefficient estimate for CEO Overconfidence is significantly positive ($\beta = 0.019$, $p = 0.012$). Model 4 was used to test Hypothesis 1, which predicts that the board network centrality mitigates the positive relationship between CEO overconfidence and acquisition intensity. The coefficient of the interaction term between CEO Overconfidence and Board Network Centrality is significantly negative ($\beta = -0.012$, $p = 0.027$), which supports Hypothesis 1. This estimate suggests that increasing one quartile of board network centrality decreases 1.012 (exp (0.012)) acquisitions undertaken by overconfident CEOs. The effects are both statistically and economically significant. In Figure 1, I elaborated on the interpretation of the moderating effect of Board Network Centrality. The interaction between CEO Overconfidence and Board Network Centrality was plotted, while other variables were held at their mean values. Figure 1 shows that Acquisition Intensity is generally higher for overconfident CEOs (solid line with circle symbol), which is consistent with the Baseline Hypothesis. The Acquisition Intensity decreases notably for overconfident CEOs when Board Network Centrality increases. Specifically, moving from the lowest centrality to highest centrality, the number of acquisitions undertaken by overconfident CEOs decreases by 14%.

Table 2 Results of Testing Baseline Hypothesis and Hypothesis 1

Dependent Variable: Acquisition Intensity (Ln)				
Variables	Model 1	Model 2	Model 3	Model 4
CEO Overconfidence (a)		0.019**	0.019**	0.069***
		(0.008)	(0.008)	(0.024)
Board Network Centrality (b)			-0.004	0.002
			(0.004)	(0.005)
(a) x (b)				-0.012**
				(0.005)
CEO Duality	0.014**	0.012*	0.012*	0.012*
	(0.007)	(0.007)	(0.007)	(0.007)
CEO Age (Ln)	-0.044	-0.056*	-0.055*	-0.054*
	(0.031)	(0.031)	(0.031)	(0.031)
CEO Bonus to Salary Ratio	0.010**	0.009**	0.009**	0.009**
	(0.004)	(0.004)	(0.004)	(0.004)
CEO Shares (Ln)	0.001	0.000	0.000	0.000
	(0.002)	(0.002)	(0.002)	(0.002)
CEO Vested Option	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Female CEO	-0.034*	-0.033	-0.032	-0.032
	(0.020)	(0.020)	(0.020)	(0.020)
Board Independence	-0.021	-0.019	-0.013	-0.012
	(0.031)	(0.031)	(0.031)	(0.031)
Board Size (Ln)	0.016	0.016	0.019	0.019
	(0.018)	(0.018)	(0.019)	(0.019)
Busy Board	0.006	0.007	0.008	0.008
	(0.022)	(0.022)	(0.022)	(0.022)
Total Assets (Ln)	0.001	-0.001	0.000	0.000
	(0.006)	(0.006)	(0.006)	(0.006)
R&D Spending	0.195***	0.192***	0.193***	0.193***
	(0.058)	(0.058)	(0.058)	(0.058)
ROA	0.209***	0.202***	0.202***	0.202***
	(0.043)	(0.043)	(0.043)	(0.043)
Free Cash Flow	0.028	0.029	0.029	0.028
	(0.027)	(0.027)	(0.027)	(0.027)
Market to Book Ratio	0.008***	0.007**	0.007***	0.007**
	(0.003)	(0.003)	(0.003)	(0.003)
Debts to Assets Ratio	0.002	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.335**	0.386***	0.383***	0.351***
	(0.131)	(0.132)	(0.133)	(0.133)
Firm Fixed effect	Included	Included	Included	Included
Year Fixed effect	Included	Included	Included	Included
Observations	23286	23286	23286	23286
F Statistic	8.711***	8.561***	8.143***	7.965***

Note. This table shows the results of testing Baseline Hypothesis and Hypothesis 1. Standard errors clustered at the firm level are reported in parentheses. 1%, 5%, and 10% significance levels of the coefficients are denoted by ***, **, and *, respectively.

Figure 1 Mitigating Effect of Board Network Centrality

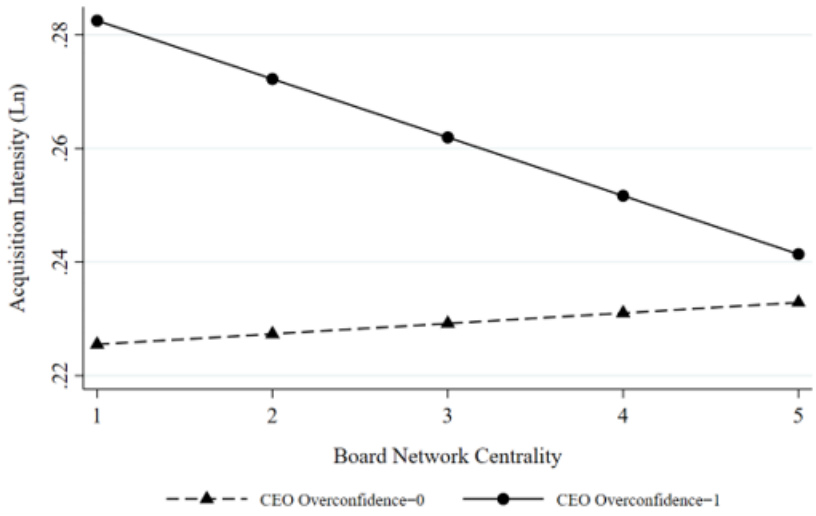


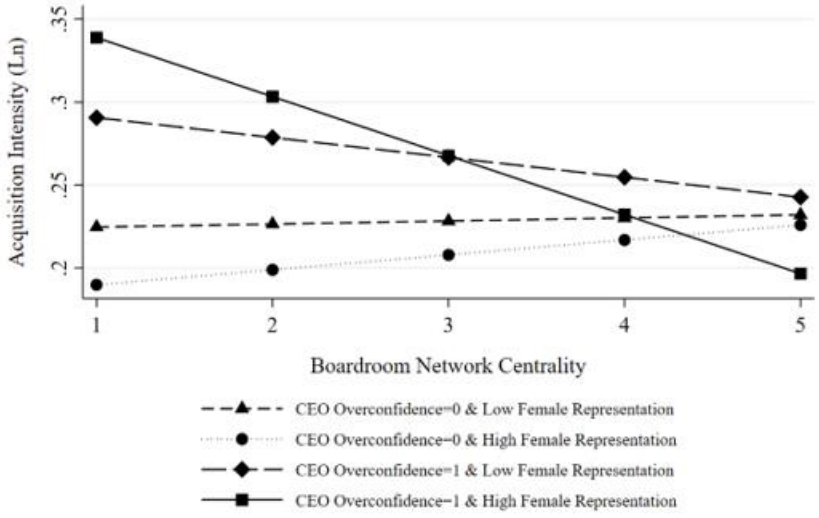
Table 3 presents the results of testing Hypothesis 2, which proposes that the mitigating effect of board network centrality is stronger if the board has greater female presentation. The coefficient of the three-way interaction term of CEO Overconfidence, Board Network centrality, and Female Board Representation supports this hypothesis (β = -0.102, p = 0.045). In Figure 3, I plotted the interaction between CEO Overconfidence, Board Network Centrality, and Female Board Representation, while other variables were held at their mean values. Figure 2 shows that the Acquisition Intensity decreases for overconfident CEOs for both Low Female Board Representation (long dash line with diamond symbol) and High Female Board Representation (solid line with square symbol) when Board Network Centrality increases. Moreover, the slope of High Female Board Representation for overconfident CEOs is significantly steeper than that of Low Female Board Representation for overconfident CEOs, which supports Hypothesis 2 that the mitigating effect of board network centrality is stronger if the board has greater female presentation.

Table 3 Results of Testing Hypothesis 2

Dependent Variable: Acquisition Intensity (Ln)	
Variables	Model 1
CEO Overconfidence (a)	0.080***
	(0.026)
Board Network Centrality (b)	0.002
	(0.005)
Female Boardroom Representation (c)	-0.155
	(0.170)
(a) x (b)	-0.014**
	(0.006)
(a) x (c)	0.376*
	(0.217)
(b) x (c)	0.025
	(0.039)
(a) x (b) x (c)	-0.102**
	(0.051)
CEO Duality	0.011
	(0.007)
CEO Age (Ln)	-0.052*
	(0.031)
CEO Bonus to Salary Ratio	0.009**
	(0.004)
CEO Shares (Ln)	0.000
	(0.002)
CEO Vested Option	0.000
	(0.000)
Female CEO	-0.025
	(0.021)
Board Independence	-0.008
	(0.032)
Board Size (Ln)	0.019
	(0.019)
Busy Board	0.009
	(0.022)
Total Assets (Ln)	0.003
	(0.006)
R&D Spending	0.190***
	(0.058)
ROA	0.203***
	(0.043)
Free Cash Flow	0.028
	(0.027)
Market to Book Ratio	0.008***
	(0.003)
Debts to Assets Ratio	0.003
	(0.002)
Constant	0.319**
	(0.135)
Firm Fixed effect	Included
Year Fixed effect	Included
Observations	23284
F Statistic	6.873***

Note. This table shows the results of testing Hypothesis 2. Standard errors clustered at the firm level are reported in parentheses. 1%, 5%, and 10% significance levels of the coefficients are denoted by ***, **, and *, respectively.

Figure 2 Three-way Interaction



1.5 Additional Analysis

1.5.1 Using Poisson Regression Model

To demonstrate the robustness of my findings, the dependent variable was measured as the number of acquisitions in a given year and the Poisson regression was conducted. Table 4 presents the results. In Model 1, the coefficient of CEO Overconfidence helps to predict Acquisition Intensity ($\beta = 0.056$, $p = 0.081$), which is consistent with the Baseline Hypothesis. In Model 3, the coefficient of the interaction term between CEO Overconfidence and Board Network Centrality supports Hypothesis 1 ($\beta = -0.064$, $p = 0.008$).

Table 4 Results of Using Poisson Regression

Dependent Variable: Acquisition Intensity			
Variables	Model 1	Model 2	Model 3
CEO Overconfidence (a)	0.056*	0.054*	0.328***
	(0.032)	(0.032)	(0.108)
Board Network Centrality (b)		-0.030*	0.007
		(0.017)	(0.022)
(a) x (b)			-0.064***
			(0.024)
CEO Duality	0.106***	0.103***	0.102***
	(0.030)	(0.031)	(0.031)
CEO Age (Ln)	-0.299**	-0.293**	-0.281**
	(0.139)	(0.139)	(0.139)
CEO Bonus to Salary Ratio	0.036***	0.036***	0.036***
	(0.014)	(0.014)	(0.014)
CEO Shares (Ln)	0.007	0.007	0.008
	(0.009)	(0.009)	(0.009)
CEO Vested Option	0.002	0.002	0.001
	(0.002)	(0.002)	(0.002)
Female CEO	-0.296***	-0.293***	-0.281***
	(0.093)	(0.093)	(0.093)
Board Independence	-0.195	-0.153	-0.151
	(0.138)	(0.140)	(0.140)
Board Size (Ln)	0.134	0.152*	0.150*
	(0.084)	(0.084)	(0.084)
Busy Board	0.096	0.102	0.102
	(0.085)	(0.085)	(0.085)
Total Assets (Ln)	0.038	0.047*	0.047*
	(0.025)	(0.025)	(0.025)
R&D Spending	1.400***	1.403***	1.401***
	(0.287)	(0.287)	(0.287)
ROA	1.641***	1.641***	1.632***
	(0.217)	(0.217)	(0.218)
Free Cash Flow	0.397***	0.394**	0.389**
	(0.154)	(0.154)	(0.154)
Market to Book Ratio	0.017	0.017	0.017
	(0.012)	(0.012)	(0.012)
Debts to Assets Ratio	0.013*	0.013*	0.013
	(0.008)	(0.008)	(0.008)
Firm Fixed effect	Included	Included	Included
Year Fixed effect	Included	Included	Included
Observations	17383	17383	17383
Wald Chi-squared	244.120***	247.370***	254.140***

Note. This table shows the results of using Poisson regression. Standard errors clustered at the firm level are reported in parentheses. 1%, 5%, and 10% significance levels of the coefficients are denoted by ***, **, and *, respectively.

1.5.2 Alternative Measures of CEO Overconfidence

The intuition of the option-based measure of CEO Overconfidence is that CEOs who hold options too long can be considered as overconfident. In my main analysis, I used the cutoff of two-thirds (67%) of the values of in-the-money options to identify overconfident CEOs. To test the robustness of my results, I re-conducted this analysis using various cutoff ratios (e.g., 50%, 75%, and 80%), which leads to consistent results. The results are available upon request.

As an alternative to my option-based measure of CEO Overconfidence, I developed a behavioral measure based on a CEO's net buying of company stock. The underlying assumption is that risk-averse CEOs should limit their investments in the equity of their own companies. If a CEO continued to purchase his own company's stock but ex post suffered loss, I inferred that the CEO was overconfident in his ability to keep his company's stock price rising. Following Malmendier and Tate (2005) and Kolasinski and Li (2013), I classified a CEO as overconfident if the CEO who had increased his company's holdings over the past year had negative returns in the following three years. Table 5 presents the results of analysis using the stock-based measure of CEO Overconfidence. In Model 1, the coefficient of the stock-based measure of CEO Overconfidence is significantly positive ($\beta = 0.026$, $p = 0.000$), which is consistent with the Baseline Hypothesis. In Model 3, the coefficient of the interaction term between the stock-based measure of CEO Overconfidence and Board Network Centrality supports Hypothesis 1 ($\beta = -0.009$, $p = 0.080$).

Table 5 Results of Using Alternative Measure of CEO Overconfidence

Variables	Model 1	Model 2	Model 3
CEO Overconfidence-Stock (a)	0.026***	0.026***	0.062***
	(0.006)	(0.006)	(0.021)
Board Network Centrality (b)		-0.005	-0.002
		(0.004)	(0.004)
(a) x (b)			-0.009*
			(0.005)
CEO Duality	0.013*	0.012*	0.012*
	(0.007)	(0.007)	(0.007)
CEO Age (Ln)	-0.041	-0.040	-0.040
	(0.031)	(0.031)	(0.031)
CEO Bonus to Salary Ratio	0.010**	0.010**	0.010**
	(0.004)	(0.004)	(0.004)
CEO Shares (Ln)	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)
CEO Vested Option	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Female CEO	-0.033	-0.032	-0.032
	(0.020)	(0.020)	(0.020)
Board Independence	-0.018	-0.012	-0.012
	(0.031)	(0.031)	(0.031)
Board Size (Ln)	0.013	0.016	0.016
	(0.018)	(0.019)	(0.019)
Busy Board	0.006	0.007	0.007
	(0.022)	(0.022)	(0.022)
Total Assets (Ln)	-0.002	0.000	-0.001
	(0.006)	(0.006)	(0.006)
R&D Spending	0.187***	0.188***	0.187***
	(0.058)	(0.058)	(0.058)
ROA	0.206***	0.205***	0.204***
	(0.043)	(0.043)	(0.043)
Free Cash Flow	0.029	0.029	0.029
	(0.027)	(0.027)	(0.027)
Market to Book Ratio	0.008***	0.008***	0.008***
	(0.003)	(0.003)	(0.003)
Debts to Assets Ratio	0.003	0.003	0.003
	(0.002)	(0.002)	(0.002)
Constant	0.340***	0.337***	0.332**
	(0.131)	(0.131)	(0.131)
Firm Fixed effect	Included	Included	Included
Year Fixed effect	Included	Included	Included
Observations	23286	23286	23286
F Statistic	9.412***	8.950***	8.624***

Note. This table shows the results of using an alternative measure of CEO overconfidence. Standard errors clustered at the firm level are reported in parentheses. 1%, 5%, and 10% significance levels of the coefficients are denoted by ***, **, and *, respectively.

1.5.3 Alternative Measures of Board Network Centrality

In my main analyses, I used Eigenvector to measure the Board Network Centrality. To corroborate my findings, I employed two alternative centrality measures: Degree and 2-Step Reach. Table 6 presents the results of analysis using alternative centrality measures. The results are consistent with my main analyses using Eigenvector. The coefficients of both interaction terms using the two alternative centrality measures are negatively and significantly correlated to Acquisition Intensity.

Table 6 Results of Analyses Using Alternative Measures of Network Centrality

Dependent Variable: Acquisition Intensity (Ln)		
Variables	Model 1	Model 2
CEO Overconfidence (a)	0.080***	0.070***
	(0.023)	(0.025)
Board Network Centrality_Degree (b)	0.000	
	(0.005)	
Board Network Centrality_2 Step Reach (c)		0.000
		(0.005)
(a) x (b)	-0.010***	
	(0.005)	
(a) x (c)		-0.010**
		(0.006)
CEO Duality	0.010	0.010*
	(0.007)	(0.007)
CEO Age (Ln)	-0.050*	-0.050*
	(0.031)	(0.031)
CEO Bonus to Salary Ratio	0.010**	0.010**
	(0.004)	(0.004)
CEO Shares (Ln)	0.000	0.000
	(0.002)	(0.002)
CEO Vested Option	0.000	0.000
	(0.000)	(0.000)
Female CEO	-0.030	-0.030
	(0.020)	(0.020)
Board Independence	-0.010	-0.010
	(0.032)	(0.032)
Board Size (Ln)	0.020	0.020
	(0.019)	(0.019)
Busy Board	0.010	0.010
	(0.022)	(0.022)
Total Assets (Ln)	0.000	0.000
	(0.006)	(0.006)
R&D Spending	0.190***	0.190***
	(0.058)	(0.058)
ROA	0.200***	0.200***
	(0.043)	(0.043)
Free Cash Flow	0.030	0.030
	(0.027)	(0.027)
Market to Book Ratio	0.010**	0.010**
	(0.003)	(0.003)
Debts to Assets Ratio	0.000	0.000
	(0.002)	(0.002)
Constant	0.350***	0.350***
	(0.133)	(0.133)
Firm Fixed effect	Included	Included
Year Fixed effect	Included	Included
Observations	23286	23286
F Statistic	8.160***	7.900***

Note. This table shows the results of using alternative measures of network centrality. Standard errors clustered at the firm level are reported in parentheses. 1%, 5%, and 10% significance levels of the coefficients are denoted by ***, **, and *, respectively.

1.5.4 Analyses in the Context of Corporate Investments

I tested and found support for my proposed relationships in the context of corporate acquisition. Given that the literature has documented various value-destroying decisions of overconfident CEO, I proceeded to test my hypotheses in another important context, corporate investment, to demonstrate that my findings are not limited to the context of corporate acquisition.

When making decisions about investment, an overconfident CEO may overestimate the possible outcome. Cognitive biases of overconfidence make CEOs reluctant to gather information about projects or focus only on information that is good for projects, which can lead to overestimating project returns and underestimating the likelihood of failure (Langer, 1975; March and Shapira, 1987). Consequently, overconfident CEOs tend to overinvest in capital expenditures (Malmendier and Tate, 2005). Based on my arguments, I hypothesize that the board network centrality mitigates the positive relationship between CEO overconfidence and corporate investments.

In this test, Capital Expenditure was used as the dependent variable, which was measured as firm capital expenditures in a given year normalized by total assets at the beginning of the year. As this variable is highly skewed, I transformed it into the logarithm form. The independent variable, moderator, as well as other control variables are consistent with those in my main analysis. Table 7 presents the results of tests on Capital Expenditure. In Model 1, the coefficient estimate for CEO Overconfidence is significantly positive ($\beta = 0.066$, $p = 0.000$), which is consistent with prior research (Malmendier and Tate, 2005). Model 3 is used to test my prediction that high capital expenditures caused by CEO

overconfidence diminishes with the increase of board network centrality. The coefficient of the interaction term between CEO Overconfidence and Board Network Centrality offers evidence to support this prediction ($\beta = -0.017$, $p = 0.032$).

Table 7 Results of Using Capital Expenditure as the Dependent Variable

Dependent Variable: Capital Expenditure			
Variables	Model 1	Model 2	Model 3
CEO Overconfidence (a)	0.066***	0.067***	0.135***
	(0.011)	(0.011)	(0.034)
Board Network Centrality (b)		0.007	0.016**
		(0.005)	(0.007)
(a) x (b)			-0.017**
			(0.008)
CEO Duality	0.067***	0.068***	0.068***
	(0.010)	(0.010)	(0.010)
CEO Age (Ln)	-0.109**	-0.110**	-0.108**
	(0.044)	(0.044)	(0.044)
CEO Bonus to Salary Ratio	0.015***	0.015***	0.015***
	(0.005)	(0.005)	(0.005)
CEO Shares (Ln)	-0.004	-0.004	-0.004
	(0.003)	(0.003)	(0.003)
CEO Vested Option	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)
Female CEO	0.028	0.026	0.027
	(0.029)	(0.029)	(0.029)
Board Independence	0.172***	0.163***	0.164***
	(0.044)	(0.044)	(0.044)
Board Size (Ln)	0.197***	0.193***	0.193***
	(0.026)	(0.026)	(0.026)
Busy Board	0.008	0.006	0.007
	(0.031)	(0.032)	(0.032)
Total Assets (Ln)	-0.130***	-0.132***	-0.132***
	(0.009)	(0.009)	(0.009)
R&D Spending	1.525***	1.524***	1.524***
	(0.082)	(0.082)	(0.082)
ROA	0.914***	0.915***	0.916***
	(0.061)	(0.061)	(0.061)
Free Cash Flow	0.365***	0.365***	0.363***
	(0.039)	(0.039)	(0.039)
Market to Book Ratio	0.073***	0.073***	0.073***
	(0.004)	(0.004)	(0.004)
Debts to Assets Ratio	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)
Constant	-2.883***	-2.878***	-2.921***
	(0.187)	(0.187)	(0.188)
Firm Fixed effect	Included	Included	Included
Year Fixed effect	Included	Included	Included
Observations	23246	23246	23246
F Statistic	195.499***	184.130***	174.184***

Note. This table shows the results of using capital expenditure as the dependent variable. Standard errors clustered at the firm level are reported in parentheses. 1%, 5%, and 10% significance levels of the coefficients are denoted by ***, **, and *, respectively.

1.5.5 Endogeneity Concerns

One important remaining concern is that my estimates could be potentially biased due to the omission of confounding variables that affect both CEO overconfidence and board network centrality. For example, if higher-quality directors are invited to guide overconfident CEOs and are more likely to accept board positions on more centrally connected boards, my finding of the moderating role of Board network centrality may simply reflect endogenous matching between higher-quality directors and overconfident CEOs. I have attempted to partially alleviate this problem by including firm-fixed effects to account for any unobservable CEO and firm characteristics that are time-invariant.

To further address such a possible concern, I developed a new variable, Indirect Connections, measured as the number of boards that were indirectly connected to the focal board. The changes of Indirect Connections are beyond the focal firm's control but may influence the centrality of the focal board in the network. Therefore, changes in indirect connections can be regarded as exogenous. Based on my description above, Degree counts the number of other unique boards that the focal board was connected with, while 2-Step Reach counts the number of boards that could be arrived at directly or indirectly through other boards that were one step away. Therefore, I operationalized Indirect Connections as the difference between Degree and 2-Step Reach. As the networks were relatively stable over time, the changes of connections each year are trivial. I created a binary variable, Increases of Indirect Connections, to indicate that the increases of indirect connections are among the top 10% of a given year. Then, I replaced Board Network Centrality in my main analysis with Increases of Indirect Connections and re-ran the regression. Table 8 presents

the results of the test using the Increase of Indirect Connections. The interaction term between CEO Overconfidence and Increases of Indirect Connections are negatively and significantly related to Acquisition Intensity (β = -0.037, p = 0.006). This robustness test suggests that it is the board network centrality that mitigates the effects of CEO Overconfidence on Acquisition Intensity.

Table 8 Results of Using the Increase of Indirect Connections

Dependent Variable: Acquisition Intensity (Ln)	
Variables	Model 1
CEO Overconfidence (a)	0.026***
	(0.008)
Increases of Indirect Connections (b)	0.013
	(0.009)
(a) x (b)	-0.037***
	(0.013)
CEO Duality	0.012*
	(0.007)
CEO Age (Ln)	-0.057*
	(0.031)
CEO Bonus to Salary Ratio	0.009**
	(0.004)
CEO Shares (Ln)	0.000
	(0.002)
CEO Vested Option	0.000
	(0.000)
Female CEO	-0.033
	(0.020)
Board Independence	-0.016
	(0.031)
Board Size (Ln)	0.018
	(0.019)
Busy Board	0.007
	(0.022)
Total Assets (Ln)	-0.001
	(0.006)
R&D Spending	0.190***
	(0.058)
ROA	0.202***
	(0.043)
Free Cash Flow	0.028
	(0.027)
Market to Book Ratio	0.007***
	(0.003)
Debts to Assets Ratio	0.002
	(0.002)
Constant	0.382***
	(0.133)
Firm Fixed effect	Included
Year Fixed effect	Included
Observations	23286
F Statistic	8.051***

Note. This table shows the results of using the increase of indirect connections. Standard errors clustered at the firm level are reported in parentheses. 1%, 5%, and 10% significance levels of the coefficients are denoted by ***, **, and *, respectively.

1.6. Discussion

1.6.1 Theorical Contributions

Many studies document that overconfident CEOs often distort significant corporate decisions (Hayward and Hambrick, 1997; Kim, Wang, and Zhang, 2016; Malendier and Tate, 2005, 2008; Roll, 1986; Schumacher, Keck, and Tang, 2020). Despite the detrimental impact on firm value, few studies have discussed how to prevent overconfident CEOs from implementing value-destroying strategies. I integrate Ocasio's (1997) ABV theory with corporate governance perspective to explore the mitigating effect of more centrally connected boards in governing overconfident CEOs.

Based on ABV, board networks shape firm social resources and the environment in which CEOs present themselves, thereby guiding CEO attention (Asad et al., 2023). Malmendier and Tate (2008) documented that overconfident CEOs undertook more acquisitions than their non-overconfident counterparts, thereby destroying firm value. I show that such destructive effects caused by CEO overconfidence can be largely mitigated by more centrally connected boards. I test my arguments in the context of corporate acquisitions. I predicted and found that a more centrally connected board can guide the attention of overconfident CEOs to more relevant information, which constrains their optimistic beliefs. Furthermore, I found the mitigating effect is stronger under conditions in which the board has greater female representation.

Typical incentives such as equity-based compensation are based on agency theory and designed to monitor managers in the case of moral hazard or adverse selection (Fama and Jensen, 1983a, 1983b; Jensen and Meckling, 1976). The governance mechanisms proposed

in this study function from the perspective of promoting CEOs' information processing. Board of directors not only monitors the behavior of overconfident CEOs, but also guides their attention in decision-making. In this study, I focus more on biased decision-making by overconfident CEOs, who may believe that their decisions can maximize shareholder welfare. Constraining the behavior of overconfident CEOs by standard incentives may not work effectively as expected (Ahmed and Duellman, 2013; Malendier and Tate, 2005). In this regard, the governance mechanism I propose in this study makes an important complement to the incentive-related governance mechanism.

My study also provides new evidence on the governance role of interlocked directors. Thus far, researchers have not reached an agreement on the net economic results of interlocked directors in corporate governance. While interlocked directors are found to be associated with increased CEO private benefits (Sauerwald, Lin, and Peng, 2016) and decreased firm value (Core, Holthasen, and Larcker, 1999; Fich and Shivdasani, 2006; Fich and White, 2003; Loderer and Peyer, 2002). Larcker, So, and Wang (2013) argued that interlocked directors helped reduce uncertainty and improve firm performance through bringing information to the focal firms. In keeping with them, my study demonstrates the role of interlocked directors in constraining overconfident CEOs by facilitating information communication and resource exchanges. My study also suggests a new channel through which interlocked directors can contribute to firm operations.

1.6.2 Limitations and Directions for Future Research

This study is not without limitations. First, my study aims to mitigate the negative effects of CEO overconfidence. Some prior studies have found many merits of CEO

overconfidence. For instance, research indicates that overconfident CEOs are good at innovation (Galasso and Simcoe, 2011; Hirshleifer, Low, and Teoh 2012). However, I did not exclude the possibility that the proposed mechanism can mitigate the merits of CEO overconfidence. Future studies could explore, to what extent, that the effects of overconfidence CEO decision-making are mitigated in different contexts and the boundary conditions that the benefits of overconfidence could be negatively affected. Second, I only tested my predictions in the context of corporate acquisition and corporate investment. Future studies may test and extend my theories in other contexts.

1.6.3 Practical Implications

Due to behavioral distortions, overconfident CEOs are frequently fired by the boards (Campbell et al., 2011). However, overconfidence is not always problematic. Considering the benefits of overconfidence (Bernardo and Welch, 2001; Gervais, Heaton, and Odean, 2011; Navis and Ozbek, 2016) and its prevalence among managers (Goel and Thakor, 2008; Malendier and Tate, 2005, 2008), replacing an overconfident CEO may not be the optimal management practice, but rather to play to their strengths while avoiding the disadvantages of overconfidence with the help of governance mechanisms, as proposed in this study. Academic research aside, my study has important implications for the design of organizations.

Chapter 2 When Overconfident CEOs Deliver Better Performance: Evidence from Acquisition Waves

2.1 Introduction

Overconfident CEOs have been frequently criticized for value-destroying activities (e.g., Kim et al. 2016; Schrand and Zechman 2012), especially in the context of corporate acquisition. Research has consistently shown that overconfident CEOs are aggressive in making excessive acquisitions (Malmendier and Tate 2008) and overpay for their targets (Hayward and Hambrick 1997; Roll 1986), which leads to poor acquisition performance (Banerjee et al. 2015; Kolasinski and Li, 2013; Malmendier and Tate 2008). If overconfident CEOs consistently destroy firm value in acquisitions, a question arises as to why they persist in these activities. Previous literature suggests the failure of boards of directors to fulfil their fiduciary duties and monitor or advise overconfident CEOs appropriately (Hayward and Hambrick 1997). By contrast, though, I argue that CEO overconfidence rather than a liability can be harnessed for firm benefit in the context of acquisition waves (Carow et al 2004; McNamara et al. 2008)

Acquisition waves are periods of intense acquisition activities caused by industry-level deregulation and economic shocks (Harford 2005; Mitchell and Mulherin 1996), which differ from non-wave periods. Acquisitions outside waves often driven by desires for growth, synergies, or empire building (Berkovith and Narayanan 1993; Walsh and Seward 1990); whereas acquisitions within waves are often motivated by a need to adapt to changing industry structures caused by deregulation and economic shocks (Harford 2005; Mitchell and Mulherin 1996). Under the context of acquisition waves, the requirements for action speed becomes critical. While acquirers in general benefit from comprehensive

information-collecting and a prudent pre-deal process (Pavićević and Keil 2021), such an approach is less beneficial in acquisition waves due to the time-consuming nature of such acquisition planning and execution. Research shows performances of acquisitions within a wave are not evenly distributed but instead largely influenced by acquirer position within the wave (Carow et al. 2004; McNamara et al. 2008) in which acquisitions in the early stage of wave tend to outperform those in the later stage of wave. Thus, speed of action is critical to the success of acquisitions within waves.

I explore whether CEO overconfidence yields benefits in acquisition waves. Acquirers that react quickly to deregulation and economic shocks benefit from market preemption (Frynas et al. 2006; Lieberman and Montgomery 1988, 1998) and high-quality targets (McNamara et al. 2008), which leads to better acquisition performance. By contrast, acquirers acting late in waves are often driven by bandwagon pressures, with limited acquisition targets, and therefore more likely to make poor acquisition decisions (McNamara et al. 2008). Research has shown overconfidence enlarges the set of opportunities CEOs perceive as possible (Navis and Ozbek 2016) and prompts fast decision-making (Ben-David et al. 2013; Pavićević and Keil 2021). Such superior opportunity perception allows overconfident CEOs to react more quickly to economic shocks and deregulations compared with their non-overconfident peers, which I posit leads to early entry in the acquisition waves. As overconfident CEOs move earlier in acquisition waves, they are more likely to capture preemption opportunities, seizing high-quality targets or targets with cospecialized assets with lower costs, resulting in more favorable market reactions. Accordingly, I hypothesize that in acquisition waves, the returns to

acquisitions undertaken by overconfident CEOs are higher than those by other CEOs, and such an effect is mediated by acquisition speed.

In addition, I explore whether the above relationships are weakened if overconfident CEO fast decision-making modes are constrained. I draw upon the existing research on organizational experience and argue that organizations with rich acquisition experience are more likely to develop routines which consist of formal procedures for screening and purchasing companies (Amburgey and Miner 1992; Paine and Power 1984). These organizational routines promote a more cautious and disciplinary approach to managing acquisitions. However, while this approach may be beneficial during non-wave periods, it likely constrains overconfident CEOs' improvisation and slows down their decision-making. Therefore, I hypothesize in acquisition waves, pre-wave organizational acquisition experience weakens the role of CEO overconfidence on both acquisition speed and subsequent acquisition performance.

Using a sample of S&P 1500 firms in a 27-year period from 1992 through 2018, I find support for my theory and hypotheses. My study has the potential to make a significant contribution in the following three areas. First, while prior studies show that CEO overconfidence is detrimental to corporate acquisitions (Hayward and Hambrick 1997; Malmendier and Tate 2008; Roll 1986), I reveal benefits of CEO overconfidence in the context of acquisition waves. During such waves, overconfidence, rather than being an unfavorable characteristic as it is in non-wave periods, becomes an advantage because overconfident CEOs are more likely to perceive target opportunities and act fast, which are critical success factors in acquisition waves. Second, scholars in finance have explored the

industry characteristics that drive acquisition waves (Mitchell and Mulherin 1996; Shleifer and Vishny 2003; Rhodes-Kropf and Viswanathan 2004) while scholars in strategic management have explored firm-level characteristics that influence firm participation and performance in acquisition waves (Haleblian et al. 2012). I extend this line of research by exploring CEO-level characteristics that influence acquirer performance in acquisition waves. Lastly, while the existing literature on organizational experience suggest benefits of routines and structural processes to conduct acquisitions (e.g., Haleblian et al. 2006; Vermeulen and Barkema 2001; Zollo and Singh 2004), I find that pre-wave experience is potentially detrimental as it mitigates the favorable effect of CEO overconfidence by slowing down acquisition speed and limiting opportunity of preemption in the acquisition waves. Thus, my study contributes to work on CEO overconfidence, acquisition waves, and organizational routines.

2.2 Theory and Hypothesis

2.2.1 First-mover Advantage in Acquisition Waves

Acquisition waves are periods of intense acquisition activities caused by industry shocks (Harford 2005; Martynova and Rennboog 2008; Mitchell and Mulherin 1996). Under conditions in which deregulation, technological or economic shocks occur in an industry, managers simultaneously react and compete to secure an optimal combination of assets to adapt to the new industry structure (Harford 2005), which leads to a clustering of acquisition activities.

Scholars in strategic management find evidence for a "first-mover advantage" in acquisition waves (Carow et al. 2004; McNamara et al. 2008), which derives from three

factors. First, early movers benefit from market preemption (Frynas et al. 2006; Lieberman and Montgomery 1988, 1998), which allows them to acquire strategic assets at lower costs (Sarkar et al. 1999). For instance, when industry shocks occur, firms engage in acquisitions to obtain better asset combinations to adapt to changes brought by these shocks. An early acquirer's foresight may allow it to acquire a target firm at a lower cost than its competitors as the early mover acquires key resources in a market and integrates them before competitors fully recognize their true value (McNamara et al. 2008). Second, the short periods following industry shocks are characterized by a high level of information asymmetry (Rhodes-Kropf and Viswanathan 2004; Garfinkel and Hankins 2011) and a large pool of available targets, which benefits early acquirers by allowing them to select high-quality targets. The acquirer's strategic insight may allow it to obtain distinctive and critical resources (Barney 1991; Finkelstein 1997), which leads to enduring economic rents. Finally, by acting early, acquirers can increase their likelihood of seizing the benefits associated with co-specialization of assets (McNamara et al., 2008). The resource-based view of the firm assumes firms create rents by selecting superior resource combinations that produce synergies (Makadok 2001). Each firm possesses resources whose value is enhanced when combined with complementary resources, as opposed to their value in isolation. By acting earlier on superior information and preempting potentially competing firms, early acquirers can access a larger pool of targets, which increases the likelihood of identifying targets that produce synergies.

By contrast, late acquirers during acquisition waves are more likely to suffer losses. As high-quality targets are acquired by early movers, the pool of quality candidates

becomes smaller. As desirable assets become scarcer and in greater demand later in waves, their price increases, which leads to higher premiums for later acquirers (Carow et al. 2004). Moreover, acquirers that join a wave late are often motivated by bandwagon pressures, rather than by rational assessments of the strategic value of acquisitions (McNamara et al. 2008). Thus, instead of conducting a comprehensive investigation of strategic opportunities and the value of alternative actions, firms motivated by an acquisition trend are less likely to scan all information and are less mindful in decision-making, which leads to value-destroying acquisitions. Therefore, acquirers earn higher returns to acquisitions if they move earlier in waves but suffer losses if they fall behind. Based on the above discussion, I derive my baseline hypothesis:

> ***Baseline hypothesis.*** *In acquisition waves, acquirers who act earlier have higher returns to acquisitions.*

2.2.2 CEO Overconfidence and First-mover Advantage in Acquisition Waves

Overconfidence refers to the belief that individuals have knowledge, skills, or ability superior to their peers (Hayward et al., 2006; Griffin and Varey 1996). One explanation for overconfidence relates to biases in information processing (e.g., Hoch 1985; Klayman 1995; Koriat et al. 1980). When making a judgement, individuals first retrieve relevant information from memory and form a preliminary answer, and then continue to search for more information. Mechanisms of associative memory draw their attention to information consistent with initial impressions, which can bias interpretations of subsequent evidence. Overconfidence occurs when individuals believe that their information search process is unbiased, and thus behave consistent with their initial guess

more than is justified (Klayman et al. 1999). Accordingly, overconfidence is manifested as the illusion of superior knowledge and ability to the averages (*above-average effect*) (Alicke 1985; Svenson 1981; Taylor and Brown 1988), an inflated perception of control and chances of success (*overestimation effect*) (Langer 1975; Presson and Benassi 1996), and excessive certainty about the accuracy of beliefs and underestimation of the volatility of random events (*miscalibration effect*) (Alpert and Raiffa 1982; Lichtenstein et al. 1977; Ronis and Yates 1987).

Based on this biased information processing, prior research argues and finds that overconfident CEOs tend to overestimate the probabilities of their desired outcomes (Griffin and Varey 1996; Hayward et al. 2006) and underestimate the potential volatility in these outcomes (Ben-David et al. 2013; Moore and Healy 2008), which leads to value-destroying decisions. For example, research shows that overconfident CEOs tend to overinvest in capital expenditures (Malmendier and Tate 2005), engage in earnings management (Schrand and Zechman 2012), ignore poor performance feedback (Schumacher et al. 2020) and incur stock crashes (Kim et al. 2016). In the acquisition context, overconfident CEOs undertake more acquisitions (Malmendier and Tate 2008) and pay higher premiums to targets in takeover transactions (Hayward and Hambrick 1997; Roll 1986), which reduces returns to acquisitions (Malmendier and Tate 2008).

However, overconfident CEOs may benefit their firms in the context of acquisition waves. Due to their inflated belief in their ability to capitalize on perceived market imperfections, overconfidence provides a cognitive justification to pursue opportunities (Navis and Ozbek 2016). Specifically, overconfidence encourages CEOs to overrate their

own problem-solving skills, underrate the resource requirements of their initiatives (Camerer and Lovallo 1999), and downplay the uncertainties they are confronted with (Li and Tang 2010). Therefore, overconfident CEOs direct attention away from factors that might doubt the feasibility of potential opportunities, which enlarges the set of perceived opportunities. Such a decision-making approach enables overconfident CEOs to identify opportunities that their counterparts may overlook (Navis and Ozbek 2016). Correspondingly, research indicates that overconfident CEOs are enthusiastic about risky, challenging, and talent- and vision-sensitive projects (Hirshleifer et al. 2012), as they usually underestimate the uncertainty (Li and Tang 2010) while simultaneously overestimating the net discounted expected payoffs (Hirshleifer et al. 2012; Malmendia and Tate 2008). Accordingly, overconfident CEOs invest more in capital expenditures and research and development (Ben-David et al. 2013; Campbell et al. 2011; Malmendier and Tate 2005), which leads to more innovations for their firms (Hirshleifer et al. 2012; Galasso and Simcoe 2011).

Furthermore, the relationship between overconfidence and opportunity perception will be strengthened in novel contexts under conditions in which CEOs encounter high levels of uncertainty (Navis and Ozbek 2016). Prior work shows the cognitive bias of overconfidence is amplified in the presence of information asymmetry (Hayward et al. 2006; Malmendier and Tate 2008). In familiar contexts where information is more readily available to determine the feasibility of possible opportunities, the effects of overconfidence on opportunities perception are mitigated. By contrast, in novel contexts in which information is less accessible for assessing opportunity feasibility, the effects of

overconfidence are amplified. Under such novel circumstances, CEO overconfidence has a positive and significant effect on the range of perceived opportunities (Navis and Ozbek 2016).

Since most CEOs rarely experience acquisition waves in their careers, these periods can be seen as novel contexts in which overconfidence enhances the perception of opportunities (Navis and Ozbek 2016). As noted above, overconfident CEOs have a heightened ability to perceive and identify opportunities than other CEOs. Such opportunity identification becomes especially significant under conditions in which industry shocks create opportunities for firms to reallocate and combine assets that enable them to better adapt to new industry structures. CEOs should be proactive to recognize such opportunities during acquisition waves (Chen 1996; Haleblian et al. 2012). Along these lines, overconfident CEOs may enter acquisition waves earlier than their counterparts because they perceive the potential to obtain synthesized resources from high-quality targets at lower costs (Carow et al. 2004; McNamara et al. 2008). The onset of acquisition waves typically involves a high degree of uncertainty (Garfinkel and Hankins 2011; Rhodes-Kropf and Viswanathan 2004), which can deter risk-averse CEOs from immediate entrance into acquisition waves. However, overconfident CEOs underestimate uncertainty in the context of deregulations and economic shocks, which further motivates their early entrance in acquisition waves.

Overconfident CEOs usually have inflated beliefs in the accuracy and adequacy of their information. Therefore, they tend to improvise and reach decisions rapidly (Ben-David et al. 2013; Hmieleski et al. 2013). For example, research indicates that

overconfident CEOs exhibit less hesitation when presented with investment opportunities (Gervais et al., 2011). Pavićević and Keil (2021) proposed three ways in which overconfidence accelerates CEO decision-making on corporate acquisitions. First, overconfident CEOs usually form opinions about acquisition price rapidly without engaging in time-consuming due diligence of the target. Second, overconfident CEOs excessively rely on their own decision-making models, which leads to less careful and time-demanding analyses (Picone et al. 2014). Third, overconfident CEOs favor a highly centralized corporate hierarchy (Hiller and Hambrick 2005), which expedites their decision-making. All these factors are unfavored in general acquisitions but may enable a firm to join an acquisition wave early.

Furthermore, overconfident CEOs embrace information consistent with their own beliefs while rejecting inconsistent information (Korsgaard et al. 1997), and as such are influenced less by the actions of their peers (Tang et al. 2018). Accordingly, in acquisition waves, overconfident CEOs respond less to bandwagon pressures (McNamara et al. 2008) and do not feel obliged to join in the wave based on peer actions. Thus, it is reasonable to infer that acquisitions undertaken by overconfident CEOs during waves are concentrated at the early stages of waves. The logic above leads to my first hypothesis:

Hypothesis 1a. *In acquisition waves, overconfident CEOs act earlier than other CEOs.*

Based on the above discussion, overconfident CEOs are prone to initiate acquisitions at the outset of waves when the pool of high-quality targets or targets with cospecialized assets is larger. Therefore, the returns to acquisitions undertaken by

overconfident CEOs during an acquisition wave are more likely to be higher than those undertaken by other CEOs. While overconfident CEOs are often criticized for making value-destroying acquisitions (Malmendier and Tate 2008) due to their tendency to overestimate the value of targets and overpay for them (Hayward and Hambrick 1997; Roll 1986), I contend that the situation is different in the context of acquisition waves. Acquisitions undertaken by overconfident CEOs during waves are mainly concentrated at the waves' onset, when the true values of the targets remain unrevealed, which allows acquirers to obtain strategic targets at lower costs (McNamara et al. 2008). Although overconfident CEOs may still pay higher premiums for these targets, given that the stock prices of these targets are low at that time, the capital market may not interpret these premiums as "overpayment", and therefore may not discount the acquirers' stock price. Therefore, I hypothesize as follows:

> ***Hypothesis 1b.*** *In acquisition waves, the returns to acquisitions undertaken by overconfident CEOs are higher than those undertaken by other CEOs.*

The preceding discussion suggests that the key mechanism through which overconfident CEO outperform others in acquisition waves is their speed, i.e., they act earlier than other CEOs. Overconfident CEOs excel in perceiving and identifying opportunities that arise from industry shocks, which enables them to make acquisition decisions swiftly and enter acquisition waves early. As noted previously, early movers benefit from market preemption in which they secure high-quality targets or targets with cospecialized assets with lower costs, which leads to higher returns to acquisitions. Therefore, I expect that acquirer action time (speed) mediates the positive relation between

CEO overconfidence and the returns to acquisitions in acquisition waves. I hypothesize as follows:

> ***Hypothesis 1c.*** *In acquisition waves, action time mediates the positive relation between CEO overconfidence and returns to acquisitions. Specifically, overconfident CEOs act earlier than other CEOs, which in turn increases the returns to acquisitions*.

2.2.3 Moderating Effect of Pre-wave Acquisition Experience

Behavioral learning theory assumes that organizational experience produces organizational routines, which can become a competitive advantage and serve significant roles in shaping the rules of strategic decision-making (Levitt and March 1988). Routines are essentially patterns of action that reflect the prior experience of an organization with particular tasks (Nelson and Winter 1982). As firms accumulate experience in a certain organizational routine, they develop expertise and competence, thereby becoming proficient in performing associated tasks (Anand et al. 2016).

In the context of acquisition, acquisition experience leads to the development of routines associated with the acquisition process (Haleblian et al. 2006), such as templates for selecting and evaluating targets or guidelines for post-acquisition integration. As the number of acquisitions increases, firms can exploit and refine routines that contribute most to their success and filter out less successful ones in the current setting (Cyert and March 1963; Vermeulen and Barkema 2001). As acquisition routines evolve, gains from deploying them become more accessible and transparent, which potentially prompts further acquisitions (Hayward, 2002). With gradually refined routines, firms can screen targets and conduct negotiations more efficiently, which facilitates the acquisition process. Firms with

more acquisition experience are exposed to a larger variety of acquisition events, which enables them to develop richer knowledge structures (Levinthal and March 1993; Levitt and March 1988, Zollo and Singh 2004).

However, I argue that routines developed by acquisition experience may reduce the role of CEO overconfidence in terms of acquisition speed. Acquisition routines contain formal procedures for screening and purchasing companies (Amburgey and Miner 1992; Paine and Power 1984), which likely constrain overconfident CEOs' improvisation (Brown and Eisenhardt 1997) and slow down their decision-making (Pavićević and Keil 2021). Formal procedures developed by previous experience may require extensive data collection and information processing (e.g., Fredrickson 1984), which include thoroughly processing essential due diligence information about targets that requires incremental deliberations over time. Moreover, formal procedures may mandate comprehensive analysis to evaluate and select targets (e.g., Wally and Baum 1994). Acquisition experience involves multiple steps to assess targets, which can be time-consuming and has the potential to frustrate overconfident CEOs that prefer to act quickly based on their own idiosyncratic assessments. Finally, formal procedures may require the extensive involvement of the board in the acquisition decision-making process. Established acquisition routines may require the board to seek and analyze decision input from a broad range of stakeholders (Judge and Miller 1991; Perlow et al. 2002) and confront an overconfident CEO if necessary (Schweiger et al. 1989). For example, the board can ask internal or external experts to provide opinions about the feasibility of an acquisition (Kim et al. 2011; Tversky and Kahneman 1974) and the suitable levels of acquisition integration (Pablo 1994).

Accordingly, overconfident CEOs that face formal acquisition routines and procedures as part of board oversight have to spend time to engage with experts, and their own views about acquisition become more limited as various viewpoints are incorporated into decision making rather than strictly their own.

Overall, although acquisition experience generally facilitates acquisitions, it diminishes the impact of overconfidence on action speed and subsequently on acquisition performance in acquisition waves. Therefore, I hypothesize as follows:

Hypothesis 2a. *In acquisition waves, pre-wave acquisition experience reduces the effect of CEO overconfidence on acquisition speed.*

Hypothesis 2b. *In acquisition waves, pre-wave acquisition experience reduces the effect of CEO overconfidence on acquisition performance.*

2.3 Research Method

2.3.1 Sample and Identification of Acquisition Waves

I collected data for this study from multiple sources. I used Excucomp database to build my sample of CEOs. The data set includes information on executives of S&P 1500 firms since 1992 (names, positions, compensation, options, etc.). I first identified CEOs of S&P 1,500 firms for the period from 1992 to 2018 through the Excucomp item "CEOANN". Then, I matched the sample of CEOs with the Compustat and CRSP databases to obtain information about firms' financial performance and stock market performance.

I used Securities and Data Corporation (SDC) database to build my sample of corporate acquisitions. Following prior studies (e.g., Hardford, 2005; McNamara et al. 2008), I considered all U.S. domestic acquisitions (both the acquirer and target are from

U.S.) from 1980 to 2018. I applied the following four steps to generate my final sample. Steps one and two were to generate the total number of acquisitions used for identifying acquisition waves, whereas steps three and four were to develop the final sample. Consistent with prior work, I excluded financial services industries (four-digit Standard Industrial Classification (SIC) codes starting with 6) since firms in these industries have different asset structures and acquisition strategies than other industries (Haleblian et al., 2012). In addition, I excluded transactions associated with repurchases, minority stake purchases, self-tender, as well as transactions in which the acquirer obtained less than 50% of the target's equity (e.g., Hayward and Hambrick 1997; Pavicevic and Keil 2021). These two steps resulted in a total of 132,368 completed acquisitions by 58,312 firms, which formed the basis for identifying acquisition waves. Consistent with prior work, I analyzed industry acquisition waves (e.g., McNamara et al. 2008; Haleblian et al. 2012) in which I calculated the number of completed acquisitions in each four-digit SIC industry by year. I then screened for relatively short periods—a maximum of six years—of intense acquisition activity[3]. If the number of acquisitions in the peak year of a period was at least twice as much as both those of the first and the last year of the period, I identified the period as an acquisition wave. This process produced 28 acquisition waves occurring in 28 industries, with a total of 5,503 completed acquisitions. The details of acquisition waves are shown in Table 9.

To analyze acquirer announcement returns, I focused on public firms, which reduced the sample to a total of 24,768 transactions. Finally, I matched these transactions

[3] My findings hold when I limit my waves to five- or four-year periods.

with a sample of CEOs, which resulted in 13,922 transactions, 625 of which occurred in acquisition waves. Hence, my sample included only acquisitions in which I was able to collect CEO-level data, and therefore, was not randomly selected. In the following analysis, I adopted a Heckman two-stage procedure to mitigate the potential concerns of sample selection bias.

Table 9 Description of Wave Industries

Acquirer SIC	Industry description	Wave Date Range	Total N	First Year N	Peak Year N	Last Year N
1389	Oil and Gas Field Services	2005-2009	110	14	38	7
2741	Miscellaneous Publishing	2004-2007	105	17	34	17
2752	Commercial Printing, Lithographic	1996-2000	115	16	37	8
3533	Oil and Gas Field Machinery and Equipment	1996-1999	64	11	27	10
3674	Semiconductors and Related Devices	1998-2002	499	59	156	65
3812	Search, Detection, Navigation, Guidance, Aeronautical	1997-2001	116	20	44	12
4841	Cable and Other Pay Television Services	1997-2001	276	32	91	36
4899	Communications Services	2002-2005	57	11	23	11
4924	Natural Gas Distribution	1997-2000	62	11	23	9
4953	Refuse Systems	1996-1999	408	57	163	60
5045	Wholesale-Computers and Peripheral Equipment and Software	1995-1998	147	23	73	29
5112	Stationery and Office Supplies	1995-1998	139	26	57	9
5113	Industrial and Personal Service Paper	1992-1996	102	12	38	3
5411	Retail-Grocery Stores	2002-2005	82	15	35	9
5511	Motor Vehicle Dealers	1996-2000	133	11	52	15
5912	Retail-Drug Stores and Proprietary Stores	1995-1999	224	26	64	26
5999	Miscellaneous Retail Stores	1999-2001	103	17	65	21
7011	Hotels and Motels	1995-1999	353	47	107	44
7359	Services-Equipment Rental and Leasing	1996-2000	207	28	81	18
7363	Help Supply Services	1995-1999	278	33	78	17
7375	Information Retrieval Services	1998-2001	1245	169	514	220
7812	Motion Picture and Video Tape Production	1999-2002	88	16	36	16
8071	Services-Medical Laboratories	2009-2012	69	12	26	12
8082	Services-Home Health Care Services	1994-1998	273	39	84	32
8721	Accounting, Auditing, and Bookkeeping Services	2000-2003	117	16	61	25
8731	Commercial Physical and Biological Research	1994-1997	69	12	28	11

2.3.2 Variables and Measurements

Dependent Variables

Action Time. Following Haleblian et al. (2012), I calculated the timing of firm action within an acquisition wave by dividing the number of days each acquisition announcement occurred after the first acquisition in a wave by the total number of days in the wave. Thus, this measure ranges from zero to one, with the first acquisition in the wave having the lowest value, and the last acquisition having the highest value. I used this ratio as the dependent variable because I aimed to capture the relative position of an acquisition within a wave. In the unreported analysis, I changed the dependent variable to the absolute number of days between an acquisition announcement date and the first acquisition date in a wave and obtained consistent results.

Cumulative Abnormal Returns (CAR). Studies on corporate acquisitions more commonly adopt the acquirer's cumulative abnormal returns around the acquisition announcement date to evaluate the performance of an acquisition (e.g., Malmendier and Tate 2008). Following prior work, I first calculated daily abnormal return as the difference between the raw return of a security and the market return, which was measured by CRSP value-weighted return (Bao and Edmans 2011; Malmendier and Tate 2008). Next, to determine the influence of an acquisition event on the acquirer, I calculated the cumulative abnormal returns as the averaged abnormal returns from three days before to three days after the announcement of an acquisition event. In the additional analysis, I repeated regressions using both shorter and longer windows to account for both possible information

leakage before announcements and any price adjustments after announcements (Carow et al. 2004; McWilliams and Siegel 1997) and obtained consistent results.

Independent Variables

CEO Overconfidence. I used CEO stock option holdings and exercising decisions to identify overconfident CEOs (Malmendier and Tate 2005, 2008; Banerjee et al. 2015). Malmendier and Tate (2015, p40) noted that "the most common approach to measuring CEO overconfidence has been to use decisions that the executive makes on his or her personal portfolio of company stock options." Kaplan et al. (2022) used detailed assessments of CEO personalities to show that the option-based measure of CEO overconfidence was significantly related to several specific characteristics that were typically associated with overconfidence, justifying the accuracy of this measure.

The basic logic is that under-diversified and risk-averse CEOs normally exercise their in-the-money options early. If a CEO persistently delayed the exercise of their in-the-money options, I inferred that he/she was overconfident in his/her ability to keep the firm's stock price rising and wanted to profit from expected price increases by holding the options. Hence, I first calculated the total value per option of in-the-money options as the total realizable value of exercisable options (Execucomp item: opt unex_exer_est_val) divided by the number of exercisable options (Execucomp item: opt_unex_exer_num). Next, I calculated the average percent value of in-the-money options by dividing the total value per option of in-the-money options by the stock price at the end of the fiscal year (Compustat item: prcc_f). If a CEO's average percent value of in-the-money options was in the top quartile of all CEOs in a given year, I assumed they exhibited overconfident

behavior in that year (Banerjee et al. 2015). I defined CEO Overconfidence as a binary variable that equaled 1 if a CEO was classified as overconfident in a given year, and 0 otherwise. In the additional analyses, I repeated regressions using an alternative measure of CEO Overconfidence based on CEO's stock purchases and obtained consistent results.

Pre-wave Acquisition Experience. Consistent with previous studies on acquisition experience (e.g., Haleblian and Finkelstein 1999), I operationalized Pre-wave Acquisition Experience as the natural logarithm of one plus the total number of acquisitions made by an acquirer from 1980 until the outset of the acquisition wave in which the acquirer was involved.

Control Variables

Several factors at CEO, firm, and deal level were included in the model to control their effects on acquisition performance. At the CEO-level, I included CEO Duality (a binary variable indicating whether the CEO was also the board chair), CEO Age (measured as the logarithm form of a CEO's age), CEO Tenure (measured as the logarithm of a CEO's tenure), CEO Bonus to Salary (measured by dividing a CEO's salary by his bonus), CEO Shares (measured as the logarithm form of a CEO's share percentage), CEO Vested Option (measured by dividing a CEO's number of unexercised exercisable options by common shares outstanding), and Female CEO (a binary variable indicating whether the CEO was a female), all of which could be correlated with the level of overconfidence and influence acquisition performance (Malmendier and Tate 2005, 2008).

At the firm-level, I controlled several factors which are found to influence acquisition behavior in waves (Haleblian et al. 2012). Research indicates that smaller firms

are more likely to conduct exploration (March 1991). Therefore, firm size may influence a firm's awareness of opportunities, which in turn influences its action time in acquisition waves (Haleblian et al. 2012). I used Total Assets (measured as the logarithm of a firm's total assets) to proxy for firm size. Research has found that firms with heavily technological development activities tend to be pioneers and early entrants in acquisition waves (Haleblian et al. 2012; Robinson and Chiang 2002; Schoenecker and Cooper 1998). I used R&D Spending (measured by dividing a firm's R&D spending by its total assets) to proxy for firm technology intensity. Since the higher financial slack and performance give a firm greater capability and legitimacy to act quickly in acquisition waves (Haleblian et al. 2012), I included Free Cash Flow (measured by dividing a firm's operation cash flow by its total assets) and ROA (measured by dividing a firm's net income by its total assets) in my models. In addition, I controlled several firm characteristics that may influence both acquisition performance and CEO overconfidence, including Capital Intensity (measured by dividing a firm's capital expenditures by its total assets), Intangible Assets (measured by dividing a firm's intangible assets by its total assets), Asset Turnover (measured by dividing a firm's sales by its total assets), Debts to Assets Ratio (measured by dividing a firm's long-term debts by its total assets), and Sales Growth (measured the ratio of a firm's sales by its lagged sales minus one (Haleblian et al. 2012; Harford, 2005; Malmendier and Tate 2008). All of the above firm-level variables were measured at the end of the year before the acquisition year.

I also controlled deal level factors that influence acquisition performance. Whether an acquisition is a diversified one or not influences the potential synergies between the

acquirer and the target (Beckman and Haunschild 2002). Consistent with this view, research shows that firms undertaking related acquisitions outperform those undertaking diversified acquisitions (Morck et al. 1990). I included Diversified Acquisition (a binary variable indicating that an acquirer and a target were in different industries based on 2-digit SIC code) to capture such effects. Carow et al. (2004) posited that the methods of payment used by acquirers were also likely to influence the relationship between the positions in the waves and acquisition performance. Cash Payment is often seen as a signal that the acquirers have great confidence in the acquisitions and that their shareholders could benefit from capital appreciation rather than being diluted with new shareholders in the targets (Eckbo et al. 1990; Myers and Majluf 1984). Therefore, acquisitions with payment of cash tend to outperform those with payment of stock. Accordingly, I included Cash Payment (a binary variable indicating that an acquirer used cash for part or the entirety of the transaction) to capture such effects. Studies show that whether the target is a public firm will influence acquisition performance (e.g., Banerjee et al. 2015). I included Public Target (a binary variable indicating the target is a public firm) to account for such effects. The attitudes underlying acquisitions are also expected to affect acquisition performance, as hostile acquisitions are likely to trigger target firms' response and resistance, leading to increased acquisition costs (Comment and Schwert 1995). I included Tender Offer (a binary variable indicating whether an acquisition started as a tender offer) to account for an acquirer's attitudes. In addition, targets would have higher bargaining power if they received more than one bid, which would lead to higher acquisition premiums and poor acquisition returns (Comment and Schwert 1995). Therefore, I included Multiple Bidders

(a binary variable indicating that there was more than one bidder for the target) to account for such effects.

Finally, I included several control variables to account for industry-specific factors and market conditions that may be related to acquisition behavior. I included industry binary variables to account for the systematic differences across the industries explored in the study (Haleblian et al. 2012). As firms highly valued by the capital market are more likely to conduct acquisitions (Rhodes-Kropf and Viswanathan 2004), I included Market to Book Ratio (measured by dividing an acquirer's market value at the end of the year before acquisition year by its book value of assets) and Run Up (an acquirer's accumulated abnormal return over 6 months before the acquisition announcement) to capture the acquirer's relative market valuation.

2.3.3 Analysis

My sample only included acquisitions that have CEO-level data, and therefore, was not randomly selected. To mitigate the potential concerns of sample selection bias, I adopted Heckman's two-stage procedure widely used in acquisition studies (e.g., Malhotra et al. 2015; Pavićević and Keil 2021). For all the completed acquisitions during the sample period, I created a dummy that equaled 1 if the acquisition was included in my sample and 0 otherwise. Next, I ran a first-stage probit model to estimate the likelihood an acquisition would be included in my sample by regressing this dummy on the set of firm level and deal level characteristics, including Total Assets, R&D Spending, Free Cash Flow, ROA, Capital Intensity, Intangible Assets, Asset Turnover, Debts to Assets Ratio, Sales Growth, Diversified Acquisition, Cash Payment, Public Target, Tender Offer, Multiple Bidders,

Market to Book Ratio and Run up. Then, I calculated the Inverse Mill's Ratio and included it in my second-stage regression models as an additional control variable.

My main analysis explores whether overconfident CEOs act earlier, and therefore, perform better than other CEOs in the acquisition waves. I first used the Tobit regression to test the hypotheses about time of action, as the dependent variable, Action Time, is censored at 0 and 1 (Haleblian et al. 2012).[4] Then, I used OLS regression to test hypotheses about acquisition performance. I used industry fixed-effect model to test my hypothesis, because it allowed us to account for idiosyncratic industry differences that are not captured by my control variables[5] (Haleblian et al. 2012). I obtained robust standard errors to account for the potential heteroskedasticity of the observations. In additional analysis, I combined within-wave observations with non-wave observations to explore whether overconfident CEOs perform better in acquisition waves than they do in other periods.

2.4 Empirical Results

Table 10 presents descriptive statistics and the correlation matrix. Overall, the correlations among variables are low. To further exclude the possibility of multicollinearity among valuables, I calculated variance inflation factors (VIF) to detect the presence of any multicollinearity. The average VIF for all variables in Panel A is 1.85, and the VIFs for individual variables range from 1.05 to 2.89, and the tolerance values range from 0.31 to 1.68. Therefore, I did not find evidence of multicollinearity in my sample.

[4] In my unreported analysis, I also turned *Action time* into a log form and ran OLS regression with industry-fixed effects, and the results are consistent.
[5] To ensure that my results are not driven by outliers, I winsorized all variables at 1% level.

Table 10 Summary Statistics and Correlation Matrix, 1992 to 2018

Summary Statistics and Correlation Matrix, 1992 to 2018

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Action Time	0.48	0.23	1													
2 CAR	0.00	0.09	-0.10	1												
3 CEO Overconfidence	0.59	0.49	-0.20	0.13	1											
4 Pre-wave Acquisition Experience (Ln)	1.33	1.16	-0.19	-0.02	0.15	1										
5 CEO Duality	0.20	0.40	0.15	-0.16	-0.25	-0.21	1									
6 CEO Age	3.98	0.15	-0.06	-0.05	0.06	0.42	0.06	1								
7 CEO Tenure (Ln)	1.87	0.69	0.08	-0.02	0.10	0.04	-0.01	0.45	1							
8 CEO Bonus to Salary	1.13	1.38	-0.02	-0.03	0.19	0.34	-0.05	0.29	-0.10	1						
9 CEO Shares (Ln)	-0.61	2.18	-0.11	-0.10	0.12	0.09	-0.19	0.03	0.37	-0.25	1					
10 CEO Vested Options	5.22	5.57	0.06	0.04	-0.06	-0.01	-0.04	0.07	0.05	0.04	-0.05	1				
11 Female CEO	0.00	0.04	0.07	-0.03	0.03	-0.05	-0.02	-0.04	0.01	-0.01	0.06	-0.04	1			
12 Total Assets (Ln)	7.26	1.52	0.16	-0.10	-0.26	0.16	0.29	0.23	-0.13	0.37	-0.37	-0.24	-0.08	1		
13 R&D Spending	0.04	0.07	0.03	0.11	0.07	-0.16	-0.02	-0.03	0.09	0.05	-0.20	0.08	-0.02	-0.01	1	
14 Free Cash Flow	0.29	0.23	-0.03	-0.12	0.07	-0.05	-0.06	-0.07	-0.09	0.09	0.08	0.01	-0.02	0.16	-0.19	1
15 ROA	0.08	0.10	-0.05	-0.07	0.23	0.04	-0.19	0.07	0.01	0.29	0.20	-0.08	0.01	-0.01	0.05	0.40
16 Capital Intensity	0.09	0.07	-0.05	0.00	0.20	-0.18	-0.19	-0.17	0.00	-0.01	0.06	0.09	-0.03	-0.13	0.15	0.28
17 Intangible Assets	0.39	0.43	0.05	0.00	0.12	-0.04	-0.16	-0.45	-0.14	-0.10	0.12	-0.09	0.02	-0.10	-0.32	0.18
18 Asset Turnover	1.59	1.24	-0.11	-0.01	0.02	-0.21	-0.20	-0.44	-0.15	-0.21	0.34	-0.18	0.04	-0.17	-0.24	0.33
19 Debts to Assets Ratio	0.31	0.30	-0.03	-0.07	0.04	-0.04	-0.08	-0.28	0.00	-0.34	0.44	-0.13	-0.04	-0.02	-0.36	0.17
20 Sales Growth	0.44	0.64	-0.01	0.09	0.24	-0.20	-0.37	-0.58	-0.14	-0.16	0.25	-0.11	-0.01	-0.29	-0.02	0.27
21 Diversified Acquisition	0.60	0.49	0.07	-0.06	-0.09	0.02	0.15	0.09	-0.06	0.10	0.05	-0.06	0.03	0.12	-0.02	0.02
22 Cash Payment	0.81	0.40	0.15	-0.02	-0.03	0.01	0.07	0.04	-0.08	0.03	0.05	-0.05	-0.08	0.03	-0.31	0.10
23 Public Target	0.08	0.26	-0.02	-0.08	-0.04	0.05	-0.02	0.06	0.00	0.08	-0.01	0.05	-0.01	0.11	0.07	0.03
24 Tender Offer	0.02	0.13	0.06	-0.06	-0.06	0.06	0.05	0.09	0.01	0.14	-0.02	-0.01	-0.01	0.12	0.04	-0.01
25 Multiple Bidders	0.00	0.06	0.05	-0.01	-0.07	0.05	0.04	0.07	0.02	0.03	-0.03	-0.03	0.00	0.06	-0.01	0.00
26 Market to Book Ratio	4.76	4.68	-0.07	0.07	0.41	-0.25	-0.18	-0.40	-0.11	0.02	0.05	-0.13	-0.02	-0.22	0.36	0.24
27 Run Up	0.04	0.37	-0.18	0.06	0.16	-0.03	-0.14	-0.12	-0.07	-0.02	0.09	-0.01	-0.02	-0.17	0.21	0.06

	15	16	17	18	19	20	21	22	23	24	25	26	27
15 ROA	1												
16 Capital Intensity	0.31	1											
17 Intangible Assets	-0.06	-0.11	1										
18 Asset Turnover	0.17	-0.01	0.50	1									
19 Debts to Assets Ratio	-0.11	0.03	0.53	0.37	1								
20 Sales Growth	0.15	0.20	0.61	0.60	0.44	1							
21 Diversified Acquisition	0.01	-0.21	-0.05	0.00	-0.02	-0.13	1						
22 Cash Payment	0.06	-0.16	0.15	0.10	0.11	0.02	0.11	1					
23 Public Target	0.06	0.05	-0.09	-0.04	-0.08	-0.03	0.00	-0.23	1				
24 Tender Offer	0.02	-0.03	-0.04	-0.05	-0.08	-0.08	0.03	0.00	0.47	1			
25 Multiple Bidders	-0.01	-0.05	0.00	-0.03	-0.02	-0.04	0.05	0.03	0.20	0.21	1		
26 Market to Book Ratio	0.29	0.24	0.38	0.30	0.20	0.51	-0.07	-0.10	-0.03	-0.04	-0.04	1	
27 Run Up	0.15	0.12	0.03	0.07	-0.02	0.17	-0.06	-0.15	0.05	-0.01	-0.01	0.37	1

Note: 625 observations. Correlations ≥0.01 or ≤−0.01 are significant at the 0.05 level.

Table 11 presents results to test my first set of hypotheses. I follow prior studies (e.g., Malhotra et al. 2015; Pavićević and Keil 2021) to adopt a Heckman two-stage regression to address the self-selection problem in my sample selection. Model 1 reports the results for the first-stage regression, which predicted the probability that an acquisition was included in the sample. The dependent variable is a dummy variable indicating whether the acquisition was included in the sample. I regressed this dummy variable on the firm-level and deal-level characteristics mentioned above. Then, I calculated the Inverse Mill's Ratio and included it in my second-stage regression models as an additional control variable.

Models 2-5 of Table 11 present the second-stage regression results. More specifically, Model 2 regresses CAR on Action Time to test the baseline hypothesis which proposes that acquirers who act earlier in waves have higher returns to acquisitions. The coefficient estimate of Action Time is negative and significant (β = -0.048, p = 0.002), which suggests acquirers benefit from the first-mover advantage in acquisition waves (Carow et al. 2004; McNamara et al. 2008). Model 3 regresses Action Time on CEO Overconfidence to test Hypothesis 1a, which proposes that overconfident CEOs act earlier in acquisition waves. In support of this hypothesis, the coefficient estimate of CEO Overconfidence is negative and significant (β = -0.088, p = 0.000); Model 4 regresses CAR on CEO Overconfidence to test Hypothesis 1b, which posits that in acquisition waves, overconfident CEOs have higher returns to acquisitions than other CEOs. The coefficient estimate of CEO Overconfidence is significantly positive (β = 0.022, p = 0.035), which supports Hypothesis 1b. In terms of economic significance, my results suggest that in

acquisition waves, overconfident CEOs act 8.8% faster and earn 2.2% higher returns than non-overconfident CEOs.

Next, I turn attention to the mediation effects of Action Time (Hypothesis 1c). The result of the mediation analysis is presented in Model 5 in which CAR was regressed on CEO Overconfidence, Action Time, and the control variables. The results show that the coefficient on CEO Overconfidence is positive and significant (β =0.018, p =0.083), which shows that within acquisition waves, overconfident CEOs are associated with higher acquisition returns than non-overconfident CEOs. More importantly, the magnitude and significance level of the coefficient (β =0.018, p=0.083) are lower than those in Model 4 (β =0.022, p=0.035), which is consistent with Action Time mediating the relationship between CAR and CEO Overconfidence. I further tested this relationship by performing a Sobel (1982) test, which also shows that Action Time is a significant mediator variable (Sobel test p=0.038). In the additional analysis, I used an alternative measure of CEO Overconfidence to repeat the analysis, and the results remain robust.

Table 11 Regression Results for Testing Hypothesis 1

Variables	Model 1 An Acquisition Was Included	Model 2 CAR	Model 3 Action Time	Model 4 CAR	Model 5 CAR
CEO Overconfidence			-0.088***	0.022**	0.018*
			(0.023)	(0.010)	(0.010)
Action Time		-0.048***			-0.043***
		(0.016)			(0.016)
Pre-wave Acquisition Experience (Ln)		-0.009	-0.083***	-0.006	-0.009
		(0.007)	(0.013)	(0.006)	(0.007)
CEO Duality		-0.017	0.054**	-0.021*	-0.019
		(0.012)	(0.027)	(0.012)	(0.012)
CEO Age		-0.002	-0.141	-0.002	-0.008
		(0.048)	(0.100)	(0.049)	(0.048)
CEO Tenure (Ln)		0.003	0.036**	0.002	0.003
		(0.007)	(0.017)	(0.007)	(0.007)
CEO Bonus to Salary		-0.002	-0.002	-0.003	-0.003
		(0.004)	(0.009)	(0.004)	(0.004)
CEO Shares (Ln)		-0.004	0.000	-0.004	-0.004
		(0.003)	(0.007)	(0.003)	(0.003)
CEO Vested Options		0.001	0.005***	0.001	0.001
		(0.001)	(0.002)	(0.001)	(0.001)
Female CEO		-0.038	0.600***	-0.070**	-0.044
		(0.032)	(0.206)	(0.032)	(0.032)
Total Assets (Ln)	0.716***	0.005	0.047***	0.005	0.007
	(0.010)	(0.008)	(0.014)	(0.008)	(0.008)
R&D Spending	0.079	-0.130	-0.427	-0.066	-0.086
	(0.136)	(0.149)	(0.286)	(0.154)	(0.151)
Free Cash Flow	-0.001	-0.058**	-0.167***	-0.048**	-0.055**
	(0.001)	(0.023)	(0.054)	(0.023)	(0.024)
ROA	0.201***	-0.046	0.014	-0.047	-0.046
	(0.033)	(0.064)	(0.115)	(0.065)	(0.064)
Capital Intensity	0.593***	-0.091	-0.195	-0.078	-0.086
	(0.093)	(0.081)	(0.162)	(0.083)	(0.081)
Intangible Assets	-0.177***	-0.018	0.070*	-0.020	-0.017
	(0.031)	(0.022)	(0.037)	(0.021)	(0.021)
Asset Turnover	0.077***	0.001	-0.031	0.002	0.001
	(0.010)	(0.012)	(0.019)	(0.012)	(0.012)
Debts to Assets Ratio	-1.028***	-0.026	-0.001	-0.031	-0.031
	(0.044)	(0.024)	(0.060)	(0.025)	(0.025)
Sales Growth	-0.021**	0.029*	0.070**	0.022	0.025
	(0.010)	(0.015)	(0.031)	(0.016)	(0.016)
Diversified Acquisition	-0.025	0.003	0.054***	0.000	0.002
	(0.025)	(0.008)	(0.018)	(0.008)	(0.008)
Cash Payment	-0.059**	0.008	0.080***	0.004	0.007
	(0.027)	(0.010)	(0.023)	(0.010)	(0.010)
Public Target	0.101**	-0.027	-0.027	-0.025	-0.026
	(0.050)	(0.016)	(0.037)	(0.017)	(0.016)
Tender Offer	0.207*	-0.013	0.062	-0.014	-0.011
	(0.119)	(0.025)	(0.070)	(0.025)	(0.025)
Multiple Bidders	0.018	0.036	0.145	0.033	0.039
	(0.198)	(0.027)	(0.145)	(0.024)	(0.026)
Market to Book Ratio	0.003	0.002	0.006*	0.000	0.001
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Run Up	0.107***	-0.002	-0.061**	0.002	0.000
	(0.028)	(0.014)	(0.025)	(0.014)	(0.014)
Inverse Miller's Ratio		0.010	-0.083*	0.014	0.011
		(0.033)	(0.046)	(0.032)	(0.032)
Constant	-4.799***	0.019	0.850**	-0.014	0.021
	(0.304)	(0.193)	(0.397)	(0.197)	(0.193)
Observations	24786	625	625	625	625
(Pseudo) R-squared	0.462	0.13	9.159	0.125	0.134
Adjusted R-squared		0.057		0.053	0.062

Note: Robust SE parentheses; * p<0.1, ** p<0.05, *** p<0.01

Table 12 presents the second-stage regression results of testing the second set of Hypotheses. Model 1 tests Hypotheses 2a, which proposes that pre-wave acquisition experience reduces the effects of CEO overconfidence on acquisition speed in acquisition waves. In support of Hypothesis 2a, the coefficient of the interaction term between CEO Overconfidence and Pre-wave Acquisition Experience significantly predicts Action Time ($\beta = 0.105$, $p = 0.000$). Model 2 tests Hypothesis 2b, which proposes that pre-wave acquisition experience reduces the effects of CEO overconfidence on acquisition performance in acquisition waves. In support of Hypothesis 2b, the coefficient estimate of the interaction term between CEO Overconfidence and Pre-wave Acquisition Experience significantly predicts CAR ($\beta = -0.018$, $p = 0.008$). In terms of economic significance, these results suggest that in acquisition waves, a one standard deviation (S.D.) increase of pre-wave experience from zero substantially slows down overconfident CEOs' action speed by 49.39% (=(0.247-(0.105*1.16-0.247))/0.247)) and correspondingly reduces the returns induced by CEO overconfidence by 42% (=(0.050-(0.050-0.018*1.16))/0.050), showing the limiting effect of acquisition experience in the context of overconfident CEO in acquisition waves.

Table 12 Regression Results for Testing Hypothesis 2

	Model 1	Model 2
Variables	Action Time	CAR
CEO Overconfidence (a)	-0.247***	0.050***
	(0.038)	(0.018)
Pre-wave Acquisition Experience (Ln) (b)	-0.142***	0.004
	(0.017)	(0.008)
(a) x (b)	0.105***	-0.018**
	(0.020)	(0.008)
CEO Duality	0.063**	-0.022*
	(0.026)	(0.012)
CEO Age	-0.205**	0.009
	(0.099)	(0.049)
CEO Tenure (Ln)	0.034**	0.002
	(0.017)	(0.007)
CEO Bonus to Salary	-0.013	-0.001
	(0.009)	(0.004)
CEO Shares (Ln)	-0.003	-0.004
	(0.007)	(0.003)
CEO Vested Options	0.005***	0.001
	(0.002)	(0.001)
Female CEO	0.665***	-0.081**
	(0.202)	(0.034)
Total Assets (Ln)	0.060***	0.002
	(0.014)	(0.008)
R&D Spending	-0.418	-0.067
	(0.280)	(0.154)
Free Cash Flow	-0.192***	-0.043*
	(0.053)	(0.024)
ROA	0.064	-0.056
	(0.114)	(0.065)
Capital Intensity	-0.089	-0.096
	(0.160)	(0.083)
Intangible Assets	0.104***	-0.026
	(0.037)	(0.022)
Asset Turnover	-0.010	-0.001
	(0.019)	(0.012)
Debts to Assets Ratio	-0.039	-0.024
	(0.059)	(0.025)
Sales Growth	0.057*	0.024
	(0.030)	(0.016)
Diversified Acquisition	0.048***	0.001
	(0.018)	(0.008)
Cash Payment	0.075***	0.005
	(0.022)	(0.010)
Public Target	-0.031	-0.024
	(0.036)	(0.017)
Tender Offer	0.063	-0.014
	(0.069)	(0.025)
Multiple Bidders	0.219	0.02
	(0.143)	(0.027)
Market to Book Ratio	0.009***	0.000
	(0.003)	(0.002)
Run Up	-0.048**	0.000
	(0.024)	(0.014)
Inverse Miller's Ratio	-0.047	0.008
	(0.046)	(0.032)
Constant	1.098***	-0.058
	(0.392)	(0.198)
Observations	625	625
(Pseudo) R-squared	10.042	0.132

Note: Robust SE parentheses; * p<0.1, ** p<0.05, *** p<0.01

2.5 Additional Analysis

2.5.1 Alternative Measure of CEO Overconfidence

I demonstrate the robustness of results with an alternative stock-based measure of CEO Overconfidence. Specifically, I created a behavioral measure based on a CEO's net buying of company stock. The underlying assumption is that risk-averse CEOs tend to limit their investments in the equity of their own companies. If a CEO continued to purchase his own company's stock but ex post suffered loss, I inferred that the CEO was overconfident in his ability to keep his company's stock price rising. Following Malmendier and Tate (2005) and Kolasinski and Li (2013), I classified a CEO as overconfident if the CEO had increased his company's holdings over the past year and experienced negative returns in the following three years. Table 13 presents the results of analysis using the stock-based measure of CEO Overconfidence. In Model 1, the coefficient estimate of the stock-based measure of CEO Overconfidence helps to predict Action Time (β = -0.126, p = 0.000), which is in support of Hypothesis 1a. In Model 2, the coefficient estimate of the stock-based measure of CEO Overconfidence helps to predict CAR (β = 0.025, p = 0.015), which is in support of Hypothesis 1b. In Model 3, the effect of the stock-based measure of CEO Overconfidence on CAR is smaller when Action Time is included (β = 0.020, p = 0.051), which is in support of Hypothesis 1c.

Table 13 Regression Results Using Alternative Measure of CEO Overconfidence

	Model 1	Model 2	Model 3
Variables	Action Time	CAR	CAR
CEO Overconfidence_Stock	-0.126***	0.025**	0.019*
	(0.022)	(0.010)	(0.011)
Action Time			-0.044***
			(0.016)
Pre-wave Acquisition Experience (Ln)	-0.074***	-0.008	-0.011*
	(0.013)	(0.006)	(0.007)
CEO Duality	0.045*	-0.020	-0.018
	(0.027)	(0.013)	(0.012)
CEO Age	-0.182*	0.019	0.011
	(0.102)	(0.050)	(0.049)
CEO Tenure (Ln)	0.027	0.002	0.003
	(0.018)	(0.007)	(0.007)
CEO Bonus to Salary	0.002	-0.003	-0.003
	(0.010)	(0.004)	(0.004)
CEO Shares (Ln)	0.001	-0.004	-0.004
	(0.007)	(0.003)	(0.003)
CEO Vested Options	0.006***	0.000	0.001
	(0.002)	(0.001)	(0.001)
Female CEO	0.553***	-0.049	-0.025
	(0.205)	(0.032)	(0.032)
Total Assets (Ln)	0.043***	0.004	0.006
	(0.014)	(0.008)	(0.008)
R&D Spending	-0.232	-0.153	-0.165
	(0.283)	(0.151)	(0.149)
Free Cash Flow	-0.172***	-0.053**	-0.061**
	(0.054)	(0.023)	(0.024)
ROA	0.078	-0.08	-0.077
	(0.117)	(0.067)	(0.066)
Capital Intensity	-0.202	-0.080	-0.089
	(0.165)	(0.085)	(0.084)
Intangible Assets	0.068*	-0.012	-0.010
	(0.039)	(0.022)	(0.022)
Asset Turnover	-0.040**	0.006	0.004
	(0.019)	(0.013)	(0.013)
Debts to Assets Ratio	0.010	-0.028	-0.028
	(0.061)	(0.025)	(0.025)
Sales Growth	0.031	0.032**	0.034**
	(0.031)	(0.016)	(0.015)
Diversified Acquisition	0.056***	0.002	0.004
	(0.018)	(0.008)	(0.008)
Cash Payment	0.067***	0.006	0.009
	(0.023)	(0.011)	(0.010)
Public Target	-0.025	-0.026	-0.027*
	(0.037)	(0.017)	(0.016)
Tender Offer	0.083	-0.020	-0.016
	(0.070)	(0.026)	(0.026)
Multiple Bidders	0.151	0.032	0.038
	(0.144)	(0.026)	(0.029)
Market to Book Ratio	0.005*	0.001	0.001
	(0.003)	(0.002)	(0.002)
Run Up	-0.059**	0.001	-0.002
	(0.025)	(0.014)	(0.014)
Inverse Miller's Ratio	-0.095**	0.004	0.000
	(0.047)	(0.032)	(0.031)
Constant	1.047**	-0.085	-0.04
	(0.407)	(0.197)	(0.193)
Observations	606	606	606
(Pseudo) R-squared	13.438	0.131	0.140

Note: Robust SE parentheses; * p<0.1, ** p<0.05, *** p<0.01

2.5.2 Alternative Acquisition Announcement Windows

In my main analysis, I calculated the CAR as the averaged abnormal returns over the three days surrounding the announcement of an acquisition event. To increase robustness and account for potential pre-announcement information leakage and post-announcement price adjustments, I repeated regressions for testing Hypothesis 1b using both shorter and longer windows, including (-1, +1), (-2, +2), (-4, +4) and (-5, +5). Table 14 presents the results using alternative acquisition announcement windows. The coefficient estimates of CEO Overconfidence predict CARs across all windows, which is consistent with Hypothesis 1b.

Table 14 Regression Results Using Alternative Acquisition Announcement Windows

	Model 1	Model 2	Model 3	Model 4
Variables	CAR (-1, +1)	CAR (-2, +2)	CAR (-4, +4)	CAR (-5, +5)
CEO Overconfidence	0.016**	0.020*	0.024**	0.029**
	(0.008)	(0.010)	(0.011)	(0.012)
Pre-wave Acquisition Experience (Ln)	0.001	-0.005	-0.011*	-0.01
	(0.005)	(0.006)	(0.007)	(0.007)
CEO Duality	-0.012	-0.024*	-0.016	-0.006
	(0.011)	(0.012)	(0.014)	(0.015)
CEO Age	-0.015	-0.047	0.022	0.098
	(0.036)	(0.047)	(0.055)	(0.062)
CEO Tenure (Ln)	0.011*	0.005	-0.001	-0.004
	(0.006)	(0.007)	(0.008)	(0.008)
CEO Bonus to Salary	-0.002	-0.001	-0.001	-0.002
	(0.003)	(0.004)	(0.004)	(0.005)
CEO Shares (Ln)	-0.004	-0.005	-0.004	-0.005
	(0.003)	(0.004)	(0.003)	(0.004)
CEO Vested Options	0.001	0.001	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Female CEO	-0.026	-0.073*	-0.075**	-0.036
	(0.030)	(0.038)	(0.034)	(0.038)
Total Assets (Ln)	0.003	0.004	0.003	0.003
	(0.006)	(0.007)	(0.008)	(0.009)
R&D Spending	-0.073	-0.045	-0.067	-0.132
	(0.130)	(0.160)	(0.168)	(0.200)
Free Cash Flow	-0.039	-0.043*	-0.050*	-0.013
	(0.027)	(0.023)	(0.029)	(0.037)
ROA	0.000	-0.053	-0.057	-0.16
	(0.059)	(0.070)	(0.071)	(0.098)
Capital Intensity	-0.027	-0.038	0.046	0.034
	(0.067)	(0.090)	(0.090)	(0.103)
Intangible Assets	-0.030*	-0.027	-0.026	-0.024
	(0.016)	(0.023)	(0.022)	(0.028)
Asset Turnover	-0.001	0.000	-0.002	0.004
	(0.013)	(0.013)	(0.012)	(0.013)
Debts to Assets Ratio	-0.034	-0.026	-0.038	-0.061*
	(0.022)	(0.024)	(0.027)	(0.035)
Sales Growth	0.034***	0.029*	0.021	0.036**
	(0.012)	(0.017)	(0.016)	(0.017)
Diversified Acquisition	0.001	0.003	0.000	0.002
	(0.006)	(0.008)	(0.008)	(0.010)
Cash Payment	-0.001	0.004	0.005	-0.016
	(0.009)	(0.011)	(0.011)	(0.013)
Public Target	-0.037**	-0.035*	-0.025	-0.041**
	(0.017)	(0.019)	(0.019)	(0.020)
Tender Offer	-0.004	-0.016	-0.009	0.01
	(0.023)	(0.025)	(0.026)	(0.029)
Multiple Bidders	0.015	0.044**	0.021	0.005
	(0.015)	(0.022)	(0.021)	(0.028)
Market to Book Ratio	-0.002	-0.001	0.000	0.000
	(0.002)	(0.002)	(0.002)	(0.002)
Run Up	-0.007	0.001	0.013	0.01
	(0.012)	(0.016)	(0.015)	(0.018)
Inverse Miller's Ratio	0.014	0.011	0.01	0.026
	(0.022)	(0.035)	(0.033)	(0.034)
Constant	0.024	0.166	-0.095	-0.396*
	(0.137)	(0.183)	(0.222)	(0.238)
Observations	625	625	624	624
R-squared	0.165	0.136	0.11	0.122

Note: Robust SE parentheses; * p<0.1, ** p<0.05, *** p<0.01

2.5.3 Overpayment of Overconfident CEOs

Prior work has argued that overconfident CEOs tend to overpay for their targets, which leads to negative acquisition returns (Hayward and Hambrick 1997). I argue that acquisitions undertaken by overconfident CEOs during waves are mainly concentrated at the beginning of waves when the true values of the targets have not been revealed and acquirers can obtain strategic targets at lower costs (McNamara et al. 2008). Therefore, the capital market may not perceive the premiums as "overpayment", and consequently, may not discount the acquirers' stock price. To further examine this assertion, I include Acquisition Premium as a control variable and test my hypothesis in the subsample of public targets. I operationalized Acquisition Premium as the initial offer price divided by target's share price 1 week prior to the announcement date, minus one. I re-ran the regression for Hypothesis 1a and 1b in the subsample of public targets. Table 15 presents the results. In Model 1, the coefficient estimate CEO Overconfidence helps to predict Action Time ($\beta = -1.003$, $p = 0.000$). In Model 2, the coefficient estimate of the stock-based measure of CEO Overconfidence helps to predict CAR ($\beta = 0.210$, $p = 0.021$). Therefore, my results hold after controlling for the acquisition premium.

Table 15 Regression Results Adding Acquisition Premium

	Model 1	Model 2
Variables	Action Time	CAR
CEO Overconfidence	-1.003***	0.210**
	(0.058)	(0.074)
Acquisition Premium	0.406***	-0.023
	(0.060)	(0.071)
Pre-wave Acquisition Experience (Ln)	0.192***	-0.116**
	(0.026)	(0.039)
CEO Duality	0.653***	-0.303***
	(0.051)	(0.056)
CEO Age	-0.736**	-1.115***
	(0.227)	(0.302)
CEO Tenure (Ln)	0.093***	0.073**
	(0.018)	(0.022)
CEO Bonus to Salary	-0.176***	-0.009
	(0.016)	(0.023)
CEO Shares (Ln)	-0.132***	-0.048*
	(0.019)	(0.025)
CEO Vested Options	0.035***	-0.050***
	(0.008)	(0.011)
Total Assets (Ln)	0.125***	-0.058
	(0.035)	(0.045)
R&D Spending	-3.897***	0.607
	(0.379)	(0.591)
Free Cash Flow	-0.682**	1.000**
	(0.251)	(0.352)
ROA	1.089***	-1.281**
	(0.309)	(0.493)
Capital Intensity	-0.482*	0.660*
	(0.245)	(0.336)
Intangible Assets	1.289***	0.473**
	(0.132)	(0.190)
Asset Turnover	-0.071	-0.221**
	(0.067)	(0.095)
Debts to Assets Ratio	-1.709***	0.065
	(0.132)	(0.156)
Sales Growth	0.362***	-0.057
	(0.040)	(0.039)
Diversified Acquisition	0.097***	-0.017
	(0.023)	(0.038)
Cash Payment	0.088***	0.002
	(0.021)	(0.028)
Tender Offer	-0.043	0.077
	(0.033)	(0.046)
Multiple Bidders	0.179***	0.047
	(0.040)	(0.041)
Market to Book Ratio	0.049***	-0.036*
	(0.010)	(0.016)
Run Up	0.091*	0.135***
	(0.042)	(0.039)
Inverse Miller's Ratio	-1.316***	0.049
	(0.213)	(0.256)
Constant	3.200**	6.257***
	(1.198)	(1.854)
N	42	42
(Pseudo) R-squared	-10.695	0.933

Note: Robust SE parentheses; * p<0.1, ** p<0.05,

2.5.4 Endogeneity Concerns

One important concern is that my estimates could be biased due to the omission of some confounding variables which affect both acquisition performance and CEO overconfidence. For example, there could be some unobservable firm level factors that enable overconfident CEOs to obtain private information and thereafter make good acquisitions. Alternatively, my measure of CEO overconfidence may simply capture a CEO's low ability, since "low ability might cause a CEO to be unable to figure out when it is the optimal to exercise options and thus to mistakenly hold on to options for longer" (Kaplan et al. 2022: 410). If these were the cases, I should expect that the acquisition performances of overconfident CEOs are similar in waves and outside waves. I combined the within wave acquisitions with the non-wave acquisitions and created a dummy, Wave, to indicate that an acquisition is within a wave. Then, I re-ran the OLS regression with the interaction term of Wave and CEO Overconfidence in the combined sample. Table 16 presents the results. The interaction term of Wave and CEO Overconfidence helps predict the CAR ($\beta = -0.016$, $p = 0.022$), which suggests that overconfident CEOs perform better within waves than outside waves. Therefore, I can exclude such possibilities.

Table 16 Regression Results Using Within Waves and Outside Waves Sample

Variables	CAR
CEO Overconfidence x Wave	**0.016****
	(0.007)
CEO Overconfidence	0.001
	(0.001)
Wave	-0.010*
	(0.005)
Pre-wave Acquisition Experience	-0.001
	(0.001)
CEO Duality	-0.002
	(0.002)
CEO Age	0.001
	(0.006)
CEO Tenure (Ln)	-0.002
	(0.001)
CEO Bonus to Salary	0.001
	(0.001)
CEO Shares (Ln)	0.001
	(0.001)
CEO Vested Options	0.000*
	0.000
Female CEO	-0.006
	(0.004)
Total Assets (Ln)	-0.001
	(0.001)
R&D Spending	-0.019
	(0.023)
Free Cash Flow	-0.001
	(0.004)
ROA	-0.02
	(0.016)
Capital Intensity	-0.029*
	(0.017)
Intangible Assets	-0.002
	(0.004)
Asset Turnover	0.003
	(0.002)
Debts to Assets Ratio	0.002
	(0.005)
Sales Growth	0.000
	(0.003)
Diversified Acquisition	-0.002
	(0.001)
Cash Payment	0.000
	(0.002)
Public Target	-0.017***
	(0.003)
Tender Offer	0.011***
	(0.004)
Multiple Bidders	-0.007
	(0.008)
Market to Book Ratio	0.000
	(0.001)
Run Up	-0.001
	(0.004)
Inverse Miller's Ratio	0.006
	(0.005)
Constant	-0.04
	(0.028)
Observations	13922
R-squared	0.045

Note: Robust SE parentheses; * p<0.1, ** p<0.05, *** p<0.01

Another possibility is that overconfident CEOs were self-selected into certain industries and made more acquisitions, which caused acquisition waves in these industries. To exclude such a possibility, I calculated the percentage of overconfident CEOs in each industry and tested whether industries that have higher percentages of overconfident CEOs are more likely to experience acquisition waves. My results show the percentage of overconfident CEOs in an industry cannot predict the occurrence of acquisition wave in that industry.

I performed another two tests to further address endogeneity concerns. First, I followed prior research (e.g., Chatterjee and Hambrick 2007, 2011; Schumacher et al 2020; Tang et al., 2018) and regressed the option-based measure of CEO overconfidence on a set of firm-level controls (Total Assets, R&D Spending, Free Cash Flow, ROA, Capital Intensity, Intangible Assets, Asset Turnover, Debts to Assets Ratio, and Sales Growth) as well as year and industry fixed effects. Then I calculated the predicted probability of CEO overconfidence and included it in the main regressions as another control. The coefficient estimates of CEO Overconfidence are consistent with my main results.

Second, I used the propensity score match method (Rosenbaum and Rubin 1983) to pair each overconfident CEO with a non-overconfident CEO based on the set of control variables used in the main test. After one-to-one matching, I obtained a treated sample of 197 overconfident CEOs and a control sample of 197 non-overconfident CEOs. Then I calculated the difference (s) in Action Time (CAR) between an overconfident and the matched non-overconfident CEO. Rather than relying on assumed distributions of differences, I used bootstrapped standard errors to conduct statistical inference (Lee and

Wahal 2003). The bootstrapping is based on 50 replications. My results show that, with the propensity score match method, overconfident CEOs on average act 9.3% (p=0.000) faster and earn 1.7% (p=0.066) higher returns than non-overconfident CEOs, which are consistent with my main results.

2.6 Discussion

2.6.1 Theoretical Contributions

Since prior work has shown that CEO overconfidence harms acquisition performance, I set to consider a possible context in which CEO overconfidence shows merits. Accordingly, I examined overconfident CEO acquisition behavior in acquisition waves. The motivations and the requirements for action speed for acquisitions occurring in waves are different from acquisitions occurring in other periods. I considered whether CEO overconfidence that is unfavorable in the context of general acquisitions becomes an advantage in the specific case of acquisition waves. Consistent with my hypothesis, I found that overconfident CEOs are more likely to capture preemption opportunities by acting earlier in acquisition waves. Moreover, during these acquisition waves, the returns to acquisitions undertaken by overconfident CEOs are higher than those by other CEOs. Furthermore, I explored the moderating effects of CEO acquisition experience on CEO behaviors in acquisition waves and found that the role of CEO overconfidence in acquisition speed and performance is mitigated if the firm has more pre-wave acquisition experience.

My study contributes to the literature on corporate acquisitions in several aspects. First, I contribute to the discussion on the relationship between CEO overconfidence and

acquisition performance. Roll (1986) came up with the hubris hypothesis of corporate targets, which holds that hubris decision makers tend to overpay for their acquisition targets. Empirically, Hayward and Hambrick (1997) found that hubristic CEOs paid larger acquisition premiums, reducing the shareholder wealth for the acquiring firms. Furthermore, Malmendier and Tate (2008) argued and found that overconfident CEOs overestimated the synergies generated from takeover, leading them to undertake more acquisitions than other CEOs in which the average value created in their acquisition was lower than other CEOs. Overall, prior studies converge on the notion that CEO overconfidence is detrimental to corporate acquisitions. However, I reveal the relationship between CEO overconfidence and acquisition performance is contingent on the acquisition context and during acquisition waves, overconfidence, rather than being an unfavorable characteristic becomes an advantage.

Second, I contribute to the literature on acquisition waves. Scholars in the finance area have explored the industry characteristics, like market overvaluation (Shleifer and Vishny 2003; Rhodes-Kropf and Viswanathan 2004), economic, regulatory, and technological shocks (Mitchell and Mulherin 1996), as well as macro-level liquidity (Harford, 2005), that drive acquisition waves. Scholars in strategic management focused on the manner in which firms outperform others during merger waves. For example, Carow et al. (2004) and McNamara et al. (2008) found that the acquirers' returns would be higher if they participate earlier in merger waves. Using the competitive dynamic framework, Haleblian et al. (2012) investigated firm-level characteristics that influence firms' participation and competitiveness in acquisition waves. I extended this line of research by

exploring beyond industry and firm level factors to show that CEO level characteristics influence acquirer performance in acquisition waves.

In addition, my paper also contributes to the organizational learning and experience literature. The existing research in this area suggests acquisition experience helps to build up acquisition routines, which makes firms more efficient in performing acquisitions. For example, Vermeulen and Barkema (2001) argued that acquisition experience broadens firms' knowledge and decreases inertia, which enhances the viability of their later ventures. Similarly, Zollo and Singh (2004) found that acquisition experience led to knowledge codification, which positively influenced acquisition performance. More recent research specified the conditions in which acquisition experience benefits firms' subsequent acquisition performance. In particular, Hayward (2002) found that acquisition experience benefited acquisition performance if prior acquisitions were moderately similar to current acquisitions. Building on this line of research, while routines likely increase information searched and slows decision processes, my study identified a context in which acquisition experience becomes a disadvantage. Namely, during acquisition waves, acquisition experience reduces the benefits of CEO overconfidence as decision speed is critical to making successful acquisitions in waves.

2.6.2 Limitations and Future Research

This study has several caveats that offer opportunities for future research. First, I argue that overconfident CEOs act earlier during acquisition waves because of their faster decision-making mode. However, my arguments are based on the psychology literature on overconfidence, and I am unable to provide data about overconfident CEOs' decision-

making process. A separate and fruitful line of future research could consider collecting data on CEOs' decision-making speed to see whether overconfident CEOs reach decisions more quickly. This will better illustrate the mechanisms of my hypotheses. Second, I investigate acquisition waves after 1992, as the Execucomp dataset only provides CEO level data after 1992. However, there were several large and famous acquisition waves occurring during the 1980s. These waves were marked by hostile acquisitions, junk bond financing, and "megadeals". I suggest that scholars could collect CEO level data during that period to test whether my results still hold.

Overconfident CEOs have been frequently criticized for making value-destroying activities (e.g., Kim et al 2016; Schrand and Zechman 2012). However, research shows that overconfident managers are more likely to be promoted to CEOs under value-maximizing corporate governance (Goel and Thakor 2008), and a large proportion of CEOs in firms share traits of overconfidence. For instance, Malmendier and Tate (2005) showed that, out of a sample of 1,200 CEOs between 1980 and 1994, 895 (74.6 %) were considered overconfident by the market. In Campbell et al. (2011)'s large sample of 3,352 CEOs between 1992 and 2006, 34.1% were classified as overconfident. This counterintuitive reality prompts management scholars to explore the broader advantage of CEO overconfidence. My study identifies acquisition waves as a context in which CEO overconfidence becomes an advantage. I hope that my study creates discussion among scholars that examine CEO overconfidence to consider boundary conditions in which CEO overconfidence can benefit, rather than harm, firms.

Chapter 3 Overconfident Venture Capitalist

3.1 Introduction

Overconfidence refers to the general belief that individuals have knowledge and abilities superior to their peers', which leads them to overestimate the likelihood that desirable outcomes will occur (Griffin and Varey, 1996). As one of the most robust findings in the psychology of judgment (DeBondt and Thaler, 1995), overconfidence is even more ubiquitous among CEOs and entrepreneurs (Malmendier and Tate, 2005). Researchers in entrepreneurship found that overconfident entrepreneurs were more likely to explore the environment rather than imitate others (Bernardo and Welch, 2001), underestimate the risks and start venture with smaller resource endowments (Hayward, Shepherd, and Griffin, 2006), all of which increased the likelihood that their ventures would fail.

Venture capitals (VCs) are critical participants in entrepreneurship. As significant equity holders in a venture (Sahlman, 1990), VCs provide strategic resources (Hochberg, Ljungqvist, and Lu, 2007) and monitor the entrepreneurs (Lerner, 1995; Gompers, 1996; Bernstein, Giroud, and Townsend, 2016) to help the venture succeed. A typical VC is led by an individual venture capitalist (Gompers, Mukharlyamov, and Xuan, 2016).[6] Researchers have explored how a venture capitalist's biographic characteristics (Gompers, et al, 2016), gender (Calder-Wang, and Gompers, 2021; Gompers, Mukharlyamov, Weisburst, Xuan, 2022), networks (cc), reputation (Nahata, 2008; Krishnan, Ivanov, Masulis, and Singh; 2011), investment experience (Lungeanu, and Zajac, 2016), as well as

[6] Based on the VC data in VentureXpert, the organization structure of a VC is similar to that of a corporation. A typical VC has a president, a CEO, or a chairman, who oversees all funds. I regard them as venture capitalists.

the collaboration history with other VCs within a syndicate (Zhelyazkov and Gulati, 2016; Wang, Pahnke, and McDonald, 2022) influence the outcome of a venture. However, considering the deep involvement of VCs in the process of entrepreneurship, it is surprising that no one explores how venture capitalists' overconfidence influences their investment decisions and their nurturing of private companies. I believe that overconfidence exists among venture capitalists for three reasons. First, venture capitalists may inherit overconfidence from their previous entrepreneurship experience. Second, the process of VC backed entrepreneurship makes the attribution of credits ambiguous and causes self-attribution bias (Hayward and Hambrick, 1997; Hilary and Menzly,2006), which is one common source of overconfidence. Third, the highly uncertain environment of entrepreneurship is quite likely to develop overconfidence (Hayward, Shepherd, and Griffin, 2006).

In this study, I investigate the influence of overconfidence on venture capitalists in two levels, VCs and private companies. In the VC-level, I explore how overconfidence influences venture capitalists' investment decisions and performances. I hypothesize that after experiencing success, venture capitalists tend to attribute the credits to their own abilities and foster overconfidence, which leads to inferior investment decisions and poor investment performances. Correspondingly, I found that venture capitalists have higher investment performance on their first fund, as they had not experienced success, and therefore, had not fostered overconfidence. However, venture capitalists whose previous funds had extraordinarily higher IPO performance than other VC funds founded in the same year tend to perform relatively worse in their current funds. To further identify the

mechanisms behind these dynamics, I explore whether venture capitalists will change their investment strategies after experiencing success. A VC usually has its own expertise in certain company stages or certain industries, and therefore, is more likely to specialize investments in its own expertise niches (Hochberg, Ljungqvist, and Lu, 2007; Gompers, Kovner and Lerner, 2009; Lungeanu and Zajac, 2016). However, I found that after experiencing extraordinarily higher IPO performance in their previous funds, VCs are more likely to invest in private companies beyond their own expertise in their current funds. The results are consistent with overconfident venture capitalists more willing to explore their environment (Bernardo and Welch, 2001), while contradicted with behavior learning theory, which assumes that good firm performances lead to behavior persistence (e.g., Miller and Chen, 1994). To further confirm the role of venture capitalist overconfidence in driving the dynamic changes of VCs' investment performance, I explore the moderating effects of venture capitalists' contribution on their portfolio companies and their prior investment experience. I hypothesize that if venture capitalists are just free riders but succeed, then their self-attribution bias will be more serious. Correspondingly, I found that if VCs' previous funds only join in the last round of private companies but enjoy huge success (IPO), or the VCs' previous funds invested little on their private companies, then their current fund performed even worse. Furthermore, I hypothesize that experience mitigates overconfidence (Hayward, Shepherd, and Griffin, 2006). Accordingly, I found that the overconfidence of venture capitalists is mitigated if they have more investment experience.

A private company is backed by a syndicate of VCs, and the group of lead VCs within the syndicate has greater influence on the entrepreneur's decision making (Sahlman,

1990). Therefore, in the private company level analysis, I explore how the percentage of overconfident venture capitalists within lead VCs in a syndicate influences the fate of the private company. A VC's proceeds come from two sources: IPO and acquisition of its portfolio companies, with the proceeds of the former multiple times higher than those of the latter (Gompers, Kovner, Lerner, and Scharfstein, 2008). As overconfidence makes people overestimate the probability that desirable outcomes will occur (Griffin and Varey, 1996), I hypothesize that overconfident venture capitalists overestimate the likelihood of IPO of their portfolio companies, and therefore, are more likely to hold their portfolio companies for IPO and give up acquisition opportunities. I identified a private company as a missed target if the private company could have the opportunities of being acquired, but it forwent the acquisition, and failed to go IPO, either. I found that a private company backed by a syndicate with a higher percentage of overconfident lead venture capitalists is more likely to be a missed target.

There are two streams of methodologies in defining overconfidence. The first stream of methodologies is based on ex ante performance. Scholars in this stream assume that higher previous performance induces overconfidence. For example, Hayward and Hambrick (1997) and Billett and Qian (2008) found that good past performance made CEOs overconfident. Hilary and Menzly (2006) found that analysts who forecasted earnings more accurately than the median analyst in the previous quarters developed overconfidence, which led to poor quality in their subsequent predictions. The second stream of methodologies is based on the ex post behaviors. Scholars in this stream infer what overconfident agents will do, and then identify agents as overconfident if they show

such behaviors. For example, Malmendier and Tate (2005) inferred that overconfident CEOs would postpone the exercise of stock options. Therefore, they identified CEOs as overconfident if they persistently delayed the exercise of their in-the-money options. Kolasinski and Li (2013) inferred that CEOs overconfident about their companies' future profitability would increase their stock holdings of their companies. Thus, they identified CEOs who increased stock holdings of their own company but suffered loss subsequently as overconfident. In this study, I combined the logic of these two streams in one context, venture capital and entrepreneurship. I hypothesize and confirm that past success makes venture capitalists become overconfident and that overconfident venture capitalists are more likely to make their portfolio companies become missed targets, with the latter confirm the validity of the former "success-based" overconfidence measure. Finally, in the robustness tests, I identified a group of venture capitalists who were, or had been top executives in S&P 1500 companies and used the option-based measure (Malmendier and Tate, 2005) to identify the overconfident venture capitalists among them. My robustness tests showed that these option-based overconfident venture capitalists are more likely to have missed targets.

This paper contributes to the area of entrepreneurship by extending the study of overconfidence from entrepreneurs to venture capitalists. Scholars in this area has explored the behavior pattern of entrepreneurs (Bernardo and Welch, 2001; Hayward, Shepherd, and Griffin, 2006; Navis and Ozbek, 2016) and CEOs (e.g. Roll, 1986; Hayward and Hambrick, 1997; Malmendier and Tate, 2005, 2008; Billett and Qian, 2008). In particular, Hayward, Shepherd, and Griffin (2006) developed a hubris theory of entrepreneurship, which

assumed that entrepreneurs acted on overconfidence when interpreting information and allocating resources, leading to higher failure rates of their ventures. However, how the overconfidence of venture capitalists, who are critical participants in entrepreneurship, influences the outcome of ventures is rarely discussed. This study fills in this gap.

3.2 Theory and Hypothesis

3.2.1 Venture Capital Investments

Venture capitals (VCs) are specialized financial intermediaries that invest in the equity of entrepreneurial ventures to monitor and cultivate them until their IPO or being sold to other acquirors (Lerner, 1995; Gompers, 1996; Wright and Robbie, 1998; Cumming and Walz, 2010; Bernstein, Giroud, and Townsend, 2016). VCs usually form a syndicate to co-invest in a private company (Lerner, 1994), and those who participate in the first financing round of the private company are considered as lead VCs (Nahata, 2008). A syndicate creates more values for a private company, as each VC within the syndicate can provide complementary resources, such as financial, human and social capital, to the private company (Zhelyazkov and Tatarynowicz, 2021), which increases its success rate (Tian, 2012). The success of a venture depends on the cooperation and joint efforts of all VCs within the syndicate, and therefore, is difficult to attribute to certain venture capitalists.

Independent VCs are usually organized as limited liability partnership, whereby limited partners[7] provide the capital and general partners, who are typically regarded as venture capitalists, establish funds with the capital and oversee the investments of all funds.

[7] Limited partners are typically institutional investors, including banks, insurance companies, pension funds, as well as governments (Sahlman, 1990; Sammut, 2011).

The typical life span of most VC funds is set to be 10 to 12 years (Sahlman, 1990; Dimov and Gedajlovic, 2010), within which venture capitalists seek promising targets, invest and nurture them, and push them to go public or sell them to other companies. During the liquidation stage of VC funds, the proceeds from IPOs or acquisitions are returned to limited partners. A VC is likely to establish a follow-up fund several years after the founding of the previous fund, if its previous fund performs well (Lee and Wahal, 2003). Table 17 presents ABS Capital Partners as an example. It shows that ABS Capital Partners founded its first fund in 1993. With the extraordinary exit rate of around 75% of its first fund, ABS Capital Partners was able to raise several follow-up funds in 1996, 1999, and so on. From 1993 to 2012, ABS Capital Partners raised 7 funds in total.

Table 17 Example

Fund Name	Fund Year	Last year	IPO	Acquisition	Performance
ABS Capital Partners, L.P.	1993	2001	0.500	0.250	0.750
ABS Capital Partners II, L.P.	1996	2001	0.278	0.111	0.333
ABS Capital Partners III, L.P.	1999	2006	0.188	0.313	0.500
ABS Capital Partners IV, L.P.	2000	2015	0.259	0.259	0.519
ABS Capital Partners V, L.P.	2005	2013	0.063	0.375	0.438
ABS Capital Partners VI, L.P.	2009	2015	0.200	0.300	0.500
ABS Capital Partners VII, L.P.	2012	2021	0.000	0.188	0.188
ABS Capital Partners VIII, L.P.	2016	2021	0.000	0.000	0.000

3.2.2 Overconfidence and Investment Performance

Overconfidence refers to the general belief that individuals have knowledge and abilities superior to their peers', which leads them to overestimate the likelihood that desirable outcomes will occur (Griffin and Varey, 1996). According to DeBondt and Thaler (1995), "Perhaps the most robust finding in the psychology of judgment is that people are overconfident." There are at least three aspects in which overconfidence will induce biased decision making. First, overconfident people are reluctant to invest in information production and overestimate the quality of their own information (Goel and Thakor, 2008). Therefore, they tend to act on their own information and ignore the actions of other individuals (Anderson and Holt, 1996; Bernardo and Welch, 2001). Second, overconfident people tend to underestimate the risk of their decision situations (Camerer and Lovallo, 1999; Gervais and Odean; 2001), as they tend to overestimate their problem-solving abilities (Griffin and Varey, 1996; Hayward, Shepherd, and Griffin, 2006;), underestimate the resource endowments that their environments require (Shane and Stuart 2002) and underestimate the uncertainties of their surroundings. Third, overconfident people tend to exhibit the bias of self-attribution, in the sense that they are more likely to attribute events that confirm the validity of their own actions to their ability while attributing events that disconfirm their actions to external noise (Hayward and Hambrick, 1997; Hilary and Menzly, 2006; Billett and Qian, 2008).

Scholars in entrepreneurship and finance find that overconfidence exists ubiquitously among entrepreneurs and CEOs. Overweighting their private information, overconfident entrepreneurs are less likely to imitate others and more willing to explore

their environment (Bernardo and Welch, 2001). Underestimating the risk of their ventures and exaggerating the utility of their unique personality and leadership skills, overconfident entrepreneurs tend to start their ventures with less resource endowments, care less about IP protection from their competitors, and reduce the liquidity of their ventures, all of which increase the likelihood of failures (Hayward, Shepherd, and Griffin, 2006). Navis and Ozbek (2016) further argued that overconfidence benefited entrepreneurial entry but was detrimental to the realization of venture opportunities. Empirically, scholars find that overconfident CEOs tend to overinvest (Malmendier and Tate, 2005), overpay in acquisitions (Roll, 1986; Hayward and Hambrick, 1997; Malmendier and Tate, 2008), ignore negative feedback (Chen, Crossland, and Luo, 2015; Schumacher, Keck, and Tang, 2020), and cause stock crash (Kim, Wang, and Zhang, 2016).

I argue that overconfidence also exists among venture capitalists for three reasons. First, venture capitalists may inherit overconfidence from their previous entrepreneurship experience. Venture capitalists are often referred to as "entrepreneurs behind the scenes", as many of them are, or once were successful entrepreneurs, CEOs, or top executives in corporations. For example, Neil Shen, who is the chairman of Sequoia Capital, China and is also considered as the most successful venture capitalist in China, founded two public companies and took them to IPOs successfully before his VC career. If they are overconfident when they are CEOs, it is reasonable to believe that they will bring overconfidence to their VC career. Second, the process of VC backed entrepreneurship is more likely to induce self-attribution bias, which is one common source of overconfidence. The success of a venture is the result of the joint efforts of entrepreneurs and the syndicate

of VCs behind, which makes the attribution of credits ambiguous and causes self-attribution bias. Individuals subject to self-attribution bias tend to over-attribute their roles in success and over-attribute external factors or bad luck to failures (Hayward, Shepherd, and Griffin, 2006; Hilary and Menzly, 2006). The enormous return of a successful venture (via IPO) will make individual venture capitalist subject to self-attribution bias so that he may believe that it is his insights and management capabilities that lead to the success of the venture, even if he may just be a free rider. Third, the highly uncertain environment of entrepreneurship is quite likely to develop overconfidence. Predictions tend to be overconfident when the target outcome is rare, when the evidence available is only weakly diagnostic, and/or when predictions are made with high confidence (Lichtenstein et al. 1982, Vallone et al. 1990). Ventures routinely fail (Hayward, Shepherd, and Griffin, 2006), and VCs write off 75.3% of their investments on average (Ljungqvist, Richardson, and Wolfenzon, 2005). The highly uncertain environment of entrepreneurship provides limited and noisy information to venture capitalists for their decision making, which develops their overconfidence.

Consider a venture capitalist who begins investments without overconfidence, but develops overconfidence based on his outstanding investment performance and self-attribution bias. When he establishes his first fund, his estimate of investment opportunities is unbiased, and he is more likely to invest in private companies consistent with his own expertise (Sapienza and Timmons, 1989). After he develops overconfidence, his estimate of the investment opportunity is too optimistic and exceeds the true value. Therefore, self-

attribution bias predicts that venture capitalists' first funds should not exhibit overconfidence, while their subsequent funds, as a whole, will. Therefore, I hypothesize:

> ***Hypothesis 1.*** *VCs' first funds have better investment performance than their follow-up funds.*

There are reasons to believe that a venture capitalist's previous success will foster overconfidence. Research on attributions (e.g., Kelley, 1971; Meindl, Ehrlich, and Dukerich, 1985) has found a strong propensity to credit leaders with success even when such success could more objectively be attributed to other factors, and such attributions become more accentuated as success becomes more pronounced (Meindl, Ehrlich, and Dukerich, 1985). In the context of VC, the successful IPOs of private companies will bring venture capitalists enormous returns and prestige (Nahata,2008; Reuer, Tong, and Wu, 2012), making them place undue faith in the efficacy of their investment skills, even becoming caricatures of their former selves (Miller and Chen, 1994; Hayward and Hambrick, 1997).

There are three mechanisms in which overconfidence dampens venture capitalists' investment performance. First, overconfidence makes venture capitalists over optimistic about the investment opportunities. Overconfident individuals always overestimate the likelihood that desirable outcomes will occur (Griffin and Varey, 1996; Hayward et al., 2006). Consistent with this, researchers have shown that overconfident CEOs tend to overinvest (Malmendier and Tate, 2005) and make more acquisitions (Malmendier and Tate, 2008; Billett and Qian, 2008). In the context of VC investment, overconfident venture

capitalists are more likely to ignore due diligent process (Pavicevic and Keil, 2021) and negative feedback before investment, and overinvest in inferior ventures (Schumacher, Keck, and Tang, 2020), which leads to poor investment performance. Second, overconfident venture capitalists are more likely to do more exploration (Bernardo and Welch, 2001) and invest in private companies beyond their expertise. A danger of previous success is that venture capitalists may become susceptible to strategic "simplicity"-relying on a narrow and rigid formular for investments and management of portfolio companies (Miller, 1993). Negative performance can result from the transfer of VCs' expertise to private companies in which the previous experiences do not apply (Barkema and Schijven, 2008). Third, overconfidence breeds arrogance (Chatterjee and Hambrick, 2007), which makes cooperation among VC firms difficult. Success reinforces the venture capitalist's stature within its current syndicate. The more successful the venture capitalist, the more likely he will develop patterns of belief (Festinger, 1954) and justification (Staw, McKechnie, and Puffer, 1983) that support his preexisting premises or "givens" (March and Simon, 1958). Besides, self-attribution bias makes venture capitalists outweigh their private information (Hilary and Menzly, 2006), while ignore the information from other VC firms in the same syndicate. Consequently, the investment performance of their next funds is more likely to be lower, compared to what it would have been without this self-attribution bias. Based on the above discussion, I hypothesize:

> ***Hypothesis 2.*** *VCs' high IPO performance of previous fund will reduce the performance of their current funds.*

3.2.3 Mediating Role of VC-Company Fit

The development of a private company usually goes through several stages, including seed, early stage, expansion, later stage, and acquisition or IPO. A VC usually specializes in one or two stages of development of private companies, solving stage-specific problems (Sapienza and Timmons, 1989). Although several VC firms may undertake tentative investments in stages of development beyond their expertise, the better fit of stage between a private company and the VCs back it increases the success rate of the private company (Lungeanu and Zajac, 2016). However, after experiencing short periods of successful investments, venture capitalists who are subject to self-attribution will tend to mistakenly credit ex post success to their own ability. "Success" from prior investment experience therefore leads to overconfidence (Billett and Qian, 2008), which makes them more likely to explore their environment (Bernardo and Welch, 2001), investing in private companies beyond their expertise. Accordingly, I hypothesize:

> ***Hypothesis 3***. *VCs' high IPO performance of previous funds will reduce the degree of stage-fit between the VCs and private companies invested by their current fund, which in turn mediates the negative relation between VCs' high IPO performance of previous funds and the performance of their current funds.*

A VC usually has expertise in one or two specific industries (Hochberg, Ljungqvist, and Lu, 2007; Gompers, Kovner and Lerner, 2009; Lungeanu and Zajac, 2016). In the same way, overconfidence makes venture capitalists explore ventures in industries beyond their expertise (Bernardo and Welch, 2001). With their familiarity with the specific market segments of their prior ventures, venture capitalists may fail to appreciate the industry-

specific actions and norms, including strategic profiles that new ventures require. Accordingly, I hypothesize:

> ***Hypothesis 4.*** *VCs' high IPO performance of previous fund will reduce the degree of industry-fit between the VCs and private companies invested by their current fund, which in turn mediates the negative relation between VCs' high IPO performance of previous fund and the performance of their current funds.*

3.2.4 The Moderating Roles of Contribution and Experience

Although most syndications are formed in the first investment rounds of private companies (Zhang, Gupta, and Hallen, 2017), many VC firms join in each successive funding round (Lerner, 1994; Zhang and Guler, 2020), adding new resources that may satisfy the evolving needs of private companies. Some VC firms join in the last investment rounds of private companies, the rounds which are just before the companies go public or are sold to other companies. The contributions of such "last-round" VC firms to the success of the ventures are not comparable to those of other VC firms who invest in the early rounds and then stay with the private companies, monitoring and nurturing them for many years. However, the enormous returns of IPOs may make these "last-round" venture capitalists forget their role as "free riders" and over-credit the success to themselves, strengthening the self-attribution bias, and therefore, the degree of overconfidence. Therefore, I hypothesize:

> ***Hypothesis 5.*** *The negative relation between VCs' high IPO performance of previous funds and the performance of their current funds is strengthened if the VCs' previous funds have more successful "last-round" investments.*

In the same sense, if VCs only invest little in the portfolio companies, the venture capitalists can also be regarded as free riders. If the portfolio companies succeed finally, the venture capitalists' self-attribution bias will also be strengthened. Therefore, I hypothesize:

> ***Hypothesis 6.*** *The negative relation between VCs' high IPO performance of previous funds and the performance of their current funds is strengthened if the VCs' previous funds invest less on their portfolio companies.*

Declines in overconfidence occur when actors maintain their confidence in judgment and become more skilled, say, through greater experience (Hayward, Shepherd, and Griffin, 2006). Therefore, I expect the degree of overconfidence can be mitigated if venture capitalists have more investment experience.

> ***Hypothesis 7.*** *The negative relation between VCs' high IPO performance of previous funds and the performance of their current funds is weakened if the VCs have more investment experience.*

3.2.5 Company-Level Analysis

A private company is backed by a syndicate of VCs, and the group of lead VCs within the syndicate has greater influence on the entrepreneur's decision making (Sahlman, 1990). Therefore, in the private company-level analysis, I explore how the percentage of overconfident venture capitalists within lead VCs in a syndicate influences the fate of the private company. A VC's proceeds come from two sources: IPO and acquisition of its portfolio companies, with the proceeds of the former multiple times higher than those of

the latter (Gompers, Kovner, Lerner, and Scharfstein, 2008). As overconfidence makes people overestimate the probability that desirable outcomes will occur (Griffin and Varey, 1996), I hypothesize that overconfident venture capitalists overestimate the likelihood of IPO of their portfolio companies, and therefore, are more likely to hold their portfolio companies for IPO and give up acquisition opportunities. I defined a private company as *Missed target* if the private company could have the chance of being acquired, but it forwent the acquisition, and failed to go IPO, either. Accordingly, I hypothesize:

> ***Hypothesis 8.*** *The percentage of overconfident venture capitalists within lead VCs in a syndicate is positively related to the likelihood that the private company is a Missed target*.

3.3 Research Method

3.3.1 Data and Sample

I collected data from VentureXpert, the most comprehensive data set of VC investment. It includes information about the characteristics of VC firms, VC investments, as well as private companies. The dataset distinguishes between VC firms (parental firms) and VC funds. A VC firm may have several closed-ended and limited partnerships VC funds founded in different years, each one of which has a life span of approximately 10 years. On the other hand, a private company may go through several financing rounds, each one of which consisting of one or more VC funds from different VC firms. In line with previous research, I only included U.S. based VC firms and private companies and excluded non-VC forms of private equity funds, such as mezzanine, leveraged buyouts funds, angel funds, and so on (Sorenson & Stuart, 2001, 2008; Zhelyazkov & Gulati, 2016).

I only included VC funds founded from 1985 to 2010[8]. As I needed to compare the performances of different VC funds founded in different years within the same VC firm, I deleted VC firms that only have one VC fund and VC firms that only have several VC funds that all established in the same year. All of the above procedures left us a total of 1,096 VC firms and 4,419 VC funds investing in 34,598 portfolio companies.

3.3.2 Variables and Measurements

Dependent Variables

Current Fund Performance. Ideally, I should use a fund's return over its life span as a measure of its performance directly. However, most VCs only disclosed the returns of their funds to their investors. Therefore, the direct measurements of VC fund performances were not available in VentreXpert. Ljungqvist et al. (2005) found that VC funds wrote off 75.3% of their investments on average, which suggested that a VC fund obtained majority of its proceeds from a small set of portfolio companies who exited through IPOs or being acquired by other companies. Thus, a VC fund's exit rate is positively associated with its return, and therefore, can be taken as an indirect measure of the fund's performance. I operationalized the exit rate of a VC fund as the ratio of the number of portfolio companies that were successfully exited through going public or being acquired by another company to the total number of portfolio companies invested by the VC fund (Hochberg, Ljungqvist, and Lu, 2007; Nahata, 2008). For example, the first fund of VC firm, ABS Capital, invested

[8] I started in 1985 for two reasons. First, VC as an investment asset class only began to attract institutional investors since 1985 (Hochberg, Ljungqvist, and Lu, 2007). Second, previous studies indicated that the investment data in VentureXpert before 1985 was incomplete. I closed in 2010 to provide at least 10 years (life span of most VC funds) of operation for youngest VC funds.

in a total of 12 private companies from 1993 to 2001, with 6 of them finally going IPO and 2 of them being acquired by other companies. Therefore, the first fund of ABS Capital had a surprisingly high exit rate of 67%.

Stage Fit. A VC's expertise of stage is evolving chronologically with its investment experience (Lungeanu and Zajac, 2016). Therefore, I identified a VC's expertise of stage in one given year based on its cumulated stage experience from previous investments. VentureXpert classifies a private company's development into six stages: Start up, Early, Expansion, Real Estate, Buy out and Later. I assumed that once a VC invested in a private company of certain stage, it obtained the expertise of that stage, and such expertise stayed with the VC in its subsequent investment years. If a VC has accumulated expertise of several stages in one year, then I chose the stage that the VC had most experience as the VC's expertise of stage. While I identified a VC's expertise of stage at firm level, I measured the degree of fit between the VC and its portfolio companies at fund level (Hochberg, Ljungqvist, and Lu, 2007). For each VC fund, I identified the stages of the portfolio companies in which the fund invested for the first time and compared them with the fund's parental firm's expertise of stage at the year before the investment. Then, I operationalized the variable *Stage Fit* as the ratio of the number of the fund's portfolio companies whose stage was the same as its parental firm's expertise of stage to the total number of the fund's portfolio companies. For example, by the year 1999, ABS Capital had invested in 3 companies in the Early stage, 10 companies in Later stage, 13 companies in Buy out stage, and 23 companies in Expansion stage. Therefore, ABS Capital's expertise of stage in 2000 is Expansion. The experience in Expansion stage continued to outweigh

experience in other stages in the subsequent years until 2013, when the experience in Later stage outweighed the experience in Expansion stage. Therefore, ABS Capital's expertise of stage changed to Later in 2013 and stayed in Later in the subsequent years. On the other hand, in 2000, ABS Capital established its fourth fund, ABS Capital Partners IV, which invested in a total of 27 private companies from 2000 to 2006, with 12 private companies in Expansion stage and 15 private companies in other stages. Therefore, the *Stage fit* of the VC fund, ABS Capital Partners IV, was 0.44.

Industry Fit. The calculation of *Industry Fit* was similar to that of *Stage Fit*. VentureXpert classifies all the private companies into 18 industries, including Transportation, Utilities, Computer Software, and so on. Once a VC invested in a private company in a certain industry, it obtained the expertise of that industry. Such industry expertise stayed with the VC in its following investment years. In the same way as the treatment of *Stage Fit*, I selected the industry that VC had most experience in one given year as the VC's expertise of industry if the VC had experience in several industries in that year. For each VC fund, I identified the industries of the portfolio company-rounds in which the fund invested and compared them with the fund's parental firm's expertise of industry at the year before the investment. Then, I operationalized the variable *Industry Fit* as the ratio of the number of the fund's portfolio company-rounds whose industry was the same as its parental firm's expertise of industry to the total number of company-rounds that the VC funds invested. [9]

[9] The treatment here is a little different from that of *Stage fit*. As a VC fund may invest in a private company many times over several years, during which the company's stage may have changed. Therefore, I only

Missed Target. I defined a portfolio venture as a missed target if the portfolio venture both failed to go IPO and missed the opportunity of being acquired. I used three filters to identify missed targets. First, the portfolio venture was never acquired but had similar characteristics to other portfolio ventures that were acquired. I identified 78,130 U.S. VC-backed private ventures in the VentureXpert database. After excluding 5,977 ventures that went public, as well as ventures whose detailed information was missing, we had a sample of 43,634 portfolio ventures, with 7,865 of them acquired by other ventures. We used the propensity score match method (Rosenbaum & Rubin, 1983) to match each portfolio venture that was never acquired with a portfolio venture that was acquired based on a set of instrumental variables. Following previous studies, we included a series of factors influencing a portfolio venture's likelihood of being acquired as instrumental variables, including growth potential (e.g., Wansley, Lane, & Yang, 1983), management efficiency (e.g., Danbolt, Siganos, & Tunyi, 2016; Tunyi, Ntim, & Danbolt, 2019), information asymmetry (e.g., Ambrose & Megginson, 1992a; Taussig & Hayes, 1968), as well as industry characteristics (Gompers & Xuan, 2006). Private ventures do not have a P/E ratio, which is frequently used to measure their growth potential. Instead, we used *Number of VCs* (measured as number of VC firms investing in the venture) and *Total Investment Amount Received* (measured as the logarithm form of total capital invested by all VC firms) to proxy for a portfolio venture's growth potential, as VCs are more likely to participate and invest more in the ventures which they consider having high potential. VCs'

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included portfolio companies in which the fund invested for the first time when calculating the *Stage Fit*. However, the company's industry does not change over time. Thus, I include all company-rounds that the VC fund invested when calculating the *Industry Fit*.

early involvement and board representations will improve a venture's governance and management efficiency (Lerner, 1994). Accordingly, I included *VC Board Representation* (a binary variable indicating VCs sent representation on a portfolio venture's board) and *VC Early Involvement* (a binary variable indicating VCs invested in a venture at its early stage). To capture the degree of information asymmetry, we included *Big 4 Auditor* (a binary variable indicating a portfolio venture had a Big 4 auditor), *Lawyer* (a binary variable indicating the portfolio venture had a lawyer), *Bank* (a binary variable indicating a portfolio venture financed from banks), and *Valuation Disclosure* (a binary variable indicating a portfolio venture disclosed its valuation after each financing round). To capture the effect of industry characteristics, we included *High-tech* (a binary variable indicating a portfolio venture was in the high-technology industry) and a set of industry dummies (based on 4-digit SIC codes). In addition, we include *Maturity Phases* (a binary variable indicating a private venture had entered maturity phases), a set of state dummies (indicating the state in which a portfolio venture is located)[10]. I used STATA 16.0 to conduct the propensity score match (STATA command: psmatch2). After a one-to-one match, I obtained 7,864 portfolio ventures that were never acquired but had similar characteristics to other portfolio ventures that were acquired.

[10] All of these variables were constructed from variables in the VentureXpert. VentureXpert contains information on venture capitalists within a VC firm and top executives and directors of the VC firm's portfolio companies. We identified whether a VC firm sent representation on a portfolio venture's board by checking whether the venture capitalists also stayed on the portfolio venture's board. The information on venture stages came from the variable "Venture Stage Level at each Round". We classified "Early Stage" and "Startup/Seed" as early stages and "Buyout/Acquisition", "Expansion", and "Later Stage" as maturity phases. The industry classification was based on "Venture Industry Class", which denoted whether an industry was high technology one or not. In addition, the information on *Big 4 Auditor, Lawyer, Bank, Valuation Disclosure* and state dummies came from "Venture Auditor", "VE Lawyer Description", "VE Banker Description", "Disclose Venture Valuation" and "Venture Location", respectively.

Secondly, the portfolio venture had entered the maturity phases (based on VentureXpert classification) and was confronted with the choice of going IPO or being acquired. Some portfolio ventures that met the first filter criteria were still early-stage start-ups and never entered the maturity phases within our sample period. The qualities of these ventures were far from the criteria for IPO, even if they had a high likelihood of being acquired. Therefore, they are not in the scope of our analysis. These two filters produced 5,992 missed targets.

To be noted, based on the definition of missed target, a venture that missed the opportunities of being acquired is because the VCs backing it compelled it to go IPO and prevent it from being acquired. However, there could be other reasons for a venture not to be acquired. In particular, entrepreneurs choose to stay alone and do not want their ventures to be acquired. But this is contradicted by VC interests, which can only be realized through IPO or acquisition. As a VC firm typically has extensive control rights in their portfolio ventures (e.g., Kaplan & Stromberg, 2003), we assume that the entrepreneurs will follow VCs' orders to choose between going IPO or being acquired. Nevertheless, to increase the robustness, I added a third filter, which requires that a VC firm can control the venture. I argue that a VC firm can control a portfolio venture through two mechanisms both by being involved in the portfolio venture at its early stage, and by sending representatives to the portfolio venture's board.

A VC firm that provides entrepreneurs with initial investments at the venture's seed or early stage has increased influence over the venture's operation, since a venture at the seed or early stage typically has limited resources endowments. A VC firm involved in this

stage helps entrepreneurs build up the fundamentals of the venture, such as recruiting and compensating key talent, engaging suppliers and customers, establishing tactics and strategies, and structuring transactions such as acquisitions (Warne, 1988; Sahlman, 1990). Therefore, entrepreneurs who receive early-stage VC investments begin operations knowing that they may be compelled to follow VC advice. If entrepreneur operations deviate from the VC firm's interests, the VC firm can easily withdraw from the relationship and shut down operations completely. In addition, a venture at the seed or early stage leaves more room for the VC firm to implement staging capital in which the VC firm reserves the right to stop investments and abandon a venture if the entrepreneurs' operations contradict the VC firm's interests (Gompers, 1996). By denying continuing capital, the VC firm signals to other capital providers that the venture in question does not deserve further investments (Shafi, Mohammadi, & Johan, 2020). Therefore, the credible threat to abandon a venture is an important mechanism for a VC firm to discipline entrepreneurs and constrain their misuse of capital. The staging capital is more threatening for entrepreneurs at the venture's early stages than at later stages, as at later stages the entrepreneurs' relationships with customers, suppliers, and capital providers are stable and cannot be easily broken up.

A VC firm with representation on the portfolio venture's board usually controls the board and is more actively involved in governance than public venture directors and public shareholders (Kaplan & Stromberg, 2009). VC representation can devise compensation schemes to provide venture managers with appropriate incentives so that they can act consistent with VC interests (Sahlman, 1990) in which they can replace top management

teams and structure smaller boards of directors with a mix of insiders, VC investors, and outsiders to ensure more effective monitoring (Gompers, 1996; Gompers, Kaplan, & Mukharly, 2016; Hellmann, 1998; Lerner, 1995). In addition, VCs often use protective provisions or veto rights to mitigate decisions made by entrepreneurs that could negatively influence their investment (Kaplan & Stromberg, 2003). Finally, board representation enables a VC firm to initiate significant transactions such as acquisitions, IPOs, and dissolutions (Fried & Ganor, 2006), which ensure the direction of venture development is consistent with VC interests. The third filter, which requires Both *VC Early Involvement* and *VC Board Representation* equaled 1, reduced the number of missed targets to 1182.

Independent Variables

First Fund. As the fund sequence information in VentureXpert was incomplete, I tried to identify a VC firm's first fund through serval criteria. Specifically, I identified a fund as *First fund* if, i) the fund's founding year was the earliest within the VC firm, ii) the fund sequence number was 1, and iii) the fund investment type was "New".[11]

Top Previous IPO Shares. Hayward and Hambrick (1997) used past success to measure a CEO's degree of overconfidence. In the same logic, I used a venture capitalist's performance of previous fund to measure his current degree of overconfidence. Although the acquisitions of portfolio companies contribute to VC funds' returns, it is the IPOs of portfolio companies that provide VCs with enormous proceeds (Gompers et al, 2008) and

[11] As a VC firm could found several funds within one year, I can not merely use founding year to determine whether the fund was the *First fund*.

huge reputation (Nahata, 2008; Reuer, Tong, and Wu, 2012). I calculated a VC fund's yearly IPO shares as the ratio of dollar market value of all its portfolio companies taken public in the year to the aggregate dollar market value of all VC-backed companies that went public in the same year (Nahata, 2008). Then, I averaged the VC fund's yearly IPO shares over its life span and ranked VC funds that founded in the same year into quartiles based on their averaged IPO shares. I defined a VC fund as having *Top Previous IPO Shares* if its previous fund's average IPO shares was in the top quantile of all VC funds founded in the same year. The life span of a VC fund was set to be 10 to 12 years. Therefore, by the time the venture capitalist began to invest using his current funds, the complete performance of the previous funds might not be revealed yet. Therefore, the above measure might have ex post bias. As the portfolio companies exit a VC fund continuously over the VC fund's lifetime, I used the VC fund's early IPO shares to mitigate such concern in my following robustness tests.

Syndicate Overconfidence. A venture capitalist made his own investment decision (Gompers, Mukharlyamov, and Xuan, 2016). However, the development and fate of a private company were determined by all VCs within it. I defined *Syndicate Overconfidence* as the percentage of overconfident venture capitalists among within a syndicate. Specifically, it is the ratio of the number of VCs who had *Top Previous IPO Shares* divided to the total number of VCs within the syndicate.

Low Participation. Some VCs stayed with the private companies from the very beginning, while others joined in later rounds. The more later rounds in which a VC joined in a private company for the first time, the less efforts it had to provide to help the

entrepreneurs, the more likely the VC became a free rider if the private company went IPO successfully. I calculated *Low Participation* as the ratio of the number of IPOs in which the VC fund joined in for the first time in the last round to the total number of IPOs in which the VC participated.

Low Contribution. I defined the *Contribution* of a VC to a private company as the ratio of the VC's monetary amount of investment in the private company to the total amount of investments the private company received. *Low Contribution* is defined as the reverse value of *Contribution*.

Control Variables

Cumulated Investments. Organizations learn from their prior experience, which in turn influences their current performances (Haleblian and Finkelstein, 1999). Venture capitalists' investment skill and experience make the returns persistent across a sequence of funds managed by the same VC firm (Kaplan and Schoar, 2005). Following Hochberg, Ljungqvist, and Lu (2007), I operationalized *Cumulated Investments* in one given year as the logarithm of the cumulated monetary amount the VC firm had invested from the creation of the firm to that year.

Degree. A VC may use its networks to bring more resources to its portfolio companies (Hochberg, Ljungqvist, and Lu, 2007). Therefore, the centrality of a VC firm in the network will influence its funds' investment performance. The social network analysis literature used several centrality measures to capture different aspects of the social and economic networks. I used the most intuitive and straightforward centrality measure,

Degree, to calculate the total number of ties a VC firm has in the network. To make sure that I captured the dynamic changes of a VC's position in the network and the related influence on its funds' portfolio companies, I calculated the centrality measures at the funds' parental firm level using 5-year trailing periods. Specifically, I calculated the *Degree* of a VC as the number of other VCs that the focal VC had met in an investment round for at least once over the previous 5 years, normalized by the maximum possible number of connections.[12] Finally, I defined a VC fund's *Degree* as the average of its parental firm's yearly *Degree* over the fund's life span.

Fund Sequence. Following Kaplan and Schoar (2005) and Hochberg, Ljungqvist, and Lu (2007), I added the sequences of VC funds as a control variable. As the data of fund sequences in VentureXpert was incomplete, I re-determined the sequences of funds within a VC firm by their founding year. If several funds within a VC firm were founded in year, I determined them as having same sequences. Finally, I operationalized the *Fund Sequence* of a fund as the logarithm of its sequence number within its parental firm.

Fund Size. Fund size will influence the fund's investment performance (Kaplan and Schoar, 2005; Hochberg, Ljungqvist, and Lu, 2007). I calculated *Fund Size* as the logarithm of the amount of capital raised by a fund reported in VentureXpert. Kaplan and Schoar (2005) reported that due to diminishing returns to scale, the relation between fund

[12] As more and more VCs continuously entered the industry, a VC's connection would increase with the total network size overtime (Chemmanur, Simonyan, and Tehrania, 2016). Therefore, a VC's absolute *Degree* was biased over time. I mitigated the bias through dividing a VC's absolute *Degree* in one given year by the total number of VCs in that year.

performance and fund size was increasing and concave, I also added the squared form of *Fund Size* as a control variable.

VC Inflows. VCs will pay higher prices when investing their portfolio companies if more money flows into the VC industry, as competition for scarce resources drives valuations up (Gompers and Lerner, 2000). Therefore, the competition for deal flow influences the quality of VCs' investments, and thus their performance (Hochberg, Ljungqvist, and Lu, 2007). Therefore, to control the competition in VC industry, I included in my fund-level regression the aggregate VC fund inflows in the year a fund was founded.

Market to Book Ratio. I used the yearly median of the market to book ratios of all public companies in Compustat to proxy for yearly investment opportunities. VC funds took several years to invest their raised capital, during which the investment opportunities might change. Therefore, to capture the dynamic change of investment opportunities, I calculated *Market to book ratio* as the average of yearly median of market to book ratios of all public companies over each VC fund's first three years of existence or each private company's first three years after their first financing round (Hochberg, Ljungqvist, and Lu, 2007).

Company-level and Syndicate-level controls. I aggregated all the VC related control variables into syndicate level in my private company-level analysis. I calculated *Syndicate Size* of a private company as the logarithm of number of VCs that joined in the first round of the company's financing. I calculated *Syndicate Degree*, *Syndicate Cumulated Investments*, and *Syndicated inflows* as the averages of *Degree*, *Cumulated Investments*,

and *VC Inflows* within syndicates, respectively. In addition, I also controlled the company-level variables, *Company Age* and *Total Investments Received*.

3.3.3 Analysis

My analysis contains two parts, fund-level and company-level. In the fund-level analysis, each unit of observations is an individual VC fund. The dependent variables are Current Fund Performance, Industry Fit, and Stage Fit. The independent variables of interest are Top Previous IPO Shares, which is my proxy for overconfidence. I ran OLS regression for each model, controlling for all kinds of VC fund-level and VC-firm level characteristics, as well as VC firm fixed effects. In my company-level analysis, each unit of observations is a private company. The dependent variable is Missed Target, which indicated whether the private company could have the opportunities of being acquired, but forwent the acquisition, and failed to go IPO, either. The independent variable of interest is Syndicate Overconfidence, which measures the percentage of overconfident venture capitalists within each syndicate. I ran logit regression for the model, controlling for company-level and syndicate-level characteristics, as well as industry fixed effects.

3.4 Empirical Results

Table 18 presents the basic descriptive statistics and correlation coefficients for all the variables. Table 19 to Table 20 present the multivariate analysis in fund-level, and Table 7 presents the multivariate analysis in company-level. Table 19 presents the results of Hypothesis 1 and Hypothesis 2. The coefficient of First Fund in Model 1 is positive and significant ($p<0.05$), consistent with the Hypothesis 1 that venture capitalists had not developed their overconfidence in the beginning of their VC career, and therefore had

better investment performances. The variable of interest in Model 2 is Top Previous IPO Shares, which is a proxy for venture capitalist overconfidence. The coefficient of Top Previous IPO Shares in Model 2 is negative and significant ($p<0.01$), consistent with Hypothesis 2.

Table 18 Summary Statistics

Variables	Mean	SD	Min	Median	Max
Performance	0.416	0.260	0	0.417	1
Past Performance	-0.002	0.191	-0.333	0.000	0.356
Stage Fit	0.390	0.259	0	0.375	1
Industry Fit	0.358	0.275	0	0.333	1
First Fund	0.099	0.299	0	0.000	1
Top Previous IPO Shares	0.222	0.416	0	0.000	1
Low Participation	0.146	0.270	0	0.000	1
Low Contribution	8.661	282.619	1	2.497	19000
Cumulated Investments	2.827	2.040	0.000	2.833	6.315
Degree	0.028	0.029	0.001	0.018	0.102
Fund Sequence	0.778	0.671	0.000	0.693	2.708
Fund Size	3.871	1.504	0.916	3.970	6.263
VC Inflows	9.920	0.980	8.283	10.148	11.422
Market to Book Ratio	1.310	0.095	1.194	1.262	1.500

Table 19 Regression Results for Testing Hypothesis 1 and 2

Variables	Model 1 Current Fund Performance	Model 2 Current Fund Performance
First Fund	0.035**	
	(0.046)	
Top Previous IPO Shares		-0.036***
		(0.006)
Past Performance		-0.168***
		0.000
Cumulated Investments	-0.008	-0.009
	(0.165)	(0.252)
Degree	1.024**	1.137**
	(0.039)	(0.029)
Fund Sequence		0.029
		(0.157)
Fund Size	0.020	0.028
	(0.305)	(0.171)
Fund Size Squared	-0.003	-0.004
	(0.220)	(0.118)
VC Inflows	-0.003	-0.005
	(0.657)	(0.503)
Market to Book Ratio	0.020	0.037
	(0.727)	(0.530)
Constant	0.127	0.102
	(0.369)	(0.485)
Observations	3299	3299
R-Squared	0.493	0.502

P values are reported in parentheses. 1%, 5%, and 10% significance levels of the coefficients are denoted by ***, **, and *, respectively.

Table 20 presents the results of Hypothesis 3 and Hypothesis 4. The coefficients of Top previous IPO shares in Model 1 and Model 2 are also negative and significant ($p<0.05$ and $p<0.1$), suggesting that once venture capitalist became overconfident, they tended to invest in companies beyond their expertise of stage and expertise of industry. However, the mediation roles of Stage Fit and Industry Fit are not obvious, which lend less support to the later part of Hypothesis 3 and Hypothesis 4.

Table 20 Regression Results for Testing Hypothesis 3 and 4

Variables	Model 1 Stage fit	Model 2 Industry fit	Model 3 Current Fund Performance
Top previous IPO shares	-0.029**	-0.022*	-0.033**
	(0.033)	(0.076)	(0.012)
Past Performance	0.015	0.012	-0.144***
	(0.633)	(0.669)	0.000
Cumulated Investments	0.008	-0.004	-0.012
	(0.320)	(0.576)	(0.111)
Degree	0.488	-0.814*	1.203**
	(0.339)	(0.075)	(0.022)
Fund Sequence	-0.040*	0.039**	0.038*
	(0.061)	(0.039)	(0.066)
Fund Size	-0.014	0.010	0.031
	(0.526)	(0.617)	(0.122)
Fund Size Squared	0.001	-0.002	-0.005*
	(0.812)	(0.473)	(0.084)
VC Inflows	0.034***	-0.003	-0.008
	0.000	(0.712)	(0.330)
Market to Book Ratio	-0.001	0.015	0.014
	(0.992)	(0.801)	(0.816)
Stage Fit			0.038
			(0.189)
Industry Fit			0.006
			(0.837)
Constant	0.143	0.230	0.133
	(0.360)	(0.115)	(0.365)
Observations	3248	3259	3248
R-Squared	0.414	0.573	0.499

P values are reported in parentheses. 1%, 5%, and 10% significance levels of the coefficients are denoted by ***, **, and *, respectively.

Table 21 presents the results of Hypothesis 5 to Hypothesis 7. In Model 1, the variable of interest is Top Previous IPO Shares x Low Participation. The coefficient is negative and significant ($p<0.01$), consistent with Hypothesis 5 that venture capitalists' self-attribution bias is stronger if they join in very late in the successful private companies. In Model 2, the variable of interest is Top Previous IPO Shares x Low Contribution. the coefficient is also negative and significant ($p<0.01$), consistent with Hypothesis 6 that venture capitalists' self-attribution bias is stronger if they contribute less to the private companies. In Model 3, the variable of interest is Top Previous IPO Shares x Cumulated Investments. The coefficient is positive and significant ($p<0.01$), which is consistent with Hypothesis 7 that experience mitigates overconfidence.

Table 21 Regression Results for Testing Hypothesis 5, 6 and 7

Variables	Model 1 Current Fund Performance	Model 2 Current Fund Performance	Model 3 Current Fund Performance
Top Previous IPO Shares (a)	-0.020	0.007	-0.099**
	(0.239)	(0.793)	(0.012)
Past Performance	-0.176***	-0.154***	-0.159***
	(0.000)	(0.000)	(0.000)
Low Participation (b)	0.033		
	(0.204)		
(a) x (b)	-0.073*		
	(0.096)		
Low Contribution (c)		-0.003	
		(0.371)	
(a) x (c)		-0.010*	
		(0.076)	
Cumulated Investments (d)	-0.005	-0.004	-0.006
	(0.519)	(0.632)	(0.488)
(a) x (d)			0.015*
			(0.092)
Degree	1.130**	1.204**	1.153**
	(0.031)	(0.021)	(0.027)
Fund Sequence	0.028	0.032	0.025
	(0.177)	(0.119)	(0.224)
Fund Size	0.028	0.028	0.029
	(0.166)	(0.162)	(0.149)
Fund Size Squared	-0.004	-0.004	-0.004
	(0.117)	(0.110)	(0.102)
VC Inflows	0.036	0.045	0.032
	(0.541)	(0.446)	(0.593)
Market to Book Ratio	0.102	0.089	0.111
	(0.489)	(0.547)	(0.449)
Observations	3299	3299	3299
R-Squared	0.503	0.504	0.503

P values are reported in parentheses. 1%, 5%, and 10% significance levels of the coefficients are denoted by ***, **, and *, respectively.

Table 22 presents the results of company-level analysis. The variable of interest is Syndicate Overconfidence. The coefficient of this variable is positive and significant ($p<0.01$), consistent with Hypothesis 8 that the syndicates which have higher percentage of overconfident VCs are more likely to miss the opportunities of being acquired.

Table 22 Regression Results for Testing Hypothesis 8

Variables	Model 1 Missed Target
Syndicate Overconfidence	0.540***
	(0.000)
Syndicate Cumulated Investments	-0.116***
	(0.001)
Syndicate Degree	8.626***
	(0.000)
Syndicate Size	0.183**
	(0.040)
Total Investments Received	0.302***
	(0.000)
Company Age	-0.307***
	(0.000)
VC Inflows	0.154***
	(0.001)
Market to Book Ratio	-2.258***
	(0.000)
Constants	-18.821***
Observations	7478

P values are reported in parentheses. 1%, 5%, and 10% significance levels of the coefficients are denoted by ***, **, and *, respectively.

3.5. Additional Analysis

Validity Test of the Measure of Venture Capitalist Overconfidence

In the above discussion, I assumed that previous success made venture capitalists overconfident, and therefore, overestimate the probability of IPO of their portfolio companies and give up many chances of acquisition. The fact that many venture capitalists were CEOs, entrepreneurs or executives provided us a chance to use the option-based measure of CEO overconfidence (Malmendier and Tate, 2005) to test the validity of my measure of venture capitalist overconfidence.

I identified a small portion of CEOs and executives in S&P 1500 companies who happened to be venture capitalists at the same time or became venture capitalists after leaving their companies. Following Malmendier and Tate (2005) and Campbell et al (2011), I used CEOs' stock option holding and exercising decisions to measure their overconfidence level. The basic idea is that under-diversified and risk-averse CEOs should exercise their in-the-money options early. If a CEO persistently delays the exercise of their in-the-money options, then I infer that he is overconfident in his ability to keep the company's stock price rising and that he wants to profit from expected price increases by holding the options. Specifically, I calculate the realizable value per option as the total realizable value of the exercisable options (ExecuComp variable OPT_UNEX_EXER_EST_VAL) divided by the number of exercisable options (OPT_UNEX_ EXER_NUM). I then subtract the per-option realizable value from the stock price at the fiscal year end (PRCCF) to obtain an estimate of the average exercise price of the options. The average percent moneyness of the options equals the per-option

realizable value divided by the estimated average exercise price. If a CEO has an average moneyness of more than 67% (Hall and Murphy, 2002; Malmendier and Tate, 2005) in a certain year, then I assume that he has exhibited overconfident behavior in that year. I require that, to be classified as an overconfident CEO, the CEO must exhibit such overconfident behavior at least twice during the sample period. The overconfidence classification is assigned, however, beginning with the first time the CEO exhibits the behavior. I define *Overconfidence_option* as a dummy variable that equals to 1 if a CEO is classified as overconfident, and 0 otherwise. I identified a VC-backed private company as *Missed target* if the private company could have the chance of being acquired, but it forwent the acquisition, and failed to go IPO, either. Based on this logic, a VC fund managed by an overconfident venture capitalist should have higher percentage of Missed target. I ran logistic regression and found that the coefficient of *Overconfidence_option* is positive and significant, consistent with my previous hypothesis.

3.6. Discussion

In this paper, I found that after experiencing success, venture capitalists tend to attribute the credits to their own abilities and foster overconfidence, which leads to inferior investment decisions and poor investment performances. To further identify the mechanisms behind these dynamics, I explored whether venture capitalists will change their investment strategies after experiencing success. I found that after experiencing extraordinarily higher IPO performances in its previous funds, venture capitalists are more likely to invest in private companies beyond their own expertise in their current funds. Furthermore, I found that the level of overconfidence is stronger if a venture capitalist is

just a free rider but succeeds and is weaker if the venture capitalist has more investment experience. In the private company level analysis, I explored how the percentage of overconfident venture capitalists within lead VCs in a syndicate influences the fate of the private company. I defined a private company as a Missed target if the private company could have the chance of being acquired, but it forwent the acquisition, and failed to go IPO, either. We find that a private company backed by a syndicate with a higher percentage of overconfident lead venture capitalists is more likely to be a *Missed target*.

This paper contributes to the area of entrepreneurship by extending the study of overconfidence from entrepreneurs to venture capitalists. Scholars in this area has explored the behavior pattern of entrepreneurs (Bernardo and Welch, 2001; Hayward, Shepherd, and Griffin, 2006; Navis and Ozbek, 2016) and CEOs (e.g. Roll, 1986; Hayward and Hambrick, 1997; Malmendier and Tate, 2005, 2008; Billett and Qian, 2008). In particular, Hayward, Shepherd, and Griffin (2006) developed a hubris theory of entrepreneurship, which assumed that entrepreneurs acted on overconfidence when interpreting information and allocating resources, leading to higher failure rates of their ventures. However, how the overconfidence of venture capitalists, who are critical participants in entrepreneurship, influences the outcome of ventures is rarely discussed. This study fills in this gap.

Conclusion

This dissertation consists of three essays examining the effects of overconfidence on CEO and venture capitalist decision making. In the first study, I found that Board network centrality mitigates the positive relationship between CEO overconfidence and acquisition intensity such that the positive relationship becomes weaker (less positive) as the board network centrality increases. Moreover, I found that there is a three-way interaction between CEO overconfidence, board network centrality, and female board representation on a firm's acquisition intensity. The mitigating effect of board network centrality on the positive relationship between CEO overconfidence and acquisition intensity is stronger for boards with greater female representation.

The first study makes significant contributions to the study of CEO overconfidence. Questions about how to manage the governance environments to mitigate the effects of CEO overconfidence are rarely explored. I strive to provide a more comprehensive picture about the relationship between CEO overconfidence and corporate decisions, by examining the moderating effect of board of directors.

In addition, this research also contributes to the literature on corporate governance by unveiling the role of interlocked directors with respect to overconfident CEOs decision-making. Thus far, researchers have not reached an agreement on the net economic results of interlocked directors in corporate governance. On the one hand, interlocked directors may serve on multiple board seats, and therefore, devote limited attention to each firm, which leads to less effective monitoring (Fich and Shivdasani, 2006). Accordingly, interlocked directors are found to be associated with increased CEO private benefits

(Sauerwald, Lin, and Peng, 2016) and decreased firm value (Core, Holthasen, and Larcker, 1999; Fich and Shivdasani, 2006). However, research also indicates that interlocked directors helped reduce uncertainty and improve firm performance through bringing information to the focal firms (Larcker, So, and Wang, 2013; Martin, Gozubuyuk, and Becerra, 2013). I propose a new channel through which interlocked directors can contribute to corporate decision-making by mitigating the effects of CEO overconfidence.

In the second study, I set the context in acquisition waves and explored how overconfidence influences CEO decision-making in acquisition waves. I found that overconfident CEOs are more likely to capture preemption opportunities by acting earlier in acquisition waves. Moreover, during these acquisition waves, the returns to acquisitions undertaken by overconfident CEOs are higher than those by other CEOs. Furthermore, I explored the moderating effects of CEO acquisition experience on CEO behaviors in acquisition waves and found that the role of CEO overconfidence in acquisition speed and performance is mitigated if the firm has more pre-wave acquisition experience.

The second study contributes to the literature on corporate acquisitions in several aspects. First, I contribute to the discussion on the relationship between CEO overconfidence and acquisition performance. Overall, prior studies converge on the notion that CEO overconfidence is detrimental to corporate acquisitions (Hayward and Hambrick 1997; Malmendier and Tate 2008; Roll 1986). However, I reveal the relationship between CEO overconfidence and acquisition performance is contingent on the acquisition context and during acquisition waves, overconfidence, rather than being an unfavorable characteristic becomes an advantage.

Furthermore, the second study contributes to the literature on acquisition waves. Scholars in the finance area have explored the industry characteristics (Harford, 2005; Mitchell and Mulherin 1996; Rhodes-Kropf and Viswanathan 2004; Shleifer and Vishny 2003;) that drive acquisition waves. Scholars in strategic management focused on the manner in which firms outperform others during merger waves (Carow et al., 2004; Haleblian et al., 2012; McNamara et al., 2008). I extended this line of research by exploring beyond industry and firm level factors to show that CEO level characteristics influence acquirer performance in acquisition waves.

In addition, my paper also contributes to the organizational learning and experience literature. The existing research in this area suggests acquisition experience helps to build up acquisition routines, which makes firms more efficient in performing acquisitions (e.g., Hayward, 2002). Building on this line of research, while routines likely increase information searched and slows decision processes, my study identified a context in which acquisition experience becomes a disadvantage. Namely, during acquisition waves, acquisition experience reduces the benefits of CEO overconfidence as decision speed is critical to making successful acquisitions in waves.

In the third study, I explored how overconfidence influence venture capitalists' decision-making. I found that after experiencing success, venture capitalists tend to attribute the credits to their own abilities and foster overconfidence, which leads to inferior investment decisions and poor investment performances. To further identify the mechanisms behind these dynamics, I explored whether venture capitalists will change their investment strategies after experiencing success. I found that after experiencing

extraordinarily higher IPO performances in its previous funds, venture capitalists are more likely to invest in private companies beyond their own expertise in their current funds. Furthermore, I found that the level of overconfidence is stronger if a venture capitalist is just a free rider but succeeds and is weaker if the venture capitalist has more investment experience. In the private company level analysis, I explored how the percentage of overconfident venture capitalists within lead VCs in a syndicate influences the fate of the private company. I defined a private company as a Missed target if the private company could have the chance of being acquired, but it forwent the acquisition, and failed to go IPO, either. We find that a private company backed by a syndicate with a higher percentage of overconfident lead venture capitalists is more likely to be a *Missed target*.

The third study contributes to the area of entrepreneurship by extending the study of overconfidence from entrepreneurs to venture capitalists. Scholars in this area has explored the behavior pattern of entrepreneurs (Bernardo and Welch, 2001; Hayward, Shepherd, and Griffin, 2006; Navis and Ozbek, 2016) and CEOs (e.g. Roll, 1986; Hayward and Hambrick, 1997; Malmendier and Tate, 2005, 2008; Billett and Qian, 2008). However, how the overconfidence of venture capitalists, who are critical participants in entrepreneurship, influences the outcome of ventures is rarely discussed. This study fills in this gap.

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