7-2019

New perspectives on M&A research

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SINGAPORE MANAGEMENT UNIVERSITY 2019

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Submitted to Lee Kong Chian school of Business in partial fulfilment of the requirements for the Degree of Doctor of Philosophy in Business (Strategic Management & Organisation)

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SINGAPORE MANAGEMENT UNIVERSITY

2019

I hereby declare that this PhD dissertation is my original work and it has been written by me in its entirety. I have duly acknowledged all the sources of information which have been used in this dissertation.

This PhD dissertation has also not been submitted for any degree in any university previously.

Zhefei Li

20 June 2019

ABSTRACT

Corporate acquisition is among the most important strategic tools wielded by managers to achieve competitive advantage. Acquisition may create strategic values for the acquirer by gaining market power through industry consolidation, diversifying into rapidly growing industries, entering into emerging markets, and most importantly by combining unique valuable resources from acquirer and target. Despite the many appealing aspects of the motive for acquisition, however, meta-analytical studies suggest that though highly beneficial for the target firm's shareholders, acquisition on average destroys acquirer shareholder values. to understand the determinants of acquisition performance success, it becomes imperative to study the antecedents as well as consequences of acquisition. Existing literature has found scores of potential culprits including agency behavior, position in merger wave, managerial hubris, poor acquisition capability in post-acquisition integration, and loss of valuable human capital resources among others. Beyond acquisition performance, acquisition also results in many other intended and unintended consequences such as employee turnover and CEO departures. What may affect various acquisition outcomes? How do these outcomes affect future acquisition decisions?

In my dissertation, I look at two additional factors that may affect the success of acquisition by conducting two empirical studies on the antecedents as well as consequences of acquisition using behavioral and resource based theories. I further explore the connections between the antecedents and outcomes of acquisitions. In the second chapter, incorporating risk taking, I focus on the influences of alliance and acquisition performance feedback on the rate of future acquisitions. The Behavioral Theory of the Firm (BTF) and performance feedback theory have been used to explain corporate acquisition behaviors both at the organizational and deal levels. However, extant literature does not agree on the relationship between acquisition performance feedback and

likelihood of subsequent acquisition. Firms may search in different directions in response to acquisitions failures. Moreover, we still lack a clear understanding of the behavioral influences on the various sourcing mechanisms. To address these questions, we built on both the BTF and prospect theory to propose a search hierarchy among corporate sourcing methods. We posit that the general search direction in corporate development follows from simple to complex and from economical to costly. We hypothesize that, under the duo influences of problemistic search and risk taking, deal performance feedback is negatively related to future acquisitions. We further investigate the interaction between alliance and acquisition performance feedback on future acquisitions.

In the third chapter, given the importance of human capital retention and turnover in the success of acquisition, I examine how target firm's knowledge base may affect acquirer's decision to retain the target's CEO. Drawing upon the firm-specific resources and strategic human capital literatures, we develop the argument that the level of firm-specific knowledge in an acquisition target may affect the likelihood of the target's CEO being retained after an acquisition. Specifically, due to the important role of target CEOs in preserving the value of and integrating firm-specific knowledge, we expect a positive relationship between a target's pre-acquisition firm-specific knowledge level and the likelihood that its CEO is retained. Furthermore, we argue that this relationship is strengthened by the target's pre-acquisition performance, which signals a higher value of firm-specific knowledge, and the target CEO's tenure, which is positively associated with both the benefit of retaining and the cost of replacing the CEO. Using a sample of acquisitions involving US target firms acquired between 1995 and 2006, we find support for our hypotheses.

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ACKNOWLEDGEMENT

In my entire adult life, I strive to live up to the motto by Mahatma Gandhi to "live as if you were to die tomorrow. Learn as if you were to live forever." My unyielding passion for research and the relentless pursuit of knowledge took me to SMU to embark on the academic endeavor. I enjoy immensely the heavy intellectual undertaking offered by the PhD program at SMU, starting from the philosophical course of *Introduction to Business Research* offered by Prof. Reddi Kotha in year one. Henry David Thoreau once said "Such is always the pursuit of knowledge. The celestial fruits, the golden apples of the Hesperides, are ever guarded by a hundred-headed dragon which never sleeps, so that it is a Herculean labor to pluck them." Indeed, throughout the five-year Odyssey, there were the rare Eureka moments of discoveries, but more were nothing but blood, toil, tears and sweat. However, to pluck the celestial fruits, the golden apples of the Hesperides, no amount of blood, toil, tears and sweat spilled while battling a hundred-headed dragon can intimidate me.

I want to give my sincere gratitude to Prof. Ilya Cuypers who has guided me in this academic marathon about problems big and small from the very beginning of my PhD journey. My admiration for Prof. Heli Wang, whose prominent scholarship brought me to SMU, grew only stronger through my interaction with her. I truly appreciate her sharp insights, professional judgements, and patient advices. I am forever indebted to Prof. Mario Schijven, whose strategy class at Mays Business School changed my life forever and made me determined to be a strategy scholar. Whenever I begin to doubt myself, I can always find refuges from him across the oceans. I also would like to thank Prof. David Gomulya, who was my first connection to Singapore when I decided to pursue a career of scholarship in strategy. In a small world, it's

truly my fortune to have him in my dissertation committee 5 years later. Beyond the committee members, I also would like to extend my appreciation to Prof. Simon Schillebeeckx who personally taught me how to clean patent data step by step and to Prof. Gokahn Ertug whose honest assessment may be blunt but highly conducive for my self-reflection. Last but certainly not the least, I would like to thank my family, especially my parents who always believe in me.

The conclusion of the PhD study represents nothing but a first milestone in my lifelong pursuit of truth. Although the path to knowledge discovery is winding and treacherous, every new discovery advances the frontier of current human knowledge. Greek philosopher Plato described a world in a cave, where the reality can only be observed from the shadows cast on the wall of the cave and the inhabitants are imprisoned by the chain of ignorance. Science forges such a torching sword that breaks the chains of ignorance, lights up the darkness, and leads us out of the cave into the real world bathed in the sunlight of knowledge and truth. Among all forms of human endeavors, science stands out with its adherence to demonstrable truth based on empirical observation. It is precisely for this very reason why science has always captivated me, from a curious child obsessed with dinosaurs and the universe to a young scholar exploring the unknowns of the business world. I cannot think of a nobler cause for a career other than growing the circle of knowledge for human civilization while eliminating ignorance and dogmas. If life craves for a purpose, I hope that I have found myself a worthy goal in the pursuit of scientific truth.

CHAPTER 1 GENERAL INTRODUCTION

With over 44,000 deals and 4.5 trillion USD total transaction volumes in 2015 (JP Morgan, 2017), acquisition has become one of the most popular strategic initiatives in firm's strategic toolkit. However, acquisition does not always create value for acquirer (Haleblian, Devers, McNamara, Carpenter, and Davison, 2009). Meta-analysis result shows that on average acquisition even destroys shareholder value for the acquirer (King, Dalton, Daily, & Covin, 2004). Scholars have discovered a number of explanations that drive acquisition activities including market power (e.g. Eckbo, 1983; Stillman, 1983), resource seeking (e.g. Capron, Dussauge, & Michell, 1998; Puranam and Srikanth, 2007), market for corporate control (e.g. Agrawal and Walkling, 1994; Jensen, 1986), resource dependency absorption (e.g. Casciaro & Piskorski, 2005), and market entry (e.g. Hennart, 1988; Hennart & Reddy, 1997), especially a variety of value destroying factors such as managerial self-interest in compensation (Agrawal & Walkling, 1994; Harford & Li, 2007) and managerial hubris (e.g., Hayward & Hambrick, 1997; Malmendier and Tate, 2008) to name just a few (see Haleblian et al., 2009 for a review).

In addition to the grim prospect of acquisition success, other outcomes of acquisition are also worth exploring. As a disruptive strategic event that affects broad stakeholders that may or may not have a say in the decision process, acquisition has significant intended or unintended consequences for various stakeholders associated with the deal. An acquisitive growth strategy may require the adjustment of compatible stakeholder strategy (Zollo, Minoja, & Coda, 2018) as acquisition often causes significant operation disruptions at both acquirer and target firm such as target employee layoffs (Fried, Tiegs, Naughton, & Ashforth, 1996; O'Shaughnessy & Flanagan, 1998). These turnovers are not limited to ordinary employees as significant executive departures often occur during the target post-acquisition process for both the target (Cannella and

Hambrick, 1993; Walsh, 1988, 1989) and even the acquiring firm (Haveman, 1995). Because of the interplays between acquisition outcomes and potential motives, it is crucial to examine how these factors independently and interactively manifest in corporate acquisitions.

In my dissertation, I look at two additional factors that may affect acquisition performance by conducting two empirical studies on the antecedents that motivate acquirer as well as consequences of acquisition from both acquirer and target's perspectives. I build on existing management theories such as the Behavioral Theory of the Firm (BTF), performance feedback theory, and Resource Based View (RBV) to contribute to a better understanding of acquisition. More specifically, because acquisition is an agreement negotiated and reached by the executives from both acquirer and target, it is pivotal to examine how acquisition may affect their personal fortunes and subsequent behaviors. Hence, I focus on arguably the most important stakeholders in the acquisition process, the decision makers of both acquiring and target firms.

To better understand why acquisition fails to deliver the expected success, it is essential to first account for what motivate acquisitions. In addition to the myriads of value creating and value destroying motives behind acquisition (Haleblian et al., 2009), because acquisition decision is often prone to behavioral bias (Jemison & Sitkin, 1986), firms may also pursue acquisitions for behavioral reasons following problemistic search (e.g., Iyer & Miller, 2008). At the same time, based on deal specific performance feedback, the consequence of acquisition may influence future acquisition decisions (Haleblian, Kim, & Rajagopalan, 2006; Kim, Finkelstein, & Haleblian, 2015). Acquirer senior managers are particularly susceptible to their wealth position and status shift in response to performance feedbacks and may respond with more risky decisions (Kumar, Dixit, & Francis, 2015). The first study delves into the motives behind acquisition by examining how performance feedbacks from corporate development activities

such as alliances and acquisitions may influence future acquisition decisions. Results indicate that following problemistic searches, both negative alliance and acquisition feedbacks trigger high rates of future acquisitions but not alliances. Furthermore, I also observe a negative interaction effect between negative alliance and acquisition feedbacks, suggesting that future acquisition decisions are dampened rather than fueled by combined negative acquisition and alliance feedbacks. This study enriches the existing literature on the antecedents of acquisitions while contributing to the performance feedback theory on the sequence of problemistic solution search.

The second study examines how target firm's resource structure may affect acquirer's decision to retain target's CEO. Because resource acquisition is the main motive behind many acquisition decisions (e.g., Kaul & Wu, 2016; Puranam & Srikanth, 2007), the decision to retain target CEO who is the chief officer of resource orchestration at the target firm often makes or breaks an acquisition (Graebner, 2004; Zollo & Singh, 2004). It is vital to understand how target firm's resource base may affect acquirer's decision to retain target's CEO. This study examines the influence of target firm's knowledge structure on target CEO retention decision. The results indicate that firm specific knowledge structure at the target firm is associated with higher likelihood of target CEO retention in the post-acquisition integration period. This relationship is strengthened by the target's pre-acquisition performance, which signals a higher value of firm-specific knowledge; and the target CEO's tenure, which is positively associated with both the benefit of retaining and the cost of replacing the CEO. Phenomenologically, this study contributes to a better understanding of the determinants of target CEO retention decision in the post-acquisition executive retention process; theoretically, this paper extends the existing literature on firm-specific knowledge studies into the realm of inter-organizational studies.

CHAPTER 2 CLIMBING THE CORPORATE DEVELOPMENT LADDER: REVISITING PERFORMANCE FEEDBACK AND CORPORATE ACQUISITION BEHAVIORS

ABSTRACT

The Behavioral Theory of the Firm (BTF) and performance feedback theory have been used to explain corporate acquisition behaviors both at the organizational and deal levels. However, extant literature does not agree on the relationship between acquisition performance feedback and subsequent acquisition likelihood. Firms may search in different directions in response to acquisitions failures. Moreover, we still lack a clear understanding of the behavioral influences on the various sourcing mechanisms. To address these questions, we built on both the BTF and prospect theory to propose a search hierarchy among corporate sourcing methods. We posit that the general search direction in corporate development follows from internal to external, from simple to complex, and from economical to costly. We hypothesize that deal performance feedback is negatively related to future acquisitions as a result of problemistic search and risk taking. We further investigate the interaction between alliance and acquisition performance feedback on future acquisitions. Using a large sample of US public firms from different industries, we find our hypotheses supported.

INTRODUCTION

The Carnegie school of organizational decision-making system builds on the premise of the bounded rationality of decision makers who are ignorant of the distribution of solution costs and payoffs (Simon, 1947; March & Simon, 1958). The Behavioral Theory of the Firm (BTF) posits that negative performance feedback induces problemistic search to seek for potential solutions near problem symptom or current alternative to restore performance shortfall (Cyert & March, 1963). Its offshoot, performance feedback theory, later augmented the risk-taking aspect to the problemistic search process (e.g., Bromiley, 1991; Chen & Miller, 2007; March & Shapira, 1987; 1992; Greve, 1998; 2003). Performance below aspirations has been found to lead to increased risk-taking behaviors in its searches to restore attainment discrepancy (Fiegenbaum and Thomas, 1996; Greve, 2003; Singh, 1986; Wiseman & Bromiley, 1996). However, such risk takings are considered a byproduct of search while ignoring how risky solutions may affect the sequence of solution searches. What remains unclear is how increased risk-taking behaviors may influence the sequence of solution search. In this paper, we explicitly consider how risks entailed in resource investments of solution implementation may bias problemistic search. Acquisition represents the most expensive, complex, and time-consuming corporate development mechanism that involves significant risks (e.g., Capron & Mitchell, 2012; Kumar, Dixit, & Francis, 2015; Iyer & Miller, 2008). Acquisition decision is also particularly suitable to study this research question because it is often prone to behavioral biases (Jemison & Sitkin, 1986). We intend to fill this research gap by examining how alliance and acquisition performance feedbacks, may affect search behaviors in corporate acquisitions.

Under the BTF framework, boundedly rational managers may engage in ‘problemistic search’ by conducting a variety of organizational search behaviors including acquisitions when

firm financial performance falls below aspiration (Iyer & Miller, 2008; Shinkle, 2012). Firms may also turn to acquisitions for growth when organic growth has stalled (Kim, Haleblian, & Finkelstein, 2011). In parallel to the studies that focus on organizational performance feedback, some scholars have focused exclusively on the association between focal acquisition feedback and the likelihood of subsequent deal (e.g. Haleblian, Kim, & Rajagopalan, 2006; Kim, Finkelstein, & Haleblian, 2015) and deal completion (e.g. Luo, 2005; Muehlfeld et al., 2012). Although some studies found a positive relationship between focal deal performance and subsequent acquisition likelihood among US commercial banks (Haleblian et al., 2006; Kim et al., 2015), a multi-industry study on recent IPO firms unexpectedly uncovered the opposite effect (Arikan & McGahan, 2010), yet other studies observed that poor acquisition performances may result in continual searches with minor adjustments such as choosing risky targets (Kumar, Dixit, & Francis, 2015) and paying lower premiums (Gong, Zhang, & Xia, 2017) in future acquisitions.

Because strategic alliance and acquisition can fulfill similar goals, they are often viewed as substitutes by managers (Dyer, Kale, & Singh, 2004). Many different rationales have been provided to analyze the choice between these two dominant external sourcing mechanisms (e.g. Villalonga & McGahan, 2005; Wang and Zajac, 2007; Yin and Shanley, 2008). Thanks to alliance's flexibility and uncertainty avoidance characteristics (Balakrishnan & Koza, 1993; Hagedoorn & Duysters, 2002), it often precedes an acquisition and serves as a real option in a series of staged equity investments (Folta & Miller, 2002; Vanhaverbeke, Duysters, & Noorderhaven, 2002; Yang, Lin, & Peng, 2011). From the BTF perspective, while organizational overall performance shortfall (e.g. Baum, Rowley, Shipilov, & Chuang, 2005; Shipilov, Li, & Greve, 2011; Tyler & Caner, 2015) and positive alliance specific performance feedback have

been found to lead to increased alliance activities (Arikan & McGahan, 2010), little is known as to how alliance performance feedback may affect future acquisition decisions.

A firm is simultaneously pulled by the opportunity prospects and pushed by its current organizational performance relative to aspirations in its decisions (Barreto, 2012; Chen, 2008). Unsatisfactory acquisition or alliance performance feedback not only indicate that the current method may be problematic (Haleblian et al., 2006) but also leave the current strategic objective unfulfilled. We propose a hierarchy of sourcing methods culminating at acquisitions enacted by firms when seeking opportunities or mitigating threats (Capron & Mitchell, 2012). We argue that negative alliance and acquisition performance feedback trigger more future acquisitions through 'problemistic search' (Cyert & March, 1963). Alliance and acquisition failures also encourage risk takings such as more acquisitions to regain the losses (Kahneman & Tversky, 1979).

This study strives to make several contributions in our understanding of acquisition behaviors as well as performance feedback theory in general. First, this finding adds to the Behavior Theory of the Firm (BTF) by identifying solution implementation cost as an important contingency in the problemistic search process. Previous studies have considered how different degrees (e.g. Baum et al., 2005) and durations of performance shortfall (Joseph, Klingebiel, & Wilson, 2016; Shimizu, 2007) may affect subsequent search directions between 'local search' of existing solutions and 'distant search' of new ones (Levinthal, 1997). By incorporating the concept of risk taking when below aspiration (Bromiley, 1991; March & Shapira, 1987; 1992), we establish a hierarchy of solution searches based on the costs, complexity, and risks involved in the solutions. Unsatisfactory performance feedback prompts problemistic search of increasingly risky and costly solutions that require significant resource investments. Our work thus adds another dimension in the failure induced search prescriptions on top of the different

moderating factors such as firm size (Audia & Greve, 2006; Greve, 2011), search experience and legitimacy (Desai, 2008), approaching deadline (Lehman, Hahn, Ramanujam, & Alge, 2011), and momentum (Lehman & Hahn, 2013) on risky problemistic searches in the extant literature. When a complex solution fails, the problemistic search process is more likely to occur within the current solution through continuous fine-tuning than reverting to a simpler solution.

Second, this paper establishes a hierarchy in the 'search' sequence of organizational sourcing mechanisms. Given the enormous complexities and risks involved (Jemison & Sitkin, 1986), acquisition is deemed to be the last resort after other alternatives have failed (Capron & Mitchell, 2012). Phenomenologically, building on the foundations of prior findings (e.g. Haleblian et al., 2006; Iyer & Miller, 2008; Kim et al., 2015; Arikan & McGahan, 2010), this study broadens our understanding of the behavioral antecedents in corporate acquisitions.

Lastly, our paper serves as the first attempt of its kind to study the interactions of performance feedback from two substitutive strategic initiatives. Whereas past studies have examined the effects of competing goals and sequential attentions (Baum et al., 2005; Greve, 2008), no study has looked at how performance feedback from two potential solutions may affect new search patterns. Answering the call from Shinkle (2012), we study the interplays between capabilities and performance feedback as well as their influences on the directions of search.

THEORY AND HYPOTHESES

Problemistic Search and Risk Taking

A central theme of the BTF lies in problemistic search triggered when performance falls below aspiration (Cyert & March, 1963). Decision makers lack the full knowledge of the perfect solution and therefore must resort to problemistic searches in order to restore performance

shortfalls (Cyert & March, 1963; Simon, 1947). In addition, bounded rationality also assumes that decision makers are largely unaware of the cost-efficiency of a given solution (Simon, 1957). Simple minded search follows a set of standard operating procedures (Cyert & March, 1963) or routines (Nelson & Winter, 1982) that start searches within "the neighborhood of the current symptom...and the neighborhood of the current alternative" (Cyert & March, 1963, p. 170). Unsatisfactory search results trigger failure induced searches in increasingly distant areas through long-jumps (Billinger, Stieglitz, & Schumacher, 2014; Levinthal, 1997). Local and distant searches have been linked to exploitation-exploration learning (Gavetti & Levinthal, 2000; Siggelkow & Rivkin, 2006). Exploratory searches are deemed inherently risky as they represent unknown distribution of outputs (Baum et al., 2005; March, 1991; March & Shapira, 1992; Lavie, Stettner, & Tushman, 2010). Parallel to problemistic search, drawing from prospect theory (Kahneman & Tversky, 1979), performance feedback theory also developed a series of predictions on organizational risk takings accompanying organizational changes (Bromiley, 1991; Chen & Miller, 2007; March & Shapira, 1987; 1992). In general, in accordance with the predictions from prospect theory (Kahneman & Tversky, 1979), organizational changes that entail significant risks are activated when performance falls below aspirational levels in the loss frame (Greve, 1998; Lehman & Hahn, 2013; Palmer & Wiseman, 1999; Sitkin & Pablo, 1992). Risks can be understood as the variations of the potential distributions of outcomes (March & Shapira, 1987; 1992; Sanders & Hambrick, 2007). However, risk taking is often implied by the degree to which decision makers are willing to put resources at stake (Lehman et al., 2011; Lehman & Hahn, 2013) and measured by the size of bet (Boyle & Shapira, 2012), capacity expansion (Audia & Greve, 2006; Desai, 2008; Greve, 2011), and acquisitions (Iyer & Miller, 2008). For example, a bet of $10,000 involves more risk takings than a bet of $100 for the same

level of risk. Therefore, a potential solution can entail significant risk taking not because it has high variations of outcome distributions but because it requires significant resource investments.

Because most local and distant search studies are conducted with simulation and lab experiments using the NK or bandit search model (e.g., Billinger et al., 2014; Denrell & March, 2001; Gavetti & Levinthal, 2000; Levinthal, 1997), the costs of solution implementation as well as the risks of failures are assumed away. Cost concern for solution implementation, nevertheless, permeates every decision in our daily lives[1]. A potential solution that may be able to address a problem behind may not be searched at first due to concerns for significant resource investment. Following the call by Posen, Keil, Kim, and Meissner (2018), we relax the somewhat unrealistic assumption of completely blind trial and error search in the traditional BTF model (Cyert & March, 1963) and argue that decision makers have a basic awareness on the costs of various potential solutions.[2] This perspective is well grounded in empirical observations of risk-taking behaviors in experiments based on the money at stake (Boyle & Shapira, 2012; MacCrimmon & Wehrung, 1986; Tversky & Kahneman, 1991). It has also been implicitly assumed in various problemistic search studies that use resource investments as a proxy for risk taking (Audia & Greve, 2006; Chen & Miller, 2007; Desai, 2008).[3] The unrealistic assumption of "a high degree of automaticity in firms' response to performance feedback and an overly

[1] For instance, it is very effective for police to use the SWAT team against an armless robber, but in view of the costs of deploying the SWAT team, it's not very efficient to use the nuclear weapon in the law enforcement arsenal. Similarly, when there is a bed bug or roach problem at home, though pest control is often very effective in handling these problems, it may be too expensive to call them for a minor problem. Instead, a minor less costly approach such as DIY spraying may be applied first before trying the ultimate solution.

[2] It is important to note that we do not claim that decision makers are fully rational homo economicus as portrayed in the classic economics. Rather, in resemblance to the psychic distance used in international business to measure perceived international distances between the host country and home country (Johanson and Vahlne, 1977), we argue that decision makers would perceive certain solutions to be costlier than others. They may not correspond perfectly to reality. For instance, acquisition is perceived costlier than alliance in general, even though, a focused acquisition is much cheaper and less risky than an open-ended alliance (Capron & Mitchell, 2012).

3 The costs under discussion may not be limited to financial costs, and may take the form of opportunity cost, adjustment cost, and sunk cost through format change (Greve, 1998), routines change (Massini, Lewin, & Greve, 2005), and changes in distant formation (Baum et al., 2005).

routinized process search" in the original traditional conceptualization of problemistic search model also came under fire recently (Posen et al., 2018, p. 54). With the premise of absolute bounded rationality relaxed, decision makers are endowed with certain cognitive ability in choosing potential solutions "offline" based on their mental models (Gavetti & Levinthal, 2000; Posen et al., 2018) with an eye on the potential costs of solution implementation before "online search". Most empirical studies assume attainment discrepancy automatically triggers organizational changes to restore performance shortfall, while this process is mediated by many intermediate steps in the problemistic solution searches, a black box in the existing literature. The performance feedback theory, nevertheless, explicitly separates solutions generated through problemistic search and the subsequent organizational change as not all potential solutions generated through problemistic search are to be implemented (Greve, 2003). More specifically, it further inserts risk taking to bridge these two processes by stating that:

> Proposals to change the organization are evaluated for their costs and benefits, and risk is central in this consideration.
>
> Whether a solution will be implemented and what kind of solution will be chosen depends on the risk preferences of the decision makers, making risk theory an important component of the theory of organizational reactions to performance feedback. Risk theory predicts that risk preferences change in response to performance feedback. Risky alternatives are more acceptable when the decision maker is in the loss domain, so performance below the aspiration level should make major organizational changes more acceptable to managers. (Greve, 2003, p. 57).

Risk taking not only may manifest through increased resource investment in existing solutions such as capacity expansion (e.g., Audia & Greve, 2006; Desai, 2008;) but also through selection

of solutions that demand resource investments. Absent from concerns of survival risk (March & Shapira, 1987; 1992)[4], risky solutions that demand significant resource investments are more likely to be chosen in a loss frame to win back the losses incurred in the past (Bromiley, 1991; Greve, 1998; Iyer & Miller, 2008; Kahneman & Tversky, 1979). As discussed previously, in this paper, risk taking is defined as the degree to which resource invested in solution implementation.

Different Hierarchies of Search

The problemistic search starts in the neighborhood of problem symptom or previously adopted actions and expands into increasingly distant areas (Cyert & March, 1963). In other words, there is a hierarchy of problemistic search process that favors local exploitative search over distant exploratory search (Billinger et al., 2014; Helfat, 1994; Levinthal, 1997; March, 1991). A hierarchy of problemistic search suggests that high level of solutions (e.g., distant search) are unlikely to be tried until the lower level alternatives (e.g., local search) have been exhausted. Failures from high level solutions (e.g., distant search) are unlikely to be followed by lower level solutions (e.g., local search). We posit that there exists another dimension of search hierarchy that ranks potential solutions based on their perceived costs, complexities, and risks of execution. Problemistic search commences with lower cost solutions and spirals upwards towards costlier solutions that demand significant resource investments. Significant performance shortfall may trigger corresponding risk takings that involve drastic increases of resources investments (Audia & Greve, 2006; Chen & Miller, 2007; Desai, 2008; Greve, 2011) while bypassing the rather moderate incremental steps. This hierarchy adds the concept of solution implementation costs missing in the original conceptualization in the BTF.[5]

[4] It is precisely for the risks of increased resource investments do firms become risk averse when firm survival is at stake.
[5] For example, when a person falls sick, there are a variety of potential solutions to choose from. Depending on the severity and duration of the symptom, the patient may start by resting, then taking some aspirin available at home or nearby pharmacy, before making doctor appointments for diagnosis or even getting hospitalized for treatment. Some

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Insert Graph 1 about here

Similarly, we argue that a similar pattern can be found in the organizational problemistic search process, in which less costly solutions are tried before more radical ones (Joseph et al., 2016; Shimizu, 2007). Escalation of commitments favors increased resource investments in expensive potential solutions (Staw & Hoang, 1995). Because decision makers are prone to take more risks when performance falls below aspiration, they are more likely to choose risker solutions in response to failures of their recent solution search to "win back the stakes lost" (Kahneman & Tversky, 1979; Tversky & Kahneman, 1991). In addition, decision makers whose prior actions fail to restore performance are reluctant to withdraw commitments to restore performance (Staw, 1976, 1981, 1997). Personal concerns such as loss of personal status prevents decision makers from admitting defeat and reversing course (Hayward & Shimizu, 2006; McNamara, Moon, & Bromiley, 2002).

Search Hierarchy in Corporate Development Activities

The distance between a firm's current capability level and the desired level forms a resource gap that it needs to bridge (Capron & Mitchell, 2009). A firm may choose to close the gap through a combination of internal and external sourcing mechanisms. We argue that when an organization seeks to search for external solutions to meet a strategic goal, the search process follows a hierarchy, in which borrowing through alliances (including basic contracting, strategic agreements, and JVs) is preferred over buying through acquisitions (Capron & Mitchell, 2012).

potential solutions are not necessarily more local or distant but costlier than others. A hospital visit always trumps taking aspiring available at home in its effectiveness in treating most illnesses, but it's by no means a more efficient solution, considering the financial costs, waiting time, and troubles involved. As a cheaper solution, aspiring may be able to solve the problem without going to the hospital. This hierarchy of search also does not spiral downwards from failed hospitalization to taking aspirin or resting at home.

External sourcing mechanisms fall on a continuous spectrum in terms of organizing mechanism from simple to complex, relationship length from transient to permanent, control intensity from loose to tight, and risk from low to high (Leonard, 1995). Basic contracting such as a licensing agreement is often considered first during external searches thanks to its relative simplicity and affordability. Because of the satisficing principle (March & Simon, 1958), search process ceases whenever the first acceptable alternative presents itself (Cyert & March, 1963). Compared with strategic alliances and acquisitions, basic contracting is much less costly, risky and uncertain. As a telecom executive stated in an interview with Capron and Mitchell (2012), "whenever possible, go for the cheapest way: the basic contract or the one-shot transaction" before turning to more complicated options (p. 70). In the event of failed contracting attempts, a firm may search for alternatives using more complex methods such as acquisitions. Because of its enormous complexity, risks, and costs, acquisition is reserved as the last resort after all other options have failed (Capron & Mitchell, 2012).[6] As an executive put it in Capron and Mitchell's (2012) study about their grueling trial-and-error search process from build to borrow to buy, "each failure revealed more of this pattern: that we needed to reach a certain threshold of competency before we could run effective internal development or be an effective partner within an alliance. We had to finally turn to acquisitions to accelerate R&D" (p. 21).

It is important to note that a hierarchy of problemistic search for firm sourcing methods does not profess that every firm religiously climbs the hierarchical search ladder step by step to reach acquisition at the top. Instead, many firms may jump to acquisitions to obtain desired resources once internal development appears insufficient (Capron & Mitchell, 2012). The BTF also

[6] For instance, IBM began its efforts to enter into the telecommunication market with failed internal development. It then turned to partnering with Mitel Corp and Rolm before finally spending $1.5 billion to acquire Rolm (Schrage, 1984).

suggests that 'problemistic search' follows standard operating procedures and turn to existing solutions (Cyert & March, 1963; Cohen, March, & Olsen, 1972). [7] In the event of emergency or significant performance decline, a decision maker may forego the middle steps and resort to the most expensive solution. In the search hierarchy model proposed here, a firm does not start its search process from complex risky acquisitions and then turns to simpler solutions such as basic contracting when those acquisitions fail. Rather, as prescribed in the BTF (Cyert and March, 1963), the search hierarchy in strategic sourcing presents a general direction of search from local to distant, from internal to external, and from simple to complex. In this study, we focus exclusively on the performance feedback and search process of two complex external sourcing mechanisms, alliances and acquisitions. Given the important roles that they play in implementing corporate strategy and achieving growth, their choices have been studied extensively in prior literature (e.g. Arikan & McGahan, 2010; Dyer et al., 2004; Shi et al., 2011; Villalonga and McGahan, 2005; Wang and Zajac, 2007; Yang et al., 2011).

Deal Specific Performance Feedback

Feedback valency, the dichotomy between success and failure is central to the BTF and performance feedback theory (Gavetti, Greve, Levinthal, & Ocasio, 2012; Greve, 2003; March & Simon, 1958). Positive performance feedback leads to satisficing behaviors, whereas negative one triggers 'problemistic search' (Cyert & March, 1963). The BTF also emphasizes on uncertainty avoidance and thus prefers immediate quantifiable results in its feedback mechanisms that can be attributed to a specific action (Cyert & March, 1963). Stock market

[7] Indeed, 40% of surveyed telecom firms in Capron and Mitchell's (2012) study "relied heavily on one main way of growing" and added just one additional pathway such as M&A to complement its internal development (p. 22). In other situations, a firm may consider a sourcing option without implementing it before choosing the more sophisticated alternative. When Wal-Mart decided to expand in Africa in 2011, after multiple failed attempts of greenfield ventures and careful deliberation of alliances, it jumped to acquiring South African retailer Massmart directly (Capron & Mitchell, 2012, p. 147).

reactions to deal announcements constitute such swift simplistic performance feedback. Natural aspiration that separates gains and losses by zero is 'cognitively simple to process' … 'capable of evoking strong reactions' (Greve, 2003, p. 40). Numerous studies have demonstrated that firms are attentive to market reactions by adjusting their subsequent behaviors such as routine repetitions (Arikan & McGahan, 2010; Haleblian et al., 2006), deal terminations (Luo, 2005), and risk takings (Kumar et al., 2015). Decision makers pay special attention to market reactions as their wealth positions and job security are affected (Kumar et al., 2015). Moreover, strategic decisions such as acquisitions and alliances are not made in isolation but come in a sequence of related decisions (Gong et al., 2017; Kumar et al., 2015). When making a series of related complex decisions, decision makers integrate gains or losses from previous outcomes (Thaler & Johnson, 1990). Hence, we examine deal specific performance feedback comprehensively.

It is also argued that "managers are more likely to favor changes that are large financially but not organizationally" such as "acquisition of other organizations" that serve as "very attractive solutions for managers who seek financial risk but not organizational risk" (Greve, 2003, p. 58). Therefore, it is very appropriate to use deal specific performance feedback to test performance feedback searches based on future acquisition activities.

Alliance Performance Feedback and Future Acquisitions

Alliances can be defined as "any voluntarily initiated cooperative agreement between firms that involve exchange, sharing, or co-development, and it can include contributions by partners of capital, technology, or firm-specific assets" (Gulati & Singh, 1998, p. 781). Alliances include arm's length transactions such as licensing, long-term strategic partnerships, and JVs (Capron & Mitchell, 2009). It differs from acquisition in that alliance partners share resources, knowledge, and controls to achieve a common goal while remaining independent entities. A flurry of studies

has examined the choice between acquisition and alliance from different angles (e.g. Dyer et al., 2004; Vanhaverbeke et al., 2002; Villalonga & McGahan, 2005; Wang & Zajac, 2007; Yin & Shanley, 2008). From the performance feedback perspective, alliances or acquisitions are found to be preceded by strong prior performances of the same deal types (Arikan & McGahan, 2010; Haleblian et al., 2006). Weak performances, however, may trigger 'problemistic search' (Cyert & March, 1963; Greve, 2003). Surveys among executives show that alliances are reflexively avoided after recent failures (Capron & Mitchell, 2012; Dyer et al., 2004).

Partner opportunistic behaviors and rising coordination costs represent two major problems that may arise in alliances (Yin & Shanley, 2008). The BTF prescribes that negative performance feedback may lead to problemistic search of potential solutions (Cyert & March, 1963). Local search would reveal takeover of the JV or alliance partner(s) as a viable option. Furthermore, managers tend to escalate commitments to an unsuccessful decision (Shimizu, 2007; Staw, 1976; 1981), especially when they are responsible for them (Staw & Ross, 1987). Research shows that two thirds of alliances exhibit serious problems within two years (Bleeke & Ernst, 1995) and 40% of alliances are terminated within four years, mostly through takeover by one partner (Harrigan, 1988).[8] Hence, acquisition is often searched as a feasible solution in problematic alliances. Unsuccessful local search often results in distant search in remote areas (Baum et al., 2005; Cyert & March, 1963; Levinthal, 1997). This may happen when it's unfeasible to acquire alliance partner(s). To accomplish the intended strategic objectives, firms may search for new alternatives in distant areas through new acquisition. Further, as prescribed in the BTF (Cyert & March, 1963), performance feedback provides a second-order opportunity, through which

[8] For example, Merril Lynch and HSBC initially set up a JV in 2000 intended to provide online banking services globally. Fed up with mounting coordination costs, HSBC eventually internalized the venture two years later (Capron & Mitchell, 2012, p. 111). In as similar case, only one year after having formed an alliance with Rolm, wary of rising tension with the partner, IBM moved to acquire it with $1.5 billion to gain total control (Schrage, 1984).

routines and strategies associated with failures are discarded and replaced with alternative ones (e.g. Greve, 1998; Lant & Mezias, 1992; Levitt & March, 1988). Regardless of the underlying mechanism, failures in alliance may prompt managers to reevaluate their external sourcing strategy and choose acquisition as an alternative (Dyer et al., 2004).[9]

Prospect theory at the individual level as well as performance reference point theory at the organizational level suggest that decision makers are risk averse when their previous decisions produce gains but become risk seeking in subsequent decisions when they suffered losses in related prior decisions (e.g. Bromiley, 1991; Feigenbaum, Hart, & Schendel, 1996; Greve, 2003; Kahneman & Tversky, 1979; Wiseman & Bromiley, 1996). Since acquisitions require irreversible resource commitments (Folta, 1998; Folta & Miller, 2002) and often fall victim to adverse selection due to information asymmetry (Balakrishnan & Koza, 1993), in comparison to alliances, they are inherently riskier (Dyer et al., 2004). [10] Acquisition is considered the most complex, risky, and costly solution only to be enacted after all other solutions have been exhausted (Capron & Mitchell, 2012).[11] However, despite being risker, acquisition is viewed more favorably by investors in value creation than alliances during firm turnaround (Morrow, Sirmon, Hitt, & Holcomb, 2007). In the problemistic search process following negative responses in alliances, in view of the potential upsides of acquisition, decision makers are likely to take risks by attempting more acquisitions.

[9] For instance, after Coca-Cola announced its proposed JV with P&G to facilitate R&D and distribution of juice, a strategy to diversify away from the stagnant carbonated drinks, its stock dropped over 6% as investors worried that the terms are unfavorable to Coke. Under pressure, Coca-Cola decided to withdraw from the deal a few months later and relied on a series of new acquisitions to build up its presence in the new market sector (Barnes & Winter, 2001).

[10] Alliance and JV are subject to knowledge leakage and appropriation risks (e.g. Khanna, Gulati, & Nohria, 1998). However, this type of risk is fundamentally different from the financial risk of resource investments considered under the prospect theory.

[11] Acquisition does not have a higher likelihood of failure than alliance per se, but it involves more risking taking as it requires more resource investment and have much more to lose.

To sum up, alliance failures reveal inadequacy in the current approach, leading to either local search within the current deal structure or distant search of new deals. The performance feedback literature suggests that failure with the current approach prompts searches for novel alternatives, whereas success biases against such changes (Denrell & March, 2001; Posen & Levinthal 2012).[12] As discussed previously, whereas success breeds persistency (Audia, Locke, & Smith, 2000; Lant & Mezias, 1992; Miller & Chen, 1994), failure induces reorientation and exploration of alternative routines and strategies (Cyert & March, 1963; Greve, 1998; Lant, Milliken, & Batra, 1992). Furthermore, decision makers are likely to be more risk seeking and search for risky solutions such as acquisition in reaction to negative performance feedbacks (Bromiley, 1991; Greve, 2003; Kahneman & Tversky, 1979). While new alliances may serve as potential solutions, given the recent alliance failures and the fundamental flaws within alliance deal structure, decision makers are likely to search upwards for more complex and risky alternatives such as acquisitions that provide solutions to these problems. Such failure induced search may lead to strong bias against past unsuccessful routines independent of the merits (Denrell & March, 2001). Survey results indeed show that alliances are reflexively avoided after recent failures due to superstitious learning (Capron & Mitchell, 2012). Therefore, either through local search that takes over alliance partner(s) within the current deal or distant search with a new target, firms are likely to conduct more acquisitions following negative alliance feedbacks.

Hypothesis 1: Recent negative alliance performance feedbacks are associated with higher rate of acquisitions in the future.

[12] Indeed, existing literature suggests that renewed cooperation is preceded by favorable outcomes of previous deals (Arikan & McGahn, 2010; Schwab & Miner, 2008).

Acquisition Performance Feedback and Future Acquisitions

As discussed previously, whereas success breeds persistency (Audia, Locke, & Smith, 2000; Lant & Mezias, 1992; Miller & Chen, 1994), failure induces reorientation and exploration of alternative routines and strategies (Cyert & March, 1963; Greve, 1998; Lant, Milliken, & Batra, 1992). Such failure induced search may lead to strong bias against past unsuccessful routines (Denrell & March, 2001), while persistent successes may lead to myopia of learning (Levinthal & March, 1993; Levinthal, 1997). Although acquisitions and alliances share many task similarities such as partner/target selection, negotiation, and value appropriation (Chi, 2000), there are some stark disparities between them as acquisitions pay special attention to due diligence (Zollo and Reuer, 2010), valuations (Laamanen, 2007), and especially post-acquisition integration as well as target human capital retention (Wulf & Singh, 2011; Zollo & Singh, 2004). Acquisition failures may push firms away from using acquisitions in future external sourcing choices and towards alliances as an alternative (Dyer et al., 2004). Based on the failure induced search argument (Billinger et al., 2014; Levinthal, 1997; Denrell & March, 2001), acquisition failure should lead to increasing search in alternative sourcing methods.

On the other hand, capabilities are developed through repeated occurrences of similar events (Levitt & March, 1988). "Capability development comes close to a chain of reactions triggered by an initial event, thereby establishing a capability trajectory. Capability development takes time and the specific way in which time has been taken (i.e., the intensity, frequency, and the duration of social interactions) is relevant for the gestalt of a capability" (Schreyögg and Kliesch-Eberl, 2007, p. 916). Indeed, based on a sample of US commercial banks, acquisition specific performance feedback is found to be positively related to the likelihood of subsequent acquisition (Haleblian et al., 2006; Kim et al., 2015). Continuous successful executions of deals of the same type may further cement future capability development trajectory (Dyer et al., 2004).

As positive investor response can be perceived as endorsement or existence of existing capability, firms are likely to continue to pursue future acquisitions following positive performance feedback (Arikan & McGahn, 2010)

Hypothesis 2a: Recent positive acquisition performance feedbacks are associated with high rate of acquisitions in the future.

Viewed as "pieces of clay that firms attempt to mold" (Karim, 2006, p. 804), acquisition, together with other sourcing method, aims to achieve an overarching strategic goal (Ansoff, 1979). A single acquisition usually only occupies one piece of the puzzle in an acquisition program (Barkema & Schijven, 2008).[13][14] As a last resort, acquisition should only be used after all other mechanisms have failed or deemed inappropriate or unfeasible (Capron & Mitchell, 2012). While it is true that negative acquisition feedback may lead to problemistic search (Haleblian et al., 2006), BTF posits that search begins locally at the problem symptoms and current solutions (Cyert & March, 1963). In response to recent acquisition failures, in the spirit of 'problemistic search', instead of experimenting with a new sourcing strategy, a firm may learn from them, search locally, and adjust correspondingly, including paying lower premium (Gong et al., 2017), developing acquisition capability (Arikan & McGahan, 2010), choosing different potential targets (Kumar et al., 2015), designing more complex deal structure (Capron & Mitchell, 2012, p. 146), and even hiring external advisers (Kim et al., 2011).[15] Unsuccessful local search drives firm to "increasingly complex search" (Cyert & March, 1963, p. 170). Risk seeking

[13] For instance, guided by its "overarching strategy to diversify into the downstream value chain of film production", entertainment company mm2 Asia decided to acquire Cathay Cineplexes' Singapore cinema operations following its unsuccessful Golden Village bid (Wong, 2017).

[14] It is conceivable that continuous failed acquisitions may lead to threat rigidity or readjustment of strategy, depending on the opportunity availability, external environment, and firm's overall financial wellbeing. In this paper, we control for survival risk using Altman's Z.

[15] For example, following a $37 billion failed merger with Aetna, insurance giant Humana decided to hire an acquisition specialist (Singer, 2017).

behaviors when framed as loss "may lead to sharp increases" of "the risk of the chosen alternative" (Greve, 2003, p .57). Because acquisition is perceived as the most costly and risky choice (Capron & Mitchell, 2012), it serves as a perfect candidate that fits the profile of a risky chosen alternative.

Because negative acquisition performance feedback may lead to deal termination (Kau, Linck, & Rubin., 2008; Luo, 2005), it may leave a void that needs to be filled by the firm through additional deals since acquisition is usually taken after other options have been exhausted (Capron & Mitchell, 2012). In other cases, in view of hefty cancellation costs and escalation of commitment (Staw, 1976; 1981), acquirer may ignore the negative market signal and persist in its current endeavor. Sometimes, this persistency and arrogance can doom an acquisition.[16] On the other hand, successful acquisition not only satisfies the expected strategic need but also requires extensive integration and restructuring to fully unleash the potential synergies (Barkema & Schijven, 2008; Haspeslagh & Jemison, 1991; Larsson & Finkelstein, 1999). However, acquisition integration is extremely complex and time consuming (Graebner, Heimeriks, Huy, & Vaara, 2016). Acquisition of nested targets (Zorn, Sexton, Bhussar, & Lamont, 2017) and high acquisition rate (Laamanen & Keil, 2008) are detrimental to firm performance. Integrating acquisition targets hence consumes a huge chunk of managerial capacity that may be used in new acquisitions (Penrose, 1959).

Acquisition embodies a complex strategic decision associated with significant risks (Kumar et al., 2015). Limited by their bounded rationality (March & Simon, 1958), managers are often subject to behavioral bias in their acquisition decisions (Jemison & Sitkin, 1986). Beyond the

[16] When Quaker announced its bid for Snapple for $1.7 billion, the news sent its stock down by almost 10% (Collins, 1994). Having ignored the warning from investors, Quaker persisted with the deal and ended up selling Snapple for a mere $300 million three years later (Feder, 1997).

general negative relationship between performance feedback and risk-taking behaviors laid out in the previous section, negative acquisition feedbacks have a unique influence on subsequent acquisition decisions. Escalation of commitments are particularly pertinent to risk seeking behaviors when negative feedback is "framed as a loss" (Greve, 2003, p. 27). Managers responsible for past decisions are likely to escalate commitments in the current strategy (Staw & Ross, 1987). Choosing between a certainty of loss and a chance to recover these losses with more investments, decision makers tend to choose the latter (Tversky & Kahneman, 1991). Beyond a risk-based understanding of escalation of commitments, individuals who feel responsible for their decision are likely to escalate further commitments to justify past failures (e.g., Staw & Ross, 1987), especially among individuals with high self-esteem (Sandelands, Brockner, and Glynn, 1988). Compared to incumbent CEO, a new CEO is more willing to reverse the past commitments and divest poorly performing acquired units (Hayward & Shimizu, 2006; Feldman, 2014). Poor acquisition performances are particularly damaging to acquirer and its entire senior management team's reputation and wealth position (Kumar et al., 2015). What's more, research has shown that CEO responsible for recent bad acquisitions is more likely to be dismissed by the board (Lehn & Zhao, 2006). Similarly, an earlier study found that acquirers that have made value-destroying deals are vulnerable to market for corporate control takeover (Mitchell & Lehn, 1990). A major reason why acquisitions are value destructive can be found in managerial self-interest (Haleblian et al., 2009). Whilst CEOs tend to be risk averse to protect their personal wealth against potential losses, they become risk seeking when faced with high compensation variability and employment risk (Larraza-Kintana et al., 2007; Wiseman & Gomez-Mejia, 1998). In addition to the reasons for risk taking as predicted by prospect theory (Kahneman & Tversky,

1979), acquirer's managers have strong self-interest to reverse the losses that have accumulated in pervious deals by taking more risky acquisitions (Kumar et al., 2015).

To recover the loss positions and regain the reputation lost in prior acquisitions failures, the acquirer's senior management team may resort to more risk-taking activities such as new acquisitions (Kahneman & Tversky, 1979; Kumar et al., 2015; Lehn & Zhao, 2006). Situated at the peak of the corporate development hierarchy, unsatisfactory acquisitions are unlikely to lead to searches downwards for lower level solutions that are less complex and risky, with reduced resource investments. Therefore, prior acquisition failures may result in increased risk takings by the means of acquisitions of risky targets (Kumar et al., 2015). Together with other factors, acquisition failure thus may lead to increased risk takings with more acquisitions.

Hypothesis 2b: Recent negative acquisition performance feedbacks are associated with high rate of acquisitions in the future. [17]

Several studies have found a multiplier effect when considering multiple goals simultaneously. Chen and Miller (2007) discover that firms can attend to multiple goals at the same time. In another example, when an investment's performance feedbacks fall below both social and historical aspirations, the tendency to search no-local partners are amplified because the "combination of social and historical performance feedback creates a double threat' that exceeds the intensity of 'either feedback type would if considered alone." (Baum et al., 2005, p. 543). This may especially be the case when a potential action may serve as the solutions for different performance shortfalls. For instance, when a firm suffers from attainment discrepancies in both product qualities and revenues, it's more likely to seek resources with both high status

[17] An implicit precondition for a search hierarchy suggests that negative performance feedback from the most complex, costly, and riskiest solution (acquisition) does not lead to increased search activities in potential solutions situated at the lower level of the hierarchy. However, given the philosophical difficulty to test a non-effect using the scientific method, we do not explicitly hypothesize it, but still test it empirically nonetheless in the robustness check.

and reputation to close the gaps on both performance shortfalls (Ertug & Castellucci, 2013). Similarly, it was hypothesized that insurance firms might attend to firm size attainment discrepancy more when its financial performance falls below aspiration, because an efficient scale may be necessary for better financial performance (Greve, 2008). While alliance and acquisition feedback do not necessarily represent two different goals, since acquisition can serve as solutions for both alliance and acquisition failures, it is reasonable to believe that combined intensity of 'problemistic search' may lead to increased acquisitions.

Hypothesis 3a: The negative association between a firm's recent alliance performance feedbacks and its future acquisition behaviors is amplified by its negative acquisition performance feedbacks.

Contrary to the multiplier-effect, the BTF posits the sequential attention view that suggests organizations meet multiple aspirations one goal at a time (Cyert & March, 1963; Ocasio, 1997). For instance, when a firm fails to meet its profitability goal, it pays less attention to its size goal (Greve, 2008). However, alliance and acquisition performance feedback do not necessarily reflect two separate goals, but rather two separate sourcing mechanisms. Though there is little justification to prioritize one mechanism over the other, there are still several reasons why the negative relationship between alliance performance feedbacks and future acquisitions may be strengthened by positive acquisition performance feedbacks.

First, as discussed in the first hypothesis, when alliances are punished by the market, a firm engages in 'problemistic search'. Positive acquisition performance feedback conveys a strong signal of acquisition capability or even its mere perception, whereas negative alliance performance feedback signals the lack thereof (Arikan & McGahan, 2010). Acquisition capability can be defined as acquirer's competence in performing a series of key acquisition activities including target identification, due diligence, negotiation, and post-acquisition

integration (e.g. Haspeslagh & Jemison, 1991; Zollo & Singh, 2004). Although alliance capability may be developed concurrently with acquisition capability (Bingham, Heimeriks, Schijven, & Gates, 2015), they entail some dissimilar tasks (Arikan & McGahan, 2010). Superficial experience spillover may lead to damaging outcomes (Zollo & Reuer, 2010). Strong acquisition capability can overcome many challenges and enable acquirers to pursue a broad range of difficult targets (Kaul & Wu, 2016). Ansoff (1979) also emphasized that aggressiveness of strategy is contingent upon organization's capability. Firm equipped with strong acquisition capability thus can serve as a more viable alternative to alliance. Further, within the tradition of Carnegie School, the search process resembles the mating process in the garbage can model, in which existing solutions look for problems (Cohen et al., 1972). Because acquisition is viewed as a substitute for alliance (Dyer et al., 2004), positive recent acquisition feedback signal that it may serve as a potential solution for failed alliances in fulfilling their strategic objectives. On the flip side, if both alliances and acquisitions receive strong backlashes from shareholders, this may be perceived as a repudiation of its overall growth strategy through external sourcing. It may also leave the firm disoriented and rigid when facing threats.

Second, another essential concept introduced in the BTF is politics and coalitions with divergent interests and goals (Cyert & March, 1963; Gavetti et al., 2012;). Although alliances can be sensitive to organizational aspirations (e.g. Baum et al., 2005; Shipilov et al., 2011; Tyler and Caner, 2015), many of them are not made at the top level (e.g. Dyer et al., 2004; Gavetti et al., 2012). Acquisition, however, often represents a strategy decision made at the top management team (TMT) level and is subject to approval by the board (e.g. Hayward & Hambrick, 1997; Nadolska & Barkema, 2014). Acquisitions and alliances hence are executed by different organizational coalitions. When alliances receive negative performance feedback while

comparable acquisition decisions are celebrated by the market, the power balance between acquisition and alliance functions shift in favor of future acquisitions.

Third, instead of a reflection of acquirer's acquisition capability, positive acquisition feedback may mirror optimistic market sentiment (Gaur, Malhortra, & Zhu, 2013), the dawn of an industry merger wave (McNamara, Haleblian, & Dykes, 2008), or even superficial institutional endorsements (DiMaggio & Powell, 1983; Zajac & Westphal, 2004). These external factors may send strong signals of validation to acquirers and encourage them to conduct more acquisitions in leu of alliances in future corporate initiatives. Consequently, acquisition units may gain an upper hand in future strategic decision power struggles (Greve & Zhang, 2016).

Hypothesis 3b: The negative association between a firm's recent alliance performance feedbacks and its future acquisition behaviors is amplified by its positive acquisition performance feedbacks.

METHODS

Data and sample

We rely on a multi-industry US public firms sample between 1998 and 2014 to test our hypotheses. Multi-industry sample has been used previously in the study of alliance and acquisition performance feedback (Arikan & McGahan, 2010). In comparison to single industry studies, its results are less likely to be subject to unique industry characteristics and therefore are more generalizable. It is particularly suitable to study generic theories such as the behavioral theory of the firm and performance feedback (e.g. Iyer & Miller, 2008).

Because a firm may attempt multiple alliances and acquisitions every year, to better capture the fast-moving dynamics of feedback from these deals, following recent performance feedback studies (e.g., Joseph et al., 2016), we collected firm financial data at the quarterly level from

Compustat Quarterly. We then merge them with both alliance and acquisition data retrieved from Thompson Reuters' Securities Data Corporation (SDC) Platinum database. For alliance and acquisition performance feedback, we take advantage of the Wharton Research Data Services (WRDS)'s Daily Event Study Tool that use data from CRSP. We further compile the corporate diversification measure from Compustat Segment data. We lastly turn to Compustat Annual Industrial data to calculate variables such as market to book ratio and bankruptcy rate. After combining all the data from different sources with no missing variable, we end up with 886 firms and 6628 firm quarter observations.

Dependent variable

We measure *Future Acquisitions* and *Alliances* by a simple count of total number of alliances (including both non-equity agreement, equity alliance, and JVs) and majority acquisitions announced in the next 12 quarters. As suggested in prior studies (Kacperczyk et al., 2015; Kuusela et al., 2017), in comparison to transaction value, count measure can better reflect the intensity of search. Described in detail as a robustness check, additional measure of acquisition and alliance count in the future 8 quarters is also tested, producing similar results. We focus on the time frame in the next 8 and 12 quarters because most failed alliances and acquisitions exhibit serious problems as early as two years into the deal (Bleeke & Ernst, 1995). Recent study has found that firms tend to simultaneously engage in divestments to fund acquisition activities (Kuusela et al., 2017). Therefore, firms are more likely to search for solutions for both alliance and acquisition failures.

Independent variables

Following previous studies (Arikan & McGahan, 2010; Kumar et al., 2015; Gong et al., 2017), we rely on stock market cumulative abnormal returns (CAR) as a measure of deal specific performance feedback. As discussed in the theory section, CAR is not only commonly used to

measure deal performance in both acquisition (e.g. Finkelstein & Haleblian, 2002; Haleblian & Finkelstein, 1999) and alliance literature (e.g. Kaplan & Weisbach, 1992). Research has also found that managers are responsive to poor CAR in their decisions to terminate the current acquisitions process (Kau et al., 2008; Luo, 2005). Compared with long term measure such as ROA, CAR is particularly suitable to measure deal specific feedback because it can avoid confounding events (McWilliams & Siegel, 1997). We choose our event windows at two days before and after the announcement day (-2,2) because (-1,1) produces significantly higher variations than other windows. It is possible that investors may take a while to digest the announcement information. To be conservative in our estimation as well as not to include confounding events, we use an intermediate 5-day window of (-2,2). However, we also try windows (-1,1) (-3,3) (-5,5) (-10,10) as robustness tests. We set the comparative market returns window at (-250, -45) over 200 days prior to the deal. We retrieve these CAR estimations from WRDS's Daily Event Study tool. Given the number of deals, it is unrealistic for us to verify each deal announcement dates. We first aggregate each individual CAR at the quarterly level for both acquisition and alliance feedback separately. Because CAR is calculated in proportion to a firm's total market value, such aggregation is appropriate in that each CAR reflects the feedback of that specific deal irrespective of firm's size. A CAR of -10% represents a debacle regardless if the firm is worth $500 million or $5 billion. Therefore, a quarterly CAR aggregation can accurately measure the quality of deals announced in that specific quarter. We then sum the quarterly total CAR in the past 4 quarters together with the current one as our independent variables. High level of accumulative negative CAR indicates strong deal specific performance shortfalls. Alternatively, as we will detail in the robustness test, we use average instead of total CAR that

produces similar results. We also try the total quarterly CAR in the last 3, 5, and 8 quarters with consistent findings.

Control variables

To rule out alternative explanations, we include a number of commonly used control variables in the previous studies (Iyer & Miller, 2008; Kuusela et al., 2017). We first control the size of the firm as the natural logarithm of its total assets (*Log Total Assets*) to account for the skewness of the data. Because organizational performance feedback may also trigger acquisition and alliance activities (Iyer & Miller, 2008; Kuusela et al., 2017; Tyler & Canal, 2015), we control a firm's financial performance with a simple return on sales measure. We choose ROS over ROA because ROS can better reflect the quarterly fluctuations. A firm's quarterly ROS is further splined into above and below its historical ROS because positive performance feedback leads to reduced problemistic searches. We control a firm's *R&D Intensity* by dividing its quarterly R&D expenses over total quarterly sales. Following the precedents (Iyer & Miller, 2008, Kuusela et al., 2017), we also calculate an Altman's Z score to control for *Bankruptcy Risk*.[18] Consistent with Iyer and Miller (2008), higher Altman's Z score is related to lower bankruptcy risk and possibly higher acquisition rates. We obtain a firm's financials needed to compute this variable from its end of year financial data in the same year as the current quarter. Similarly, we then compute market to book ratio (*M/B Ratio*) to control for growth opportunities.[19] Since firm market value data only became available after 1998, our data starts are truncated prior to 1998. We also account for the level of free cash flow that has been found to be linked to more unrelated diversification in the pecking order financing model (Jensen, 1986; Myers, 1984;

[18] "Altman's (1983) Z score is calculated as (1.2 x working capital divided by total assets) + (1.4 x retained earnings divided by total assets) + (3.3 x income before interest and taxes divided by total assets) + (0.6 x market value of equity divided by total liability) + (1.0 x sales divided by total assets)." (Kuusela et al., 2017)

[19] Following Iyer and Miller (2008), M/B ratio is calculated as (market value of equity + book value of liability – book equity – deferred taxes)/book value of assets.

Myers & Majluf, 1984).[20] Corporate *Diversification* is measured using an Entropy index calculated as $\sum p_{it} * ln(1 / p_{it})$, in which p_{it} represents the amount of assets from segment *j* at time *t* (Kuusela et al., 2017). Next, we try to control the influence of slack with a *slack index* that includes potential slack (debt/equity ratio), absorbed slack (SG&A/sales), and unabsorbed slack (current ratio = current assets / current liabilities). Following Tyler and Caner (2015), we calculate each category separately before standardizing and summing them into a slack index. We then calculate the *acquisition and alliance experience* by counting the total number of acquisitions and alliances that the firm has taken 8 quarters before the current quarter. We create another pair of variables that measure *acquisition and alliance rate* as the count of recent acquisitions and alliances taken within the last 8 quarters. Previous studies have also made similar distinctions in terms of these related yet different constructs (Laamanen & Keil, 2008; Castellaneta & Zollo, 2014). Experience has been found to alleviate the negative performance impact of high activity load (Castellaneta & Zollo, 2014). At the same time, they also serve as lagged dependent variable to control for potential endogeneity and strategic momentum (Amburgey & Miner, 1992; Haleblian et al., 2006). Because alliance often precedes acquisition as minority equity investment, to rule out the possibility that acquisition decision may result from alliances, we control for the concurrent alliance activities as the total count of *future alliances* in the next 12 quarters (Kuusela et al., 2017). Lastly, we add year and industry controls to account for eccentric industry and year effects on acquisitions such as merger waves (McNamara, Haleblian, and Dykes, 2008).

[20] Free cash flow is calculated as (operating income – taxes – interest expense -preferred dividend – common dividend)/ equity (Haleblian & Finkelstein, 1999; Iyer & Miller, 2008)

ANALYSES AND RESULTS

Because the dependent variable of interest is the count of future acquisitions, both Poisson and negative binomial model are suitable for estimation. We choose negative binomial estimation over Poisson because the dependent variable is over-dispersed. We nevertheless run an additional robustness check with fixed effects Poisson model that produce robust standard errors; the results are consistent with those from the negative binomial model. A problem with fixed effects count models is that observations that take the value of zero are dropped out of the sample. This practice may lead to estimation bias. To maintain the integrity and completeness of our sample, we decide to use random effects negative binomial estimator (Kuusela et al., 2017). However, we still run fixed effects negative binomial as an additional check that produces similar results. We also winsorize all our variables at 1% level to exclude any potential outliers.

Insert Table 1 about here

Table 1 produces the correlation table and descriptive statistics. Although alliance and acquisition experience and rates variables are all highly correlated, the average model variance inflation factors (VIFs) are at 2.11. The VIFs for those highly correlated variables share range from 3.18 to 4.24, way below the level of 10 deemed to be prone for multicollinearity.

Insert Table 2 about here

We present our random effects negative binomial regression results in Table 2. Most control variables such as firm total assets show the expected effects. We didn't find any significant effects of positive or negative ROS performance discrepancy on future acquisitions perhaps because the ROS is measured at the quarterly level. It is noteworthy that in Model 7, 8, and 9,

below aspiration ROS performances prompt more future alliances. It is natural to find R&D intensity to be strongly and negatively associated with future acquisitions as internal development serves as a substitute for external sourcing. Contrary to Iyer and Miller (2008), we find M/B ratio to be a positive predictor of future acquisitions. It is possible that firms with high growth prospect may require access to more external resources. A firm's corporate diversification level is also significantly related to more future acquisitions. While future acquisitions do not seem to display any connection with slack index, it is positively influenced by free cash flow. Unexpectedly, recent acquisition and alliance experience seem to reduce future acquisitions. This may be explained by firm's desire to ease the negative influence of heavy activity load to digest the acquired units (Castellaneta & Zollo, 2014).

In Model 1 and 2, we gradually add the alliance and acquisition feedback variables. Both variables are negatively and significantly associated with future acquisitions. After we entered both variables simultaneously in Model 3, the results continue to be negative and significant for both alliance ($p < .01$) and acquisition feedback ($p < .001$). Therefore, we find strong supports for H1 and H2b while rejecting H2a. The interpretations for the results are complicated by the non-linear nature of negative binomial maximum likelihood model. We rely on incidence rate ratios (IRR) to inform us the practical magnitude of the effect. Compared with a 10% positive total acquisition feedback, a symmetrical negative 10% total CAR increases the number of future acquisition attempts by about 8%. A similar magnitude of change in alliance feedback increases the number of future acquisitions by about 5%, controlling for acquisition feedback.[21]

[21] Although this effect magnitude may seem small, it is comparable to the effect of other variables including M/B ratio, diversification, free cash flow, and bankruptcy risk in our model.

H3a predicts that the negative relationship between alliance performance feedback are weakened by the increase of acquisition feedback, while H3b expects the opposite. To test these two competing hypotheses, we entered an interaction variable between alliance and acquisition feedback in Model 4. The interactive term is negative and significant ($p < .05$), suggesting that the negative effect of alliance feedback on future acquisitions are strengthened by the increase of acquisition feedback. This finding thus provides support for H3b over H3a. One problem with the interaction effect measure is that though counterintuitively, it may be argued that the negative relationship between acquisition feedback and future acquisitions is strengthened by positive alliance feedback. Hence, we use the level of corporate diversification as an alternative measure for acquisition capability (Kaul & Wu, 2016) by interacting it with both alliance and acquisition feedback in Model 5. Whereas the interaction between acquisition feedback and level of corporate diversification is insignificant, we observe that the negative relationship between alliance feedback and future acquisitions is reinforced by high level of corporate diversification ($p < .001$). This result further supports Hypothesis 3b. We then enter the interactions between alliance feedback with both acquisition feedback and diversification in Model 6. The significant interaction effects reported in both Model 4 and 5 continue to hold. This result indicates that acquisition feedback and diversification independently influence the negative effects of alliance feedback on future acquisitions. It is also interesting to note the interaction between diversification and acquisition feedback is not significant, showing a firm's diversification level does not lead to more acquisitions in response to poor acquisition performances. We plotted the interaction effects in Figure 1 and 2 for a graphic presentation. Consistent with both Model 4 and 5, the negative effects of alliance feedback and future acquisitions become stronger at high level of acquisition feedback and corporate diversification.

Insert Figure 1 & 2 about here

Robustness Tests

We conducted several robustness tests using alternative measures to gauge the reliability of the results. First, instead of using event windows (-2,2), we tested multiple alternative event windows including (-1,1) (-3,3) (-5,5) (-10,10). The results remain largely consistent with the smaller windows, but not the longer windows. Second, we winsorized the variables from at 5% level instead of 1% to further rule out any potential outliers. The results are consistent with the 1% winsorize. Third, we checked the influences of acquisition and alliance feedback in the next 8 quarters rather than 12 quarters. Both main effects and moderating effects continue to be significant. Fourth, as an alternative specification, while aware of the drawbacks of ratio measure, following (Kuusela et al., 2017), we still adopted an alternative dependent variable and specification and ran a random-effects GLS panel models. We measured the dependent variable based on the number of acquisitions over alliances in the future 8 or 12 quarters. This approach inadvertently dropped observations where there is no alliance conducted. The results reported in Table 3 are largely consistent with those from the Table 2. While the results for acquisition over alliance ratio measure is consistent with the count measure for the next 8 quarters ($p < 0.05$), the acquisition feedback predictor is not significant for the future 12 quarters.

Insert Table 3 about here

Fifth, as one of the preconditions for a hierarchy search process, though we did not formerly hypothesize it, we still tested to see how alliance and acquisition performance feedbacks as well as their interactions affect future alliances. In line with the prediction outlined in the search

hierarchy, the results are not significant across the broad, suggesting that alliances are not searched as potential solutions for failed alliances and acquisitions. Sixth, we also changed the total performance feedback to average performance feedback and the aggregation of CAR in the last 4 quarters to last 5 or 3 quarters. These changes produced similar results. Seventh, we also explored the possibility that proposed relationship may be non-linear by including squared terms for both acquisition and alliance feedback. Though the square term for alliance feedback do not show any effect, interestingly, the acquisition performance feedback square displays consistent strong positive relationships with future acquisition rates, suggesting a positive curvilinear effect. This finding may suggest that both strong and weak acquisition performance feedback increase future acquisitions, thereby helping to bridge our findings with the momentum effects from Haleblian et al. (2006). To further examine this curvilinear effect, we splined the acquisition performance feedback at zero, creating two new variables by assigning value zero to all negative and positive feedback separately. Although the negative spline function (positive values are assigned value zero) are negatively and significantly associated with future acquisitions, providing robust support to Hypothesis 2b, positive spline functions are not significantly connected to acquisitions in any way. Hence, we remain cautious and skeptical in terms of our curvilinear finding. Lastly, we further examined how acquisition and alliance feedback may influence future alliances. As demonstrated in Model 7, 8 and 9 of Table 2, the results are insignificant, showing that neither acquisition nor alliance failures trigger more future alliances. This finding provides additional support to the corporate sourcing hierarchy thesis.

DISCUSSIONS AND CONCLUSION

This paper investigated how performance feedback from prior alliances and acquisitions affect future acquisition rates. Acquisition and alliance are not strategies themselves but tools for executing strategies. Our results suggest that both alliance and acquisition performance feedbacks are negatively related to future acquisitions. We argue that when one strategic action fails to produce satisfactory results, firms search with increasingly more complex and risky solutions till the strategic need is satisfied. As we do not limit ourselves to IPO firms (Arikan & McGahan, 2010), our findings suggest that the influences of alliance and acquisition performance feedback are not constrained by initial path dependency (Dyer et al., 2004). Moreover, we also tested the interaction effects between alliance and acquisition feedback on future acquisitions. Our results indicate that the effects of alliance negative feedback on future acquisitions are strengthened with the increase of acquisition performances.

Theoretically, this paper integrates the risk-taking factor into solution search sequence in the problemistic search process. Risk taking has often been invoked when studying organizational change through problemistic search (e.g., Baum et al., 2005; Desai, 2008; Iyer & Miller, 2008; Chen & Miller, 2007). Such synonymous mentions, however, have come under criticism recently (Kacperczyk et al., 2015). We share their critique that the risk construct derives from prospect theory (Kahneman & Tversky, 1979) and further dissect risk in term of variances of potential outcomes (Kacperczyk et al., 2015) from risk taking in terms of the money on the table (Boyle & Shapira, 2012; Tversky & Kahneman, 1991). Whilst the former may not go hand in hand with organizational changes (Kacperczyk et al., 2015), the latter often takes the form of resource invested in solution implementations (Audia & Greve, 2006; Desai, 2008; Iyer & Miller, 2008). Although myriads of studies have assumed risk taking in problemistic search (see Shinkle, 2012 for a review), based on our knowledge, this is the first study of its kind that applies risk taking in

the form of resource investments to explain the direction and sequence of problemistic search. This escalating search process is directional and sequential as simple solutions are unlikely to be sought after the failures of more complex, costlier, and risker ones. Instead of treating all potential solutions as homogeneous 'bandits' randomly pulled through trials and errors (Denrell & March, 2001; Posen & Levinthal, 2012), in the context of 'problemistic search', firms may search sequentially based not only on a solution's proximity to problem symptom (Cyert & March, 1963) but also on its perceived relative complexity, risk, and costs within a hierarchy of potential solutions. While we are agnostic about under what circumstances does the cost hierarchy dominant, we contribute to the performance feedback theory another dimension of solution search hierarchy, on top of the existing hierarchies that favors local over distant searches (Cyert & March, 1963; Levinthal, 1997) and success over failure in performance feedbacks (Denrell & March, 2001; Posen & Levinthal, 2012).

This paper also introduces the concept of perceived solution implementation cost that has always been assumed away in the problemistic search literature. Answering the call from Puranam, Stieglitz, Osman, and Pillutla (2015), our study thus bridges the gap between modelling and a messy world. In computer simulation and laboratory experiments, the costs of solution execution are non-existent (e.g., Denrell, 2008; Levinthal, 1997; Billinger et al., 2014), but in a real world, where bounded rational decision makers may perceive certain solutions as costlier than others may reserve them as the last resorts. By relaxing the stringent definition of bounded rationality, we contend that though managers may not have perfect knowledge on the effectiveness and efficiency on every potential solution, they may perceive certain solutions to be risker and costlier than others. Such cognitive bias may cause decision makers to consider these solutions as last resorts.

Furthermore, when acquisition and alliance activities are viewed as strategic thrusts (Ansoff, 1979) rather than isolated deals, instead of calling the acquisition method into question (Haleblian et al., 2006), negative acquisition feedbacks reflect failures to satisfy strategic needs and spur more 'problemistic searches' near the problem symptoms. Our results are consistent with the unexpected finding from Arikan and McGahan (2010) who also took an acquisition program view of performance feedback. Acquisition feedback may both serve as an endorsement that reaffirms current strategy as well as a thermometer that activates 'problemistic search'. It is possible that individual acquisition feedback has a reassuring effect on the subsequent deal, while weak periodical acquisition feedbacks reflect unsatisfactory executions of the entire strategy. Or perhaps as acknowledged in their limitations (Haleblian et al., 2006), the positive momentum effect may be limited to their unique empirical setting of commercial banking industry which views acquisition as a tool for horizontal growth (Kim et al., 2011).

Phenomenologically, we contribute to the literature on the behavioral antecedents of acquisition (e.g., Haleblian et al., 2006; Iyer & Miller, 2008; Kuusela et al., 2017). Our results suggest that searched as remedies, acquisitions are preceded by negative alliance and acquisition feedback. Whilst strong alliance performances may reinforce the future use of alliance (Arikan & McGahan 2010), weak alliance and acquisition performances trigger acquisitions following 'problemistic search' as acquisition sits at the pinnacle of complex, risky, and costly solutions.

This is also the first study known to us that examined the interactions between acquisition and alliance feedback. Although previous studies have considered the interplays among multiple goals and aspirations (e.g. Baum et al., 2005; Greve, 2008; Kim et al., 2015), little is known regarding the interactions between two substitutive strategic tools. Alliance and acquisition feedback signify not only problems but also capabilities. Our results suggest that acquisition is

more likely to be sought as a solution for failed alliances after it has demonstrated success. This paper thus contributes to the BTF and the 'direction of search' question (Shinkle, 2012).

There are several limitations in this study that provide ample future research opportunities. First, though we postulate a hierarchy of organizational sourcing, given the data availability, we are only able to test the interplays between alliances and acquisitions. Future studies should also include the search process in internal development and arm's length transaction in their examinations (Lungeanu, Stern, & Zajac, 2016). Second, we didn't differentiate different types of alliances. Alliances can range from relatively simple licensing agreements to more complicated equity alliances and JVs. Before moving to acquisition, firms may turn to more complex alliances first (Capron & Mitchell, 2012). Third, despite our assumption of underlying strategies, we are unable to determine whether these alliance and acquisition programs serve any strategic purpose. More specifically, we don't know if these deals occurred in the recent past are intended to achieve one or multiple strategic objectives. It is conceivable that if multiple acquisitions that pursue one strategy fail, the strategy may be abandoned. Fourth, although we base our study on the BTF and problemistic search, we are unable to verify if the new acquisitions are intended to accomplish the unfinished business from prior alliances or acquisitions. It is possible that the new acquisitions are pursued for completely different purposes. Future studies may need to code individual deals into specific strategies to address this problem. Fifth, while we looked at the interaction between alliance and acquisition feedback, an interesting future research idea is to study the interplay between organizational level aspiration and deal specific feedback. Recent studies have called for the attention to understand the 'direction of search' (e.g. Shinkle, 2012; Greve & Zhang, 2016). Consistent with the logic in this paper, strong recent performances may guide the directions of future searches of organizational

performance shortfall. Finally, though we intend to add perceived solution complexity, risks, and costs as another dimension to the 'problemistic search' process, we are unable to tell how firms process and resolve the conflicts between different search rules. Future studies should examine the contingent factors that elevate one from the others. For instance, under what circumstances are familiar yet costly solutions chosen over simple but distant ones? What role does past experience play in amplifying or diminishing the concern for solution costs?

Our study shows a hierarchical sequence in firm's searches for strategic sourcing, with acquisition perched at the top as a last resort (Capron & Mitchell, 2012). Theoretically, we argue that firms may not always engage in reinforcement learning (Denrell & March, 2001) and reflexively choose the alternative after failures (Dyer et al., 2004) or search in the neighborhood of problem symptoms before expanding the radius of search to distant areas (Cyert & March, 1963). Depending on the perceived relative complexity and costs of the current choice and its alternatives, firms may continue 'local search' with increasing complexity rather than reverting to lower level simpler alternatives. We also further inform the acquisition literature in the relationship between acquisition performance feedback and future acquisitions. Not only didn't we find a positive feedback multiplier effect as a result of reinforcement learning (Haleblian et al., 2006), we found the opposite effect. Our finding suggests that this relationship is far more complex than previously expected. Indeed, our robustness test even uncovered a curvilinear effect. More future works are needed to understand the different boundaries and contingencies that influence this phenomenon.

GRAPH 1: Hierarchy of Search in Sickness

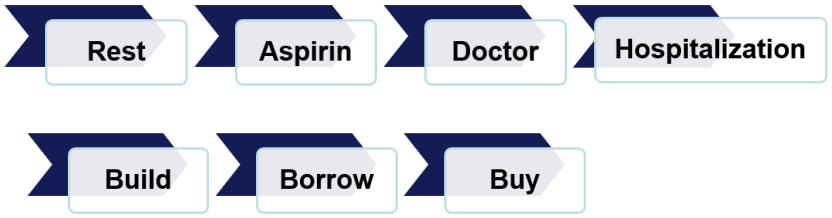


FIGURE 1: The Moderating Effect of Acquisition Feedback

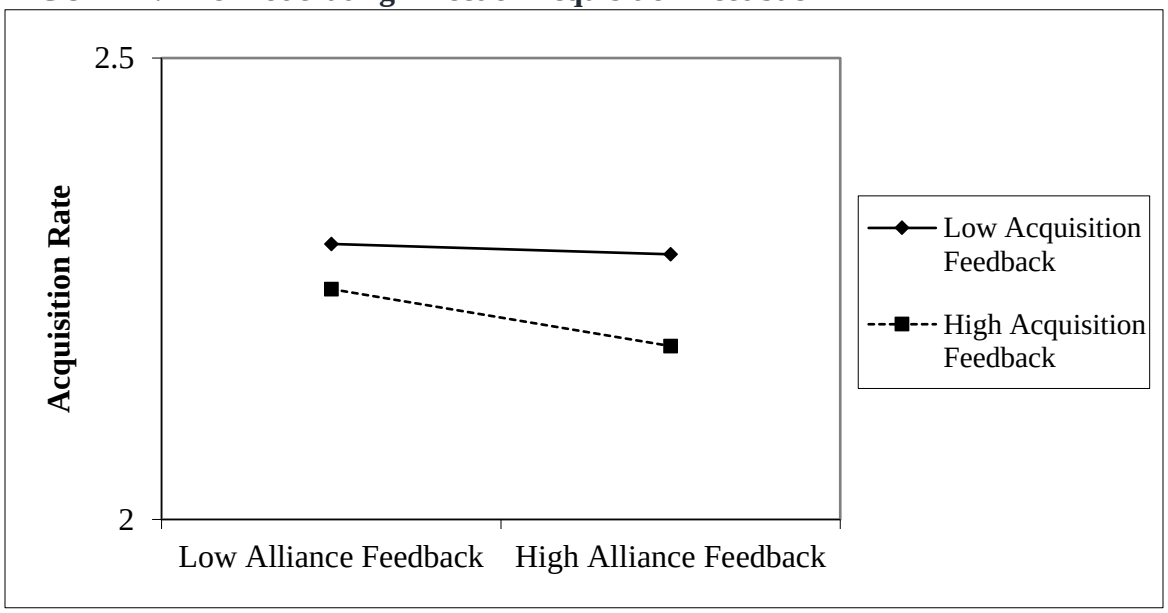


FIGURE 2: The Moderating Effect of Corporate Diversification

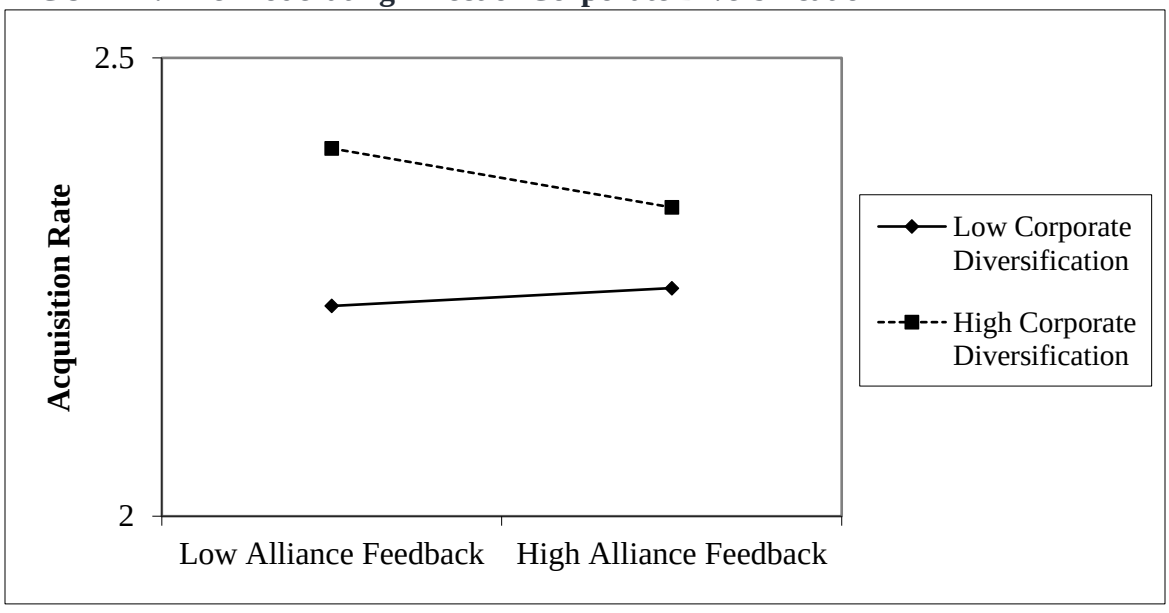


TABLE 1: Descriptive Statistics and Correlations

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Future Acquisitions																	
2	Future Alliances	0.59																
3	Log Total Assets	0.57	0.38															
4	Above Historical Aspirations (ROS)	-0.08	-0.04	-0.21														
5	Below Historical Aspirations (ROS)	0.06	0.02	0.14	0.13													
6	R&D Intensity	-0.15	-0.06	-0.26	0.22	-0.20												
7	Bankruptcy Risk	0.04	0.08	-0.03	-0.01	0.03	0.00											
8	M/B Ratio	0.16	0.19	0.05	0.12	-0.02	0.08	0.47										
9	Diversification	0.23	0.13	0.37	-0.08	0.09	-0.23	-0.13	-0.08									
10	Free Cash Flow	0.12	0.06	0.28	-0.09	0.30	-0.30	0.18	0.02	0.08								
11	Slack Index	-0.36	-0.23	-0.61	0.08	-0.12	0.45	0.33	-0.03	-0.43	-0.12							
12	Acquisition Experience	0.56	0.31	0.61	-0.08	0.08	-0.17	-0.10	0.01	0.33	0.11	-0.41						
13	Alliance Experience	0.62	0.58	0.46	-0.04	0.03	-0.09	-0.02	0.10	0.20	0.07	-0.28	0.71					
14	Alliance Rate	0.54	0.86	0.36	-0.03	0.00	-0.05	0.08	0.16	0.12	0.04	-0.21	0.30	0.59				
15	Acquisition Rate	0.66	0.40	0.52	-0.09	0.05	-0.13	0.00	0.07	0.24	0.08	-0.34	0.57	0.52	0.44			
16	Acquisition Feedback	-0.07	-0.07	-0.07	0.02	0.00	-0.04	0.02	0.02	-0.02	0.00	0.02	-0.04	-0.06	-0.07	-0.01		
17	Alliance Feedback	-0.04	-0.02	-0.04	0.07	0.00	0.05	0.05	0.08	-0.05	-0.05	0.06	-0.02	0.01	-0.02	-0.01	0.03	
	Mean	6.75	6.68	7.18	0.01	0.00	0.13	5.89	0.34	0.41	0.00	0.83	15.19	52.96	6.37	3.93	0.00	0.01
	S.D.	9.48	17.52	2.18	0.02	0.02	0.17	7.45	0.86	0.61	0.19	1.77	26.10	162.01	15.99	4.84	0.09	0.07

TABLE 2: Random Effects Future Acquisition Counts in The Next 12 Quarters Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log Total Assets	0.236***	0.238***	0.236***	0.234***	0.235***	0.233***	0.195***	0.195***	0.196***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Above Historical	-0.885	-0.918	-0.862	-0.835	-0.920	-0.895	0.255	0.258	0.256
Aspirations (ROS)	(0.61)	(0.61)	(0.61)	(0.61)	(0.61)	(0.61)	(0.59)	(0.59)	(0.59)
Below Historical	0.834	0.774	0.813	0.799	0.774	0.759	1.170*	1.170*	1.163*
Aspirations (ROS)	(0.57)	(0.57)	(0.57)	(0.57)	(0.57)	(0.57)	(0.56)	(0.56)	(0.56)

Table 2 Continued

R&D Intensity / Sales	-0.601***	-0.632***	-0.615***	-0.614***	-0.631***	-0.629***	0.218*	0.215+	0.214+
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.11)	(0.11)	(0.11)
Bankruptcy Risk	0.005**	0.005*	0.005*	0.004*	0.004*	0.004*	0.000	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
M/B Ratio	0.092***	0.097***	0.098***	0.099***	0.096***	0.098***	0.024	0.026	0.025
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Diversification	0.111***	0.109***	0.107***	0.109***	0.110***	0.112***	-0.013	-0.013	-0.012
(Entropy)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Free Cash Flow	0.203*	0.201*	0.198*	0.202*	0.204*	0.209*	-0.053	-0.053	-0.053
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.08)	(0.08)	(0.08)
Slack Index	0.020	0.020	0.020	0.019	0.021	0.020	-0.001	-0.001	-0.001
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Acquisition	-0.013***	-0.013***	-0.013***	-0.013***	-0.012***	-0.012***	-0.002*	-0.002*	-0.002*
Experience	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Alliance	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	-0.001***	-0.001***	-0.001***
Experience	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Alliance Rate	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	0.002**	0.001**	0.002**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Acquisition Rate	0.005**	0.005**	0.005**	0.005**	0.005**	0.005**	-0.002	-0.002	-0.002
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Future Alliances	0.000	0.000	0.000	0.000	0.000	0.001			
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)			
Alliance Feedback	-0.246**		-0.241**	-0.253**	0.039	0.040	-0.012	-0.013	
	(0.09)		(0.09)	(0.09)	(0.12)	(0.12)	(0.10)	(0.10)	
Acquisition Feedback		-0.417***	-0.414***	-0.392***	-0.468***	-0.426***	0.088		0.089
		(0.08)	(0.08)	(0.08)	(0.10)	(0.10)	(0.09)		(0.09)
Alliance #				-2.004*		-2.221*			
Acquisition Feedback				(0.88)		(0.88)			
Alliance # Entropy					-0.457***	-0.479***			
Diversification					(0.12)	(0.12)			
Acquisition # Entropy					0.103	0.073			
Diversification					(0.10)	(0.10)			
N	6628	6628	6628	6628	6628	6628	6628	6628	6628
Chi-squared	1066.63	1086.90	1099.713	1107.960	1129.470	1140.579	3567.748	3566.800	3568.335

Two tailed p-value for all variables. Standard errors in parentheses. + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Year and industry controls are included

TABLE 3: Future Acquisition / Alliance Ratio Random Effects GLS

	(1) (-2,2) t+12	(2) (-2,2) t+12	(3) (-2,2) t+8	(4) (-2,2) t+8	(5) (-3,3) t+8
Log Total Assets	0.132*	0.134*	0.190**	0.110**	0.111***
	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)
Above Historical	1.977	-1.936	1.493	1.544	1.571
Aspirations (ROS)	(1.92)	(1.925)	(1.49)	(1.49)	(1.488)
Below Historical	-3.888*	-3.866*	-2.478	-2.490	-2.439
Aspirations (ROS)	(1.918)	(1.918)	(1.52)	(1.521)	(1.521)
R&D Intensity Sales	-0.268	-0.268	-0.250	-0.251	-0.256
	(0.323)	(0.323)	(0.24)	(0.24)	(0.237)
Bankruptcy Risk	-0.018*	-0.018*	0.011*	0.011*	-0.011*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
M/B Ratio	0.133*	0.129***	0.142**	0.146**	0.143**
	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)
Diversification	0.148	0.145	0.137+	0.137+	0.140+
(Entropy)	(0.11)	(0.11)	(0.08)	(0.08)	(0.08)
Free Cash Flow	0.14	0.127	0.125	0.130	0.128
	(0.24)	(0.24)	(0.17)	(0.17)	(0.17)
Standard Slack Index	-0.066	-0.064	0.005	0.005	0.006
	(0.05)	(0.05)	(0.03)	(0.03)	(0.03)
Acquisition	0.002	0.002	0.005+	0.005+	0.005+
Experience	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Alliance Experience	-0.005***	-0.005***	-0.003***	-0.003***	-0.003***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Alliance Rate	0.006+	0.006+	0.007*	0.007*	0.007*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Acquisition Rate	0.067***	0.067***	0.061***	0.061***	0.061***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Future Alliances	-0.036***	-0.036***	-0.031***	-0.031***	-0.031***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Alliance Feedback	-1.078*	-1.090*	-0.792*	-0.776*	-0.677*
	(0.43)	(0.43)	(0.34)	(0.34)	(0.28)
Acquisition Feedback	0.387	0.275	-0.492*	-0.386*	-0.558*
	(0.378)	(0.373)	(0.29)	(0.29)	(0.25)

Acquisition * Alliance Feedback	-7.563^{+} (4.198)			-6.891* (3.25)	
Industry Control	Yes	Yes	Yes	Yes	Yes
Year Control	Yes	Yes	Yes	Yes	Yes
N	4994	4994	5049	5049	5049
Chi-squared	827.35	823.41	919.21	923.95	921.56
R^2	0.182	0.182	0.229	0.229	0.229

Two tailed p-value for all variables. Standard errors in parentheses. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Year and industry controls are included

CHAPTER 3: TARGET KNOWLEDGE STRUCTURE AND POST-ACQUISITION TARGET CEO RETENTION

ABSTRACT

Drawing upon the firm-specific resources and strategic human capital literatures, we develop the argument that the level of firm-specific knowledge in an acquisition target may affect the likelihood of the target's CEO being retained after an acquisition. Specifically, due to the important role of target CEOs in preserving the value of and integrating firm-specific knowledge, we expect a positive relationship between a target's pre-acquisition firm-specific knowledge level and the likelihood that its CEO is retained. Furthermore, we argue that this relationship is strengthened by the target's pre-acquisition performance, which signals a higher value of firm-specific knowledge, and the target CEO's tenure, which is positively associated with both the benefit of retaining and the cost of replacing the CEO. Using a sample of acquisitions involving US target firms acquired between 1995 and 2006, we find support for our hypotheses.

INTRODUCTION

The importance of firm-specific knowledge assets and firm-specific human capital in helping firms gain and sustain superior performances has been extensively highlighted in the strategy literature (e.g., Coff, 1997; Wang, He, & Mahoney, 2009). As firm-specific knowledge is generally difficult for competitors to imitate and cannot be easily transferred to other firm settings (Helfat, 1994; Teece, 1986), it often constitutes an important source of firm competitive advantage. Furthermore, several recent studies suggest that the effective deployment of firm-specific knowledge often requires the investment of corresponding specialized human capital by top managers, especially CEOs (Wang, Zhao, & He, 2015; Wang, Zhao, & Chen, 2017). Accordingly, firm CEOs and their specialized human capital investments are often considered critical in ensuring that the firm benefits from its firm-specific knowledge and achieves superior performances (Barney, 1991; Castanias & Helfat, 1991, 2001).

What is less well understood and examined in the existing literature is how the value generating potential of firm-specific knowledge may be affected when a firm is under the risk of leadership change, and further how the knowledge structure and specifically the level of firm-specific knowledge in such firms may in turn affect the likelihood of CEO turnover. This is an important omission as there is likely to be an interrelationship between firm-specific knowledge and CEO firm-specific human capital, which would imply that firm-specific knowledge also might have an influence on the benefits and costs associated with replacing or retaining a CEO. In this study, we fill this gap by examining this issue in the context of acquisitions and explore how the level of firm-specific knowledge in the target firm may affect an acquirer's decision to replace or retain the target's CEO.

In general, the decision to retain or terminate a target CEO represents an important decision that is likely to affect value creation in an acquisition. However, this decision seems to be complex

and contingent on a number of factors. Not surprisingly, there is a growing and burgeoning literature (for a recent review see Bilgili, Calderon, Allen, & Kedia, 2017) that looks at the factors that drive post-acquisition CEO retention in the target firm. This literature has considered factors such as target performance (Hambrick & Cannela, 1993; Walsh & Ellwood, 1991; Wulf & Singh, 2011), target CEO's relative standing in the new company (Hambrick & Cannela, 1993; Lubatkin, Schweiger, & Weber, 1999), factors related to target CEO's human capital (Buchholtz et al., 2003), and acquirers' corporate governance standards (Wulf & Singh, 2011). However, to date, relatively little attention has been paid to the influence of target firms' resource base on the decision to retain the target CEO.

In the context of acquisitions, acquirers often aim to access and acquire target firm-specific knowledge (e.g., Kaul & Wu, 2016; Puranam & Srikanth, 2007). However, it would be difficult for the acquirer to take full advantage of firm-specific knowledge acquired without the cooperation of the target's CEO (Bergh, 2001; Graebner, 2004; Zollo & Singh, 2004), given the interrelationship between firm-specific knowledge and CEO firm-specific human capital. We thus argue that the likelihood of a target CEO's retention increases with the level of firm-specific knowledge in the target. Furthermore, we try to further disentangle the mechanisms underlying this proposed baseline relationship by exploring a few contingency factors. First, we argue that our baseline effect may become stronger when a target has demonstrated strong pre-acquisition performance which suggests that the target's firm-specific knowledge is of higher value. In addition, we argue that our baseline effect will be stronger when the target CEO has longer tenure, which relates to the importance of target CEO in terms of his/her accumulated firm-specific human capital and the amount of cost associated with replacing the target CEO. We test our predictions using a sample of acquisitions involving US targets from 1995 to 2006.

We aim to make several contributions to the existing literature. First, we contribute to the literature on the resource-based view of the firm and literature on firm-specific knowledge by elaborating on the role of the CEO (in our case the target's CEO) in realizing the value of such knowledge for the firm in the context of acquisitions. Specifically, while firm-specific knowledge often can be a source of a firm's competitive advantage, we also show that retaining the CEO is important for leveraging and retaining this value.

Second, we aim to contribute to the post-acquisition executive retention literature (e.g., Hambrick & Cannela, 1993; Walsh & Ellwood, 1991; Wulf & Singh, 2011) by focusing on the role of firm-specific knowledge, an important target feature that so far has received little scholarly attention. Our findings shed light on the importance of a target's knowledge structure in the target CEO retention decision, especially when a target has achieved superior performances prior to the deal. By drawing from the resource based view and extending the literature on firm-specific knowledge, this study thus enriches our understanding of target CEO retention decision.

BACKGROUND

Target CEOs Post-Acquisition Turnover

Mergers and acquisitions (M&As) have become one of the most popular strategic tools utilized by managers to pursue their strategic objectives. However, despite their popularity, there is an increasing body of empirical evidence that suggests that the majority of deals fail to create value for the acquirer (e.g., King, Dalton, Daily, & Covin, 2004; Cuypers, Cuypers & Martin, 2017). This can be at least partially attributed to the complex and disruptive nature of the post-acquisition integration process, in which the sources of value which the acquirer intends to capture are often destroyed (e.g., Puranam & Srikanth, 2007; Zollo & Singh, 2004). Such value destruction can be caused by the departure of a target firm's CEO who often embodies a considerable source

of value for the acquirer. Namely, in many cases the target firm's CEO has accumulated valuable knowledge about the target firm and may play a vital role in post-acquisition integration (Bergh, 2001; Butler, Perryman, & Ranft, 2012; Cannela & Hambrick, 1993; Haleblian et al., 2009). Indeed, it has been shown that the retention of target's CEO can mitigate the disruption caused in an acquisition (Graebner, 2004; Zollo & Singh, 2004). However, retaining the CEO in a target firm is not a given for an acquirer. For example, when an acquisition is aimed at creating value by improving a poorly performing target, the departure of its CEO often becomes a desirable and necessary outcome. Furthermore, in some cases, entrenched target CEOs may also pose an obstacle to post-acquisition integration (Buchholtz, Ribbens, & Houle, 2003; Cannela & Hambrick, 1993).

Given the importance of the issue it is not surprising that management scholars have studied the post-acquisition turnover of target firm's CEOs for three decades (e.g., Walsh, 1988; 1989) (for a review see Krug and Aguilera (2004), Krug, Wright, and Kroll (2014), and Bilgili et al., (2017)). Early work in this body of research primarily drew from agency theory and focused on the *market discipline hypothesis* which argues that acquirers often take over badly performing targets to replace the CEO, thereby trying improving target's performance. While M&As have been found to be positively related to abnormal target executives and CEO turnover (Walsh, 1988; Walsh & Ellwood, 1991), there is little evidence that acquirers indeed commonly engage in M&As as corporate raider to rid of CEOs and other top managers (Krug et al., 2014; Walsh & Kosnik, 1993).

Another stream of work in this literature has instead focused on reasons why some target CEOs are retained. They found that acquirers often retain executives from targets with good pre-acquisition performance as this is an indication of their competence (Hambrick & Cannella, 1993). The retention of target executives then in turn contributes to better acquisition outcomes because

they represent an "intrinsic component of the acquired firm's resource base" (Cannela & Hambrick, 1993: 137). Subsequent work examined a number of other factors that influence target CEO retention. For example, drawing from the resource based view, Bergh (2001) studied the effect of target CEOs' organizational tenure on CEO retention and post-acquisition performance. However, although target CEO tenure has been found to improve post-acquisition performance (Bergh, 2001), several studies failed to uncover an association with post-acquisition retention (e.g., Buchholtz et al., 2003; Wulf & Singh, 2011). Some other studies suggest that acquirers also tend to value and retain target CEOs who can bring in complementary functional skills (Krishnan et al., 1997) or industry knowledge (Buchholtz et al., 2003) that the acquirer lacks.

While several of the afore-mentioned studies draw from the resource based view, none of these studies has directly taken into consideration the role of the target's knowledge structure, and its level of firm-specific knowledge in particular, in influencing target CEO retention. By directly examining the level of firm-specific knowledge of targets, we aim to make an important extension to the existing resource based view explanations or target CEO retention.

Firm-specific Knowledge Resources and the Role of CEOs

The resource based view (RBV) argues that a firm's competitive advantage lies in its resources, especially in the knowledge based resources that the firm possesses (Barney, 1991; Kogut & Zander, 1992; Wernerfelt, 1984). Given the importance of knowledge in the RBV, it is not surprising that scholars have explored differences among firms' resources and identified that knowledge resources can also be further categorized as general knowledge that is universally applicable and firm-specific knowledge that is tailored for a specific organizational context (Becker, 1964; Williamson, 1988). While both types of knowledge are important, firm-specific knowledge is of particular importance to a firm's competitiveness. The development of firm-specific knowledge resources generally requires long term path dependent investments that build

on a firm's existing knowledge base (Cohen & Levinthal, 1990; Dierickx & Cool, 1989; Peteraf, 1993). As a result, firm-specific knowledge assets are particularly difficult for competitors to imitate (Helfat, 1994; Teece, 1986), and cannot be easily transferred to another firm setting without incurring significant value loss (Grant, 1996). As a result, they often contribute to a firm gaining a competitive advantage.

Another important feature of firm-specific knowledge resources, as compared to physical or other non-specific organizational resources, is that they rarely generate value for the firm independently (Helfat, 1994; Teece, 1986). Instead, their effective deployment is often coupled with the corresponding human capital embedded in the CEO and other (top) managers (Wang, Zhao, & He, 2015; Wang, Zhao, & Chen, 2017). Accordingly, CEOs often play a pivotal role in the resource based view as the bridge between the possession of firm-specific valuable resources and superior firm performances (Barney, 1991; Castanias & Helfat, 1991, 2001). This insight is also emphasized by Penrose (1959: 78) who argued that the value of resources lies in the 'services' that the resources can generate, or in other words, "the capacities of the men using them…". Thus, this suggests that the mere possession of resources seems to be a necessary but insufficient condition for value creation (Sirmon, Gove, & Hitt, 2008). In order to realize the value contained in these resources, resources need to be effectively managed and deployed by the CEO (Mahoney, 1995; Sirmon, Hitt, and Ireland, 2007). This is particularly the case for firm-specific knowledge resources. The effective deployment of firm-specific knowledge generally requires specialized human capital from the CEO. This then in turn has implications for how beneficial or costly it is to replace or retain a CEO. Namely, a CEO who possesses specialized human capital that is related to the firm's specific knowledge will generally be more difficult and costlier to replace.

In sum, firm-specific resources are of particular importance for the competitiveness of a firm and CEOs play an important role in the development and deployment of such resources. In the next section, we will apply these arguments in the context of acquisitions and explore why an acquirer might find it particularly important to retain the target's CEO when firm-specific resources are at play.

THEORY

Target Firm-Specific Knowledge and Target CEO Retention in M&A

In comparison to internal development, acquisitions are commonly used to plug significant resource gaps (Capron & Mitchell, 2009; Kaul & Wu, 2016) and to achieve strategic renewal (Agarwal & Helfat, 2009). Unlike lengthy path dependent internal development (Ahuja & Katila, 2004; Rosenkopf & Nerkar, 2001; Zander & Kogut, 1995), firms can obtain resources including firm-specific knowledge resources in a timely manner through acquisitions (Ahuja & Katila, 2001; Capron & Mitchell, 2009; Puranam, 2001; Puranam & Srikanth, 2007). However, to create value in an acquisition involving a target with a high level of firm-specific knowledge, it becomes important for acquirers to preserve or integrate the target's unique knowledge assets (Puranam, Singh, & Chaudhuri, 2009; Puranam, Singh, & Zollo, 2006; Puranam & Srikanth, 2007). We believe that the target's CEO can play an important role in this for several reasons.

As argued earlier, in a target with a high level of firm-specific knowledge, its CEO often develops corresponding specialized human capital which makes the CEO particularly valuable. A CEO's specialized human capital may include two components: managerial human capital specific to the knowledge resource itself (Kor & Mahoney, 2005; Ndofor, Sirmon, and He,., 2011; Sirmon et al., 2008) and managerial social capital that is specific to the network of knowledge workers who play a more direct role in deploying the firm-specific knowledge resources (Wang et al., 2009).

In the first case, top managers' specialized human capital may reflect the unique insights of potential opportunities associated with the firm-specific knowledge, which enables a more effective deployment of firm-specific knowledge resources. It has been argued that there is a co-evolution between a CEO and a firm's knowledge structure (e.g., Penrose, 1959), which has indeed been demonstrated in a number of recent studies suggesting that managerial initiatives are essential in the development of firm-specific knowledge (Wang et al., 2015; Kor & Mahoney, 2005: Wang et al., 2017). Similarly, in the acquisition context, the target's CEO becomes highly valuable to the acquiring firm when the target comprises a high level of firm-specific knowledge (Buchholtz et al, 2003; Graebner, 2004; Zollo & Singh, 2004). Not only are the CEOs of such targets more valuable, they are also more difficult to replace (Bergh, 2001; Jemison & Sitkin, 1986). While managers with general human capital can be more readily hired externally from the managerial labor market (Castanias & Helfat, 1991; Custodio, Ferreira & Matos, 2013), it is more difficult to find a replacement that possesses human capital that is specific to the target firm. Furthermore, it is likely there will be additional cost for the firm as it will require time for any replacement to accumulate such human capital that is specific to the firm (Cohen & Levinthal, 1990; Dierickx & Cool, 1989).

In the second case, social capital in the form of embedded relationships with employees serves as the vessel, through which firm-specific knowledge resources are deployed (Kor, 2003; Shaw, Duffy, Johnson, & Lockhart, 2005). In the case of firm-specific knowledge, key target employees are likely to play a pivotal role in utilizing the firm-specific knowledge assets in order to effectively deploy the knowledge and gain a competitive advantage (Wang et al., 2009). Accordingly, the retention of these key target employees becomes particularly important in order to reduce the disruptive impact of the acquisition on the target's unique knowledge base (Kogut & Zander, 1992; Larsson & Finkelstein, 1999) and organizational routines (Haspeslagh & Jemison,

1991; Zollo & Singh, 2004), thereby contributing to positive value creation and acquisition performance (Cannela & Hambrick, 1993; Cording, Christmann, & King, 2008).

As a target CEO often has built specialized relationships with its employees, target managers' retention helps to increase key target employee performance and engender post-acquisition synergies (Kiessling & Harvey, 2006). In contrast, the departure of the target CEO may send a negative signal and instill uncertainty among key target employees already wary of their future prospects (Coff, 1999, 2002). This then might pose a threat to the success of the acquisition (Bergh, 2001; Cannela & Hambrick, 1993) as it might lead to increased target employee turnover (Graebner, 2004; Ranft & Lord, 2000; Raes, Bruch, & De Jong, 2013). Specifically, such turnover would be damaging for the acquiring firm as it might become more challenging or even impossible to access the target firm's unique knowledge resources. Hence, in addition to the loss of firm-specific managerial human capital in the target as we discussed earlier, a target CEO's departure may also lead to direct loss of firm-specific knowledge due to increased employee turnover in the target.

In sum, acquirers often find it difficult to manage the process of preserving the value of firm-specific knowledge due to the highly disruptive nature of M&As (Ranft & Lord, 2002; Zollo & Singh, 2004). Retaining the target's CEO can significantly reduce the disruptive damage occurred in an acquisition and facilitate the preservation of firm-specific knowledge and the potential transfer of the knowledge from the target to the acquirer (Graebner, 2004; Ranft & Lord, 2000; Zollo & Singh, 2004). Therefore, we propose:

Hypothesis 1: There is a positive association between a target firm's pre-acquisition level of firm-specific knowledge resources and the likelihood that the target CEO is retained after an acquisition.

So far, we have derived a baseline prediction regarding the relationship between a target's firm-specific knowledge level and the likelihood of post-acquisition target CEO retention. However, the benefits derived from retaining the target's CEO (or the cost of replacing the CEO) are likely to rise or fall under certain conditions. Therefore, we are interested in contingencies that affect our baseline prediction. Specifically, we propose two factors that are likely to affect the benefits of retaining (or the cost of replacing) the CEO of a target with a high level of firm-specific knowledge. The first factor is target CEO tenure, which reflects how long the CEO's knowledge has been co-evolving with the target's knowledge base. The second factor is the pre-acquisition financial performance of the target, which signals the value of target's firm-specific knowledge, and accordingly the importance of target CEO in preserving and integrating the firm-specific knowledge. Together these two moderating factors will also help us improve our understanding of the proposed mechanisms underlying our baseline prediction.

The Moderating Role of Target CEO Tenure

In our baseline prediction we proposed that acquirers might benefit more from retaining the target CEO when the target has higher levels of firm-specific knowledge. Underlying this is the notion that the target CEO becomes increasingly important for the acquirer to create value as the target's firm specific knowledge increases because his/her firm-specific human capital is critical in the preservation of firm-specific knowledge and the potential transfer of such knowledge from the target to the acquirer. However, even with the same level of target firm-specific knowledge, the importance of a target CEO may still vary depending on how much (firm-specific) human capital he/she has developed. We will focus on one factor that has been shown to closely relate to the accumulation of CEOs' specialized human capital, namely their tenure.

Previously we highlighted that the target CEO's specialized human capital may include two components: managerial human capital specific to the knowledge resource itself (Kor &

Mahoney, 2005; Ndofor et al., 2011; Sirmon et al., 2008) and managerial social capital that is specific to the network of knowledge workers who play a more direct role in deploying the firm-specific knowledge resources (Brown & Duguid, 2001; Shaw et al., 2005; Wang et al., 2009). Accordingly, we discuss below how CEO tenure might affect the development of these components of human capital and thereby act as a moderating factor on the relationship between firm-specific knowledge and CEO retention considering these components.

First, it has been argued and demonstrated that the CEOs' knowledge and human capital co-evolves with the firm's knowledge structure (e.g., Penrose, 1959). The longer a CEO's human capital has been coevolving with the firm's knowledge base, the more likely it is customized to be complementary to the knowledge base as long tenured CEOs have greater incentives and opportunities to engage in such endeavors. Therefore, compared with a newly appointed target CEO, a target CEO with a long tenure is more likely to have accumulated human capital that is specialized to the firm-specific knowledge controlled by the firm (Wulf & Singh, 2011; Wang et al., 2015).

Second, another important component of the target CEO's human capital relates to the long-term cooperative relationship that he/she has developed with employees who possess firm-specific technical knowledge (Kor, 2003; Wang et al., 2009). These relationships manifest in the form of social capital known as "assets embedded in relationships" (Shaw et al., 2005). A target CEO with longer tenure is more likely to have accumulated rich social capital related to firm-specific knowledge resources deployment (Wang et al., 2015). Furthermore, compared with newly appointed CEOs, their longer tenured counterparts are more likely to have developed a common identity and shared purpose based on their shared experience with firm employees (e.g., Hatch & Dyer, 2004; Luo, Kanuri, & Andrews, 2014; Souder, Simsek, & Johnson, 2012).

For these reasons, we believe that retaining the target CEO will be more instrumental for the acquirer to benefit from the target's firm specific knowledge when the target CEO has longer tenure. As a result, we expect the relationship between firm-specific knowledge and the likelihood that the target CEO is retained after the acquisition to be stronger when then CEO has longer tenure. Accordingly, we predict:

Hypothesis 2: The positive relationship between a target's pre-acquisition firm-specific knowledge resources and the retention of its CEO after an acquisition is strengthened by the target CEO's pre-acquisition tenure.

The Moderating Role of Target Pre-Acquisition Performance

Although firm-specific resources are essential for firms' potential competitive advantage, they are generally associated with higher risk as compared to general resources, since the economic value of firm-specific resources is ultimately influenced by various factors such as firm context and market conditions (Bowman & Ambrosini, 2000; Priem & Butler, 2001). For example, firm-specific knowledge often develops and accumulates based on unique organizational contexts (Amit & Schoemaker, 1993; Dierickx & Cool, 1989; Peteraf, 1993). The often path dependent nature of firm-specific knowledge might then constrain the directions of future development and application (Helfat, 1994). In line with this argument, Wang and Chen (2010) found that the value of firm-specific innovations in dynamic environments is lower because firms with such firm-specific resources generally have greater difficulty in making necessary adaptations and changes. In addition, Wang, He and Mahoney (2009) highlighted that the value of firm-specific knowledge might depend on the presence of complementary resources and that firms differ in terms of possession of such resources. These studies illustrate that not all firm-specific knowledge is equally valuable and that there might be considerable heterogeneity in the value of firm-specific

knowledge across firms. Hence, it becomes important for an acquirer to assess the value potential of the target's assets in general and its firm-specific knowledge in particular.

However, acquirers are likely to face considerable information asymmetry that pertains to the value of the target's firm-specific knowledge. Acquirers generally face challenges in evaluating their potential targets (e.g., Aboody & Lev, 2000; Balakrishnan & Koza, 1993; Reuer & Ragozzino, 2008; Cuypers, Cuypers & Martin, 2017). These challenges are likely to be even greater when the targets have high levels of firm-specific knowledge. As firm-specific knowledge is often tacit in nature and tailed to a specific organizational context (e.g., Wang et al., 2009; Wang, et al., 2016), this makes it particularly difficult to understand and assess for outsiders.

To cope with information asymmetry that results due to the difficulties associated with the valuation of firm-specific knowledge, the acquirer is likely to look for information queues which signal the value of the target firm and its firm-specific knowledge. One such important information cue is the target's financial performance prior to the acquisition. The target's past performance can signal the quality of the target's knowledge base and thereby mitigate some of the acquirer's concerns due to information asymmetry. Indeed, several studies have shown a direct link between target's pre-acquisition performance and the quality of their resources (e.g., Hambrick & Cannela, 1993; Wulf & Singh, 2011). Hence, the target's firm-specific knowledge is more likely to be perceived to be of value by the acquirer if the target has stronger pre-acquisition performance.

As we argued before, retaining the CEO is likely to be important to facilitate the preservation of firm-specific knowledge and potential transfer of the knowledge from the target to the acquirer. Therefore, an acquirer is likely to see more benefits in retaining the CEO for a given level of firm-specific knowledge if there are clear indications that this knowledge has high value

potential. Considering that the target's past performance is likely to act as a signal of the value of the target's firm-specific knowledge, we propose:

Hypothesis 3: The positive relationship between a target's pre-acquisition firm-specific knowledge resources and the retention of its CEO after an acquisition is strengthened by the target's pre-acquisition financial performances.

RESEARCH DESIGN

Sample

To test our hypotheses, we drew from multiple databases. We started constructing our sample by identifying acquisitions using Thompson Reuters' Securities Data Corporation (SDC). We identified all deals that have US target firms. We also only focused on deals that were completed and in which the acquirer took a majority ownership stake in the target and we omitted deals that were mergers of equals given the nature of our research question. Furthermore, we filtered out deals labeled as self-tender, share repurchase, leveraged-buyouts (LBOs), and that involved financial acquirers.

Next, we used the NBER patents file compiled by Hall, Jaffe, and Trajtenberg (2001). This database tracks nearly all patents granted to US firms until 2006. We matched this data to the target firms that we derived from SDC. As we will detail below, the merged data enable us to calculate our firm-specific knowledge measure for the targets we obtained from SDC (and which we were able to match to the NBER patents file with confidence). To obtain information on the departure of CEOs and CEO characteristics in general for the acquisitions deals for which we have matched with NBER patent data, we used various commonly used sources: BroadEx, Compustat Annual Execucomp, Bloomberg, LinkedIn, and press releases obtained through Factiva (e.g., Custodio et al., 2013). Finally, we obtained additional financial data from Compustat North America Annual Financial Database.

Using the above filters resulted in a sample of 117 acquisitions between 1995 and 2006 for which we have complete data on all variables. This sample size is comparable to extant studies on target CEO retention.[22]

Dependent Variable

Consistent with other studies that have looked at CEO retention (e.g., Wulf & Singh, 2011), our dependent variable is a dummy variable coded 1 if the CEO was retained in any managerial capacity by the acquirer one year after the completion of the acquisition, and 0 otherwise.[23] Specifically, to calculate this measure, we used data from BoardEx and Bloomberg. Unlike acquiring firm's proxy statement filings, this allows us to verify if the CEO was retained in any managerial capacity. We further verify each case using press releases and media reports from Factiva.

As we will elaborate in the robustness section, we have used alternative specification of our dependent variable to check the robustness of our findings including using a specification based on a two-year window.

Independent Variables

Target Firm-specific knowledge (H1, H2, and H3): Following previous studies (e.g., Wang et al., 2009), we calculate *target's pre-acquisition firm-specific knowledge* using patent and citations data. This measure is based on the premise that firm-specific knowledge is often the

[22] Our sample is slightly smaller than Wulf and Singh's (2011) sample that consists out of 188 deals, Bergh's (2001) sample that consists out of 124 deals, and Buchholtz et al.'s (2003) sample that consists out of 181 deals. This is due to the having to match the CEO and acquisition data with additional patent data which is only available in a consistent and reliable way until 2006. Having to combine additional data sources with the acquisition data compared to other studies explains why the size of final sample size is slightly smaller.

[23] As discussed in more detail in for example Buchholtz, Ribbens, and Houle (2003: 509), for non-retention cases. it generally is impossible to infer whether the target CEO's departure is voluntary or not. While the same limitation may apply to our paper, we believe that it is less of a concern. In particular, we expect that firm specific knowledge reduces the likelihood of both voluntary departure and dismissal. Namely, as we argued in our baseline prediction, we expect the target CEO to be more valuable for the acquirer when there is more firm-specific knowledge in the target. This will reduce both the incentives for the acquirer to dismiss the target CEO, and the incentives for the target CEO to depart voluntarily. Hence, voluntary turnover is less likely in our case and it is less essential to differentiate between voluntary and involuntary CEO turnover.

outcome of searching and accumulating new knowledge on top of a firm's established knowledge base (e.g., Cohen & Levinthal, 1990; Wang et al., 2015). Patents provide information on a firm's existing and newly created knowledge as well as information on the path of knowledge flows. A higher frequency with which a firm's existing patents cite its own previous patents (vs. citing other firms' patents) indicates a higher degree to which the firm's new knowledge is built on its own knowledge base. Thus, a higher frequency of backward self-citations thus suggests higher level of firm-specific knowledge.

Accordingly, the base measure of *firm-specific knowledge* is the number of prior backward self-citations made (adjusted by the number of employees) for a firm's patents in a given year.[24] Furthermore, to account for variations in firm patent filling patterns over time, we reconstruct the measure using a three-year window preceding the focal acquisition year. To do so, we calculate the three-year average with a 15% yearly depreciation rate (e.g., Hall, Jaffe, & Trajtenberg, 2005; Kaul, 2012). In particular:

$$\textit{Firm-specific Knowledge} = (0.85^{2} \times FSK_{t-3} + 0.85 \times FSK_{t-2} + FSK_{t-1}) / 3$$

We believe that using a multi-year measure is more appropriate because a firm's patent filing pattern varies from year to year; furthermore, it is reasonable to expect that the level of self-citations in knowledge creation is not constant over time. Thus, a three-year lag average measure reduces the probability that the measured firm-specific knowledge level in a given year is due to an anomaly.

[24] Previous studies (e.g., Wang et al., 2015) have also looked at the degree of firm-specific knowledge (i.e. the share of backward self-citations made by the firm over the firm's total citations). However, in the context of acquisitions we believe that an absolute measure of firm-specific knowledge, rather than a relative measure, is more appropriate as acquirers are more likely to be interested in how much firm-specific knowledge there is in the target. We nevertheless check the robustness of our results using a measure that captures the degree of firm-specific knowledge.

As we will discuss in the robustness section, we also tested the robustness of our results using several alternative specifications of our Firm-Specific Knowledge measures including using a measure that captures the degree of firm-specific knowledge (i.e. the share of backward self-citations made by the firm over the firm's total citations) rather than the absolute level of firm-specific knowledge, a longer estimation window, and using an undiscounted measure.

Target CEO's Tenure (H2): We measure target's CEO tenure as the number of years that a target CEO has served in this position at the time of the acquisition (Wulf & Singh, 2011), using data from S&P Compustat Execucomp and BoardEx databases. Subsequently, we also verified our measure using additional data from Bloomberg, LinkedIn, and press releases obtained from Factiva.

Target Pre-acquisition Financial Performance (H3): Consistent with several recent studies (e.g., Wulf & Singh, 2011; Wang et al., 2017), we measure the target's pre-acquisition financial performance as its industry median adjusted return on assets (*ROA*) one year preceding the acquisition. We also check the robustness of findings using a measure that uses the average of the target's industry median adjusted return on assets (*ROA*) in the three-year window preceding the acquisition.

Control Variables

We control for several other factors at the acquirer-, target--, deal- and CEO-level that might influence the likelihood the target CEO is retained or dismissed. First, we control for the *target's R&D intensity* using target's R&D expenditures adjusted for firm size, measured one year before the acquisition (e.g., Hall et al., 2005). Second, as larger firms may differ from smaller firms in terms of the unique managerial skills they require (e.g., Wulf & Singh, 2011), we also controlled for the target's size. Specifically, we capture *target size* using the natural logarithm of its assets in the year preceding the acquisition. Third, the relative size of target vis a vis acquirer

has been shown to influence CEO retention (e.g., Wulf & Singh, 2011). Therefore, we capture *relative size* using the ratio of target's assets relative to those of the acquirer. Fourth, we control for *target's level of diversification* (Wang & Barney, 2006). To do so, we use a count of the number of 4-digit SIC codes in which it operated at the time of the acquisition (Cuypers et al., 2017). Fifth, we also include the *Target Patent Count*, calculated as the three-year total patents filed by the target firm one year before the deal, to account for the possibility that target firm with rich patent resource stock may motivate target CEO retention (Bergh, 2001; Jemison & Sitkin, 1986). Sixth, we also control for the number of firms that share the same 4-digit SIC code with the target at the time of acquisition. We label this variable *Target Peers*. The number of firms in the same industry as the target provides a proxy for the labor market conditions for target CEOs. It is conceivable that target CEOs from industries with abundant potential employers may be more likely to depart in pursuit of more attractive positions given the uncertain environment following an acquisition (Cappelli & Hamori, 2013). Seventh, as previous studies have found a relationship between the target *CEO age* and post-acquisition retention (e.g., Buchholtz et al., 2003), we control for the age of target's CEO. Eighth, we control for *CEO duality* using a dummy variable which is coded 1 if the target CEO also serves as chairman of the board and zero otherwise. Ninth, to control for CEO competence, we use the natural logarithm of the target *CEO's total compensation* one year before the deal (Wulf & Singh, 2011). Tenth, we control for the *time to completion* by the number of days between the deal announcement date and the completion date divided by 100 (Wulf & Singh, 2011). Eleventh, as target CEO might be more likely to depart following a cross-border deal than a domestic one (Krug & Hegarty, 1997; Krug & Nigh, 1998), we include a dummy variable that captures whether a *deal is cross-border* or domestic. This dummy variable is coded 1 if the deal is cross-border and 0 if the deal is domestic. Twelfth, we account for whether the deal is a *tender*

offer using a dummy variable which is coded 1 if the deal is a tender offer and 0 otherwise. Thirteenth, we control for *deal relatedness using a* dummy variable which takes the value of 1 if the acquirer and target share the same two digits primary SIC industry code (e.g., Bergh, 2001). Fourteenth, we control for the *acquirer's acquisition experience.* Specifically, we count the total number of completed acquisitions made by the acquirer in the past 5 years preceding the focal deal. Fifteenth, we capture *acquirer size* using the natural logarithm of its assets in the year preceding the acquisition. Sixteenth, we also control for the *acquirer pre-acquisition financial performance* using its return on assets (ROA) one year preceding the acquisition.[25] Seventeenth, paralleling our measure of *target diversification*, we use the count of the number of 4-digit SIC codes, in which the acquirer operated at the time of the acquisition to account for *acquirer's diversification* level (e.g., Cuypers et al., 2017). Finally, we also include year fixed-effects.

Estimation Approaches

As our dependent variable is binary in nature, we use both logistic regression and linear probability models (LPM) to test our hypotheses. While logistic regression is more commonly used for binary dependent variable, researchers have noted that the interpretation of the practical magnitude of any findings and of interaction effects can be problematic in non-linear models such as logistic regression (e.g., Ai & Norton, 2003; Hoetker, 2007; Zelner, 2009; Greene, 2010).

In contrast, linear probability models do not suffer from these issues and allow for a more intuitive interpretation of interaction effects and the practical magnitude of any findings. Therefore, linear probability models are commonly used in economics (e.g., Wooldridge, 2012) and are becoming increasingly common in strategy research (e.g., Carnahan, Agarwal, & Campbell, 2012;

[25] While an industry adjusted measure of ROA might better capture the acquirer's financial performance, we are not able to do so as some of our acquirers (contrary to our targets who are all U.S. firms) are foreign for which we cannot calculate the industry-level ROA. Therefore, we have opted to use a non-adjusted ROA specification to capture the acquirer's performance.

Conti, Gambardella, & Mariani, 2013; Reitzig & Sorenson, 2013; Ganco, Ziedonis, & Agarwal, 2015; Chatain & Meyer-Doyle, 2017; Silverman & Ingram, 2017).

We present the estimated coefficients using a linear probability models alongside those estimated using logistic regression. This allows us to plot our interaction effects and interpret the practical magnitude of our findings in a more straightforward way, while at the same time showing that our results are consistent across both estimation approaches. Finally, to adjust for possible non-independence of observations that involve the same acquirer, we report clustered robust standard errors.

RESULTS

In Table 1, we provide the descriptive statistics and the correlation matrix. The correlations do not point to serious problems with collinearity. We observe in Table 1 that in our sample, the average target CEO retention rate one year after the completion of the acquisition is about 31%. This rate is in line with other studies on CEO retention after acquisitions (e.g., Walsh, 1988; Hambrick & Cannela, 1993). Consistent with Hypothesis 1, we also observe positive and significant correlations between *Firm-Specific Knowledge* ($\rho = 0.33$, $p < 0.01$) and CEO retention rate one year after the completion of the acquisition.

Insert Table 1 here

To further explore this, we conduct some univariate analysis by looking at the differences at the mean values of the level of firm-specific knowledge across sub-samples. Specifically, we compare the mean values of the level of firm-specific knowledge in a subsample of acquisitions in

which target CEO is not retained with the mean values in a subsample in which target CEO is retained. This reveals similar patterns. Namely, we find that the mean level of firm-specific knowledge is statistically ($p < 0.001$) higher when a CEO is retained (mean = 5.575) one year after deal completion than when a CEO is not retained (mean = 1.210). This univariate finding is in line with Hypothesis 1.

Table 2 presents the results of the logit regression and the linear probability models. Model 1 shows the baseline model including all control variables. In Model 2, we introduce the *Firm-Specific Knowledge* measure to test the Hypothesis 1. Finally, in models 3 and 4 we introduce our interaction terms.

Some of the significant control variables in models 1a and 1b are worth mentioning. First, we find that respectively, target R&D intensity (*p-value* = 0.006 in Model 1a, *p-value* = 0.001 in Model 1b) and target pre-acquisition performance (*p-value* = 0.005 in Model 1a, *p-value* = 0.012 in Model 1b) are positively and significantly related to CEO retention. We also observe that target CEO tenure alone in both models is not significantly related to post-acquisition target CEO retention decisions (*p-value* = 0.995 in Model 1a, *p-value* = 0.936 in Model 1b). These findings are consistent with those found in prior studies (e.g., Bergh, 2001; Wulf & Singh, 2011). In addition, we find that the number of peer firms in target's industry is significant (*p-value* = 0.039 in Model 1a, *p-value* = 0.076 in Model 1b) and negatively associated with our dependent variable.

Insert Table 2 here

In models 2a and 2b, we find a positive and significant (*p-value* = 0.002 in the Model 2a and *p-value* < 0.001 in Model 2b) relationship between *Firm-Specific Knowledge* and *CEO*

retention, which is consistent with Hypothesis 1. In terms of the practical magnitude of this effect, a one standard deviation change in the target firm's *Firm-Specific Knowledge* is associated with a 15.25% increase in the probability of the CEO being retained (Model 2b).

In models 3a and 3b, we look at the moderating effect of the target's CEO tenure. In line with Hypothesis 2, *target CEO tenure* positively moderates (i.e. strengthens) (*p-value* = 0.007 in Model 3a, *p-value* = 0.003 in Model 3b) the relationship between *Firm-Specific Knowledge* and the likelihood of *CEO retention.*

Next, in models 4a and 4b, we look at the moderating effect of target's pre-acquisition financial performance. We find, as predicted in Hypothesis 3, that target's pre-acquisition financial performance positively moderates (i.e. strengthens) (*p-value* = 0.003 in Model 4a, *p-value* < 0.001 in Model 4b) the relationship between *Firm-Specific Knowledge* and the likelihood of *CEO retention*. We also added in both interaction terms simultaneously in separate models. However, doing so seems to cause collinearity issues and therefore we opted to focus on the models with each of the interaction terms added in individually.[26]

To facilitate the interpretation of our interaction effects, we plotted our two interaction effects in Figures 1 and 2. Specifically, Figure 1 is based on the estimates of Model 3b and Figure 2 is based on the estimates of Model 4b. In each figure the y-axis measures the probability that the

[26] Specifically, we ran a logit and LPM model with both interaction terms included simultaneously. In these models, we continue to find a positive and significant moderating effects for *Target ROA* ($p < 0.05$ in the logit model, $p < 0.05$ in the LPM) but we fail to find consistent support for the moderating effect for *Target's CEO Tenure* ($p = 0.091$ in the logit model, $p = 0.736$ in the LPM). However, we also observed that the standard errors of several of the variables in these models increased drastically which might be an indicator of collinearity issues (Boyd, Gove & Hitt, 2005; Godfrey & Hill, 1995; Pearson, 1920). To further explore this potential issue, we have conducted two tests: the conditional number test and the Farrar-Glauber test. The conditional number test yielded values above 30 which indicates that the estimated models might suffer from significant collinearity issues. Similarly, Farrar-Glauber also suggested that the models are suffering from collinearity ($p < 0.001$). Mean-centering our interaction effects did not resolve any of these issues. Therefore, as high levels of collinearity might lead to Type II errors (i.e. failing to reject the null hypothesis while it is false), we believe that the models with only a single interaction term included at a time provide more reliable estimates.

target CEO is retained, while the x-axis represents the target's level of firm-specific knowledge. The lines that depict the interactions effects are plotted by setting the moderators at a high (1 standard deviation above the mean) and low (1 standard deviation below the mean) level. The practical examination of our interaction effects in Figures 1 and 2 support our statistical inference.

Insert Figures 1, and 2 here

ADDITIONAL ANALYSIS AND ROBUSTNESS CHECKS

Alternative Specification of the Firm-Specific Knowledge Variable

First, we first checked the robustness of our main findings using an alternative measure of firm specific knowledge. Instead of using a measure that captures the absolute level of firm-specific knowledge, we use a measure that captures the *degree of firm specific knowledge* (Wang et al., 2015; 2017). Specifically, this alternative measure is calculated by counting all citations made in a firm's new patents that cite the firm's own previous patents and dividing it by the total number of citations made by the firm in the same period. Hence:

Degree of Firm-Specific Knowledge = Share of backward self-citations (over total citations) made by the focal firm.

Similar to our main *variable*, we adopted a three-year lag average measure. While the main effect of *Degree of Firm-Specific Knowledge* has a strong and positive relationship with target CEO's retention ($p < 0.001$ in both models), neither moderators appear to be significant.

Additionally, in our main analysis, we discounted our *Firm-Specific Knowledge* measure

using a 15% discount rate. Here, we have also checked the robustness of our findings using a measure that is calculated without any discounting. We continue to find a positive and significant ($p = 0.002$ in the logit model, $p < 0.001$ in the LPM) direct effect as well as positive and significant moderating effects for *Target's CEO Tenure* ($p = 0.006$ in the logit model, $p = 0.001$ in the LPM) and *Target ROA* ($p = 0.003$ in the logit model, $p < 0.001$ in the LPM).

Alternative Specification of the Dependent Variable

We also checked the robustness of our findings using an alternative specification of our dependent variable. Specifically, following Wulf and Singh (2011), we also use a measure that captures target CEO retention two years after deal completion instead of the one-year measure we used in our main analysis. This yielded results that are consistent with our main analysis. Specifically, we find a significant and positive association between, *Firm-Specific Knowledge* ($p = 0.004$ in the logit model, $p = 0.001$ in the LPM) and CEO retention two years after deal completion. We also find positive moderating effects for both *target CEO tenure* ($p = 0.012$ in the logit model, $p < 0.001$ in the LPM) and *target's pre-acquisition financial performance* ($p = 0.002$ in the logit model, $p = 0.001$ in the LPM).

In sum, our findings remain robust using these alternative specifications of our *Firm-Specific Knowledge* measures.

Alternative Specification of the Target Pre-acquisition Financial Performance

Instead of only one year preceding the acquisition, we took the three-year average of target's industry adjusted ROA. This change does not affect the significant level of the moderating effect ($p = 0.002$ in the logit model, $p = 0.008$ in the LPM).

Ownership Levels in the Target

In our main sample we only have deals in which the acquirer took a majority share. The overwhelming majority (99.7%) of these deals are full acquisitions (i.e. deals in which the acquirer took 100% ownership in the target) which does not provide us enough variance to control for this

in our main models. Therefore, we checked the robustness of our findings using a sub-sample of only full acquisitions. This again yields a positive and significant (p = 0.001 in the logit model, p = 0.001 in the LPM) direct effect as well as positive and significant moderating effects for *Target's CEO Tenure* (p = 0.014 in the logit model, p = 0.084 in the LPM) and *Target ROA* (p = 0.013 in the logit model, p = 0.001 in the LPM).

DISCUSSIONS AND CONCLUSION

Target executive retention has been studied extensively from a variety of different theoretical perspectives (for a recent review see Bilgili et al., 2017) including agency theory (Walsh & Ellwood, 1991; Walsh & Kosnik, 1993), the RBV (Bergh, 2001), and the upper echelons theory (Krishnan et al., 1997). The factors considered in this literature are as varied (e.g., Hambrick & Cannella, 1993; Krishnan et al., 1997; Lubatkin et al., 1999; Wulf & Singh, 2011). However, the specific role of different types of target resources has not been systematically examined. To our best knowledge, this study serves as the first attempt to investigate the role of the target firm's resources by examining the influence of its knowledge structure on target CEO post-acquisition retention decisions. We therefore aim to fill the void in the target executives post-acquisition turnover literatures by introducing a number of recent insights from the literature on firm-specific knowledge (e.g., Wang et al., 2015; Wang et al., 2017). Our results suggest that acquirer is more likely to retain a CEO from a target with high level of firm-specific knowledge resources.

In additional to contributing to target CEO post-acquisition retention literature, we also extend firm-specific knowledge research which typically has focused on intra-organizational settings by considering the role of firm-specific knowledge within a firm. Our study, with a focus on the M&A context, provides an opportunity to explore the effects of firm-specific knowledge

across firm boundaries. In particular, it extends the discussion of firm-specific knowledge from an intra- to an inter-organizational setting by examining how firm-specific knowledge in a target firm affects an acquirer's decision with regard to target CEO retention. Thus, our study opens the door for future studies to further examine the role of firm-specific knowledge in other potentially relevant inter-organizational contexts, such as strategic alliances, joint ventures, or supply chain relationships.

Furthermore, our finding that the relationship between firm-specific knowledge and target CEO retention is strengthened by CEO tenure sheds lights on the literature examining the role of CEO tenure on the decision to retain a CEO. Extant literature has largely failed to uncover a direct relationship between CEO tenure (as a proxy for firm specific human capital) and post-acquisition CEO retention (e.g., Buchholtz et al., 2003; Wulf & Singh, 2011). Our findings suggest that the effect of CEO tenure might be more complicated than previously thought as it might play more of a role as a moderating factor than a factor that has a direct effect of CEO retention. Specifically, our results suggest that CEO tenure moderates the relationship between firm-specific knowledge on CEO retention rather than having a direct effect. This finding should encourage future studies to examine the role of CEO tenure in more complex ways.

Limitations and Future Research

Our study is not without its limitations and we identified several opportunities for future research. First, in line with some previous studies (e.g., Wang et al., 2009), we use patent citation data to obtain measures of firm-specific knowledge. However, patent only reflects one, albeit generally an important aspect of knowledge creation and flows within a firm. However, in some cases or environments (e.g., markets with weak regime of intellectual property), a firm may develop highly firm-specific knowledge structure without this being completely reflected in patent citation patterns. To capture other aspects of knowledge creation and flow within a firm which

patents do not fully capture, future studies may want to explore using survey or other means that would allow for a more holistic measure of firms' knowledge structure (e.g., Cohen, Nelson, & Walsh, 2000).

Second, we have examined two moderators (i.e. CEO tenure and target pre-acquisition performance) that are expected to affect the relationship between target firm-specific knowledge and target CEO turnover. However, some other factors may also be of theoretical interest for future research to explore. Specifically, future studies might be able to explore the effect of acquirer characteristics or acquirer-target dyadic factors.

Despite these limitations and opportunities for future research, this study makes several important contributions to the post-acquisition executive turnover and firm-specific knowledge literatures by integrating both these literatures.

TABLE 1 Descriptive Statistics and Correlations

Variable Name	Mean	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Target CEO Retention	0.41	0.49																				
Target firm-Specific Knowledge	3.00	6.48	.33																			
Target Patent Count	54.17	121.85	.16	.10																		
Target R&D Intensity	0.09	0.10	.12	.10	-.11																	
Target Industry Adjusted ROA	0.03	0.18	.11	-.17	.02	-.38																
Target Total Assets (Log)	6.51	1.50	.11	-.16	.57	-.46	.23															
Target Peers	92.47	111.11	-.05	-.05	-.16	.39	.19	-.24														
Target Diversification	4.15	3.08	-.03	-.12	.33	-.35	.04	.56	-.23													
Target CEO Compensation (Log)	7.79	1.08	.09	-.17	.35	-.23	.20	.66	.01	.33												
Target CEO Age	54.32	7.19	-.07	-.13	-.08	-.26	.10	.19	-.25	.17	-.05											
Target CEO Tenure	6.74	5.92	-.11	-.03	-.18	-.06	.18	-.13	.11	-.14	-.15	.27										
Target CEO Duality	0.53	0.50	-.08	-.10	.08	-.14	-.05	.16	-.14	.03	.07	.39	.16									
Time to Completion	1.19	0.72	.17	.12	.45	-.12	-.06	.48	-.08	.32	.25	.06	-.19	.15								
Cross Border Deal	0.21	0.41	.05	-.10	.03	-.20	.07	.21	-.18	.20	.17	.12	-.01	.05	-.01							
Tender Offer	0.27	0.45	-.04	.02	.01	.03	-.10	-.06	-.06	-.01	-.12	-.05	.08	.01	-.23	.26						
Deal Relatedness	0.47	0.50	-.09	.01	.05	.18	-.15	-.02	.25	-.07	-.08	.01	.07	.10	-.01	-.22	-.23					
Target Relative Size	0.19	0.20	-.06	-.10	.33	-.17	.11	.42	-.05	.24	.20	.07	-.01	-.14	.24	-.11	-.08	.10				
Acquirer Total Assets (Log)	8.74	1.84	.02	-.05	.20	-.21	.08	.42	-.12	.25	.36	.03	-.07	.24	.12	.33	.06	-.18	-.49			
Acquirer ROA	0.07	0.09	.03	.05	-.05	-.17	.25	.15	-.09	.01	.10	.03	.06	.05	-.11	.04	.10	-.12	.07	.03		
Acquirer Diversification	7.85	6.83	-.02	-.09	-.01	-.19	.13	.13	-.15	.22	.10	.13	.07	.13	-.07	.23	.12	-20	-.25	.52	.07	
Acquirer Acquisition Experience	18.15	27.56	-.07	-.10	-.02	-.16	.08	.10	-.07	.00	.12	.13	.14	.05	-.18	.22	.16	-.10	-.29	.60	-.05	.50

TABLE 2: Logistic Regression and LPMs Predicting Target CEO Retention

Variables	Model 1-A		Model 1-B		Model 2-A		Model 2-B		Model 3-A		Model 3-B		Model 4-A		Model 4-B	
	Logit		*LPM*		*Logit*		*LPM*		*Logit*		*LPM*		*Logit*		*LPM*	
Constant	-1.585		0.388		-3.163		0.132		-3.571		0.136		-3.140		0.231	
	(3.483)	*[0.649]*	*(0.719)*	*[0.591]*	*(3.852)*	*[0.412]*	*(0.641)*	*[0.837]*	*(4.279)*	*[0.404]*	*(0.638)*	*[0.832]*	*(4.392)*	*[0.475]*	*(0.630)*	*[0.715]*
Target Patent Count	0.002		2.8e+04		2.8e-04		2.1e-05		5.0e-04		1.2e-06		-0.001		3.2e-05	
	(0.003)	*[0.514]*	*(0.001)*	*[0.611]*	*(0.003)*	*[0.910]*	*(0.005)*	*[0.966]*	*(0.003)*	*[0.862]*	*(0.000)*	*[0.980]*	*(0.003)*	*[0.742]*	*(0.001)*	*[0.950]*
Target R&D Intensity	10.200	**	1.594	**	10.835	**	1.748	***	12.213	**	1.861	***	12.785	**	1.874	***
	(3.720)	*[0.006]*	*(0.486)*	*[0.001]*	*(3.946)*	*[0.006]*	*(0.462)*	*[0.000]*	*(4.011)*	*[0.002]*	*(0.467)*	*[0.000]*	*(4.139)*	*[0.002]*	*(0.441)*	*[0.000]*
Target Industry Adjusted ROA	5.347	**	0.811	*	6.136	**	0.890	**	6.900	**	0.885	**	4.032	*	0.638	*
	(1.921)	*[0.005]*	*(0.317)*	*[0.012]*	*(2.212)*	*[0.006]*	*(0.283)*	*[0.002]*	*(2.421)*	*[0.004]*	*(0.279)*	*[0.002]*	*(1.862)*	*[0.030]*	*(0.280)*	*[0.025]*
Target Total Assets (Log)	-0.148		0.004		0.069		0.042		0.051		0.042		0.170		0.049	
	(0.399)	*[0.711]*	*(0.079)*	*[0.964]*	*(0.403)*	*[0.864]*	*(0.073)*	*[0.565]*	*(0.406)*	*[0.902]*	*(0.072)*	*[0.561]*	*(0.425)*	*[0.689]*	*(0.072)*	*[0.497]*
Target Peers	-0.006	*	-0.001	†	-0.005	†	-0.001		-0.006	†	-0.001		-0.006	†	-0.001	†
	(0.003)	*[0.039]*	*(0.001)*	*[0.076]*	*(0.003)*	*[0.095]*	*(0.000)*	*[0.127]*	*(0.003)*	*[0.052]*	*(0.001)*	*[0.103]*	*(0.003)*	*[0.055]*	*(0.001)*	*[0.096]*
Target Diversification	-0.154		-0.023		-0.097		-0.016		-0.124		-0.016		-0.085		-0.011	
	(0.097)	*[0.111]*	*(0.019)*	*[0.214]*	*(0.105)*	*[0.355]*	*(0.019)*	*[0.426]*	*(0.105)*	*[0.235]*	*(0.019)*	*[0.411]*	*(0.107)*	*[0.429]*	*(0.019)*	*[0.574]*
Target CEO Total Compensation	-0.056		-0.005		-0.041		-0.006		-0.095		-0.016		-0.143		-0.026	
	(0.331)	*[0.867]*	*(0.069)*	*[0.941]*	*(0.361)*	*[0.909]*	*(0.064)*	*[0.925]*	*(0.359)*	*[0.792]*	*(0.064)*	*[0.805]*	*(0.357)*	*[0.688]*	*(0.062)*	*[0.677]*
Target CEO Age	-0.036		-0.007		-0.030		-0.006		-0.023		-0.006		-0.020		-0.007	
	(0.045)	*[0.424]*	*(0.008)*	*[0.404]*	*(0.049)*	*[0.539]*	*(0.007)*	*[0.427]*	*(0.053)*	*[0.658]*	*(0.007)*	*[0.439]*	*(0.053)*	*[0.709]*	*(0.007)*	*[0.333]*
Target CEO Tenure	0.001		-0.001		-0.026		-0.003		-0.101	†	-0.007		-0.007		-0.002	
	(0.044)	*[0.994]*	*(0.008)*	*[0.936]*	*(0.045)*	*[0.568]*	*(0.007)*	*[0.697]*	*(0.059)*	*[0.083]*	*(0.007)*	*[0.307]*	*(0.048)*	*[0.878]*	*(0.006)*	*[0.732]*
Target CEO Duality	-0.301		-0.045		0.032		-0.001		0.043		-0.002		-0.086		0.006	
	(0.539)	*[0.577]*	*(0.106)*	*[0.669]*	*(0.566)*	*[0.956]*	*(0.102)*	*[0.996]*	*(0.596)*	*[0.943]*	*(0.101)*	*[0.981]*	*(0.624)*	*[0.891]*	*(0.102)*	*[0.954]*
Time to Completion	0.606		0.105		0.245		0.057		0.185		0.041		-0.054		0.013	
	(0.422)	*[0.151]*	*(0.075)*	*[0.163]*	*(0.461)*	*[0.596]*	*(0.073)*	*[0.432]*	*(0.461)*	*[0.689]*	*(0.075)*	*[0.589]*	*(0.563)*	*[0.924]*	*(0.801)*	*[0.868]*
Cross Border Deal	1.198		0.179		1.301		0.187		1.543	†	0.200		1.221		0.202	
	(0.764)	*[0.117]*	*(0.138)*	*[0.197]*	*(0.857)*	*[0.129]*	*(0.133)*	*[0.161]*	*(0.903)*	*[0.087]*	*(0.133)*	*[0.135]*	*(0.843)*	*[0.148]*	*(0.132)*	*[0.131]*
Tender Offer	-0.512		-0.061		-0.591		-0.080		-0.664		-0.097		-0.936		-0.142	
	(0.563)	*[0.363]*	*(0.115)*	*[0.595]*	*(0.685)*	*[0.388]*	*(0.112)*	*[0.475]*	*(0.705)*	*[0.346]*	*(0.112)*	*[0.387]*	*(0.790)*	*[0.236]*	*(0.113)*	*[0.211]*
Deal Relatedness	-0.322		-0.055		-0.546		-0.071		-0.462		-0.079		-0.644		-0.081	
	(0.575)	*[0.575]*	*(0.117)*	*[0.637]*	*(0.653)*	*[0.403]*	*(0.117)*	*[0.550]*	*(0.633)*	*[0.466]*	*(0.117)*	*[0.498]*	*(0.691)*	*[0.351]*	*(0.115)*	*[0.487]*
Target Relative Size	2.783		0.253		3.010		0.275		3.980	†	0.366		3.127		0.342	
	(2.363)	*[0.239]*	*(0.476)*	*[0.596]*	*(2.307)*	*[0.192]*	*(0.467)*	*[0.558]*	*(2.239)*	*[0.075]*	*(0.474)*	*[0.443]*	*(2.413)*	*[0.195]*	*(0.467)*	*[0.466]*

Table 2 *(continued)*	Model 1-A		Model 1-B		Model 2-A		Model 2-B		Model 3-A		Model 3-B		Model 4-A		Model 4-B	
	Logit		*LPM*		*Logit*		*LPM*		*Logit*		*LPM*		*Logit*		*LPM*	
Acquirer Total Assets (Log)	0.456		0.039		0.427		0.023		0.533		0.032		0.388		0.027	
	(0.303)	*[0.132]*	*(0.053)*	*[0.462]*	*(0.303)*	*[0.160]*	*(0.049)*	*[0.640]*	*(0.327)*	*[0.103]*	*(0.050)*	*[0.518]*	*(0.323)*	*[0.230]*	*(0.049)*	*[0.576]*
Acquirer ROA	-0.493		-0.019		-1.302		-0.060		-1.054		-0.088		-1.213		-0.096	
	(3.088)	*[0.873]*	*(0.579)*	*[0.974]*	*(3.437)*	*[0.705]*	*(0.557)*	*[0.914]*	*(3.546)*	*[0.766]*	*(0.545)*	*[0.872]*	*(3.823)*	*[0.751]*	*(0.560)*	*[0.864]*
Acquirer Diversification	0.042		0.006		0.045		0.006		0.033		0.005		0.034		0.003	
	(0.035)	*[0.238]*	*(0.006)*	*[0.343]*	*(0.040)*	*[0.260]*	*(0.006)*	*[0.349]*	*(0.039)*	*[0.401]*	*(0.006)*	*[0.430]*	*(0.042)*	*[0.420]*	*(0.006)*	*[0.624]*
Acquirer Acquisition Experience	-0.022	†	-0.002		-0.022		-0.002		-0.020		-0.001		-0.022		-0.001	
	(0.013)	*[0.096]*	*(0.002)*	*[0.179]*	*(0.014)*	*[0.117]*	*(0.002)*	*[0.363]*	*(0.014)*	*[0.167]*	*(0.002)*	*[0.453]*	*(0.016)*	*[0.180]*	*(0.002)*	*[0.487]*
Target Firm-Specific Knowledge					0.177	**	0.024	***	-0.033		0.010		0.379	**	0.032	***
					(0.056)	*[0.002]*	*(0.006)*	*[0.000]*	*(0.063)*	*[0.598]*	*(0.007)*	*[0.168]*	*(0.125)*	*[0.002]*	*(0.005)*	*[0.000]*
Target Firm-Specific Knowledge									0.050	**	0.002	**				
x Target CEO Tenure									*(0.019)*	*[0.007]*	*(0.001)*	*[0.003]*				
Target Firm-Specific Knowledge													0.997	**	0.075	***
x Target Industry Adjusted ROA													*(0.332)*	*[0.003]*	*(0.019)*	*[0.000]*
Year Fixed Effects	*Included*		*Included*		*Included*		*Included*		*Included*		*Included*		*Included*		*Included*	
Observations	117		117		117		117		117		117		117		117	
Log likelihood	-58.91				-52.85				-50.55				-48.96			
R-Squared			0.291				0.363				0.381				0.401	

All tests are two-tailed. Estimated coefficients are in bold. Robust standard errors are in parentheses. P−values are between square brackets.

† p < .10 * p < .05 ** p < .01*** p < .001

FIGURE 1: Plot of The Interaction Between Target Firm-Specific Knowledge and Target CEO'S Tenure

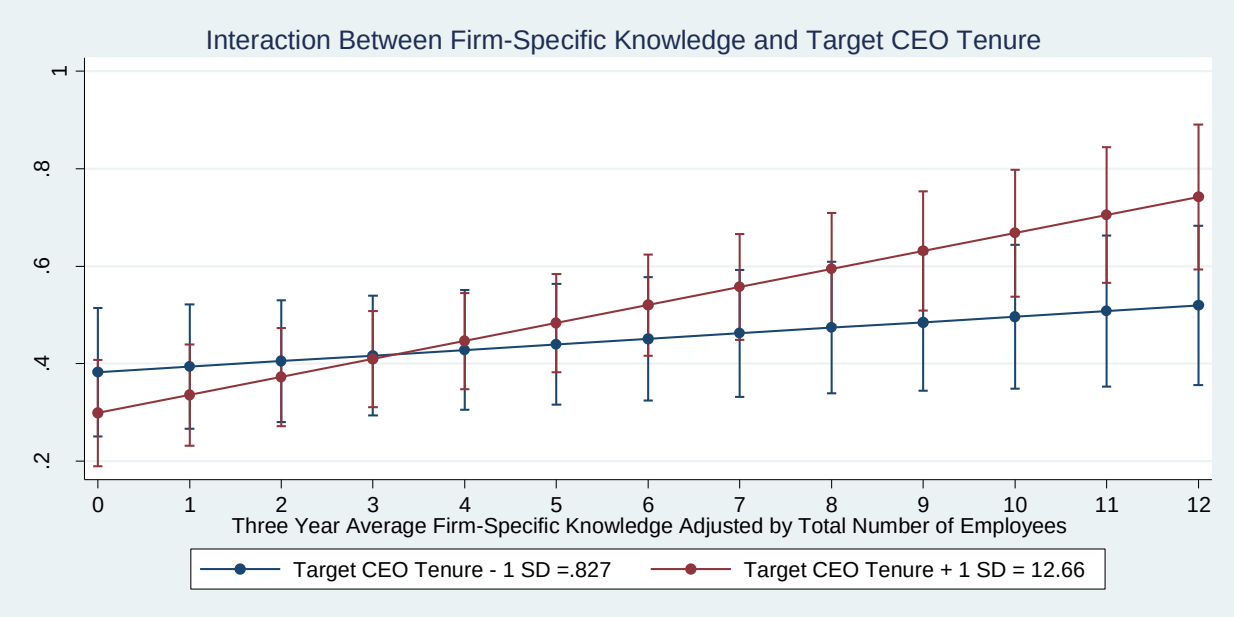
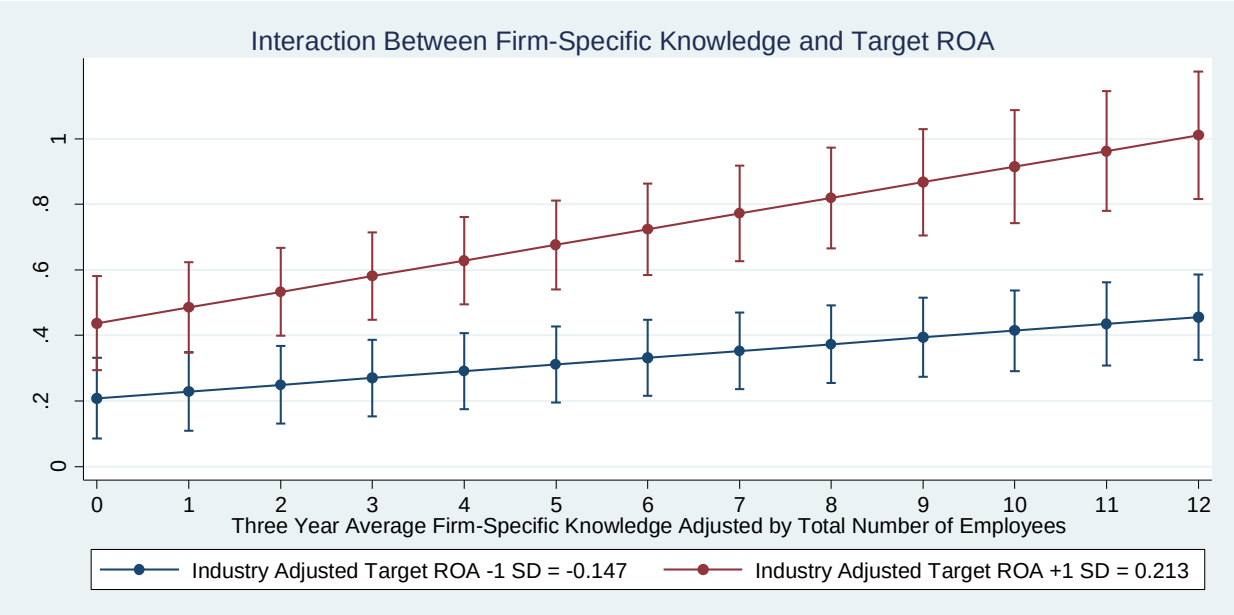


FIGURE 2: Plot of The Interaction Between Target Firm-Specific Knowledge and Target Pre-acquisition Financial Performance



Chapter 4 GENERAL CONCLUSION

In this dissertation, I examined antecedents as well as consequences of acquisition that may influence acquisition success. The conclusion from the second chapter suggests that the behavioral antecedents for acquisition is far more complicated than previously expected. While previous studies have found a positive relationship between acquisition performance feedback and subsequent action (Haleblian et al., 2006), I uncover the opposite effect when considering a series of recent feedbacks together (Arikan & McGahn, 2010). As negative performance feedback is associated with increased risk-taking behavior, problemistic search conducted under such circumstances is likely to choose the potential solution with the highest risk. Because it is considered as the last resort after all other solutions have been exhausted, acquisition conducted under such condition is likely to be desperate, which may force flawed deals through or pay hefty premiums (Haleblain et al., 2011) and end up destroying rather than creating value. From the third chapter, we can conclude that acquirer is more likely to retain target firm's CEO when the target firm has developed a highly specific knowledge structure. Because of the indispensable value brought by target firm's CEO, acquirers that fail to retain target firm's CEO are likely to suffer in the post-acquisition integration process.

In addition to acquisition success, there are significant implications to be drawn about our understanding regarding the coevolution of M&A antecedents and outcomes. Acquisition outcomes can be separated between those that affect decision making stakeholders and those that affect bystander stakeholders. The former includes decision makers who are responsible for acquisition decisions at the top echelon position within an organization, while the latter only refers to those stakeholders such as employees, customers, alliance partners, and bondholders who are affected by acquisition but have no say in the process.

Agency theory suggests that decision making stakeholders are likely to make acquisition decisions that maximize their personal interests instead of the interests of the firm (Jensen, 1986). One of the key implications from my research lies in how acquisition outcomes may influence the stakeholders who are decision makers involved in the previous deal. Driven by a combination of motives for problemistic solution search and risk seeking to recover personal wealth in a loss frame, future acquisition behaviors are inextricably linked to performance feedback in prior deals. Because decision making stakeholders are personally responsible for the prior alliances and acquisitions, unlike new CEO, they are more likely to escalate their commitments through increased resource investments (Staw, 1976, 1981) rather than admitting fault through divestitures (Hayward & Shimizu, 2006; Feldman, 2014). This is especially pertinent to corporate acquisition decisions as poor acquisition performance is linked to higher likelihood of CEO dismissal (Lehn & Zhao, 2006). Similarly, as target CEOs are more likely to be retained when the target firm has developed a firm-specific knowledge structure, compared to target CEOs who are subject to heightened risks of unemployment, they might be more likely to agree to acquisition requests. A potential remedy is to separate decision makers from the direct consequences of their decision making to a degree that they are not incentivized to take excessive risks when it is unwarranted.

It will be interesting for future research to study the performance implications for acquisitions that have the blessings of bystander stakeholders such as labor unions or borrowers. On one hand, stakeholder cooperation is desirable and conducive to better firm performance (Bosse, Phillips, & Harrison, 2010; Harrison, Bosse, & Phillips, 2010). On the other hand, because acquisition synergies hinge on disruptive integration and restructuring that often necessitate mass layoffs, it might not be helpful to only pursue deals that the labor union agrees with (Zollo et al.,

2018). In the same vein, an interesting future research question to ask is to inquire whether acquisitions taken following risk taking and problemistic search are likely to underperform. Both BTF and prospect theory make predictions on the actions following performance feedback but remain largely silent on the consequences of such actions. Taking into account the behavioral motives behind acquisitions would yield new insights about acquisition performance.

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