

## Shifting Interorganizational Boundaries: An Empirical Examination of the Implications of Strategic Alliance Exit

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## DOCTORAL THESIS

Title	<b>Shifting Interorganizational Boundaries: An Empirical Examination of the Implications of Strategic Alliance Exit</b>
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*The more you know,  
the more you know you don't know.*

Well actually...  
Dedicated to Stacy for keeping me grounded

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# 1

## Introduction

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This chapter introduces the topic of the PhD thesis,  
and presents its structure and contents.

## **1.1. Introduction to the topic of the PhD thesis**

Strategic alliances remain a ubiquitous firm strategy as increased competition and globalization place knowledge resources at the heart of competitive advantage. Strategic alliances are key mechanisms for firms to increase learning and innovation, pursue market power, enter new markets, and share risks and costs (Kogut, 1988). The importance of alliances is also reflected in numerous studies that demonstrate a positive contribution of alliances to firm value (e.g., S. Das, Sen, and Sengupta, 1998; Kale, Dyer, and Singh, 2002; Oxley, Sampson, and Silverman, 2009) and performance (e.g., Lavie, 2007; Powell, Koput, and Smith-Doerr, 1996; Stuart, 2000). In knowledge-intensive industries with soaring R&D costs, like the life sciences, alliances may perform a particularly central role in diversifying risks and knowledge sources (Powell et al., 1996). Alliances can provide preferential access to external knowledge held by partner firms, thus aiding in the search for innovation and development of an idiosyncratic resource base.

Yet, the life of a strategic alliance is inherently temporal, or inherently unstable, as past research has referred to the finite duration of alliances (e.g., Inkpen and Beamish, 1997; Kogut, 1989; Yan and Zeng, 1999). In spite of the proliferation and importance of strategic alliances, the high incidence of alliance exit prevails with exit rates averaging from 30 to 50 (e.g., Cui, Calantone, and Griffith, 2011; Das and Teng, 2000a; Greve, Baum, and Rowley, 2010). The high exit rate has drawn the attention of researchers since the pioneering work of Franko (1971). The following four decades of research on alliance instability has addressed various exit related issues but largely ignored its implications. As strategic alliance exit is pervasive and anticipated by many theoretical perspectives, there is considerable conceptual work on the topic (e.g., Arend and Seale, 2005; Das and Teng, 2000a; Yan and Zeng, 1999). Scholars have suggested

potential detrimental effects to alliance exit (e.g., Bruyaka, Philippe, and Castañer, 2018; Lane and Beamish, 1990; Parkhe, 1993; Simonin, 1997), particularly when unplanned or premature (Park and Ungson, 2001).

Extant research has made significant progress identifying the motives for alliance exit (e.g., Cui, Calantone, and Griffith, 2011; Das and Teng, 2000a; Fang and Zou, 2010; Greve, Mitsuhashi, and Baum, 2013) and has recognized instability as part of the dynamic alliance process (e.g., Ariño and de la Torre, 1998; Cui, 2013; Kogut, 1989; Wassmer, 2008). Still, there is scarce empirical evidence related to the implications of alliance exit. This is surprising given the importance of alliances for achieving strategic goals such as firm learning and considering that flexibility is one of the most valuable features of strategic alliances (Kogut, 1991; Kumar, 2005). Perhaps precisely because flexibility and temporality (Bakker and Knobens, 2015) are defining characteristics of alliances, extant research has generally disregarded the implications of alliance exit and short alliance lifespans.

Nonetheless, the outcomes associated with alliance exit are highly relevant to organizational performance and academic inquiry. Firms must constantly adapt to changing internal and external conditions, including alliance evolution (Majchrzak, Jarvenpaa, and Bagherzadeh, 2014; Makino, Chan, Isobe, and Beamish, 2007), and thus, they must reconfigure alliance portfolios (Hoffmann, 2007). For example, a recent alliance study found that an overly complex alliance portfolio can hinder firm performance (Wassmer, Li, and Madhok, 2017) suggesting that firms may need to modify alliance ties to avoid complexity. Thus, firms may need to exit existing alliances in order to form new collaborations that are best aligned with the internal resource base (Wassmer & Dussauge, 2011) and current firm-specific opportunities. Research demonstrates that firm reconfiguration activities have a significant impact on firm performance



(e.g., Bergh, 1998; Capron, Dussauge, and Mitchell, 1998; Capron and Hullan, 1999) and learning (Bergh, 1995; S. J. Chang, 1996). In line, the effect of alliance exit on firm performance and learning is likely key to understanding the net value of strategic alliances and to designing alliance portfolios and best exit practices to maximize overall alliance outcomes.

Thus, with a more inclusive yet nuanced conceptualization and empirical research strategy, alliance exit is a fertile extension ground for testing theoretical predictions and generating insight for organizations. Early and recent research on the effects of alliance formation and portfolios highlights firm performance and innovation as key outcomes linked to alliance activity (e.g., Jiang and Li, 2009; Kale et al., 2002; Lahiri and Narayanan, 2013; Powell et al., 1996; Stuart, 2000). However, most of the empirical research linking alliance exit to firm performance has focused on joint ventures (JVs) and venture internalization (e.g., Kumar, 2005; Meschi, 2005; Reuer, 2001) rather than non-equity alliances and exit via dissolution (Dussauge, Garrett, and Mitchell, 2000). Furthermore, research has largely overlooked the implications of alliance exit on learning outcomes such as innovation and knowledge building even though learning is one of the strongest motives for alliance formation in today's knowledge economy and a likely area for post-alliance residual effects. Thus, building on existing literature and addressing the scarcity of empirical research on alliance exit implications, this thesis aims to answer the question of *if and under what conditions alliance exit impacts firm performance and learning*.

## **1.2. Concepts and definitions**

This PhD thesis defines a *strategic alliance* as a voluntary interfirm collaborative arrangement that involves exchange, sharing, and co-development of resources (Gulati, 1995b; Meier, 2011),

and thus includes JVs, equity alliances, non-equity alliances, and licensing agreements aligning with this definition. The term *alliance exit* refers to organizations ending contractual collaborative arrangements, remaining independent entities or becoming a single entity. Due to journal conventions, Chapters 3 and 4 use the term *alliance termination* as synonymous with alliance exit. The studies also demarcate two modes of alliance exit, which are both included in the empirical analysis of Chapter 3 on firm performance: dissolution and internalization (Dussauge et al., 2000). *Alliance dissolution* (Polidoro, Ahuja, and Mitchell, 2011), the focus of Chapter 4, refers to alliance activities or resources being abandoned by one or both partners without purchase. *Alliance internalization* (Folta, 1998), the focus of Chapter 5, refers to a merger between partners, the acquisition of an alliance partner by another, or the acquisition of the venture or alliance resources by one partner. Chapter 5 further divides alliance internalization into *partner internalization (PI)* to refer to a full acquisition or merger of partner firms (Porrini, 2004; Ragozzino and Moschieri, 2014), and *venture internalization (VI)* to refer to the acquisition of the venture stake (Kumar, 2005; Reuer, 2001; Stienstra and Martin, 2017) or alliance resources by one of the partners. The *alliance exit motive* refers to the driving force that causes one or both of the firms to leave the alliance (Kumar, 2005; Meschi, 2005). Finally, *premature exit*, similar to the construct of unplanned dissolution, refers to an exit that does not coincide with the completion of alliance objectives (Khanna, 1998) or with contract expiration (Bakker and Knoben, 2015). A summary of definitions is provided below in Table 1.

Table 1. Key concepts and definitions

<b>Term</b>	<b>Definition</b>	<b>Guiding References</b>
<i>Strategic alliance</i>	Voluntary interfirm collaborative arrangement that involves exchange, sharing, and co-development of resources.	Gulati (1995) Meier (2011)
<i>Alliance exit</i>	Organizations ending contractual collaborative arrangements, remaining independent entities or becoming a single entity.	Das and Teng (2000a)
<i>Premature exit</i>	Alliance exit that does not coincide with the completion of alliance objectives or with contract expiration.	Khanna (1998) Makino et al. (2007)
<i>Exit motive</i>	The driving force that causes one or both of the firms to leave the alliance.	Kumar (2005) Meschi (2005)
<i>Exit mode</i>	The ownership outcome of the alliance exit.	Dussauge et al. (2000)
<i>Alliance dissolution</i>	Alliance activities or resources being abandoned by both partners without purchase.	Polidoro et al. (2011)
<i>Alliance internalization</i>	A merger between partners, the acquisition of an alliance partner by another, or the acquisition of the venture or alliance resources by one partner.	Folta (1998) Stienstra and Martin (2017)
<i>Partner internalization (PI)</i>	A full acquisition or merger of alliance partner firms.	Porrini (2004) Ragozzino and Moschieri (2014)
<i>Venture internalization (VI)</i>	The acquisition of the venture stake or alliance resources by one of the partners.	Kumar (2005) Reuer (2001)

### 1.3. Structure of the PhD thesis

The overarching research design of this PhD thesis relies on a mixed-method approach that includes systematic literature review, exploratory interviews, and a large-scale secondary data collection effort. The study tracks 4,460 strategic alliances in the life science industry formed between 1990 and 2005 and exited through 2015. The content of over 2,000 press releases on alliance exit were analyzed following the Gioia method to develop a code of alliance exit motives and determine exit modes. Given the nature of the research questions of chapters three and four, different econometric analysis and estimation strategies were employed, namely, an

event study methodology and difference-in-differences estimation with a carefully constructed control sample. The sub-samples utilized for the analyses are aligned with the respective research questions and corresponding data on firm performance (Chapter 3 uses U.S. publicly traded firms) and innovation (Chapter 4 focuses on R&D alliances). The empirical examination is guided by the tenets of two related theories: the resource-based view (RBV) and the knowledge-based view (KBV) of the firm. This PhD thesis adopts the form of a monograph based on articles, addressing sub-research questions but building on the overarching research design and dataset (chapters 3 and 4 employ subsets of the complete study sample). A brief overview of the structure and content of this PhD thesis is presented below:

Chapter 2 contains the overarching framework of this PhD thesis. Concretely, it discusses the related research and relevance of alliance exit, identifies research gaps, and provides an overview of the applied theoretical lenses. In addition, this chapter details the overarching research design, including the empirical setting, sample construction, and coding procedure that form the basis of the dataset employed in the empirical chapters of this thesis (Chapters 3 and 4). As the research design of this study is aimed at gaining a better understanding of firm-level implications of alliance exit, the complete data construction design is fundamental to the validity of the subsequent chapters. Thus, this chapter explains the origin of the full study sample and non-archival measures built for and employed in the empirical analyses of Chapters 3 and 4.

Chapter 3 addresses the effects of alliance exit on firm performance. Specifically, it aims to empirically investigate to what extent firm market valuation is impacted by different forms of alliance exit. Drawing on the RBV, it employs an event study methodology to explore the influence of alliance governance and exit modes and motives on the relationship between exit

and firm value. This chapter proposes that the exit mode and motive reveal planned firm resource reallocation and the value of alliance resources and current firm-specific opportunities. Accordingly, the first research objective of this PhD thesis is to empirically investigate the performance effects of alliance exit to better understand resource reconfiguration in the context of alliance portfolios and shared resources. Furthermore, in Chapter 3, we aim to shed light on the differential effects on firm performance of alliance governance and exit mode alternatives, as well as four central exit motives: growth, refocusing, performance issues, and unexpected external change. The article that constitutes this chapter is entitled “Alliance termination modes and motives: an event study on the effects of alliance termination on firm value” and was written in collaboration with my advisor Dr. Jan Hohberger. We hope to submit the article in the near future to a journal such as the *Strategic Management Journal* or the *Journal of Management*.

Chapter 4 focuses on the learning implications of alliance exit for organizations. In dynamic and complex environments, it becomes increasingly challenging to source all of the potentially relevant knowledge distributed across organizations and individuals (Kogut and Zander, 1993). Empirical evidence on the sources of innovation (von Hippel, 1988) has supported the organizational imperative to access and integrate knowledge residing outside firm boundaries and has cited strategic alliances as an appropriate mechanism to achieve these aims (e.g., Almeida, Song, and Grant, 2002; Baum, Calabrese, and Silverman, 2000). Taking a KBV perspective, the study applies a difference-in-differences and matching estimation to a sample of exited and non-exited alliances to explore the impact of exit on innovation and knowledge building patterns. More specifically, the study explores the influence of premature dissolution on interfirm knowledge building, the internal orientation of knowledge building, and firm innovation performance, while considering the potential moderating effects of alliance governance, geographic proximity, and same industry alliances. Moreover, the study explores

whether alternative firm-level knowledge sourcing, namely internal R&D and alliance portfolios, influences these outcomes. Thus, the second overarching research objective is to reveal the extent to which alliance dissolution influences firm learning under distinct alliance and organizational conditions. The article that constitutes this chapter is entitled “Does separation hurt? The impact of premature termination of R&D alliances on knowledge building and innovation” and was developed in collaboration with Dr. Jan Hohberger and Dr. Paul Almeida. The article is currently under review in *Research Policy*.

Chapter 5 deals exclusively with internalization as an alliance exit mode. Alliance internalization is viewed as an exit alternative with potentially positive organizational implications. The study connects M&A and alliance research to identify the drivers of alliance internalization, which may further reveal conditions fostering internalization performance. Hence, the third objective connects to the first goal of uncovering the effect of alliance exit on firm performance and explores extant evidence on a specific exit mode: internalization. The article comprising this chapter is entitled “When transitional governance transitions: a review of evidence on alliance internalization drivers” and was developed with the guidance of advisors and mentors. A conceptual extension of this article will be submitted to a journal such as the *Academy of Management Annals* or the *Journal of Management*.

Chapter 6 contains the conclusion of this PhD thesis. Concretely, it provides an integrated discussion of the findings, implications for theory and practice, limitations, and future research opportunities related to the research area and articles that compose Chapters 3, 4, and 5.

Finally, a combined and unique list of references of the works cited in all the chapters that constitute this PhD thesis is included at the end of the monograph.



# 2

## **Overarching framework**

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This chapter discusses the theoretical background, identifies the research gaps, and presents the specific research objectives and methodologies that will be addressed in the articles that constitute Chapters 3, 4, and 5.



## 2.1. Literature review

Although firms must continually seek combinations of external resources that best leverage internal resources and firm-specific opportunities, thus exiting activities, research has predicted detrimental effects to alliance exit (e.g. Bruyaka, Philippe, and Castañer, 2018; Lane and Beamish, 1990; Parkhe, 1993; Simonin, 1997). More specifically, particularly when exit is premature, firms may experience uncompensated technology transfers, loss of proprietary information, loss of reputation, and operational difficulties (Hamel, Doz, and Prahalad, 1989; Park and Ungson, 2001). The scarce empirical research on the implications of alliance exit generally supports negative outcomes for firms. For example, alliance dissolution due to partner closure has a negative impact on start-up survival when alliance partners are not replaced (Singh and Mitchell, 1996). In line, a more recent study finds that exit from venture syndicates, cited as a form of alliance, reduces future alliance formations (Zhelyazkov and Gulati, 2016). On the other hand, a multi-party alliance study investigated the persistence of a brokerage position in an alliance network and found that continuity does not enhance firm performance (Min and Mitsuhashi, 2012).

Interestingly, research on business exit and firm restructuring activities shows reallocating firm resources has conditional positive effects on firm performance. For example, past studies that examine stock market reactions to asset sales undertaken for refocusing find firms realize above average returns of between 2 and 9 percent (e.g., Datta and Iskandar-Datta, 1996; Roy and Manley, 1997). Research on firm resource redeployment (Capron and Hülland, 1999), and divestiture (Capron, Mitchell, and Swaminathan, 2001) also demonstrates positive effects of business exit and firm restructuring events. Finally, several studies explore the value creation from acquiring and divesting JVs and find the outcomes are generally positive but contingent

on alliance and firm conditions such as the motive for exit (Kumar, 2005; Meschi, 2005; Reuer, 2001). These results are aligned with theoretical predictions, as firms may realize several important benefits to abandoning peripheral businesses and reallocating those investments into core competencies, such as greater synergies and more effective utilization of organizational learning (Bergh, 1995, 1998).

Relatedly, research on alliance portfolios demonstrates the importance of portfolio configuration, and hence, alliance exit. For example, Wassmer et al. (2017) found that an overly complex alliance portfolio may harm firm performance since a more focused portfolio enhanced firm performance. This helps explain the mixed findings of research on the effect of alliance portfolio size (Deeds and Hill, 1996; Lahiri and Narayanan, 2013; Wassmer, 2008) by demonstrating that a firm's ideal number of alliances depends on the fit with the firm's internal resource base and external opportunity set. Furthermore, research has shown that firms also balance alliance portfolios with alternative external and internal growth and innovation strategies (e.g., Shi and Prescott, 2011; Stettner and Lavie, 2014). Alliance exit may also allow the firm to respond in a timely manner to changing environmental conditions. Thus, firms may need to frequently adapt their alliance portfolio, forming new and exiting old alliances, to better exploit firm resources and opportunities (e.g., Greve et al., 2013). Accordingly, alliance exit is likely an important firm strategy as it can increase firm competitiveness by focusing attention and investment on the portfolio of distinctive resources that constitute competitive advantage (Bergh, 1998; Decker and Mellewigt, 2007).

## **2.2. Theoretical relevance and applied lenses**

Alliance exit offers a fruitful opportunity to test and extend organizational theory. The implications of alliance exit are particularly relevant to expanding theory on strategic management and firm collaboration. Firm exit from a strategic alliance entails resurrecting or removing interfirm boundaries, depending on the exit mode accorded by the firms. In the case of alliance dissolution, firms shift from permeable or overlapping boundaries that permit the recombination of partner resources and return to market transaction with clear interfirm boundaries (Williamson, 1979). On the other hand, when a firm internalizes an alliance partner or alliance resources, firms select a level of integration for the acquired assets within the boundaries of the parent firm (Folta, 1998; Williamson, 1988). Thus, the end phase of a strategic alliance may offer important insight to theory on the boundaries of the firm and firm growth. Further understanding of alliance exit could also enlighten theory on cooperation and competition given the distinct alternative post-alliance scenarios. The opportunity to observe firm trajectories following a potentially unexpected shock in a firm's path also provides an opportunity to test path-dependence arguments core to several theories of organizational behavior (Cyert and March, 1963; Nelson and Winter, 1982; D. Teece, Pisano, and Shuen, 1997). Knowledge on post-alliance exit can provide additional insight on the stability of organizational routines, the bounded rationality of organizations, and the competing loyalties of organizational members.

Aligned with the theoretical relevance of the phenomenon, scholars have applied a multitude of lenses to explain the motives and implications of alliance exit. Interestingly, alliance exit motive research has paid considerable attention to sociological explanations such as trust and relational embeddedness (e.g., Ariño and de la Torre, 1998; Greve et al., 2010; Heidl, Kevin

Steensma, and Phelps, 2014) while studies on exit implications have focused more on views rooted in economics and finance (e.g., Kumar, 2005; Reuer, 2000, 2001). Nevertheless, research on alliance exit motives is extensive and covers the full range of theories including grounded theories developed to explain interorganizational collaboration and alliance stability (e.g., Ariño and de la Torre, 1998; Hamel, 1991) and grand theories, such as organizational learning (e.g., Fang and Zou, 2010) and network theory (e.g. Greve et al., 2010; Polidoro, Ahuja, and Mitchell, 2011). Theoretical perspectives related to resources, experience, and relationships are particularly prominent along with real option views when considering alliance exit implications. Also, noteworthy is the focus on culture and other aspects related to the international character of alliances (e.g., Luo, 2008; Xia, 2011). This is unsurprising given the importance of strategic alliances for firm internationalization. In line with the relevance of alliances to the international business field as a viable mechanism for international market growth and knowledge (e.g., Steensma and Lyles, 2000; Tong, Reuer, and Peng, 2008), JVs receive vast attention. The separate organizational entity and observability of JVs lend nicely to empirical exploration of the alliance exit phenomenon leading most research to focus on this particular type of alliance. Although the theoretical relevance is well substantiated, the limited data on exit (Schilling, 2009) have left research substantial opportunity to extend alliance and organizational theory through further empirical testing of extant theory.

This dissertation will be guided by two pillar theories to shed light on the questions proposed on the organizational performance and learning implications of alliance exit. Alliance exit underscores the relevance of resource reallocation. Thus, following several studies examining alliance exit (e.g., Cui et al., 2011; Dussauge, Garrett, and Mitchell, 2000; Meschi, 2005) and business exit (e.g., Bergh, 1995; Capron et al., 2001), Chapter 3 utilizes the resource-based view (RBV) of the firm to explore the implications of alliance exit on firm performance.

Alliance exit also highlights the importance of organizational boundaries for firm learning. Accordingly, in line with numerous studies examining learning-driven strategic alliances (e.g., Almeida et al., 2002; Grant and Baden-Fuller, 2004; Steensma and Corley, 2000), Chapter 4 employs the knowledge-based view (KBV) to examine the knowledge building and innovation implications of alliance exit. Given the limited empirical research on the topic, rather than focusing on one perspective, chapter five reviews extant evidence on the drivers and implication of alliance internalization across all theoretical traditions.

### *2.2.1. Resource-based view*

The RBV focuses on the analysis of the bundle of resources possessed by the firm and its recombination with externally acquired resources (Barney, 1991; Wernerfelt, 1984). Such resources are firm-specific and may be physical or intangible, including knowledge of specific markets, of users and technologies, of firm processes and routines, and of complex distribution and social networks. Barney (1991) proposes that firms are continuously heterogeneous in their resource bases because many resources are not perfectly mobile or imitable. The view suggests that valuable firm resources are usually scarce and lacking in direct substitutes (Barney, 1991; Peteraf, 1993). Thus, sustained firm resource heterogeneity becomes a possible source of competitive advantage, which can in turn lead to superior economic rents. In addition, resources such as tacit knowledge are subject to considerable uncertainty with regard to performance and quality making them difficult to acquire from market channels. Market transactions are subject to high risk of failure given the uncertain and immobile nature of many firm resources (Pisano, 1990; D. J. Teece, 1982). Thus, the same features that enable a firm to extract economic rents from its resources make it difficult for the firm to sell them on the market and apply them to new uses or unrelated lines of business (Mowery, 1983). Hence, strategic alliances are widely

employed to access and acquire external resources when internal development and market transactions are cumbersome. Accordingly, the economic incentive to many alliances can be found in the desire to use existing firm resources more completely and efficiently (Kogut, 1988).

Thus, the RBV is particularly appropriate for examining alliances since firms largely use alliances to gain access to other firms' valuable resources, whether marketing, manufacturing, or technological capabilities. The view emphasizes firm value maximization through pooling and utilizing valuable resources. Firms are viewed as striving to find the optimal resource bundle through which the value of their resources is better realized than with alternative resource combinations. In turn, the trading, accrual, and development of resources becomes a strategic necessity. However, changing experience and knowledge within a firm and continual change in external conditions constantly alter the productive opportunity set of the firm that leverages existing resources most efficiently. This lends to the RBV being an ideal lens through which to examine the resource reconfiguration inherent in alliance exit. Several studies have linked the view to firm divestitures (e.g., Bergh, 1995), JV selloffs (e.g., Meschi, 2005), and the motives and outcomes of alliance termination (e.g., Cui et al., 2011; Dussauge et al., 2000). Similarly, alliance research has used the view to explain the forces driving alliance formation and performance outcomes (e.g., Das and Teng, 2000b; Lavie, 2006; Mowery, Oxley, and Silverman, 1998). RBV can also offer insight on the organizational performance effects of alliance exit given the alternative paths it represents for the development, reconfiguration, and reallocation of firm resources from current alliance portfolios.

### 2.2.2. *Knowledge-based view*

The KBV of the firm (Grant, 1996b; Kogut and Zander, 1993) assumes that asymmetries in the economics of knowledge are the reason firms exist. Markets are unable to fulfill the coordination role of converting inputs into economic output due to the immobility of tacit knowledge and the risk of appropriation of explicit knowledge. A wealth of empirical research corroborates the challenges of knowledge transfer and replication, particularly for tacit knowledge (e.g., Fabrizio and Thomas, 2012; Rosenkopf and Almeida, 2003; Simonin, 1999). The KBV sees the organization as a social community that transforms the individually held knowledge of its members into goods and services. Firms must strive for the achievement of flexible integration across multiple knowledge bases, as efficiency in the acquisition of knowledge requires individual specialization, while the application of knowledge to produce goods and services requires bringing many areas of specialized knowledge together (Demsetz, 1988). The greater specialization needed for knowledge acquisition than utilization further requires individual members to specialize in particular areas. According to the view, organizations should minimize knowledge transfer due to inefficiency and establish a mode of interaction where specialized knowledge is directly integrated to produce economic output.

A strategic alliance is one intermediary organizational forms that allows firms to leverage overlapping knowledge bases and underutilized specialist knowledge of the members of partner organizations. Grant and Baden-Fuller (2004) argue the advantage of alliances resides in this form of knowledge sharing, where each member accesses its partner's knowledge base to exploit complementarities with the intention of maintaining distinct stocks of specialized knowledge. Thus, in spite of the inert nature of knowledge (Kogut and Zander, 1993), empirical evidence supports the achievement of knowledge and innovation outcomes through the use of

strategic alliances (e.g., Gomes-Casseres, Hagedoorn, and Jaffe, 2006; Meier, 2011; Oxley and Wada, 2009). In line, past research on alliances has used the KBV as an appropriate lens to predict and explain performance outcomes linked to interfirm collaboration (e.g., Almeida et al., 2002; Carayannopoulos and Auster, 2010). Alliances offer a wide range of media for interfirm interactions, including the face-to-face communication needed for the transfer of tacit knowledge, typically across a substantial period of time (Almeida et al., 2002). The interface and individuals involved provide an appropriate context to access and share tacit and organizationally embedded knowledge bases (Grant and Baden-Fuller, 2004; Hamel, 1991; Kogut, 1988).

Grant (1996a, 1996b) points to two mechanisms for integrating knowledge within the firm: direction, such as policies and procedures (Demsetz, 1988), and organizational routines (March and Simon, 1958). A routine is a pattern of activity that is repeatedly invoked (Nelson and Winter, 1982). Organizational routines provide a mechanism of coordination that is not dependent upon the need for communication of knowledge in explicit form. Thus, the potential interorganizational social communities and knowledge recombination routines established during the alliance period may have important implications for post-alliance firm knowledge sourcing and innovation. Since individuals and organizations may be highly reliant on routines for the integration of knowledge, especially inert tacit knowledge, the persistence of routines is key to an extended understanding of alliance exit. The development of routines is substantiated in alliance research in that organizational inertia leads to a tendency to form repeat partnerships (Beckman, Haunschild, and Phillips, 2004; Gulati, 1995b), remain in alliances beyond their useful life (Inkpen and Ross, 2001), and engage in local search (Rosenkopf and Almeida, 2003). Returning to the implications of alliance exit, individuals may follow alliance routines, seeking and integrating knowledge inputs from the same knowledge sources as prior to exit. Beyond



routine dependence arguments, social relationships offer one mechanism for the continued exchange of knowledge between ex-alliance partners. Thereby, the KBV can offer insight into the learning and innovation implication of strategic alliance exit.

### **2.3. Research approach**

In order to fully understand the current state of academic knowledge and the alliance exit phenomenon, a mixed-method approach was employed in this thesis. The process began with a basic overview of the literature on alliance exit to guide the analysis of the secondary qualitative and quantitative data rather than to develop a full understanding that could bias conclusions and construct development (Eisenhardt, 1989). To better understand the implications of alliance exit, and to check some of the underlying assumptions of our theorizing, eight interviews with individuals in the life science industry were conducted. The interviews were completed with CEOs, alliance and R&D directors, and scientists who had experienced an alliance exit. The semi-structured interviews focused on identifying important themes in the post-alliance period.

The empirical strategy to delineate exit motives and modes incorporated an inductive approach to interpreting the data aligned with the Gioia method (Gioia, Corley, and Hamilton, 2012). Using a large number of mini-cases, the study converts findings to count data for subsequent empirical analysis and to generate generalizable conclusions. The next stage of the methodology was to return to the extant literature to build a theoretical model to compare with the observed patterns in the study sample.<sup>1</sup> The entanglement of the alliance exit, instability,

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<sup>1</sup> The model of alliance exit motives derived from extant empirical evidence uncovered in the review is illustrated in Figure 1 in the Appendix.

and performance constructs led to validation of the model with a systematic literature review methodology to avoid misconceptions about alliance exit.<sup>2</sup> A second systematic literature review was later conducted (Chapter 5) when the demarcation of research on alliance dissolution and internalization emerged from the understanding of the alliance exit literature and empirical data.

Finally, the individual research questions of Chapters 3 and 4 were addressed through the analysis of large-scale quantitative longitudinal data resulting from the process outlined below. The quantitative analyses rely on econometric techniques, namely an event study (Chapter 3) and difference-in-differences (Chapter 4) estimation that are described in detail in the respective chapters.

### *2.3.1. Empirical context*

The empirical setting of this dissertation is the life science industry. The life sciences are defined as all sciences related to organisms, and the industry includes firms in the fields of biotechnology, pharmaceuticals, biomedical technologies, life systems technologies, nutraceuticals, food processing, environmental sciences, and biomedical devices. The life science industry is one of several knowledge-intensive industries that are highly reliant on the use of strategic alliances to reach firm objectives (Meier, 2011). When restricted to biotechnology, research revealed the highest alliance frequency even among industries characterized by high alliance activity (Hagedoorn, 1993; Rothaermel and Deeds, 2004). This

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<sup>2</sup> The complete details on the systematic literature methodology and findings form part of a paper not included in this PhD thesis entitled “Alliance survival: a reconceptualization and test of constructs”.

is attributed in part to the extreme uncertainty and devotion of time and resources needed for the discovery and development of new drugs.

In the late 1970s, the biotechnology industry emerged and presented a ‘competence destroying’ technological change to pharmaceutical firms (Lane and Lubatkin, 1998; Tushman and Anderson, 1986). Pharmaceutical firms formed alliances with biotech firms to create opportunities to learn new drug discovery capabilities and other technological advancements (Pisano and Mang, 1993). In return, pharmaceutical firms offer biotech firms access to production and marketing capabilities and often capital. Thus, for a richer examination of the implication under different alliance exit conditions, this study included alliances in both industries and other alliances related to organisms in line with our definition of the life science industry.

Furthermore, the dynamic nature of the life science industry provides an interesting context to examine firm trajectories since shifts may be more perceivable in the 20-year period studied than in more static industries. The low success rate of alliances leading to an approved drug (Lerner, Shane, and Tsai, 2003) also makes this a rich setting to study alliance exit. Finally, the widespread use of patents in the life science industry allows for analysis of knowledge building and innovation addressed in Chapter 4 of this dissertation (Almeida, Hohberger, and Parada, 2011).

### *2.3.2. Full sample construction*

In this section, the data collection process is explained in detail since the resulting alliances constitute the overall study sample from which Chapters 3 and 4 are drawn. Provided space

limitations of the respective target journals, the process is only summarized in the corresponding empirical chapters and the sample statistics provided therein align with the respective populations of interest. Nonetheless, the data collection was guided by this thesis' overall objective to further understanding of the implications of alliance exit on firm performance and learning, and accordingly, the intention to continue developing empirical studies building on the overall study design and resulting database.

This PhD thesis includes strategic alliances in the life science industry formed between 1990 and 2005. Initially, alliance formations from 1990 to 2000 with SIC codes for drug development were drawn from the SDC Platinum Database: 2833, 2834, 2835 and 2836, a total of 2,812 alliances. Only alliances between two parties, both being for-profit firms with disclosed names were considered. Also, alliances that were announced but not realized, upon closer examination were duplicate observations, or a sale rather than license of IP, were excluded (787 alliances). The exclusion of these alliances resulted in a sample of 2,025 alliances. After completing the alliance exit identification procedure and running pilot tests on the preliminary sample, an expansion of the dataset was completed. Additional SIC codes for the life science industry were identified in extant research on the biotech and pharmaceutical industries (P. Davis, 1983; Phene and Tallman, 2012) including: 3842, 3843, 3844, 3845, 5122, 8071, 8731, 8732, 8733, and 8734. The time period was also extended through 2005. Following this procedure, an additional 4,205 alliances were identified in SDC. The manual construction of the exit event allowed us to exclude 794 alliances from this sample that did not pertain to the life science industry. The non-life science alliances are the result of SIC codes in the expansion sample such as 8732 for commercial R&D establishments that includes several semiconductor- and other technology-related alliances. Following the same process to include only two-partner for-profit

alliances aligned with the study's definition of strategic alliances, an additional 976 alliances were dropped leaving 2,435 in the sample.

Thus, the final sample of alliance formations between 1990 and 2005 in the life sciences included in the exit identification stage contained 4,460 alliances (i.e., 2,025 first stage and 2,435 second stage). Given the nature of the research question on firm market performance, the sub-sample statistics reported in Chapter 3 represent the alliances formed between 1990 and 2005 and exited by 2015 of U.S. publicly traded firms and includes both dissolution and VI. Aligning with the interest in knowledge and innovation, the sub-sample of Chapter 4 corresponds to R&D alliances formed between 1990 and 2003 and dissolved by 2003 of NBER patenting firms.

The SDC database is an extensive source for alliance formation announcements (Schilling, 2009) but does not systematically track and report alliance exits. Thus, the study design follows the extant alliance exit identification procedure outlined in peer-reviewed literature (e.g., Lavie, 2007; Park and Ungson, 1997; Xia, 2011). For each alliance dyad, the author searched for evidence of alliance exit in press releases using Factiva, Lexis-Nexis, company websites, and if necessary, Google searches. Following this procedure, 906 alliance exits were identified aligning with our definition, corresponding to 20.3% of the sample in line with a previous study on exit including non-equity agreements (Xia, 2011).

When an alliance exit was identified, both partners' press releases in a minimum of a five-year period surrounding the first hit were examined. Press releases with non-duplicate texts reporting alliance exits were saved and summarized into a vignette explaining the exit scenario (examples mapped to exit motive and mode coding are provided later in Figure 2 of the Appendix). In line

with the definition of alliance exit, both dissolution and internalization (Das and Teng, 2000b) were included in the identification stage. However, the cases that ended in partner internalization were excluded from the content analysis of exit motives since the motives for internalizing an alliance partner were largely unreported and outside the scope of the empirical examination of this thesis.

The remaining 3,554 alliances did not report exit and the outcome could not be determined, including 213 alliances that also had no press or company reporting on formation. To create a counterfactual for the difference-in-differences estimation employed in Chapter 4, alliance modifications, successes, extensions, and any reporting on the remaining 3,341 alliances verifying survival were recorded in the database of alliance formations.<sup>3</sup> Overall, this procedure prevents assuming that no report of an exit equates with the continuation of an alliance and improves the coding accuracy of non-exited alliances.

The empirical analyses follow the study by Gomes-Casseres et al. (2006) on strategic alliance and duplicates the alliance dyads to reverse the order of the partners. For example, the 1998 alliance exit between Genetics Institute and Yamanouchi exists as two observations in the dataset with Genetics Institute as the focal firm and with Yamanouchi as the focal firm:  $GI > Y$  and  $Y > GI$ . This is appropriate given this work's interest in firm-level implications linked to alliance exit. SDC reports both the CUSIPs and names of the participant and parent firm of the alliances, which were used to identify and match the firms to Compustat, Eventus, and the United States Patent and Trade Office (USPTO) data. The final sub-sample size of alliance exits of U.S. publicly traded firms is 667 (Chapter 3) and the sub-sample of unilateral R&D alliance

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<sup>3</sup> The procedure to compile evidence on non-terminated alliances is detailed in Chapter 4 Section 4.4.3. *Non-terminated alliance and signs-of-life*.

exits of focal firms with patent activity in the period is 319 (Chapter 4). Both of these studies focus on premature exit and exclude the case of PI since the firms do not remain separate entities following exit. Chapter 3 includes VI while Chapter 4 focuses exclusively on dissolution given the scope of the paper and more limited sample size. PI and VI are the core of Chapter 5, a conceptual review on alliance internalization rooted in extant empirical evidence and the focus of future empirical research paths building on this thesis.

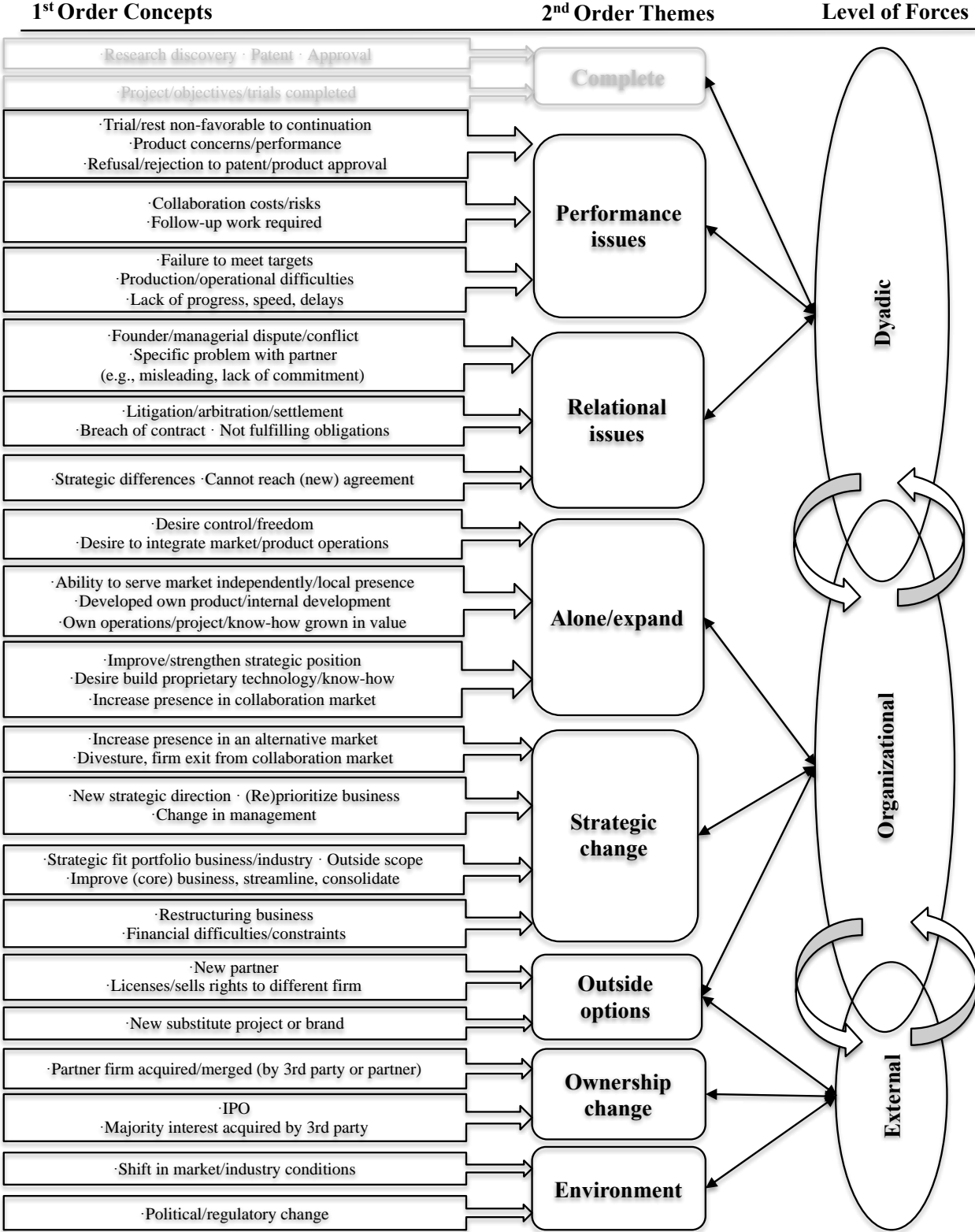
### *2.3.3. Coding exit motives and modes*

This thesis bases the coding approach to content analysis of the press releases, and structures the resulting data, on Gioia et al. (2012). The research design adapts this approach to the goal of advancing existing theory as opposed to building new theory. Although not working with primary observational or interview data, the same principles were applied for the inductive analysis of the qualitative data as previous studies (e.g., Corley and Gioia, 2004; Harrison and Rouse, 2014). We examined all the full-text press releases found for each exited alliance and eliminated duplicate texts. Based on the articles for each exit, a summary text was written recording any details related to alliance exit and evolution including reported exit motives.<sup>4</sup> The summaries from the press articles were examined until a list of general concepts emerged. Figure 1 illustrates the exit motive coding process moving from first-order codes, to second-order themes, to level of forces.

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<sup>4</sup> Two examples are provided in Figure 2 of the Appendix of the vignettes written from alliance exit announcements, including their map to first order concepts, second order themes, and alliance exit mode.

Figure 1. Alliance exit motive coding





An initial 19 first-order codes that represent general concepts of exit motives emerged without much abstraction from the phrasing of the press releases (Figure 1: 1<sup>st</sup> Order Concepts). From these first-order codes, categories were further collapsed into eight general themes, exhaustive yet with minimal overlap, connecting the exit motives (Figure 1: 2<sup>nd</sup> Order Themes). The eight motives include: complete, performance issues, relational issues, alone/expand, strategic change, outside options, ownership change, and environment. Two categories, bankruptcy and unknown/unreported, were excluded from the final code as they offer limited information. The two codes for intended alliance exit motives, complete and contract expiration, were also excluded from the final code.

Noteworthy, 75.9% of the identified exits announcements report on the motives for exit, demonstrating the feasibility of operationalizing the construct in future research. Less distinctive fault lines emerged between the categories reflecting deliberate strategic choices such as alone/expand, strategic change, and outside options. The key difference was the intention for continuation in the collaboration market post-exit, with alone signaling a desire to grow, strategic change to refocus, and outside options either increasing or decreasing firm presence with new collaborations or projects. Returning to the literature, the study further classifies exit motives by mapping them to the levels of analysis where the motive occurs. Finally, qualitative findings were converted to count data to calculate and interpret the descriptive statistics on the prevalence of various exit motives discovered in the previous stages.

Following a similar iterative process between data collection, analysis, and theory, the reoccurring themes in the press releases related to the mode in which the alliance was exited were examined. Eight different exit modes were originally identified based on the exit summaries. However, due to a lack of conceptual distinction between the exit mode for an

alliance that achieved objectives (complete) and a poorly performing alliance (dissolved), the modes were collapsed into seven. Considering the more parsimonious three modes generally offered in extant literature (i.e., dissolution, buy-out, and partner acquisition) the seven modes were aggregated into four conceptually distinct categories that facilitate operationalization and identification of the constructs: PI, VI, third party venture internalization (VI3), and dissolution. We also constructed a variable to account for intended versus premature exit distinct from the exit mode coding. Accordingly, alliance exit is considered intended if the end of the formal collaboration agreement coincides with the completion of alliance objectives or contract expiration (see Figure 1), and premature otherwise. Table 1 provides the distribution of the full alliance exit sample across the four exit modes. Table 2 presents the distribution of alliance exit motive and premature versus intended coding in the sample of exited alliances after dropping the alliance exits via PI since these exits fall outside the scope of the boundaries of the empirical objectives of this thesis.

Table 1. Distribution of alliance exit modes

<b>Alliance Variable</b>	<b>JVs (N)</b>	<b>Non-JV (N)</b>	<b>Total</b>	<b>Percent</b>
Alliance Formations	654	3806	4460	
<b>Exit Mode</b>				
PI	20	83	103	11.4%
VI	101	45	146	16.1%
VI3	15	32	47	5.2%
Dissolution	50	560	610	67.3%
<b>Total Exited</b>	186	720	906	20.3%*

\*Percent of alliance formations with identified exit

Table 2. Frequency exit motive coding and intended vs. premature exits

<b>Exit Motive</b>	<b>JVs (N)</b>	<b>Non-JV (N)</b>	<b>Total</b>	<b>Percent*</b>
Completion	3	28	31	56.36%
Contract expiration	0	24	24	36.92%
<b>Total Intended Exits</b>	<b>3</b>	<b>52</b>	<b>55</b>	<b>6.89%</b>
Ownership change	16	49	65	8.75%
Alone/expand	41	51	92	12.38%
Environment	4	19	23	3.10%
Outside options	4	28	32	4.31%
Performance issues	15	111	126	16.96%
Relational issues	8	46	54	7.27%
Strategic change	40	106	146	19.65%
Unknown	30	149	179	24.09%
Bankruptcy	5	21	26	3.50%
<b>Total Premature Exits</b>	<b>163</b>	<b>580</b>	<b>743</b>	<b>93.11%</b>
<b>Total Exits (Non-PI)</b>			<b>798</b>	

\*Percent of total intended/premature exit for complete coded sample; individual motive percent represent the proportion of the intended or premature sample respectively

# 3

## **Alliance termination modes and motives: an event study on the effects of alliance termination on firm value**

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This article will be submitted to the *Strategic Management Journal* or the *Journal of Management*.

### **3.1. Abstract**

Studies examining the impact of alliance termination on firm value are limited to joint ventures and termination by internalization, although alternative alliance governance and termination modes are more prevalent. Thus, this study investigates the impact of alliance termination on firm market valuation across different termination modes, motives, and alliance governance forms. Applying an event study with 667 alliance terminations of US publicly traded firms in the life science industry we show that, different to internalization, alliance dissolution results in a negative market reaction. Distinct to alliance governance, the termination motive significantly impacts the stock results. Terminations motivated by growth and refocusing result in positive market reactions while terminations motivated by performance issues and unexpected external changes result in negative market reactions. The negative market reactions are particularly pronounced for terminations by internalization.

*Keywords:* alliances; termination; event study; termination motive, internalization, dissolution

### **3.2. Introduction**

Alliances have become widespread organizational tools to acquire and access complementary skills and resources necessary to compete and gain sustainable competitive advantage (Grant and Baden-Fuller, 2004; Lavie, 2006; Oxley and Wada, 2009). Thus, it is not surprising that a large body of literature argues that alliances enhance firm performance (Lavie, 2007; Stuart, 2000) and, consequently, alliance formation announcements result in positive stock market reactions (Oxley et al., 2009). However, the alliance literature also shows the challenges firms face in managing alliances and achieving envisioned alliance goals (Christoffersen, 2013). Various studies highlight the temporal nature of alliances (Inkpen and Beamish, 1997; Kogut,

1989) and empirical evidence reveals a high proportion of alliances terminate prematurely (Makino et al., 2007).<sup>5</sup> Although termination, particularly when premature, is often interpreted negatively by previous studies (e.g., Hamel, 1991; Park and Ungson, 2001; Simonin, 1999), it does not necessarily imply failure (Ariño, 2003). Even premature alliance termination may be based on a more efficient allocation of resources as firms, partner relations, and the external environment evolve. As firms terminate alliances to reallocate resources to evolving strategic objectives, or as a result of alliance performance, the effect of alliance termination on firm value is unclear.

Despite the importance of alliances for firm performance and valuation, relatively little research examines the ending of alliances and even less attention has been placed on the different firm level and alliance level factors when discussing performance effects (see table 1 for an overview). A limited number of studies examine the effect of joint venture (JV) internalization on firm market valuation, whereby internalization refers to cases where alliance resources are bought out by one partner. Constrained to JV internalization, Reuer (2001) finds a positive effect on the acquiring partner's market valuation when the partner firms have multiple alliance ties and high R&D intensity. Meschi (2005) explores the effects of JV internalization from the selling partner perspective and reveals similar results to studies on firm asset sales that find market reactions are largely positive and dependent on the *motive* for the sale. Additional preliminary evidence also suggests that the underlying motive for termination is key to evaluating the effects on firm performance. Kumar (2005) found JVs internalized for growth and expansion had little effect on abnormal returns while JVs divested to refocus the firm's portfolio were associated with positive returns.

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<sup>5</sup> Premature alliance termination refers to the ending of formal collaboration agreements that does not coincide with the completion of objectives or contract expiration.

Table 1. Studies focusing on alliance termination and market reactions

Author(s), Year	Main Findings	Multivariate approach	Sample size	Alliance types	Termination mode			Termin. motives
					Intern./ Acquirer	Intern./ Seller	Dissolu.	
<b>Reuer &amp; Miller (1997)</b>	JV internalization shows mixed effects. Parent firm valuation effects are positively related to the ownership percentage of JV equity held by the firm and the interaction of debt financing and free cash flow	✓	77	IJV	✓	-	-	-
<b>Reuer (2000)</b>	JV internalization displays (non-significant) positive relationship with firm market valuation. The parent firm termination valuation is positively related to the alliance formation market valuation and negatively related to non-core JVs.	-	215	IJV	✓	✓	-	-
<b>Reuer (2001)</b>	JV internalization has no clear effect on firm market valuation. The parent firm termination valuation is positively related to the number of alliance ties between the partner firms and parent firm R&D intensity, and negatively related to cultural distance.	✓	56	IJV	✓	-	-	-
<b>Kumar (2005)</b>	JVs divested to refocus a parent firm's product market portfolio were associated with significant market value creation. In contrast, ventures acquired with the objective of growth and expansion in a target market did not create or destroy firm value.	(-)	54	IJV	✓	✓	-	✓
<b>Meschi (2005)</b>	JV sales motivated by JV failure and firm refocusing led to a positive market valuation within short and long time windows respectively. Sales motivated by debt reduction and involuntary sales had no impact on firm valuation.	-	151	IJV	-	✓	-	✓

While these studies have improved understanding of JV internalization, the lack of studies exploring other forms of alliance termination and non-JV alliance governance is troubling for various reasons. For example, empirical research remains largely silent on alliance dissolution, i.e., termination where activities are abandoned by one or both partners without purchase (Dussauge et al., 2000; Reuer and Miller, 1997). This is surprising given dissolution is the most frequent ending to an alliance (Dussauge et al., 2000) and presents fundamental differences to internalization with potentially opposing results. Further, the existing research has focused exclusively on JVs, which is a particular form of alliance whose separation from the parent business likely influences the ability to reconfigure alliance resources upon termination. Alliance research frequently shows that JVs and non-JVs are different along a variety of dimensions (e.g., integration (Zaheer, Hernandez, and Banerjee, 2010), organizational embeddedness (Almeida et al., 2002), and commitment (Reuer and Ragozzino, 2006)), which could have an important influence on the implications of alliance termination.<sup>6</sup>

Thus, addressing some of these gaps, this study provides insight into the question: *How do alliance termination modes (internalization vs. dissolution), alliance governance (JV vs. non-JV), and termination motives influence firm market valuation?* Grounded in the Resource-Based View of the firm (RBV), we hypothesize on the differences between internalization and dissolution, JV governance, and four central motives for termination: growth, refocusing, performance issues, and unexpected external change. Following past studies, we analyze market reactions of termination announcement using an event study methodology. We run our analyses on a sample of 667 alliance termination announcements of US publicly traded firms

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<sup>6</sup> It also should be noted that the existing studies frequently have a limited sample size and only two studies use a large set of control variables (Reuer, 2001; Reuer and Miller, 1997). While this is a reflection of the difficulties in access to adequate data on termination (Schilling, 2009), it might also be a reason for the mixed empirical conclusions of the studies.



from 1991-2015 identified from alliance formations in the life science industry from 1990-2005.

Our study provides important additional insight into prior research on alliance termination. It demonstrates that alliance internalization and dissolution are interpreted differently by the market; dissolution has an overall negative effect on firm market valuation, while internalization shows positive coefficients (although they are not statistically meaningful). This result, together with our observation that dissolution is five times more frequent than internalization, highlights the importance of investigating alliance dissolution and addresses the longstanding call for more research on dissolution (Dussauge et al., 2000; Kogut, 1991). Additionally, we find that termination motives related to growth and refocusing have a positive impact on firm value, while motives linked to performance issues and unexpected external change have a negative effect. Unlike previous studies demonstrating the importance of JV governance as a moderator of alliance outcomes, our regression model shows that JV governance has little impact on the relationship between alliance termination and market valuation. We do find relevant differences in the interaction of termination modes and motives as alliance internalization creates market value when termination is motivated by growth and refocusing, while dissolution under these conditions has a negative effect. Although alliance dissolution reduces firm value, it is less damaging than internalization when termination is motivated by performance issues or unexpected external change. Additionally, our study has conceptual implications on how firms value resources within alliances. Alliances frequently imply a significant resource commitment for firms (Madhok, Keyhani, and Bossink, 2015), and premature alliance termination generally hurts firm market value, even when indicating a more efficient use of firm resources by exiting non-performing activities. This may suggest a limit to the value of resource commitment deferral and flexibility afforded by strategic alliances.

This paper proceeds with the development of theoretical arguments situated in prior literature on alliance termination and RBV. We develop a set of hypotheses on the effect of alliance termination on firm market valuation related to termination modes, alliance governance, and termination motives. Next, we describe the data and methodology employed in our empirical analysis, including several robustness tests and an extended analysis, followed by the results. We close with a discussion of the findings, implications, and limitations of our study.

### **3.3. Theory and hypotheses**

The RBV suggests that firms' sustainable competitive advantages derive from their access to and use of idiosyncratic resources (Barney, 1991; Penrose, 1959). Given the diversity and inert nature of resources, alliances have become ubiquitous tools to access and acquire external resources and skills (Grant and Baden-Fuller, 2004; Hohberger, Almeida, and Parada, 2015; Lavie, 2006). Hereinto, alliances also provide a mechanism to share and develop resources progressively, to reduce uncertainty and risk, and offer an organizational context to facilitate the transfer of tacit knowledge and other inert resources (Almeida et al., 2002). The RBV rationale has explained various alliance aspects including alliance formation (Eisenhardt and Schoonhoven, 1996), evolution (Hamel, 1991), and performance issues (Das and Teng, 2000a; Mowery et al., 1998). In line, studies have applied the RBV view to examine alliance termination motives (e.g., Fang and Zou, 2010; Hamel, 1991), JV selloffs (Meschi, 2005), and other forms of firm resource redeployment (Capron and Hullan, 1999) and divestiture (Capron et al., 2001). Additionally, according to resource-based theory, general business exits can result in better resource utilization and the removal of negative synergies, thus leading to value creation (Bergh, 1995, 1998). Thus, the RBV can offer insight on the market valuation effects

of alliance termination given the alternative paths it represents for the development, reconfiguration, and reallocation of firm resources from current alliance agreements.

### *3.3.1. Alliance termination mode*

Distinguishing between alliance internalization and dissolution is fundamental to understanding firm-level alliance outcomes since it implies different resource configurations post-termination. The alliance termination mode suggests whether the new resources are useful in recombination and embedded within the firm. In this sense, Chang and Singh (1999) show that business unit exit mode (selloff vs. dissolution) and entry mode are interrelated, since internally developed units tend to be highly integrated and idiosyncratic, inhibiting a high sale price. Similarly, the distinction between alliance internalization and dissolution may display the resource development undertaken during the alliance, such as inter-partner learning (Mata and Portugal, 2015). Dussauge, Garrett, and Mitchell (2000) propose that internalization of an alliance tends to mark greater acquisition of capabilities during the alliance than dissolution.

The empirical studies examining the effect of alliance termination announcements on firm performance have focused exclusively on internalization in the context of JV alliance governance (Kumar, 2005; Meschi, 2005; Reuer, 2001) (Table 1). Although the results are mixed, the evidence points to a positive relationship between internalization and firm market valuation, particularly in the case of the focal firm as the selling rather than the acquiring partner (Kumar, 2005). For example, Meschi (2005) found JV sales do not differ from ordinary asset sales in generating a positive market reaction. Research from Reuer and Miller (1997) and Reuer (2000, 2001) examines the effect of internalization from the acquiring partner perspective. They find, on average, the market does not respond negatively to internalization

announcements, yet no clear positive effect is revealed. Average returns to internalization were positively related to specific contingencies, such as firm R&D intensity and multiple alliances between the partners, while conditions such as longevity and division of equity had little influence. Given that internalization events are defined by the exchange of resources upon termination, we may expect these terminations to reveal that valuable resource development occurred during the alliance. Demonstrating the firms' ability to reconfigure and reallocate resources are the acquiring party's willingness to pay and the selling party's desire to apply proceeds and existing resources, such as managerial capability into core competencies or alternative directions (Meschi, 2005). Previous studies put forth a similar argument about the value of exercising the option inherent in JV stakes (Kogut, 1991; Kumar, 2005). Moreover, the internalization of the alliance activities allows the acquiring firm to further embed the resources within firm boundaries and the divesting firm to extract rent from the transfer of resources. Thus,

*H1a: Alliance termination by internalization has a positive effect on firm market valuation.*

Even though alliance scholars have urged for research to consider the distinction between alliance termination modes given the different paths it represents for alliance evolution and firm outcomes (Dussauge et al., 2000; Kogut, 1991), research on dissolution implications is lacking. Scholars propose the flexibility to relatively easily abandon current trajectories (Kogut, 1991; Kumar, 2005; Meschi, 2005) and reconfigure resources constitutes part of the value of forming any type of alliance. Still, it is doubtful that alliance dissolution would realize the positive effect on firm market valuation as ordinary firm asset sales. Although dissolution may demonstrate one firm's successful growth in a new direction, leveraging resource development carried out during the alliance, scholars have typically viewed premature termination as a negative alliance

outcome (e.g., Park and Ungson, 2001; Simonin, 1999). One study predicts detrimental effects to alliance termination such as uncompensated transfers of technology (Hamel et al., 1989), loss of proprietary information, damaged reputation, and operational difficulties, particularly in the case of premature or unplanned dissolution (Park and Ungson, 2001).

The potential loss of resources to partners (Hamel, 1991) and the apparent lack of valuable resource development during the alliance may outweigh the value perceived in the pursuit of improved resource allocation. Moreover, alliance termination can create more risk and uncertainty. Thus, considering the evidence from studies examining JV internalization, and that the resource-based perspective would suggest internalization allows for continued development of alliance resources, termination by internalization may see a positive reaction. Thus, we argue that alliance dissolution more likely indicates limited development of valuable resources during the alliance or in combination with the existing firm-specific resource base and opportunity set. Hence,

*H1b: Alliance termination by dissolution has a negative effect on firm market valuation.*

### *3.3.2. Alliance governance mode*

Studies frequently show that JVs and non-JVs are different along a variety of dimensions. In particular, alliance research has revealed a distinction between JV and non-JVs in facilitating knowledge transfer (Mowery, Oxley, and Silverman, 1996) and recombining key resources given the distinct organizational contexts provided (Gulati, 1995a; Phene and Tallman, 2012). JV governance, in comparison to non-JV governance, is generally associated with greater interdependence and integration (Zaheer et al., 2010). This, in turn, fosters joint problem solving and learning. Enhanced integration of partner firms should ease the transition to internal

organization as joint processes are already established. Further, JVs are cited as superior in fostering common organizational identity (Almeida et al., 2002) and mutual trust (Gulati, 1995a), two key elements for embedding the alliance in the organizational context. Thus, JV governance offers increased organizational embeddedness during the active alliance period. This may foster successful transition by providing a better understanding of partner firms and their value-added assets. Finally, JV governance is generally associated with greater organizational and resource commitment than contract alliances (Reuer and Ragozzino, 2006) since they are typically larger and involve a separate business entity. Thereby, the increased commitment of a JV during the alliance period may make internalization a natural step to continue developing alliance resources. Thus, we predict JV internalization shows positive returns.

*H2a: Alliance termination by internalization has a more positive effect on firm market valuation for JVs than for non-JVs.*

JV governance is generally associated with greater organizational and resource commitment than contract alliances (Reuer and Ragozzino, 2006) and is subject to more extensive reporting and monitoring. The increased commitment of JVs may heighten the stakes for successful alliance outcomes and lead investors to be more aware and react more strongly to premature dissolution, interpreting JV dissolution more negatively than non-JV alliances. More commitment and integration during the alliance may also lead to more problems (negative spillover) when firms separate via alliance dissolution. For example, Diestre (2018), found JV governance increases negative spillovers to a partner when a firm suffers a negative event, which is attributed to the closer, more integrated nature of JVs. Non-JV alliance governance offers greater flexibility (van de Vrande, Vanhaverbeke, and Duysters, 2009), and hence, may be more easily unwound in the case of dissolution. The enhanced flexibility of non-JV may

offer advantages in resource reallocation and less organizational disruption than dissolving a separate legal entity.

On the other hand, JVs' independent legal status allows resources to be separated from parent firms at alliance formation (Das and Teng, 1998). Although potentially enhancing resource recombination during the alliance, the separation of JVs from the parent firm business may also protect against unwanted spillover of non-alliance related knowledge (Oxley and Wada, 2009) and facilitate resource valuation and restructuring upon termination. It is important to note there is an implicit assumption that JVs are more likely to end in internalization (Madhok et al., 2015), perhaps due to the increased ability to separate alliance resources for transfer. In spite of the protection that separation may provide the parent firm, we expect the JV governance to have a negative impact on firm market valuation given the increased resource commitment and integration. In sum,

*H2b: Alliance termination by dissolution has a more negative effect on firm market valuation for JVs than for non-JVs.*

### *3.3.3. Alliance termination motive*

The effect of alliance termination on firm market value is likely linked to the underlying motive for the termination. Previous studies on the effect of JV termination on firm market value find the motive for the sale or purchase of a JV stake is associated with firm abnormal returns (Kumar, 2005; Meschi, 2005). Additionally, research on alliance formation and stability emphasizes the importance of formation motives in predicting alliance outcomes and performance (e.g., Kogut, 1989; Reuer and Ragozzino, 2006). From an RBV lens, the termination motive may help elucidate the planned reallocation of firm resources previously

dedicated to the alliance and changing opportunity set of the firm. In a related context, research on business exit (Bergh, 1995; Brauer, 2006) also shows the motive for the sale of a set of firm assets is important in predicting the market's reaction. Building on previous research (e.g., Bergh, 1995, 1998; Kumar, 2005), we examine four central motives for alliance termination: growth, refocusing, performance issues, and unexpected external change. *Growth*-motivated alliance termination refers to firms terminating alliances to pursue the alliance (or related) opportunity alone or with a new partner. A firm may also terminate an alliance to *refocus* the business, often to return to concentrate on the core resources that constitute firm competitive advantage (Meschi, 2005). Alliance termination driven by *performance issues* includes motives related to poor firm relations and task performance, such as product failures or delays. Alliance termination motivated by *unexpected external change* refers to regulatory and market conditions including M&A activity. M&A-motivated alliance termination occurs when one partner undergoes an ownership change that drives reconfiguration of the firm's alliance portfolio.<sup>7</sup>

*Growth.* As firm-specific resources and opportunities evolve over time, whether due to alliance, firm, or unexpected external change, more attractive applications of firm resources may emerge, or partner resources may become less valuable. Pursuing growth alone or through alternative modes once valuable resources, such as product and market knowledge, are acquired and developed during the alliance may allow firms to better leverage specialized resources. In the case of a new partner or opportunity, the exit indicates a new strategy for firm growth, potentially building on the resources developed in the alliance. Terminating the alliance may allow the firm to respond in a timely manner to favorable conditions specific to the current firm

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<sup>7</sup> The date of announcement of the M&A and the termination event where a minimum of 10 days apart to be included in the sample.



resource base. Thereby, alliance termination may result in a more effective use of the firm resource base and enhance firm performance.

Additionally, limited resources, including time and attention, restrict the potential to take advantage of new and potentially more valuable opportunities. They may also lead firms to pursue alliance activities alone. Although alliances provide the firm access to valuable resources, they are costly, time consuming, and require the attention and focus of the organization (Almeida et al., 2011; Gulati, 1995a). Thus, when efficient market exchange of resources is possible, firms are more likely to rely on the market and continue alone (Eisenhardt and Schoonhoven, 1996). Given these high costs of managing alliances, pursuing opportunities alone may be a more efficient use of firm resources, thus enhancing firm performance. Further, market valuation is determined by investors who have been shown to react positively to announcements of firm growth (Woolridge and Snow, 1990), particularly when valuable investment opportunities are present (K. H. Chung, Wright, and Charoenwong, 1998). Thus, firms terminating alliances in order to pursue growth alone or via new opportunities or partners (Greve et al., 2013), may experience increased market valuation.

*H3a: Alliance termination motivated by growth has a positive effect on firm market valuation.*

*Refocusing.* Refocusing often results in separating businesses, thus eliminating resources the firm considers least valuable in pursuing current firm-specific opportunities. Thus, termination may increase firm value as it increases firm competitiveness by focusing attention and investment on its portfolio of distinctive resources that constitute competitive advantage (Bergh, 1998). A firm may realize several important benefits by abandoning peripheral businesses and reallocating those investments to core resources, such as greater synergies and

more effective utilization of organizational learning (Bergh, 1995). The positive impact of refocusing on firm performance is evidenced in past studies unrelated to alliances that examine stock market reaction to asset sales undertaken for refocusing. For example, studies show firms realize above average returns between 2 and 9 percent on asset sales motivated by refocusing (e.g., Datta and Iskandar-Datta, 1996; Roy and Manley, 1997).

In the alliance context, a firm may terminate an alliance to refocus on core resources whether or not seeking financial compensation for those resource through the sale of the alliance or related business. When an alliance is terminated without an asset sale (i.e., dissolution), this may hint at less value of the alliance resources. However, it would not change the argument for the value of refocusing firm resources, including managerial capability, on core competencies. There is economic incentive for a firm to find a way of using resources more fully when resources are not employed most efficiently in current operations. Thus, reallocating resources dedicated to the alliance may increase firm performance even when the alliance is performing satisfactorily, particularly as the firm adapts to its subjective opportunity set. Research on internalization in JVs supports this prediction as JV stakes sold for refocusing created significant positive market reactions (Kumar, 2005; Meschi, 2005).

*H3b: Alliance termination motivated by refocusing has a positive effect on firm market valuation.*

*Performance issues.* In line with previous interpretations of alliance termination (Hamel, 1991; Park and Ungson, 2001), we predict negative direct and indirect effects of terminations motivated by performance issues. Firms often form alliances with the expectation of valuable synergies and resource development (Eisenhardt and Schoonhoven, 1996; Lavie, 2006; Wassmer and Dussauge, 2011). Performance issues offer tangible evidence that valuable

resource recombination was not obtained. When firms terminate an alliance and abandon efforts for growth in the intended direction, the promised gains from alliance formation are unlikely to materialize. The market may interpret an ineffective use of firm resources in entering the alliance and development of invaluable resources during the alliance. Termination related to performance issues may also imply the partners lose the potential to leverage dormant or extra resources and to acquire new expertise, particularly when compared to growth termination motives.

Firms may also suffer indirect consequences of performance issue motivated termination in the form of negative spillovers that harm firm value. Compared to alliances terminated for proactive strategic change, such as growth and refocusing, managing performance issue motivated termination may require more firm resources. The organizational disruption of the termination itself may hurt firm performance as firm attention and managerial capability are redirected to managing the change. Alliance termination related to performance issues may trigger organizational reorientation. The resulting changes can cause high levels of anxiety, myopic decision making, and stressful reactions related to increased pressure on immediate results (Luscher and Lewis, 2008; de Rond and Bouchikhi, 2004). Additionally, performance issue motivated alliance termination often relates to poor partner relations, hinting that firm market value may be affected by the anticipated loss of resources. Lack of reciprocity in economic exchange fuels mistrust that can both limit access to resources (Ko, Kirsch, and King, 2005) and drive opportunistic behavior related to partner resources (Kogut, 1989).

Finally, performance issue driven termination can negatively impact the trustworthiness and reputation of the firm, both elements viewed as sources of competitive advantage (Barney and Hansen, 1994). For example, markets may perceive alliance termination motivated by relational

performance issues as signaling a lack of trustworthiness, which is associated with fewer opportunities for new alliance formation and a higher risk of misappropriation of valuable knowledge-based assets. Along the same lines, alliance termination due to poor task performance would signal less value of the firm resource base and potential challenges in forming new alliances and accessing external resources. Thus, we predict the likely decline in resource access and value, increased uncertainty about future performance, and organizational disruption generated by performance motivated termination would harm firm market value.

*H3c: Alliance termination motivated by performance issues has a negative effect on firm market valuation.*

*Unexpected external change.* Although primarily motivated by forces outside the alliance, the termination confers knowledge about the current environment faced by the firm. Unexpected external change, such as industry consolidation and increased market regulation, may decrease the value of the firm's current resource base and opportunity set. It may indicate declining opportunities and heightened competition, and thus, constrained firm growth. Although alliance termination motivated by unexpected external change may show the firm's ability to adapt to the changing environment, it still suggests barriers to firm growth and potential waste of resources previously dedicated to the alliance. The uncertainty regarding the value of the firm resources given a changed environment, and thus firm-specific opportunity set, is likely to have a negative impact on investor perceptions of firm value. For example, research has shown that uncertainty reduces investors' positive reaction to increases in market demand (Bloom, Bond, and Van Reenen, 2007). Empirical evidence may also point to a negative influence of alliance termination when motivated by unexpected external change. The limited research on 'involuntary' firm asset sales (Boudreaux, 1975) and JV selloffs (Meschi, 2005) find a reduction in shareholder value, although the test statistic was not meaningful in the case of JVs.

In line with these arguments and evidence, we may expect termination motivated by unexpected external change to be particularly damaging to firm market value.

*H3d: Alliance termination motivated by unexpected external change has a negative effect on firm market valuation.*

### **3.4. Methods**

#### *3.4.1. Sample*

We test our hypotheses on a sample of alliance terminations undertaken by publicly traded firms active in the life science industry.<sup>8</sup> The initial sample is comprised of alliance formations announced between 1990 and 2005 and terminations announced between 1990 and 2015. The year 1990 was selected as the commencement given the limited data on alliance formations prior to this date (Schilling and Phelps, 2007), and 2005 was chosen as the end date to provide a large time window to track termination. All alliances were obtained from the SDC Platinum Database. We excluded multi-partner alliances, university, government, and non-profit alliances, and alliances that upon closer examination were duplicate observations or strictly acquisitions of intellectual property. A total of 4,173 alliance formations were included in this initial sample.

As the SDC and other databases do not systematically track termination (Schilling, 2009), we applied the identification methodology from extant alliance termination and portfolio studies (e.g Lavie, 2007; Park and Ungson, 1997; Xia, 2011). For each dyad, we searched for evidence

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<sup>8</sup> SIC codes for the life science industry were identified in extant research on the biotech and pharmaceutical industries (e.g Phene and Tallman, 2012) including: 2833, 2834, 2835, 2836, 3842, 3843, 3844, 3845, 5122, 8071, 8731, 8732, 8733, and 8734. We define the life sciences as all sciences having to do with organisms. We excluded alliances outside the industry from the sample during the manual tracking of alliance histories.

of termination in press releases using Factiva and Lexis-Nexis, and in cases, complemented this with Google searches and company Web sites. This process resulted in a sample of 906 terminations. Given our interest in firm-level market valuation, we duplicate the alliance dyads and reverse the order of the firms for each firm to appear once as the focal firm. We restrict our analysis to premature terminations where the focal firm appears in the Compustat North America database. This is appropriate given our study's interest in firm market performance and allows us to control for organization-level heterogeneity in addition to dyad-level forces. Finally, we exclude alliances ending in complete acquisition or merger of the alliance partner and confounding events. The resulting sample includes 667 premature alliance terminations, of which 334 observations report termination motives and a full set of control variables.

### 3.4.2. Event study

Event studies are a popular tool to examine the expected effect of alliance activity on the value of a firm in an alliance (Oxley et al., 2009). We employ a standard event study approach to calculate the market reaction to news of an alliance termination and the associated motive offered for the termination. Therefore, we generated a predictive model estimating the expected returns for each firm had the event not occurred based on two asset pricing models: the market model and the market-adjusted model. Similar to prior research, we find that the results are very similar (S. J. Brown and Warner, 1985; Sorescu, Warren, and Ertekin, 2017) and, therefore, only present the results for the market model:  $AR_{it} = R_{it} - E(R_{it}) = R_{it} - (R_{ft} + \beta(R_{mt} - R_{ft}))$ , whereby,  $AR_{it}$  is defined as the daily abnormal returns for given firm  $i$  and time  $t$ . The calculation is based on the difference of the expected  $E(R_{it})$  and the actual returns  $R_{it}$  of firm  $i$  at time  $t$ , whereby  $E(R_{it})$  is based on the average rate of return of all stocks trading in the stock market  $R_{mt}$  at time  $t$ ,  $R_{ft}$  is the risk-free rate of return at time  $t$ , and  $\beta$  is the risk factor

estimated from a regression before the event date. Our estimation model uses all trading data from the year prior to and ending 11 days before the event itself (i.e., between 255 and 10 trading days prior to the event):  $E(R_{it}) = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$ , where  $E(R_{it})$  represents the expected daily returns for firm  $i$  on day  $t$  assuming the event had not taken place,  $R_{mt}$  represents the daily returns of the market index,  $\alpha_i$  and  $\beta_i$  are firm-specific parameters, and  $\varepsilon_{it}$  is the *i.i.d.* and normally distributed error term (Brown and Warner 1985).

To select the appropriate time window, we calculate the average abnormal returns (AARs) for the 10 days before and after the termination event as  $AAR_t = \frac{1}{n} \sum_{i=1}^N AR_{it}$ , where  $AAR_t$  is aggregate abnormal returns for all  $N$  firms at time  $t$ , and cumulative average abnormal returns (CAAR) as  $CAAR_T = \sum_{t=1}^T AAR_t$ , with  $T$  describing the days in the event windows (e.g., [-1,1]; [-1,0]; [0,1]; [0,3];) and 0 being the day of the event.

### 3.4.3. Independent variables

Following previous alliance termination studies, we recorded the date of the earliest press release announcing the alliance termination. This date was used in the predictive models for analyzing potential firm abnormal returns at the time of the event (termination announcement). We read the full-text press releases and documents to identify the termination mode and motive.

*Termination mode.* Mode distinguishes between agreements terminated via internalization, where alliance activities, resources, or related business units are acquired by one partner, and dissolution, where activities are abandoned by one or both partners without purchase. Therefore, we created a binary variable, *dissolve*, taking the value 1 for termination by *dissolution* and withdrawal, and 0 for termination by *internalization*.

*Termination motive.* Motive identifies the firm-reported motivation for alliance termination. We distinguish between four main reasons of the termination event in line with extant research and content analysis of the press releases. We followed an approach for iterative analysis between extant literature and qualitative data (Gioia et al., 2012) to collapse 19 reoccurring alliance termination concepts identified in the announcements to four groups aligned with the resource-based logic of alliance termination: *growth*, *refocusing*, *performance issues*, and *unexpected external change*.<sup>9</sup> Growth refers to alliance termination realized for increased firm expansion and growth in the area of the alliance whether via new partners or solo projects. For example, Duramed dissolved an alliance with Ortho-McNeil when federal regulators approved their application to market the generic drug independently. Refocusing refers to alliance termination for firm-level strategic change specifically related to a strategy of streamlining or developing other areas of the business. One illustration is the alliance Celltech terminated with Targeted Genetics when the company shifted its focus away from respiratory products. Performance issues include alliance termination motivated by relational performance, such as conflict, and task performance, such as speed and trial results. For example, Wyeth ended its alliance with MedImmune for FluMist following a disappointing first season on the market. Unexpected external change represents alliance terminations due to market and industry changes, such as new regulations and M&A activity. One example from the data is the alliance termination by SmithKline Beecham for use of the Human Genome Sciences' gene sequence database citing other high-quality sequence data becoming increasingly available in the public domain. Alliance termination where a clear termination motive was not reported were coded as

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<sup>9</sup>A vignette of the press releases was created for each alliance termination. Later, a content analysis of the vignettes was conducted until a list of general concepts emerged. Following an accepted approach (Gioia et al., 2012) for inductive iterative analysis of qualitative data, the first order concepts were then collapsed into categories based on general themes connecting the termination motives. The next stage of our approach was to return to the extant literature to build a theoretical model to compare with the observed patterns in the data. We mapped seven themes identified to four termination motives tied to the RBV and extant alliance and business exit literature (i.e., growth, refocusing, performance, and external conditions).



“unknown” (n=274) and excluded from the analyses incorporating termination motives. Terminations initiated for motives at the firm level (growth and refocusing) are restricted to the focal firm driving the termination while the partner motive is coded as unknown.

#### 3.4.4. *Confounding events*

A frequent concern in event studies are *confounding* events that may lead to abnormal returns for firms without being related to the event of interest (e.g., simultaneous mergers or acquisitions, major new product announcements, executive succession or death, etc.) (Oxley et al., 2009; Sorescu et al., 2017). While it might be unnecessary for event studies to drop confounding events as the distribution of the abnormal returns of confounding events should have the mean of zero, and thus should not impact the abnormal returns to the focal event (Sorescu et al., 2017),<sup>10</sup> we dropped confounding events from our sample.<sup>11</sup>

#### 3.4.5. *Control variables*

The model controls for several characteristics at the level of the focal alliance and the focal firm, including their alliance portfolio. We include the *scope of the alliance* (e.g., Khanna, 1998), measured as the number of different activities (R&D, marketing, and manufacturing) involved in the alliance, since termination of an alliance with broader scope might have more impact on firm performance. We account for whether or not the alliance is a *R&D agreement* given the distinct risk profile. We also account for alliances between competitors with a dummy

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<sup>10</sup> The argument is based on the idea of efficient market, in which the expectations of abnormal returns to future events is always zero. If investors could anticipate that the average abnormal returns of future events for a given firm are significantly positive (or negative), investors should adjust the firm’s share price accordingly (Sorescu et al., 2017).

<sup>11</sup> We also run all models including potentially contaminated events and the results are only marginally different.

variable *competitor alliance* (e.g., Park and Ungson, 2001) which is coded as 1 if partner firms have the same primary SIC code and 0 otherwise. *Alliance relatedness* is measured by comparing the alliance and focal firm SIC codes, assigning a dummy variable 1 if the alliance and focal firm have the same SIC codes and 0 otherwise. This control is relevant, as termination of an alliance unrelated to core firm resources may potentially have a smaller impact on a firm (Reuer, 2000). We control for the *duration* of the alliance in months between the alliance formation and termination announcements (Reuer, 2001). We also include the squared alliance duration to account for any curvilinear effect of time. We include a dummy variable for whether the alliance is with an *international partner*, 1, and 0 otherwise. Finally, analyzing the press releases, it was apparent that several alliance partners kept collaborating despite the termination of the focal alliance, perhaps supplying via market transactions or forming new alliances. Thus, a dummy variable for *continued collaboration* was created and assigned the value of 1 when partners continued collaborating.

Regarding firm level controls, we include the size of the focal firm's *alliance portfolio* across all industries as the aggregate of alliance formations from the previous 5 years (removing any terminations identified in the life science sector). Alliance portfolio is an important control since a larger alliance portfolio may reduce the impact of an individual alliance termination. Moreover, this variable has been used to approximate alliance experience, a construct suggested to improve alliance performance (Villalonga and McGahan, 2005), and, thus, potentially termination outcomes as firms accumulate collaboration knowledge with alliance experience. We also account for the *formation of R&D alliances* and the *formation of other alliances*. The formation of new alliances can indicate a strategy shift within the organization, which also has potential consequences for the importance of the focal alliance. Finally, we control for *revenue*,

*R&D investments, total assets, Return on Assets (ROA), and Investment into Property, Plant and Equipment (PP&T).*<sup>12</sup>

#### 3.4.6. Hypothesis testing

Although our hypotheses are specific to an analysis technique, we provide detailed event study and regression results for all aspects of our inquiry to provide a comprehensive and detailed analysis of the termination event. Similar to earlier event studies on alliance terminations (e.g., Kumar, 2005; Meschi, 2005; Reuer, 2001), hypotheses 1a, 1b, and 3a-3d test whether an event leads to a positive or negative market reaction ( $AR_{it} \neq 0$ ).<sup>13</sup> In contrast, hypotheses 2a and 2b compare the results of two conditions of termination events ( $AR_{it}^{JV} \neq AR_{it}^{nonJV}$ ).

Thus, we incorporate the event study results in a regression-based analysis. This also allows us to incorporate a wide set of control variables and to provide more detailed understanding of the differences between termination modes and motives. The regression analysis relaxes the focus on the zero-market reaction as the reference point (hypotheses 1a, 1b, and 3a-3d) and makes the testing relative to other alliance termination alternatives (similar to hypotheses 2a and 3b). For example, it is possible that neither internalization nor dissolution are different from zero if one is slightly positive and one slightly negative, but they may still be different from one another. The regression analysis is also fundamentally connected to the pure event study approach and the associated hypotheses. For example, hypotheses 1a and 1b imply that if we find the expected differences in the modes of termination, dissolution should also have more of

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<sup>12</sup> We standardize revenue, R&D investments and property, plant and equipment with the total assets of the firm.

<sup>13</sup> Following recent advice from Marks and Musumeci (2017), we use the Standardized Cross-Sectional Test, which is an adjustment of the Patell Test. Additionally, we report the Time-Series Standard Deviation Test (also called the “crude dependence adjustment test”) (S. J. Brown & Warner, 1985).

a negative market reaction than internalization. Similar, growth and refocusing should both experience less of a negative market reaction than performance issues and unexpected external change terminations. In the case of the regression model, we estimate our models using an OLS approach with clustered standard errors to account for multiple alliances by the same firm.<sup>14</sup> We include industry fixed effect in all models to account for different appraisals of termination announcements explained by for competitor differences between industries as well as year fixed effects to account for market fluctuation, sentiment, and turbulence.

### **3.5. Results**

#### *3.5.1. Market reaction to termination*

First, we explored the general market reaction to alliance termination. Table 2 shows the AAR 10 days before and after the announcement day. We find a negative market reaction on the day of the announcement of around -0.56% ( $p_z=0.004$ ). The finding that the reaction is tightly focused on the day of the announcement indicates there is relatively little leakage or delay in the response of the market. This is important as the event study methodology assumes efficient information processing of press announcements, implying that the stock price reaction should be specific to the trading day of the announcement. We also investigated the behavior of CAARs using various event windows (Table 3). While most event windows show a negative effect, the strongest are found for the windows [0;1] (CAAR=-0.57%;  $p_z=0.003$ ) and [0;3] (CAAR=-0.99%;  $p_z=0.000$ ). This again supports the idea of a clear market reaction around the

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<sup>14</sup> Multiple alliance terminations by the same firm cannot be in the estimation window of the event study otherwise the alliance termination was dropped as confounding event.

day of the termination announcement. Consequently, we mainly discuss the [0;1] event window, but also test for the robustness of the results for [0;3].

Table 2. AAR 10 days before and after the announcement

Day	N	AAR	Std. Csect. z	p-values	Portfolio	
					Time-Series t	p-values
-10	667	-0.16%	-0.290	0.386	-0.892	0.186
-9	667	0.00%	-0.406	0.342	0.026	0.490
-8	667	0.14%	0.889	0.187	0.741	0.229
-7	667	-0.13%	0.128	0.449	-0.719	0.236
-6	667	0.08%	0.149	0.441	0.434	0.332
-5	667	0.32%	1.891	0.029	1.747	0.040
-4	666	-0.14%	-1.249	0.106	-0.760	0.224
-3	666	0.29%	1.100	0.136	1.562	0.059
-2	667	-0.10%	-0.674	0.250	-0.552	0.291
-1	667	0.20%	1.172	0.121	1.064	0.144
0	667	-0.56%	-2.650	0.004	-3.008	0.001
1	667	-0.02%	-0.864	0.194	-0.082	0.468
2	667	-0.33%	-1.601	0.055	-1.796	0.036
3	667	-0.09%	-1.311	0.095	-0.475	0.317
4	667	0.03%	-0.100	0.460	0.175	0.431
5	667	0.22%	1.239	0.108	1.177	0.120
6	667	-0.09%	-0.932	0.176	-0.467	0.320
7	667	-0.09%	-0.638	0.262	-0.469	0.320
8	667	-0.07%	-0.214	0.415	-0.394	0.347
9	667	-0.18%	-0.395	0.347	-0.949	0.171
10	667	-0.06%	0.074	0.471	-0.347	0.364

Table 3. CAAR various event windows

Event window	N	CAAR	Std. Csect. z	p-values	Portfolio	
					Time-Series t	p-values
(-1,1)	667	-0.37%	-1.879	0.030	-1.170	0.121
(-1,0)	667	-0.36%	-1.548	0.061	-1.375	0.085
(0,1)	667	-0.57%	-2.786	0.003	-2.185	0.015
(0,3)	667	-0.99%	-3.476	0.000	-2.680	0.004

### 3.5.2. Alliance termination and governance mode

Next, in Table 4 we show the stock market reaction (CAARs) for termination mode (Panel A and B), the f (Panel C and D), and the intersection of both (Panel E to H). In the case of dissolution, we find a negative stock market reaction (e.g., [0;1], CAAR=-0.95%;  $p_z=0.002$ ) supporting Hypothesis 1b. In the case of internalization, the market reaction is consistently positive (with high CAARs), however the test statistics provide a mixed picture. The Standardized Cross-Sectional Test has  $p$  values between 0.145 and 0.481, whereas the Time-Series Standard Deviation Test has  $p$  values ranging from 0.000 to 0.099. The mixed findings that alliance termination by internalization results in no or potentially positive market reactions is similar to previous studies on JVs (Reuer, 2000, 2001; Reuer and Miller, 1997). For completeness of our analysis, we also examine the mean comparison of termination modes and the main effects of alliance governance mode. The mean comparison between internalization and dissolution shows that alliance termination by dissolution leads to a generally more negative market reaction than alliance termination by internalization (diff.= 2.423%;  $p=0.036$ ).<sup>15</sup> We also test for differences between JVs and non JVs and find a negative reaction for both (JVs: [0;1], CAAR=-0.90%;  $p_z=0.030$ , non-JVs: [0;1], CAAR=-0.52%;  $p_z=0.012$ ). Additionally, these categories are not different from one another (diff.=0.049%;  $p=0.968$ ).

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<sup>15</sup> The relevant group comparisons can also be found in the online appendix in Table A1.

Table 4. CAAR alliance termination and governance modes

Event window	N	CAAR	Std. Csect. z	p-values	Portfolio Time-Series t	p-values
Panel A: Internalize						
(-1,1)	112	1.79%	0.238	0.406	2.437	0.007
(-1,0)	112	2.38%	1.083	0.139	3.968	0.000
(0,1)	112	1.30%	-0.316	0.376	2.171	0.015
(0,3)	112	0.75%	-0.908	0.182	0.882	0.189
Panel B : Dissolution						
(-1,1)	555	-0.81%	-2.217	0.013	-2.247	0.012
(-1,0)	555	-0.91%	-2.343	0.010	-3.094	0.001
(0,1)	555	-0.95%	-2.924	0.002	-3.220	0.001
(0,3)	555	-1.34%	-3.409	0.000	-3.219	0.001
Panel C : Joint Venture						
(-1,1)	96	-0.57%	-1.391	0.082	-0.682	0.248
(-1,0)	96	-0.58%	-0.995	0.160	-0.863	0.194
(0,1)	96	-0.90%	-1.878	0.030	-1.323	0.093
(0,3)	96	-0.99%	-1.475	0.070	-1.032	0.151
Panel D: Non-Joint Venture						
(-1,1)	571	-0.34%	-1.457	0.073	-0.986	0.162
(-1,0)	571	-0.32%	-1.268	0.103	-1.135	0.128
(0,1)	571	-0.52%	-2.269	0.012	-1.823	0.034
(0,3)	571	-0.99%	-3.147	0.001	-2.474	0.007
Panel E: Joint venture & Internalize						
(-1,1)	63	0.22%	-0.962	0.168	0.214	0.415
(-1,0)	63	0.67%	-0.068	0.473	0.815	0.208
(0,1)	63	0.13%	-1.031	0.151	0.162	0.436
(0,3)	63	0.07%	-0.809	0.209	0.057	0.477
Panel F: Joint venture & Dissolution						
(-1,1)	33	-1.73%	-1.044	0.148	-1.087	0.139
(-1,0)	33	-3.00%	-1.972	0.024	-2.306	0.011
(0,1)	33	-2.10%	-1.452	0.073	-1.616	0.053
(0,3)	33	-2.19%	-0.731	0.232	-1.189	0.117
Panel G: Non-Joint venture & Internalize						
(-1,1)	49	3.98%	1.414	0.079	3.457	0.000
(-1,0)	49	4.66%	1.558	0.060	4.956	0.000
(0,1)	49	3.10%	0.819	0.206	3.292	0.001
(0,3)	49	2.21%	0.153	0.439	1.662	0.048
Panel H: Non-Joint venture & Dissolution						
(-1,1)	522	-0.75%	-2.064	0.020	-2.047	0.020
(-1,0)	522	-0.79%	-2.092	0.018	-2.644	0.004
(0,1)	522	-0.86%	-2.702	0.004	-2.866	0.002
(0,3)	522	-1.29%	-3.365	0.000	-3.060	0.001

The analysis of the alliance termination mode based on the alliance governance shows a generally negative effect for dissolution, which is somewhat more pronounced, with a larger but less strong effect, for cases of JV dissolution (e.g., for [0;1], CAAR=-2.10%;  $p_z=0.073$ ) than for non-JV dissolution (e.g., [0;1], CAAR=-0.86%;  $p_z=0.004$ ). However, the mean comparison indicates that JV dissolution and non-JV dissolution are not meaningfully different (diff.=1.144%;  $p=0.559$ ) to one another, rejecting hypothesis 2b. On the other hand, the effects of non-JV internalization are relatively large and positive but with somewhat mixed test results (e.g., [0;1], CAAR=3.10%;  $p_z=0.206$  and  $p_t=0.001$ ) while the effects of JV internalization are smaller but mostly not different from zero (e.g., [0;1], CAAR=0.13%;  $p_z=0.151$ ). Despite the relatively large difference in means between JV internalization and non-JV internalization, the mean comparison indicates that these groups are also not different from one another (diff.=2.632%;  $p=0.175$ ), rejecting hypothesis 2a.

### *3.5.3. Termination motive*

To test the hypotheses regarding the termination motive, we show the average market reaction across the four different reasons. Table 5 depicts the CAARs for alliance termination based on growth (Panel A), refocusing (Panel B), performance issues (Panel C), and unexpected external change (Panel D). In the case of terminations undertaken for growth (e.g., [0;1], CAAR =1.38%;  $p_z=0.366$ ,  $p_t=0.040$ ) and refocusing (e.g., [0;1], CAAR =1.21%;  $p_z=0.154$ ,  $p_t=0.062$ ), we find largely positive reactions but not consistently different from zero (hypotheses 3a and 3b). The market reaction for termination based on performance issues (e.g., [0;1], CAAR =-1.92%;  $p_z=0.001$ ) and unexpected external change (e.g., [0;1], CAAR =-0.61%;  $p_z=0.135$ ) are both negative, but only statistically meaningful for the case of performance issue terminations as predicted in hypothesis 3c.



Table 5. CAAR alliance termination motives

Event window	N	CAAR	Std. Csect. z	p-values	Portfolio Time-Series t	p-values
Panel A: Growth						
(-1,1)	61	1.09%	0.233	0.408	1.131	0.129
(-1,0)	61	0.83%	0.328	0.372	1.052	0.146
(0,1)	61	1.38%	0.344	0.366	1.757	0.040
(0,3)	61	0.30%	-0.679	0.249	0.271	0.393
Panel B: Refocus						
(-1,1)	73	2.78%	1.502	0.067	2.884	0.002
(-1,0)	73	3.10%	1.701	0.045	3.931	0.000
(0,1)	73	1.21%	1.021	0.154	1.536	0.062
(0,3)	73	0.63%	0.573	0.283	0.569	0.285
Panel C: Performance issues						
(-1,1)	194	-1.36%	-2.376	0.009	-2.119	0.017
(-1,0)	194	-0.78%	-1.687	0.046	-1.490	0.068
(0,1)	194	-1.92%	-3.030	0.001	-3.654	0.000
(0,3)	194	-2.40%	-3.271	0.001	-3.230	0.001
Panel D: Unexpected external change						
(-1,1)	61	-0.93%	-1.151	0.125	-1.028	0.152
(-1,0)	61	-1.29%	-1.377	0.084	-1.752	0.040
(0,1)	61	-0.61%	-1.102	0.135	-0.833	0.202
(0,3)	61	-1.21%	-1.212	0.113	-1.156	0.124

### 3.5.4. Multivariate analysis

The descriptive statistics of the control variables are shown in Table 6 and the regression results are depicted in Table 7.<sup>16</sup> Following an initial model focusing on the control variables (Model 1), we first separately test the dissolution effect (Model 2) before the interaction effect of alliance governance mode and termination mode (Model 3). In line with our earlier analysis (hypotheses 1a and 1b), we find that dissolution results in a relatively more negative market reaction than internalization ( $b=-0.102$ ,  $p=0.016$ ) (Model 2). However, the JV dummy while

<sup>16</sup> The correlation matrix can be found in the online appendix Table A2. High correlation exists only between the firm-level control variables revenue and total assets, and between the CAARs for the event windows [0;1] and [0;3].

negative, is not different from zero in Model 1 ( $b=-0.017, p=0.502$ ) nor is the interaction effect in Model 3 ( $b=0.027, p=0.465$ ).

Table 6. Descriptive statistics

Variable	Mean	S.D.	Min	Max
CAR [0;1]	-0.01	0.14	-0.87	0.76
CAR [0;3]	-0.02	0.16	-1.31	0.61
Duration	4.22	3.08	0.38	19.64
Duration (sq)	27.28	45.89	0.14	385.56
Competitor All.	0.40	0.49	0.00	1.00
International Partner.	0.35	0.48	0.00	1.00
Form. R&D alliance	2.61	3.33	0.00	40.00
Form. other alliance	1.98	2.56	0.00	20.00
Core vs non-core alliances	0.16	0.37	0.00	1.00
Alliance scope	1.37	0.78	0.00	3.00
R&D agreement	0.65	0.48	0.00	1.00
Alliance portfolio	14.50	20.48	0.00	257.00
Revenue	0.54	0.43	0.00	3.74
R&D investments	0.25	0.32	0.00	2.39
Total Assets	10.44	22.25	0.00	212.95
ROA	-0.23	0.61	-5.69	0.36
PE&E	0.38	0.30	0.00	2.43
Dissolution	0.82	0.39	0.00	1.00
Joint Venture	0.14	0.35	0.00	1.00
Growth	0.17	0.38	0.00	1.00
Refocus	0.19	0.39	0.00	1.00
Performance issues	0.48	0.50	0.00	1.00
Unexpected ext.change	0.17	0.37	0.00	1.00

Table 7. Regression results

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Duration	0.006 (0.536)	0.011 (0.314)	0.004 (0.570)	0.007 (0.465)	0.007 (0.465)	0.007 (0.465)	0.007 (0.465)
Duration (sq)	-0.000 (0.757)	-0.001 (0.350)	-0.000 (0.429)	-0.001 (0.447)	-0.001 (0.447)	-0.001 (0.447)	-0.001 (0.447)
Competitor All.	0.014 (0.446)	0.009 (0.575)	0.004 (0.761)	0.013 (0.440)	0.013 (0.440)	0.013 (0.440)	0.013 (0.440)
International Partner.	0.013 (0.489)	0.021 (0.215)	0.019 (0.121)	0.019 (0.260)	0.019 (0.260)	0.019 (0.260)	0.019 (0.260)
Alliance portfolio	0.000 (0.506)	0.000 (0.654)	0.000 (0.425)	0.000 (0.466)	0.000 (0.466)	0.000 (0.466)	0.000 (0.466)
Form. R&D alliance	-0.000 (0.888)	0.001 (0.657)	-0.000 (0.911)	0.000 (0.907)	0.000 (0.907)	0.000 (0.907)	0.000 (0.907)
Form. other alliance	-0.006 (0.254)	-0.004 (0.300)	-0.002 (0.576)	-0.003 (0.364)	-0.003 (0.364)	-0.003 (0.364)	-0.003 (0.364)
Core vs non-core alliances	-0.040 (0.092)	-0.031 (0.131)	-0.023 (0.154)	-0.034 (0.108)	-0.034 (0.108)	-0.034 (0.108)	-0.034 (0.108)
Alliance scope	0.001 (0.955)	0.002 (0.904)	0.008 (0.483)	0.003 (0.850)	0.003 (0.850)	0.003 (0.850)	0.003 (0.850)
R&D agreement	-0.027 (0.240)	-0.019 (0.336)	-0.016 (0.266)	-0.015 (0.412)	-0.015 (0.412)	-0.015 (0.412)	-0.015 (0.412)
Revenue	0.064 (0.097)	0.059 (0.109)	0.042 (0.128)	0.059 (0.125)	0.059 (0.125)	0.059 (0.125)	0.059 (0.125)
R&D investments	-0.038 (0.515)	-0.033 (0.529)	-0.027 (0.532)	-0.021 (0.669)	-0.021 (0.669)	-0.021 (0.669)	-0.021 (0.669)
Total Assets	0.000 (0.574)	0.000 (0.569)	0.000 (0.622)	0.000 (0.387)	0.000 (0.387)	0.000 (0.387)	0.000 (0.387)
ROA	-0.052 (0.329)	-0.047 (0.362)	-0.012 (0.672)	-0.042 (0.422)	-0.042 (0.422)	-0.042 (0.422)	-0.042 (0.422)
PP&E	-0.021 (0.712)	-0.037 (0.489)	-0.018 (0.609)	-0.043 (0.409)	-0.043 (0.409)	-0.043 (0.409)	-0.043 (0.409)
Joint Venture	-0.017 (0.502)	-0.057 (0.085)	-0.048 (0.083)	-0.116 (0.073)	-0.116 (0.073)	-0.116 (0.073)	-0.116 (0.073)
Dissolution		-0.102 (0.016)	-0.070 (0.012)	-0.110 (0.026)	-0.110 (0.026)	-0.110 (0.026)	-0.110 (0.026)
Joint Venture x Dissolution			0.027 (0.465)	0.078 (0.280)	0.078 (0.280)	0.078 (0.280)	0.078 (0.280)
Growth					0.071 (0.109)	0.066 (0.046)	0.068 (0.038)
Refocus				-0.071 (0.109)		-0.005 (0.833)	-0.003 (0.918)
Performance issues				-0.066 (0.046)	0.005 (0.833)		0.002 (0.914)
Unexpected ext. change				-0.068 (0.038)	0.003 (0.918)	-0.002 (0.914)	
Constant	0.010 (0.853)	0.142 (0.091)	0.080 (0.107)	0.184 (0.057)	0.113 (0.101)	0.118 (0.135)	0.116 (0.125)
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.194	0.246	0.214	0.277	0.277	0.277	0.277
Adjusted R-squared	0.0026	0.0624	0.0193	0.0886	0.0886	0.0886	0.0886
Observations	344	344	344	344	344	344	344

Note: Robust p values in parentheses

In Model 4 to Model 7, we compare the different motives against a changing reference group. The results for the control variables are consistent between the models. The results show that alliance termination undertaken for growth motives has a more positive market reaction than alliance termination based on performance issues ( $b=0.066$ ;  $p=0.046$ ) and unexpected external change ( $b=0.068$ ;  $p=0.038$ ). Although not different from zero, we also find that termination undertaken for growth has smaller negative effects than termination for refocusing ( $b=0.071$ ;  $p=0.109$ ). Additionally, the differences between refocusing, performance issues, and unexpected external change are all relatively small.

### *3.5.5. Robustness tests and extended analysis*

We conduct different robustness tests for our regression results. First, we perform the analysis with the CAAR [0;3] event window (Table 8). Even though the results are weaker than the case of CAAR [0;1], the direction and strength of the results are similar to our previous findings. We find a negative effect of the dissolution dummy ( $b=0.096$ ,  $p=0.022$ ) and the most negative differences between growth driven termination against performance issues ( $b=-0.050$ ,  $p=0.082$ ) and unexpected external change motivated termination ( $b=-0.050$ ,  $p=0.107$ ). Second, we run the analysis only for the non-JVs to focus explicitly on the part of the sample which has not been previously studied. Again, the results of this analysis are very comparable to the results of the main analysis. The dissolution dummy shows a negative effect ( $b=-0.117$ ,  $p=0.039$ ) and the difference between growth motives and performance issues ( $b=-0.068$ ,  $p=0.058$ ) and unexpected external change ( $b=-0.071$ ,  $p=0.049$ ) termination motives is positive.

Table 8. Robustness tests

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: CAR [0;3]							
JV	-0.018 (0.495)	-0.056 (0.105)	-0.069 (0.186)	-0.064 (0.255)	-0.093 (0.127)	-0.093 (0.127)	-0.093 (0.127)
Dissolution		-0.096 (0.022)	-0.102 (0.055)	-0.076 (0.067)	-0.096 (0.045)	-0.096 (0.045)	-0.096 (0.045)
JV x Dissolution			0.020 (0.746)	0.029 (0.648)	0.046 (0.488)	0.046 (0.488)	0.046 (0.488)
Growth					0.060 (0.177)	0.057 (0.094)	0.056 (0.079)
Refocus				-0.047 (0.269)		-0.003 (0.895)	-0.004 (0.893)
Performance issues				-0.050 (0.107)	0.003 (0.895)		-0.000 (0.980)
Unexpected ext. change				-0.050 (0.082)	0.004 (0.893)	0.000 (0.980)	
Observations	344	344	344	344	344	344	344
Panel B: Without JVs							
JV	-	-	-	-	-	-	-
Dissolution		-0.117 (0.039)	-	-0.108 (0.031)	-0.108 (0.031)	-0.108 (0.031)	-0.108 (0.031)
JV x Dissolution			-	-	-	-	-
Growth					0.059 (0.199)	0.068 (0.058)	0.071 (0.049)
Refocus				-0.059 (0.199)		0.009 (0.694)	0.012 (0.644)
Performance issues				-0.068 (0.058)	-0.009 (0.694)		0.004 (0.868)
Unexpected ext. change				-0.071 (0.049)	-0.012 (0.644)	-0.004 (0.868)	
Observations		298		298	298	298	298
Panel C: Including unknown termination motives							
JV		-0.008 (0.584)	-0.038 (0.108)	-0.057 (0.107)	-	-	-
Dissolution			-0.058 -0.049	-0.070 (0.067)	-	-	-
JV x Dissolution				0.037 (0.408)	-	-	-
Observations		521	521	521			
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust p values in parentheses

Our previous analysis excludes alliance terminations of firms, for which we could not determine a clear termination reason. However, despite being legally required to provide accurate information, firms might have expectations of how the market could react to their alliance termination announcement. Thus, firms might act strategically in their decision to communicate termination and with the information provided to the public. To explore the potential bias of this behavior in our analysis we perform the analyses of hypotheses 1a - 2b incorporating the alliances with unknown termination reason ( $n=499$ ).<sup>17</sup> Again, the outcome of this analysis is very much in line with the earlier results. The dissolution dummy shows a negative market reaction ( $b=-0.058$ ;  $p=0.049$ ), whereas the results for JV ( $b=-0.008$ ;  $p=0.584$ ) or the interaction term of JV and dissolution ( $b=-0.037$ ;  $p=0.408$ ) are not different than zero.

As a final analysis, we explore whether the termination and alliance governance mode moderate the relationship between the termination motive and firm market valuation. We interact the alliance termination mode (dissolution or internalization) with the termination motive (growth, refocusing, performance issues, or unexpected external change). Table 9 shows the main and interaction effects of dissolution with the four termination motive dummies. Similar to the previous analysis, we show the results for different reference groups. To ease the interpretation of the effects, we plot the interaction effect in Figure 1. Supporting earlier results, this analysis also shows that the market has a generally more positive reaction for internalization than for dissolution. However, only in the case of termination motivated by unexpected external change do we see a relevant interaction and shift in the pattern where dissolution shows a more positive effect than internalization.

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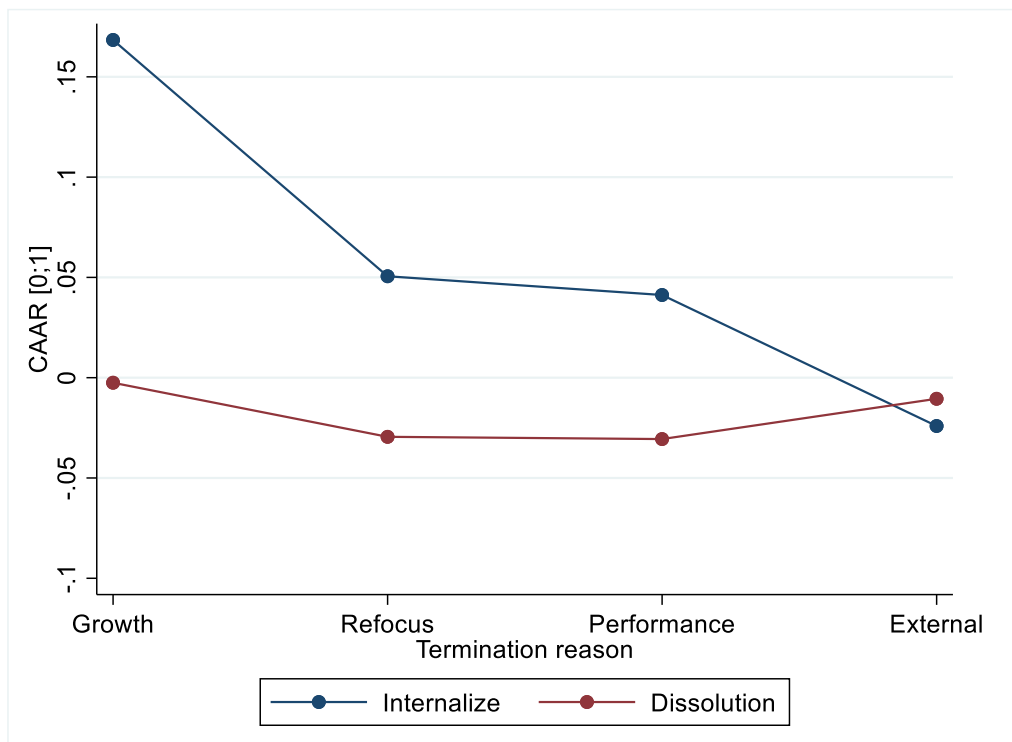
<sup>17</sup> Hypotheses 3a-3d are relative to each other and should not be impacted by this potential bias.

Table 9. Interaction termination mode and motive

VARIABLES	(1)	(2)	(3)	(4)
Dissolution	-0.171 (0.0374)	-0.0801 (0.0486)	-0.0718 (0.0526)	0.0136 (0.0460)
Growth		0.118 (0.0527)	0.127 (0.0571)	0.192 (0.0480)
Refocus	-0.118 (0.0527)		0.00936 (0.0682)	0.0747 (0.0584)
Performance issues	-0.127 (0.0571)	-0.00936 (0.0682)		0.0653 (0.0652)
Unexpected ext. change	-0.192 (0.0480)	-0.0747 (0.0584)	-0.0653 (0.0652)	
Growth x Diss.		-0.0908 (0.0598)	-0.0991 (0.0609)	-0.184 (0.0578)
Refocus x Diss.	0.0908 (0.0598)		-0.00825 (0.0718)	-0.0936 (0.0659)
Performance issues x Diss.	0.0991 (0.0609)	0.00825 (0.0718)		-0.0854 (0.0700)
Unexp. ext. change x Diss.	0.184 (0.0578)	0.0936 (0.0659)	0.0854 (0.0700)	
Controls	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Industry F.E.	Yes	Yes	Yes	Yes
R-squared	0.298	0.298	0.298	0.298
Adjusted R-squared	0.108	0.108	0.108	0.108
Observations	344	344	344	344

Note: Robust p values in parentheses

Figure 1. Interaction termination mode and motive



### 3.6. Discussion

This study set out to answer the question of *how alliance termination modes, alliance governance, and termination motives influence firm market valuation*. Thereby, it addresses the long standing appeal to investigate the distinction between alliance termination modes (Dussauge et al., 2000; Kogut, 1991). Alliance dissolutions are not only more frequent (roughly five to one), but they also have an overall negative effect on firm market valuation and a particularly strong effect when compared to internalizations, which tend to have a more positive market reaction. On average, alliance dissolution leads to a negative market reaction around 1%, whereas internalization leads to a positive market around 1%. While these are already economically relevant differences, they become pronounced when we account for control variables in our regression analysis. Here we find a 10.2% difference between dissolution and internalization.



While the effect is more pronounced for JVs, our analysis also shows that the negative effect of dissolution holds for both JV and non-JV alliance governance. Thus, firms may be wise to consider internalization as an exit option for alliances under certain conditions, even when no separate entity (JV) has been formed by the firms. This offers empirical evidence in support of the advice of early research that interfirm alliances can be used as an exit strategy for assets a firm seeks to divest, as they allow the firm to demonstrate the value of the resources to potential buyers (Mathews, 2007). It also suggests that JV governance may have less influence on final firm-level alliance outcomes than on intermediate alliance performance and outcomes (e.g., Mowery et al., 1996; Oxley and Wada, 2009). Adding an interesting perspective to earlier studies on internalization that focus on JVs, our event study results indicate particularly high abnormal return for non-JV internalization alongside a high variance of market reactions compared to relatively low values for JV internalization. This might be attributed to the fact that the value of JV resources is already incorporated into firm value to a larger extent than non-JV alliances. Moreover, the acquisition of business unit resources is likely interpreted differently by the market, provided the newly integrated resources are familiar to the partner firm but not shared with JVs, which may make the internalization particularly valuable. However, more detailed research focusing on internalization, and most importantly on the case of non-JVs, is needed to shed more light on this phenomenon.

Our results also provide a more complete picture of alliance termination motives and firm market valuation. Kumar (2005) predicted a positive effect of internalization motivated both by expansion (given the potential for firm growth) and refocusing (given the potential to strengthen core competencies) for JVs, but only found clear support for a positive relationship with firm value when undertaken for refocusing. In contrast, we find strong evidence of a positive effect of termination for growth motives for both internalization and dissolution events

when compared to alternative termination modes. Terminations motivated by growth are not necessarily higher than the expected market return, but, are 6.8% and 6.6% when compared to unexpected external change driven termination or performance issue based termination. Additionally, the negative effect of performance issue and external change termination motives aligns with previous research and offers consistent effects to support past mixed findings on involuntary JV sales (Meschi, 2005).

Our results for the interaction of termination mode and motive suggest internalization is especially linked to positive market reactions when the firm reports the termination was undertaken for firm refocusing or when the acquiring partner seeks growth. However, when termination is motivated by performance issues or unexpected external change, the market responds even more negatively to internalization than dissolution. This aligns with resource-based logic since internalization indicates continued access and development of valuable alliance resources by one of the firms while dissolution suggests the contrary. With alliance performance issues or unexpected external change, dissolution may be less damaging to firm market valuation than continuing to pursue the opportunity given the revealed uncertainty and potential partner insufficiencies.

In summary we offer empirical evidence that firm market valuation is affected differently depending on alliance termination conditions. Firms utilize alliances to access external resources but often return to market transactions (dissolution) or seek to embed these resources within the firm (internalization). Given the costs and coordination challenges of alliances, market channels are the default mode for resource trading (Eisenhardt and Schoonhoven, 1996). Still, efficient exchanges are often not possible since resources are not perfectly tradable and mingled with other resources or embedded in organizations (Tailan Chi, 1994). An alliance

allows firms to access and recombine resources without separation from the firm resource base. However, the process of alliance evolution means alliances end in distinct ways and for various motives that convey information about the value of the firm resources and subjective opportunity set. Our results show that alliance termination unlikely sees the same positive effect of business exit when resources are not exchanged at termination. This suggests a limit to the value of the flexibility afforded by interfirm alliances. Although fewer upfront resources are committed as compared to acquisitions, alliances that fail to develop resources valued by the partners for subsequent internalization hurt firm valuation. This appears to be the case even when dissolution may suggest more efficient use of firm resources by exiting non-performing activities.

Our results advance strategy research by helping elucidate the implications of changes in firm activity portfolios related to interfirm alliances. Although firms must continually seek the productive set that best leverages firm resources and opportunities, and thus terminate alliances, managers are well advised to develop a strategy for exiting alliances. Thereby, the market interprets a more effective and efficient use of firm resources, such as valuable resource redeployment in pursuing alternative opportunities. The findings further suggest firms are best to dissolve alliances with performance issues and under adverse external conditions rather than attempting to embed alliance resources or preempt competition (Folta and Miller, 2002) through internalization. Finally, the limited differences in the effect of JV and non-JV termination announcements on firm market value offers some evidence that the increased commitment and embeddedness of JVs does not result in greater penalty to alliance termination, perhaps due to the separation from the parent firm. This may support the case for selecting JV governance since enhanced performance outcomes such as knowledge transfer are not undermined by less flexibility at termination.

### **3.7. Limitations**

The results of this study must be interpreted in the context of various limitations. First, building on related studies, we use an event study approach to measure firm market valuation as the performance outcome variable. Although this is a generally accepted approach making our study comparable to previous work, systemic biases may underlie such reactions. Thus, further research might rely on alternative metrics for firm performance (e.g., changes in cash flow or long-term firm performance). While these measures are also not without limitation, they might provide additional insight to alliance termination research.

Second, we focus explicitly on the market reaction at the day of termination announcement. While this is an important addition to alliance research, several questions remain open. For example, what happens after the initial market reaction to termination and how does the termination condition impact future firm behavior and performance? Future research might investigate how certain termination conditions impact future alliance formation or firm innovation.

Third, although we undertook great effort in manual coding and data cleaning of alliance data, we are limited by our reliance on secondary data reporting. While the publicly traded nature of the firms reduces some concerns of firms reporting false motives given the requirement to disclose truthful information, it raises the usual question on the generalizability of our findings to non-traded firms. Similarly, the single country and industry focus of the study signal the need for future research to examine the replicability of our findings in additional contexts.

Finally, in comparison to other alliance termination research, our study is based on a relatively large sample size with a wide set of control variables. This allowed us to analyze different alliance and termination conditions, while controlling for a range of confounding effects. However, the sample size for each specific alliance and termination condition is still limited and reduces statistical power and the potential for additional analysis. In spite of these limitations, this study extends the scarce evidence on the implications of alliance termination and offers insight on how alliance termination modes, governance, and motives influence firm level performance outcomes.

## Appendix

Table A1. Mean Comparisons

Comparisons groups	diff.	p-value
Internalize (>) Dissolution	2.423%	0.036
Joint Venture (na) Non Joint Venture	0.049%	0.968
Internalize: Joint Venture (>) Non-Joint Venture	-2.632%	0.175
Dissolution: Joint Venture (<) Non-Joint Venture	-1.144%	0.559
Joint Venture: Internalize (na) Dissolution	-0.762%	0.247
Non-Joint Venture: Internalize (na) Dissolution	3.770%	0.024

Note: Results based on two tailed t-test of CAAR[0;1]; (>) and (<) indicates expected relationship based on hypotheses, (na) indicates relationships that were not hypothesized.



# 4

## **Does separation hurt? The impact of premature termination of R&D alliances on knowledge building and innovation**

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This article is under review  
in *Research Policy*



## **4.1. Abstract**

Although R&D alliances are a commonly used mechanism to facilitate knowledge building and innovation, they are temporally bounded and often terminate prematurely. While there is vast work on alliances linked to innovation and learning, research is limited on alliance termination and the resulting organizational implications. Addressing this gap and building on the knowledge-based view of the firm, we analyze the impact of premature termination on knowledge building and innovation performance. We apply a difference-in-differences and matching-based estimation to a sample of terminated and non-terminated R&D alliances in the life sciences from 1990-2003. Our analysis suggests that alliance termination reduces innovation performance, knowledge building becomes less technologically diverse, and firms build less on internal knowledge. However, we found no relevant drop in knowledge building between alliance partners post-termination. Our exploration of conditional effects shows that firm-level factors, particularly a firm's alliance portfolio, moderate termination effects, while alliance-specific conditions had little impact.

*Keywords:* Alliances termination; Innovation; Patents; Alliance portfolio; Difference-in-differences; Knowledge-based view

## **4.2. Introduction**

Research on alliance formation and R&D collaborations in an innovation context has received considerable scholarly attention over the last decades. Studies have not only examined the overall innovation outcomes of alliances (Baum et al., 2000; Powell et al., 1996; Stuart, 2000) but also the underlying mechanisms driving innovation (Jiang and Li, 2009; Lahiri and Narayanan, 2013; Laursen and Salter, 2006). More specifically, alliances have often been

linked to the access, exchange, and creation of knowledge that promotes firm innovation. For example, research on firm knowledge sourcing patterns has demonstrated the relationship between R&D alliances and enhanced knowledge building across partner firms (Gomes-Casseres et al., 2006; Mowery et al., 1996) as well as links between the diversity and orientation of firm knowledge building (Rosenkopf and Nerkar, 2001; Subramanian, Bo, and Kah-Hin, 2018). Consequently, much is known about how alliance formation affects knowledge sourcing and creation as well as the overall impact on innovation performance.

Although all alliances eventually come to an end and the majority do so prematurely (Das and Teng, 2000b; Greve et al., 2010; Makino et al., 2007), little is known about the implications of termination for firm knowledge building and innovation. Nonetheless, understanding termination, and particularly premature termination, is fundamental to building realistic models of firm alliance behavior and knowledge sourcing activities. Alliances are key mechanisms for the knowledge access, exchange, and creation that fosters firm innovation (Baum et al., 2000; Jiang and Li, 2009; Powell et al., 1996; Randhawa, Wilden, and Hohberger, 2016), and thus these goals often drive R&D alliance formation (Hamel, 1991; Kogut, 1988). Alliance termination implies a shift in a firm's ability to build, create, and share knowledge with an external partner and, in turn, across organizational and technological boundaries. Yet, research has not examined the impact of termination on knowledge building and innovation.

Particularly in the case of R&D collaboration, much of the existing alliance formation and performance literature is rooted in knowledge perspectives of the firm (e.g., Carayannopoulos and Auster, 2010; Steensma and Corley, 2000). This research stream stresses: (1) knowledge as a key resource for firm innovation, performance, and survival; (2) the importance of collaboration for accessing, exchanging, and creating knowledge (Almeida et al., 2002; Grant

and Baden-Fuller, 2004). Premature alliance termination may have the opposite effect on innovation outcomes as it strips firms of the mechanisms shown to facilitate these processes. Whereas alliance formation fosters learning and innovation outcomes, alliance termination may reverse the process. Thus, further empirical research on alliance termination is needed to better understand the impact of this common event in the alliance lifecycle. Moreover, knowledge on premature termination can improve understanding of the temporality of alliances and the management of alliance formation and evolution.

Thus, to extend research on alliances and the knowledge-based view of the firm (KBV), we ask three related research questions. Namely, to which extent does premature alliance termination affect: (1) interfirm knowledge building; (2) knowledge building patterns; and (3) firm innovation performance? We use the terms ‘knowledge building’ in the context of the KBV to reflect not only the access of knowledge from outside the organization but also the subsequent processes of knowledge development and integration (within a firm) for innovation (Almeida et al., 2002). This is important as alliances also improve the efficiency with which knowledge is integrated and used within the firm (Grant and Baden-Fuller, 2004). Thus, we distinguish between: (i) interfirm knowledge building (a relational measure that refers to knowledge building from the partner knowledge base), and (ii) firm knowledge building (a firm-specific measure related to the knowledge implications for the focal firms’ use of diverse and internal knowledge). These are key aspects of the KBV perspective on R&D alliances because they capture the idea that alliances are mechanisms that: (a) facilitate knowledge building with and from partners and (b) can alter a firm’s knowledge base and innovation potential, and thus impact innovation performance (Almeida et al., 2002; Grant and Baden-Fuller, 2004).

Our empirical analysis is based on a sample of R&D alliances formed in the life science industry from 1990 to 2003. We compare prematurely terminated R&D alliances (terminated before 2004) and non-terminated R&D alliances with evidence of survival. Similar to earlier termination research (e.g., Pangarkar, 2009; Polidoro et al., 2011), we focus on premature alliance termination, which refers to the ending of formal collaboration agreements that does not coincide with the completion of objectives or contract expiration. We also restrict our investigation to alliances terminated via dissolution (Polidoro et al., 2011), thus excluding alliances that end in internalization or acquisition. We follow established practices in innovation research to interpret patent citation counts as measures of innovation performance and value (Hall, Jaffe, and Trajtenberg, 2001; Trajtenberg, 1990; Yang, Phelps, and Steensma, 2010), and patent citation data to measure interfirm and firm knowledge building.

To account for the non-randomness and possible endogeneity of the alliance termination event, we conducted our analysis in three steps. First, we ran the panel DID estimation with firm-alliance specific and year fixed effects to control for unobserved time invariant heterogeneity. Next, we used lead-and-lag regressions to assess reverse causality and other unobserved events (Roberts and Whited, 2013). Then, we applied conditional DID strategies (combination of matching and DID) (Heckman, Ichimura, and Todd, 1997) to address possible differences between the treatment and control sample (selection bias). In all cases, we estimated the effect of the treatment (termination) on the outcome variables by comparing prematurely terminated and non-terminated alliances before and after the treatment. To explore the robustness and heterogeneity of our results, we also examined the impact of frequently discussed firm and alliance conditions on the relationship between alliance termination and knowledge building and innovation. In the case of alliance conditions, we examined joint venture (JV) governance (e.g., Gomes-Casseres, Hagedoorn, and Jaffe, 2006; Mowery et al., 1996; Phene and Tallman,

2012), geographic proximity (e.g., Gomes-Casseres et al., 2006; Hohberger, 2014; Rosenkopf and Almeida, 2003), and same-industry alliances (e.g., Hamel, 1991; Mowery et al., 1996). For specific firm conditions, we tested the alliance portfolio size (Frankort, Hagedoorn, and Letterie, 2011; Lahiri and Narayanan, 2013; Wassmer et al., 2017) and level of internal R&D (Cassiman and Veugelers, 2006; Hagedoorn and Wang, 2012).

As one of few empirical investigations into outcomes linked with alliance termination, our study contributes in important ways to a better understanding of the alliance phenomena and research within the KBV. From a phenomenological perspective, we provide relevant insights on a common and impactful issue that has seldom been studied. Alliances are not only ubiquitous across many industries, their focus is often on knowledge building and innovation outcomes, particularly in science and technology-driven sectors (e.g., Baum et al., 2000; Stuart, 2000). Along the same lines, premature alliance termination is frequent but still relatively scarcely investigated when compared to the scholarly effort put into alliance formation and management research (Gomes, Barnes, and Mahmood, 2016; Zhelyazkov and Gulati, 2016). Thus, empirical evidence on termination is not only needed to gain a better grasp of the impact of termination but also to improve understanding of the overall value and management of alliances throughout their life spans. This is also important from a managerial perspective as practitioners can benefit from a detailed understanding of alliance termination and the post-termination phase to anticipate action prior to termination.

From a theoretical perspective, we provide a knowledge-based driven explanation of relational and firm-specific knowledge building and innovation performance implications. Our results therefore provide a more nuanced picture of alliances, where the impact of the termination event is not necessarily symmetrical to the effects of alliance formation. It shows a partial

reversal of the alliance formation effects proposed by the KBV that facilitate knowledge building and innovation, particularly in the case of enhanced technological diversity and innovation performance. This also provides indirect evidence for role of alliances as mechanisms to recombine diverse external knowledge to foster innovation since the premature termination reduces these outcomes, and thus the positive effects of initial alliance formation. Our paper also paints a nuanced picture of the implications of termination where firm-specific and relational outcomes are not necessarily affected equally. For example, the diversity of firm knowledge building declines after the termination, but this is not the case for partner-based learning.

Furthermore, we also show the termination effect is conditioned by firm-specific characteristics related to its internal and external knowledge base. In particular, we show that a larger alliance portfolio can reduce the negative effects on innovation performance and interfirm and firm knowledge building. This extends the idea that the alliance portfolio is an important resource for firm knowledge sourcing and innovation outcomes as access to a larger external knowledge pool seems to help protect against declines in innovation while mitigating the reduced recombination of ex-partner, diverse, and external knowledge. On the other hand, and unlike alliance formation outcomes, we found that alliance-specific conditions had little influence on the relationship between termination and knowledge building and innovation. This again highlights the asymmetry between alliance formation and termination.

### **4.3. Background research and theory**

#### *4.3.1. Research on alliance termination*

Most studies on alliances, whether focused on innovation or other aspects, explore the formation phase (e.g., Colombo et al., 2006; Gomes et al., 2016; Lin et al., 2009; Russo et al., 2019) or alliance evolution and dynamics (e.g., Chung and Beamish, 2010; Hagedoorn and Sadowski, 1999; Reuer et al., 2002). However, most of this research only examines alliances until the end of their active lives, with only limited research exploring alliance termination (e.g., Madhok et al., 2015) with a particular focus on the drivers of alliance termination (e.g., Cui et al., 2011; Reuer and Zollo, 2005; Xia, 2011).

Very few studies have advanced our understanding of the implications of alliance termination. For example, Zhelyazkov and Gulati (2016) found negative relational and reputational consequences of venture capital syndicate withdrawal as the propensity to withdraw from deals reduced new deal formation. Illustrating how alliance termination may be particularly detrimental for start-ups, Singh and Mitchell (1996) found that firm survival is negatively influenced by alliance termination although the effect was attenuated by forming new partnerships. While these studies have deepened our understanding, they do not examine termination's influence on firm knowledge building and innovation. This is surprising given these outcomes are often the *raison de'être* for forming an alliance (Hamel, 1991; Kogut, 1988) and key mechanisms linked to performance (Baum et al., 2000; Jiang and Li, 2009; Stuart, 2000).

#### *4.3.2. Knowledge-based view and alliances*

The KBV is a prominent theoretical lens within alliance and innovation research (e.g., Almeida et al., 2002; Steensma and Corley, 2000). The central idea of the KBV is that knowledge is the firm's most important and primary resource (Grant, 1996b) and that the coordination, integration, and management of knowledge is a firm's central activity, if not the main reason for its existence (Kogut and Zander, 1992). A firm's competitive advantage stems from the coordination and combination of different knowledge resources rather than the individual business or products (Spender, 1996). The strategic potential of knowledge depends on its complexity, tacitness, and heterogeneity. These characteristics can make knowledge rare and hard to imitate and transfer, and thus can drive sustained competitive advantage of firms (Spender, 1996).

According to knowledge-based theory, strategic alliances are an important tool to access, transfer, and build on other firms' resources, especially if the required knowledge resides outside of the firm and cannot be developed through its own ability (Madhok, 1996). The relatively interdependent relationship between the partner firms in alliances allows for more face-to-face interaction and closer working relationships than market transactions, and thus enables the effective transfer of tacit knowledge (Mowery et al., 1996; Rosenkopf and Almeida, 2003). Thus, alliance perspectives within the KBV can address the issue of access to resources and capabilities and, simultaneously, the transfer and exchange problem of knowledge (Steensma and Lyles, 2000).

Abundant research on alliance formation and performance has evidenced the positive affect of alliance formation on knowledge building and innovation performance (e.g., Jiang and Li, 2009; Stuart, 2000). The KBV has proven a useful lens given its focus on internal and external



knowledge recombination (Carayannopoulos and Auster, 2010; Grant and Baden-Fuller, 2004). However, the majority of this research measures knowledge and innovation outcomes at a single point in time in relation to the date of alliance formation (e.g., Steensma and Corley, 2000). At the same time, research on alliance dynamics and termination highlight the unstable and evolutionary nature of alliances (e.g., Reuer et al., 2002; Reuer and Zollo, 2005), particularly concerning knowledge outcomes. For example, the exchange of knowledge has been cited as both a driver of alliance formation and termination in that when the alliance objectives are achieved and a firm absorbs partner knowledge, the alliance is no longer useful (Fang and Zou, 2010; Hamel, 1991). In line, there is growing research on the evolution of individual alliances and firm alliance portfolios (Schilling and Phelps, 2007; Wassmer et al., 2017), particularly with regard to firm knowledge building and innovation performance (Frankort, 2016; Lavie and Rosenkopf, 2006). Still, research has yet to consider the extent to which termination events undermine the gains in knowledge building and innovation performance tied to alliance formation. Nonetheless, such a line of enquiry is closely linked with the understanding of alliance performance and subsequent firm knowledge sourcing strategies.

#### *4.3.3. Interfirm knowledge building*

The use of R&D alliances as an organizational mechanism to access, acquire, and internalize external knowledge from partner firms is well established (Grant, 1996b; Hamel, 1991; Inkpen, 1998). Knowledge has both a public and private component, the latter imparting its inertness (Hoetker and Agarwal, 2007). Theoretically, alliances are an important knowledge sourcing mechanism as they allow partnering firms to gain a better understanding of the private component by observing the application of partner knowledge in joint execution of alliance

activities (Inkpen, 1998). Alliances also offer an organizational context to help individuals develop a shared identity and common language that facilitates the transfer of tacit knowledge (Kogut, 1988).

The enhanced access and exchange of knowledge between alliance partners is demonstrated in numerous empirical studies (Meier, 2011; Subramanian et al., 2018). In particular, early research on the role of learning in alliances stresses that collaboration enables firms to access and internalize valuable technological knowledge from partner firms (e.g., Grant, 1996b; Hamel, 1991). For example, Gomes-Casseres et al. (2006) and Almeida et al. (2002) argue that alliances are superior to markets at transferring knowledge. Mowery et al. (1996) found greater partner-related knowledge sourcing when firms formed a JV regardless of the formation motive, and Oxley and Wada (2009) evidenced greater transfer of knowledge covered in the scope of an agreement relative to knowledge not covered in the agreement.

Terminating an alliance may have an opposite effect on knowledge access and exchange as it removes the mechanisms shown to facilitate interfirm knowledge building. Alliances not only provide the initial access to knowledge, but also the context and interaction needed to build on partner knowledge. An alliance is a setting that helps integrate specialized knowledge through rules and directives, sequencing, routines, and group problem solving (Grant, 1996b). Moreover, the alliance context facilitates face-to-face interaction. When an alliance is terminated prematurely, these mechanisms would no longer be available to members post-terminating, thus hindering knowledge recombination. Furthermore, the social knowledge and shared identity lower coordination costs and influence the direction of search and learning toward partners during the alliance period. When the alliance context is removed by premature termination, these mechanisms driving knowledge building toward partners are likely

constrained.<sup>18</sup> Although the firm might continue to use and develop knowledge from the partner accessed prior to the termination, it may be more difficult to exploit as the partner interaction is relevant to understand and apply the knowledge in future applications. Thus, we predict:

*Hypothesis 1: The premature termination of an R&D alliance reduces interfirm knowledge building.*

#### 4.3.4. Firm knowledge building

Central to the KBV perspective on R&D alliances is the idea that interfirm collaboration is a mechanism for knowledge access and exchange, which can alter the knowledge base and innovation potential of the firm (Almeida et al., 2002; Grant and Baden-Fuller, 2004). To capture this, we hypothesize on two different concepts: *Technological diversity of firm knowledge building and internal (self) knowledge building*. The diversity of the firm's knowledge base bears on the notion that alliances provide access to and exchange of external knowledge that is new or complementary to the firm's knowledge base. Internal (self) knowledge building is aimed to capture if alliances allow firms to rely less on their own knowledge base. In both cases, we hypothesize that alliance termination reverses this effect.

The KBV proposes that alliances allow organizations to leverage underutilized specialist knowledge through integration with diverse external knowledge from partner firms (Grant, 1996b; Grant and Baden-Fuller, 2004). Thus, building on the idea that R&D alliances are an organizational mode that reconciles knowledge specialization with flexible integration, we

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<sup>18</sup> Nevertheless, while arguments for sustained knowledge building post-termination can be made, - e.g. studies have shown that innovators rely on social relationships to access diverse social communities (e.g. Fleming, 2001; Hargadon and Sutton, 1997; Powell et al., 1996) - without the specific alliance context, the contact is likely to be less frequent and intense, and thus, provide less opportunities for interfirm knowledge building.

emphasize that firms use alliances to seek diverse and external knowledge. Several studies show that R&D alliances can be used to acquire different types of knowledge, and thus influence the direction of firm innovation (Colombo et al., 2006; Hohberger, 2014; Rosenkopf and Almeida, 2003). Particularly for technology and science intensive industries, innovation takes place along a number of technological and scientific dimensions. In biotechnology, for instance, Powell et al. (1996) suggest that the pace of innovation is rapid and diverse - not only are there a number of research problems that can be solved (or locks that can be opened) but also an increasing number of approaches (or keys) that can be used to solve these problems. Under such conditions, no one firm can possess all the diverse technological and scientific knowledge needed for successful innovation. Thus, R&D alliances and other knowledge acquisition mechanisms are used to increase the amount and diversity of knowledge for successful innovation (Almeida et al., 2011).

Similarly, firms seek knowledge from outside their boundaries to expand the external knowledge needed for recombination with internal knowledge and successful innovation. When one access point to external knowledge is reduced by premature termination, firms may need to refocus on their internal knowledge base. Even if firms retain some of the knowledge acquired from previously terminated alliances internally, they would have reduced access to an important source of complementary and diverse external knowledge. Additionally, building on partner knowledge may be difficult as the partner firm is likely still relevant to understand and apply its knowledge. Hence, subsequent knowledge building activities of the firms may grow less technologically diverse and internally oriented.

*Hypothesis 2a: The premature termination of an R&D alliance reduces the technological diversity of firm knowledge building.*

*Hypothesis 2b: The premature termination of an alliance increases firm knowledge building toward internal (self) knowledge building.*

#### *4.3.5. Innovation performance*

Research has uncovered a largely positive relationship between alliance activity and innovation performance. For example, Jiang and Li (2009) found that the interaction of knowledge sharing and creation stemming from alliance activity significantly contributes to partner firms' innovation performance. Almeida et al. (2011) evidenced that R&D alliances increased innovation performance in the biotechnology industry. Similarly, Baum et al. (2000) found alliances enhanced innovation performance of biotechnology start-ups. The argument underlying these studies is strongly grounded on greater access to valuable knowledge and improved knowledge exchange within alliances. For example, Baum et al. (2000) propose the impact on innovation performance is consistent with the common belief that alliance networks form a 'locus of innovation' in high tech sectors (e.g., Powell et al., 1996) and with the alliance research's focus on alliances as mechanisms to access and transfer technological knowledge.

These results are underpinned by research on search and innovation outcomes that demonstrates a more diverse knowledge base in the innovation process is associated with higher innovation performance (Ahuja and Lampert, 2001; Katila, 2002; Phene, Fladmoe-Lindquist, and Marsh, 2006). Being able to combine distinct perspectives and capabilities, or technologically diverse knowledge from alliance partners encourages creativity and novel solutions to problems. Reversing the same argument, alliance termination may have a negative impact on innovation performance. The dissolution of the formal interorganizational context

would reduce access to both unfamiliar and familiar knowledge, and thus the inputs to innovation.

In addition to knowledge-based arguments, the disruption caused by premature termination may hurt innovation in the short-term as attention is redirected to managing the change. Alliance termination can be a time of reorientation and shifting technological focus. The resulting organizational changes can lead to a phase of high levels of anxiety, re-orientation, and stressful reactions with heightened pressure on immediate results and myopic decision making (de Rond and Bouchikhi, 2004; Luscher and Lewis, 2008). This is especially likely to be true when the termination is premature, which is the focus of this study and represents up to 90 percent of terminations (Makino et al., 2007).

*Hypothesis 3: The premature termination of an alliance reduces firm innovation performance.*

## **4.4. Methods**

### *4.4.1. Research setting and sample*

We use panel DID and conditional DID (matching based DID) to explore the impact of termination on knowledge building and innovation with a panel analysis of R&D alliances in the life science industry<sup>19</sup> formed from 1990 to 2003. Our treatment group is based on alliances prematurely terminated before 2004 and the counterfactual on non-terminated alliances with

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<sup>19</sup> SIC codes for the life science industry were identified in extant research on the biotech and pharmaceutical industries (e.g Phene and Tallman, 2012) including: 2833, 2834, 2835, 2836, 3842, 3843, 3844, 3845, 5122, 8071, 8731, 8732, 8733, and 8734. The manual construction of the termination event allowed us to exclude 694 alliances from this sample that did not pertain to the life sciences defined as all sciences that have to do with organisms and encompasses firms in the fields of biotechnology, pharmaceuticals, biomedical technologies, life systems technologies, nutraceuticals, food processing, environmental, and biomedical devices.

continued evidence of survival. The life science industry is a particularly appropriate context to study alliance terminations given the high rates of alliance activity and low success, high uncertainty, long development times, and above average investment and resources needed for the discovery and development of new drugs (Hohberger et al., 2015). The year 1990 was selected as the starting point due to sparse data on alliance formations prior to this date (Schilling and Phelps, 2007). We selected 2003 as the end date to provide a sufficiently large time window after a potential termination for tracking of patent activity in the National Bureau of Economic Research (NBER) patent file (Hall et al., 2001).

Alliances were identified from the SDC Platinum Database. We included alliances of various governance forms including purely contractual relationships, alliances with equity stakes, and JVs. To facilitate comparability and increase internal validity by assuring knowledge building related alliance goals, we focused on R&D alliances between for-profit firms. We excluded alliances that were announced but not realized, multi-partner alliances, and those that upon closer examination were duplicate observations, mere patent acquisitions, bankruptcies, or outside the life science industry. A total of 2,310 R&D alliances met these inclusion criteria. We identified 528 alliances with a termination event and 1,782 alliances with no reported termination through 2015<sup>20</sup>. Next, we linked the sample with the NBER patent file, which reduced the sample to 359 terminated alliances and 1,069 counterparts. After excluding non-premature terminations and internalization, the sample consisted of 275 premature R&D alliance terminations (i.e., dissolutions). Then, we followed Gomes-Casserres et al. (2006) and duplicated the alliance dyads so that each partner appeared as the focal firm. This is appropriate given our study's interest in firm-level implications and the need to control for firm-level

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<sup>20</sup> This corresponds to 22.9%, a rate above the previous study that includes and reports on non-equity alliances (Xia, 2011).

heterogeneity in addition to dyadic-level forces. This procedure yielded 549 firms with premature alliance terminations and 1,162 firms with no alliance termination reported. The final matching with the Compustat databases to obtain firm control variables further reduced the sample to a minimum of 319 firms with premature alliance terminations and 539<sup>21</sup> counterparts.

#### 4.4.2. Identification of termination data

The SDC database (similar to most other databases) does not systematically and reliably track and report the termination of alliances (Schilling, 2009). Thus, the alliance terminations dates were identified using detailed manual search of company and news-based information (e.g., Factiva) (similar to Lavie, 2007; Park and Ungson, 1997; Xia, 2011). For each alliance dyad, we searched for evidence of alliance termination in press releases using Factiva and Lexis-Nexis, and if necessary, complemented this with company Web sites and Google searches. We read the full-text press releases and documents to identify the termination date and outcome (i.e., premature/intended; dissolved/internalized). The termination year was identified through content analysis of the press releases rather than the date of the news itself whenever possible. Then, we created two variables reflecting the termination event. First, *alliance terminated*, was set to 1 for each year the alliance was terminated, including the year of termination, and 0 for the years the alliance was active. Next, we created the variable *termination year*, which counts the years before and after the alliance termination. Our analysis was based on the 3 years before and 4 years after the termination. This coding allowed us to compare termination events across different points in time.

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<sup>21</sup> The sample size for the counterfactual was further reduced in the next step by including only non-terminated alliances with evidence of ongoing alliance activity ('signs-of-life), see 3.3. Non-terminated alliances and signs-of-life.



Table 1. Standardization of alliance termination years

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005
Termination				x					
Termination year	-3	-2	-1	0	1	2	3	4	5
Alliance terminated	0	0	0	1	1	1	1	1	1

#### 4.4.3. *Non-terminated alliances and signs-of-life*

To improve the accuracy of our estimations, we accounted for evidence of continued collaboration in order to code for non-terminated alliances. This is important as one cannot assume that no reported termination means the alliance persists. Thus, to ensure that our counterfactual alliances were still in existence, we recorded the persistence of an alliance using press releases similar to the termination identification procedure. Only alliances with evidence of continued activity, signs-of-life (SOL), were considered as counterfactuals and incorporated in our analysis. This reduced the sample of non-terminated alliances from 1,162 to 866 observations. The matching with the Compustat databases further reduced the sample of SOL alliances from 539 to 379 observations.

To conduct our estimations, it is necessary to compare the terminated alliances to non-terminated alliances (counterfactual) at a specific point in time. However, the termination event for the non-terminated alliances does not exist. Thus, we used different procedures to generate a termination event for the counterfactual. For the Panel DID model, we matched the alliances from the terminated sample to the control group of non-terminations based on a randomly-generated termination event during the alliance life of non-terminated alliances. The advantage of this approach is that there are no prior assumptions about the alliance duration nor how alliance knowledge building changes during the life of the terminated alliance. To test

robustness, we also created a sample where the counterfactual of the non-terminated alliances was based on the average observable alliance duration from the date of formation. The average alliance duration in the sample of terminated alliances is 3.3 years so we estimated our model with an average termination period of three years. This approach accounts for different possible general trends of knowledge building during an alliance as it leaves the temporal pattern of the alliance intact. However, this approach ignores the different lifespans and possible non-linear trends in alliances.

The conditional DID (matching based DID) allowed us to incorporate more specific matching variables. Thus, we first checked the robustness of our previous panel DID by matching on the full set of firm control variables and a random termination date for the counterfactual alliances. Then, we also estimated models based on the best match of the combination of firm control variables, alliance duration, and JV governance. The matching for the alliance duration was based on exact matching of the alliance formation year. This ensured a comparison of the same number of years of alliance duration for the terminated alliances and the counterfactual (non-terminated) alliances.

#### *4.4.4. Dependent variables*

We followed earlier studies using patents, patent citations, and IPC patent classes as traceable indicators for firm innovation and knowledge building activities (Gomes-Casseres et al., 2006; Rosenkopf and Almeida, 2003). Despite the various inherent limitations, (Alcácer and Gittelman, 2006; Gittelman, 2008), patents and patent references provide one of the most accepted and reliable sources to measure knowledge building and innovation activities in large-scale archival studies. Moreover, patents are a particularly appropriate measure of knowledge

building in the context of the life science industry given their widespread use. However, due to the complexity of the innovation process and measurement issues (e.g., patent referee citation), it is important to highlight that patent citations can only be seen as indirect measures of knowledge transfer and building and not as direct knowledge inputs. The patent data was obtained from the NBER patent database, which contains detailed information for USPTO patents applied for from 1975 to 2006.<sup>22</sup>

*Interfirm knowledge building.* Partner-based knowledge building is defined as the extent to which (former) alliance partners build on each other in the development of an innovation. It is measured by cross-citations (similar to Mowery et al., 1996; Rothaermel and Boeker, 2008). Cross-citations provides a proxy and indirect indicator of how much of the knowledge a firm builds on originates from the former alliance partner by measuring the extent to which a firm in a given dyad cites the other firm's patents. It is measured as the sum of (backward) citations  $C$  to firm  $j$  patents in firm  $i$  patents in a given year  $t$ :  $= \frac{C_{j \rightarrow i}^t}{C_j^t}$ . To control for the overall citation propensity of a firm, we accounted for the total citation  $C$  of a firm  $j$  in year  $t$ .

*Firm knowledge building.* To capture the firm knowledge building, we hypothesize on two different concepts: *Technological diversity of firm knowledge and internal (self) knowledge building.* To measure the diversity of firm knowledge building, we used the Blau index of diversity based on patent IPC classes to approximate the technological diversity of firm innovation activities (Lahiri, 2010). The index is calculated with  $p$  as the proportion of an IPC class, of a given firm  $i$ , and  $N$  the number of all IPC classes in year  $t$ :  $D_I = 1 - \sum_{i=1}^N p_{it}^2$ . To account for potential downward bias of this diversity measures attributable to fact that the index

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<sup>22</sup> Our analysis relies on the patent application date rather than grant date as it is closer to the actual knowledge production since the patent grant process can take multiple years

is calculated including the occurrence of empty patent classes, we followed previous patent research (e.g., Frankort, 2016; Phelps, 2010) and corrected the Blau index by multiplying it with  $N_{it} / (N_{it} - 1)$  as suggested by Hall et al. (2005). A low value indicates a low level of technological diversity (high technological focus) while a high value suggests a high level of technological diversity.

To capture the internal (self) knowledge building, we relied on patent self-citations. Within patent research, self-citations are often used to approximate cumulative innovation activities and the appropriability of internal knowledge (Hohberger, 2014; Rosenkopf and Nerkar, 2001; Sorensen and Stuart, 2000). Thus, we used the ratio of self-citations to total citations (self-appropriation) to capture the internal orientation toward previous firm generated knowledge.

*Innovation performance.* We used the number of (forward) citations as an innovation performance measure. In patent and technology-based studies, forward citations are a well-established proxy for invention value because they correlate positively with the market value of firms, patent renewals, patent quality, intellectual property values, and technological importance (Hall et al., 2001; Trajtenberg, 1990; Yang et al., 2010). To account for the truncation of the citations measure, we discounted older citation counts with an exponentially decaying component:  $e^{-\left(\frac{2006-Y_t}{C}\right)}$  where  $Y$  is the patent publication year of patent in  $t$  and  $C$  is a constant of knowledge loss, which was set at 5 years (similar to Fleming, 2001).<sup>23</sup>

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<sup>23</sup> We also used raw citation counts for the estimation and found comparable results.

#### *4.4.5. Control variables*

The question of if and which time variant controls to include in DID designs is a nuanced one. Atanasov and Black (2016) argue that including covariates, which are unaffected by the treatment, can increase precision and will not introduce bias. For example, time-varying covariates can reduce the importance of non-parallel trends as they account for unobserved heterogeneity potentially causing non-parallel trends. However, including controls potentially affected by the treatment, can bias the estimated treatment effect (Atanasov and Black, 2016). To avoid misspecification, we ran all models with and without control variables. Stable results across these different specifications should increase confidence in the findings.

We controlled for R&D expenditures, number of employees, sales, advertising expenditures, and cash flow. The number of employees, sales, and cash flow can provide indication of the firm size, resource availability, and the overall impact of individual alliances. Controlling for R&D expenditures (internal R&D) is particularly important as it directly relates to the research focus of the firm. Additionally, internal R&D activities might be compliments or substitutes to external R&D activities such as R&D alliances (Hagedoorn and Wang, 2012).

In a similar vein, we also accounted for other external R&D activities, including the formation of R&D alliances, non-R&D alliances, and acquisitions given that these can affect the resources and attention dedicated to the underlying alliance, and create alternative channels for external knowledge. Similarly, we accounted for the size of the R&D alliance portfolio (Lahiri and Narayanan, 2013; Wassmer, 2008), measured as the total number of alliance formations in the past five years subtracting any premature and intended terminations of those alliances prior to the end of the five-year window. The alliance portfolio is related to the alliance experience of

the firm (Wassmer, 2008) and the importance of the individual alliances for a firm. Finally, numerous studies show that proximity in firm technological positioning (low technological distance) also facilitates knowledge building across alliance partners (Gomes-Casseres et al., 2006; Rosenkopf and Almeida, 2003). Thus, we accounted for the relative technological positioning based on the Euclidian distance between the patent portfolios of the partner firms based on IPC classes (Rosenkopf and Almeida, 2003),  $\sqrt{\sum(p_{ikt} - p_{jkt})^2}$  where  $p$  represents the proportion of patenting activity for a firm  $i$  or  $j$  in a given patent subclass  $k$  in year  $t$ .<sup>24</sup>

#### 4.4.6. Estimation

*Panel DID.* First, we applied a panel DID with ‘alliance-firm’ and year fixed effects, where  $Y_{ij}$  is the one of the dependent variables, for an alliance  $j$ , of firm  $i$  in year  $t$ :

$$E[Y_{ijt}] = \exp(\alpha(\text{Alliance terminated}_{ijt}) + \beta(\text{Alliance terminated}_{ijt} * \text{Treatment}_i) + \tau(X)_{it} + \delta_t + \mu_{ij})$$

To account for time invariant firm ( $i$ ) and time invariant alliance-specific ( $j$ ) effects, we created one firm-alliance specific fixed effects ( $\mu_{ij}$ ). Year dummies ( $\delta_t$ ) account for year-specific variance and the different length of the citation windows of the patents. The vector of control variables ( $X_{it}$ ) includes firm-specific time variant controls for innovation and knowledge building. The firm-alliance-fixed effects ( $\mu_{ij}$ ) subsume the classical treatment group dummy ( $\text{Treatment}_i$ ). Unlike classical panel DID estimation, the  $\text{Termination}_{it}$  is not subsumed in the model due to alliance termination at different points in time. The DID effect is the  $\beta$  of ( $\text{Alliance terminated}_{it} * \text{Treatment}_i$ ).

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<sup>24</sup> We also explored the interaction with the technological distance, but due to the length of the paper and the non-significant results, we do not include this analysis.

We adopted a Poisson quasi maximum-likelihood estimation as it is robust to distributional misspecification and can be applied to count data (e.g., citations) and to continuous non-negative data (e.g., self-citations and Blau index) (Wooldridge, 1997). Following Bertrand et al. (2004), we incorporated robust standard errors clustered at the alliance-firm level to address the potential serial correlations among observations in the DID model.

Despite controlling for general productivity trends (time fixed effects), and alliance and firm specific time invariant attributes, and several time variant firm-specific attributes, concern remains that other time variant effects could lead to misidentification of causal effects. Thus, we extend our analysis to further support a causal interpretation of our findings.

*Lead-and-lag analysis.* The key assumption for the consistency of the DID estimator is that in the absence of treatment, the average change in the response variable would have been the same for both the treatment and control groups (often referred to as the ‘parallel trends’ assumption) (Atanasov and Black, 2016; Roberts and Whited, 2013). While this assumption cannot be directly observed and thus cannot be tested, we followed recommendations offered in the literature on DID estimation (Atanasov and Black, 2016; Roberts and Whited, 2013). We used a full set of leading and lagging indicators of the termination variable to estimate the main specification. The model takes the form:

$$\begin{aligned}
 E[Y_{ijt}] = & \exp(\alpha(Termination_{ijt-3}) + \alpha(Termination_{ijt-2}) + \\
 & \dots \dots \alpha(Termination_{ijt+4}) + \beta(Termination_{ijt-3} * Treatment_i) + \\
 & \dots \dots + \beta(Termination_{ijt+4} * Treatment_i) + \tau(X)_{it} + \delta_t + \mu_{ij}
 \end{aligned}$$

We used the leading indicators to measure whether knowledge building and innovation performance affects the likelihood of termination to determine the extent to which reverse-

causality influences the coefficients. This is important as events in the evolutionary path of an alliance can influence its success and final outcomes (Gulati, 1998), and thus premature termination could be related to (poor) alliance performance on objectives such as learning. The leading indicators also serve to identify concerns of omitted changes in the alliance that precede the termination. The lagged indicators help discern the temporal dynamics of termination on knowledge building and innovation including the speed of initial impact and rate of continued decay, which is important as the alliance termination might have a delayed impact. Analysis of lead and lags lends itself to graphical interpretation; thus, we also plot the lead-and-lag models for each variable. In the case of a ‘clean’ leads-and-lag graphs with no apparent pre-treatment trends, one can predict that any potential shocks also had an insignificant impact (Atanasov and Black, 2016).

*Balancing & matching.* Within DID estimation the treatment and control groups should be relatively similar along observable dimensions relevant for treatment, i.e., balanced (Roberts and Whited, 2013). To rule out this potential selection bias, we applied conditional DID (matching based DID) on the pooled pre and post-termination samples. Conditional DID combines the strength of DID and matching approaches as it extends the conventional DID estimate by reweighing the observations according to the weighting function of a matching estimator (Smith and Todd, 2005). From a matching perspective, the conditional DID estimation relaxes the assumption of conditional unconfoundedness as it allows for unobservable but time invariant differences in outcomes between participants and nonparticipants by comparing the conditional before and after outcomes of the two groups (Heckman et al., 1997).



There are multiple matching estimators with various characteristics and suitability for DID estimation. Thus, it is often recommended to apply multiple estimators to account for the different advantages and limitation of the different matching estimators (Caliendo and Kopeinig, 2008; Heckman et al., 1997).<sup>25</sup> Following the advice from Heckman et al. (1997) and Smith and Todd (2005), we first used kernel matching. Its key advantage is the lower variance that is achieved because more information is used for constructing counterfactual outcomes. This is particularly beneficial for the underlying study due to its relatively small sample size<sup>26</sup>. Next, we applied the bias-corrected nearest neighbor (nn) matching estimation (Abadie and Imbens, 2002).<sup>27</sup> This estimator allows for straightforward integration of exact matching criteria, which enabled us to match on discrete variables, including JV governance and alliance duration. All matching estimations (kernel and nearest neighbor) are estimated on the full set of control variables and only based on SOL counterfactuals.

## **4.5. Findings**

### *4.5.1. Main effects*

Table 2 shows the descriptive statistics for each alliance observation at the firm level. To make the variables comparable across different alliance termination years and alliance durations, we calculated the descriptive statistics based on the three years before the alliance termination.

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<sup>25</sup> For a detailed overview of matching and the advantages and disadvantages of matching, please see the review by Caliendo and Kopeinig (2008).

<sup>26</sup> We used the Epanechnikov kernel in our estimations due to its slight superiority in terms of efficiency and chose a 0.06 bandwidth (similar to Heckman et al., 1997). We also emphasized the common support condition in our analysis to mitigate the risk of bad matches. We show various matching quality indicators in Table A1 before and after the matching (i.e., mean standardized difference, pseudo R2,  $\chi^2$ -test). These indicators suggest that the matching procedure was successful in balancing the covariates.

<sup>27</sup> We allowed for replacement and used robust standard errors from the weighted regressions.

Table 2. Descriptive statistics alliance level

Variable	Alliance (total)				Alliance (treatment group)				Alliance (control group)						
	n	Mean	S.E.	Min	Max	n	Mean	S.E.	Min	Max	n	Mean	S.E.	Min	Max
Citations	1415	10.70	24.80	0.00	159.06	549	13.58	29.10	0.00	159.06	866	8.88	21.45	0.00	159.06
Self-citations	1415	0.14	0.25	0.00	2.00	549	0.10	0.21	0.00	1.45	866	0.16	0.27	0.00	2.00
Diversity	1415	0.40	0.33	0.00	0.97	549	0.46	0.33	0.00	0.95	866	0.36	0.33	0.00	0.97
Cross citations	1415	0.00	0.00	0.00	0.01	549	0.00	0.00	0.00	0.01	866	0.00	0.00	0.00	0.01
Techn. distance	1415	0.49	0.23	0.00	1.13	549	0.57	0.22	0.00	1.13	866	0.44	0.23	0.00	1.06
R&D expenditures	762	1.39	19.85	0.00	524.00	338	2.67	29.77	0.00	524.00	424	0.36	0.54	0.00	4.05
Employees	739	0.02	0.04	0.00	0.32	330	0.02	0.03	0.00	0.17	409	0.02	0.04	0.00	0.32
Sales	769	31.75	571.79	0.00	15,081.33	339	65.06	860.63	0.00	15,081.33	430	5.49	12.30	0.00	114.66
Advertising	763	0.17	0.48	0.00	4.08	338	0.19	0.54	0.00	2.89	425	0.15	0.42	0.00	4.08
Cash flow	698	0.22	0.81	-7.58	8.01	319	0.32	0.87	-4.29	6.16	379	0.15	0.74	-7.58	8.01
R&D alliances	1415	0.64	1.01	0.00	6.67	549	0.98	1.28	0.00	6.67	866	0.43	0.71	0.00	5.00
Non R&D alliances	1415	0.18	0.40	0.00	3.33	549	0.27	0.51	0.00	3.33	866	0.13	0.30	0.00	2.00
Acquisition	1415	0.43	0.72	0.00	4.33	549	0.61	0.88	0.00	4.33	866	0.32	0.58	0.00	4.00
Alliance portfolio	1409	3.30	4.72	0.00	27.33	549	5.00	5.80	0.00	27.33	860	2.22	3.46	0.00	23.00
Same-industry alliance	1415	0.67	0.47	0.00	1.00	549	0.62	0.48	0.00	1.00	866	0.70	0.46	0.00	1.00
JV governance	1415	0.08	0.27	0.00	1.00	549	0.07	0.25	0.00	1.00	866	0.09	0.29	0.00	1.00
Geographic location	1415	0.13	0.33	0.00	1.00	549	0.15	0.35	0.00	1.00	866	0.11	0.32	0.00	1.00

Table 3 shows the results for the main DID coefficient<sup>28</sup> for the different outcome variables based on the randomly-generated control group of non-terminated alliances. For each variable, we show the main DID coefficient for the specification with and without control variables, and estimation with the randomized termination date for the counterfactual (Panel A) and the average alliance duration for the termination date of the counterfactual (Panel B).

Table 3. DID main estimation

Dependent variable	Interfirm knowledge building		Firm knowledge building				Innovation performance	
	1a	1b	Techn. diversity		Self approp.		4a	4b
Model			2a	2b	3a	3b		
<i>Panel 1: Randomized termination date for counterfactual</i>								
Alliance term.	-0.040	-0.107	-0.017	-0.005	0.024	-0.002	-0.059	-0.054*
	0.123	0.138	0.015	0.018	0.035	0.059	0.038	0.031
Alliance term. x treat.	0.618***	0.470*	-0.179***	-0.237***	-2.116***	-1.510***	-0.264***	-0.310***
	0.204	0.276	0.037	0.041	0.089	0.123	0.078	0.078
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Firm-alliance fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Full	Reduced	Full	Reduced	Full	Reduced	Full	Reduced
<i>Panel 2: Average termination duration for counterfactual</i>								
Alliance term.	0.088	-0.161	-0.167***	-0.107***	-0.803***	-0.737***	-0.386***	-0.319***
	0.152	0.197	0.020	0.025	0.079	0.088	0.052	0.051
Alliance term. x treat.	-0.322	0.351	-0.171***	-0.131***	-0.297**	-0.153	-0.182**	0.136*
	0.237	0.294	0.036	0.043	0.119	0.131	0.086	0.078
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Firm-alliance fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Full	Reduced	Full	Reduced	Full	Reduced	Full	Reduced

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1; included control variables: Techn. distance, R&D expenditures, employees, sales, advertising, cash flow, R&D alliances, non R&D alliances, acquisition, alliance portfolio; counterfactual based on "sign of life"

While we found a negative effect for all four estimations of interfirm knowledge building (Model 1a and 1b; Panel A and B), only the model with the randomized termination date was significant (Panel A), providing only partial support for Hypotheses 1. In contrast, we found a negative and significant effect on the outcome variable of firm knowledge building across all estimations in the case of technological diversity (Models 2a and 2b; Panel A and B), which

<sup>28</sup> For space considerations, we only show the DID relevant coefficients, but all models were performed with a full set of control variables and only on SOL counterfactuals.

supports Hypothesis 2a. Contrary to our reasoning in Hypothesis 2b, we found a largely negative and significant effect of termination on the internal orientation of firm knowledge building. Only in model 2b of Panel B, was the effect non-significant. Thus, the mostly negative and significant coefficients suggest that the rate of building on internal knowledge is reduced by alliance termination. Finally, as argued in Hypothesis 3, we found a significant decline in firm innovation performance (Models 4a and 4b; Panel A and B) following premature alliance termination.

Table 4 shows the results for the lead-and-lag estimation with the random termination year for the non-terminated alliances. The results are very much in line and confirm Table 3 with mixed results for interfirm knowledge building. However, more important than the analysis of individual coefficients is the direction and strength of the coefficients along the time dimension. Negative effects after the alliance termination year  $\geq 0$  and small effects before termination (termination years  $< 0$ ) would indicate a clear termination effect with neither anticipatory effects nor indication of reverse causality. The estimation of innovation performance with control variables is a good example of this pattern (Model 4b). Before the termination event the estimates are only partially significant, and the effects are relatively small. After the termination event the effects are consistently and increasingly significant. Additionally, the effect becomes larger. By contrast, estimations showing significant positive (or negative) decreasing (or increasing) effects for the pre-termination period indicate violation of the parallel trend assumption and might indicate anticipatory effects or reverse causality. The estimations of internal knowledge building (Models 3a and 3b) indicate this pattern. However, it is noteworthy that in the case of internal knowledge building the model without control variables show a stronger pre-trend (Model 3a) than the model with control variables

(Model 3b). This highlights the importance of the covariates to correct for possible violation of the parallel trends assumption (Atanasov and Black, 2016).

Table 4. DID lead-lag estimations

Dependent variable	Interfirm knowledge building		Firm knowledge building				Innovation performance	
	1a	1b	Techn. diversity		Self approp.		4a	4b
Model			2a	2b	3a	3b		
Alliance term.	-0.180	0.113	-0.012	0.012	-0.031	0.053	-0.006	0.098
	0.292	0.410	0.032	0.042	0.080	0.133	0.083	0.069
Alliance term.	0.080	0.550*	-0.007	-0.016	-0.083	-0.042	0.026	0.048
	0.254	0.328	0.034	0.041	0.079	0.122	0.079	0.061
Alliance term.	0.016	0.297	0.019	0.093**	-0.018	0.140	-0.099	0.016
	0.277	0.394	0.033	0.040	0.078	0.127	0.081	0.066
Alliance term.	0.277	0.752**	0.006	-0.021	-0.037	-0.073	-0.039	0.001
	0.238	0.351	0.032	0.042	0.081	0.128	0.080	0.060
Alliance term.	-0.237	0.278	-0.028	0.018	-0.045	-0.019	-0.096	-0.012
	0.283	0.396	0.032	0.042	0.078	0.128	0.075	0.066
Alliance term.	-0.175	0.507	-0.004	0.058	0.013	0.140	-0.104	0.086
	0.285	0.438	0.032	0.043	0.075	0.129	0.088	0.073
Alliance term.	-0.024	0.323	-0.064*	0.018	0.016	0.109	-0.113	-0.002
	0.274	0.374	0.033	0.042	0.084	0.133	0.078	0.073
Term. year (-3) x treat.	0.001	-0.623	0.164***	0.111*	0.728***	0.350*	0.240**	0.022
	0.395	0.500	0.048	0.063	0.153	0.206	0.104	0.097
Term. year (-2) x treat.	0.041	-0.626	0.187***	0.179***	0.550***	0.408**	0.133	-0.029
	0.322	0.406	0.049	0.059	0.147	0.196	0.095	0.079
Term. year (-1) x treat.	0.159	-0.455	0.085*	0.003	0.303**	0.078	0.196**	-0.075
	0.364	0.473	0.045	0.054	0.126	0.170	0.090	0.075
Term. year (1) x treat.	-0.277	-0.550	-0.124**	-0.034	-0.238	-0.191	-0.178*	-0.026
	0.345	0.420	0.049	0.062	0.165	0.222	0.094	0.089
Term. year (2) x treat.	-0.309	-0.582	-0.145***	-0.139**	-0.601***	-0.637***	-0.353***	-0.100
	0.426	0.518	0.049	0.065	0.164	0.199	0.097	0.096
Term. year (3) x treat.	0.141	-0.386	-0.340***	-0.292***	-1.346***	-1.240***	-0.616***	-0.376***
	0.392	0.541	0.055	0.074	0.151	0.202	0.125	0.123
Term. year (4) x treat.	-0.566	-0.790	-0.368***	-0.292***	-1.692***	-1.401***	-0.811***	-0.363**
	0.443	0.545	0.061	0.076	0.167	0.232	0.143	0.151
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Firm-alliance fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Full	Reduced	Full	Reduced	Full	Reduced	Full	Reduced

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1; included control variables: Techn. distance, R&D expenditures, employees, sales, advertising, cash flow, R&D alliances, non R&D alliances, acquisition, alliance portfolio; counterfactual based on "sign of life"

The graphical representation of the lead-and-lag estimation provides a nice illustration of these effects (Figure 1). The lead-and-lag graph for interfirm knowledge building does not show a clear pattern of difference between treatment and control groups. The graph for innovation

performance depicts parallel trends before the termination followed by a drop for the terminated group, while the estimation for the control group of non-terminated observations remains stable. On the other hand, the graphs for technological diversity and internal knowledge building indicate not only a drop after the termination but also reveal potential pre-termination trends.

Figure 1. Lead- and-lag graphs

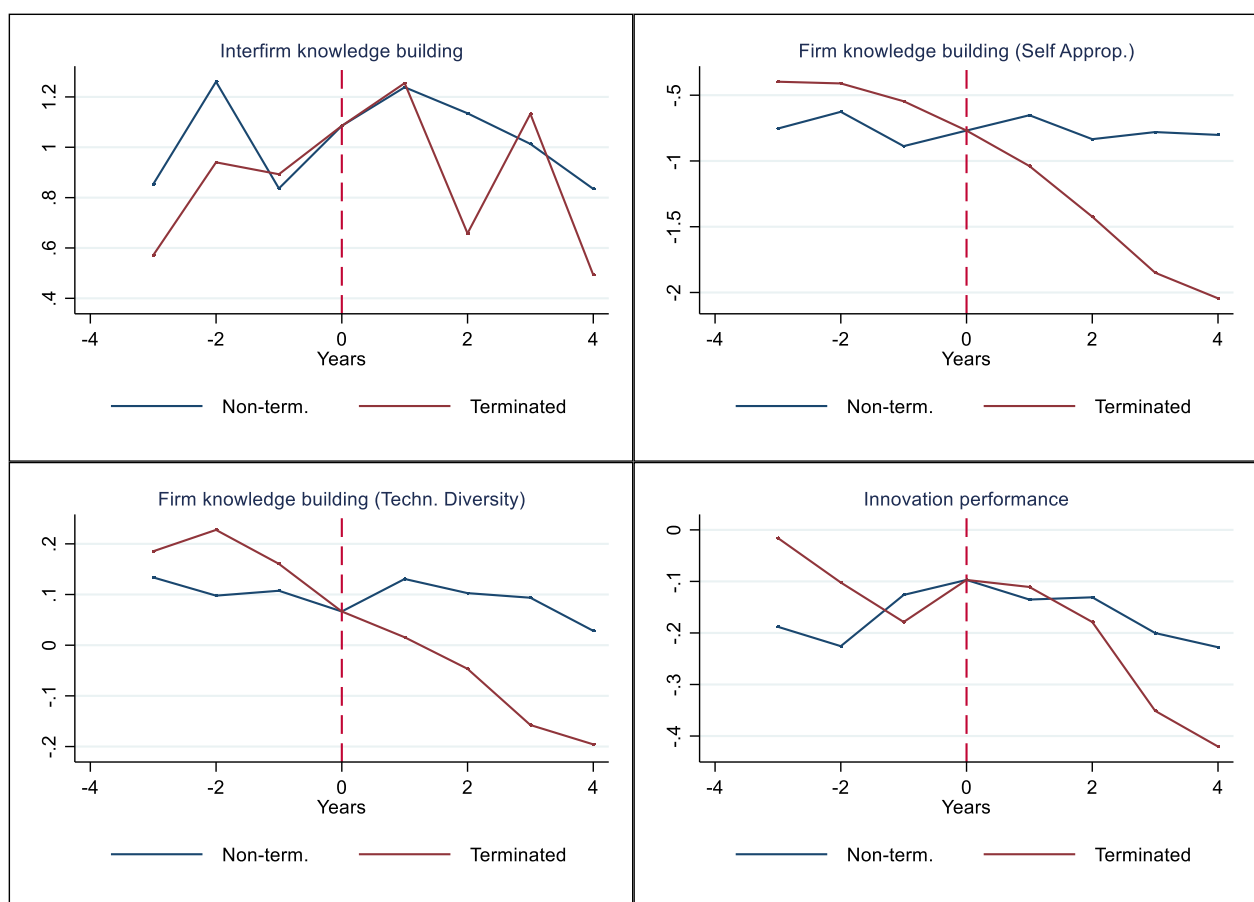


Table 5 shows the results for the conditional DID using the Kernel matching and the bias corrected nn-matching. Similar to the earlier findings of the conventional DID estimation, we found a negative effect of alliance termination for innovation performance in support of Hypotheses 3 and partial support for Hypothesis 2a on the negative effect on the diversity of knowledge building. However, the negative effect (kernel matching) and non-significant results (nn-matching) for internal knowledge building leads to the rejection of Hypothesis 2b. Similarly, the non-significant results for interfirm knowledge building (cross-citations) leads to the rejection of Hypotheses 1.

Table 5. Conditional DID

Variable	Kernel matching		Nearest neighbor matching	
	ATT	St. Er.	ATT	St. Er.
Partner knowledge building	0.000	0.000	0.000	0.000
Firm knowledge building				
Tech. Diversity	-0.151***	0.013	-0.189***	0.023
Self-citations	-0.090***	0.001	0.013	0.020
Innovation performance	-8.151***	0.988	-13.662***	1.867

Note: ATT = average treatment effect on the treated, matching variables and bias corrected: R&D expenses, employees, sales, advertising expenses, cash flow, R&D alliances; non R&D alliances, technological distance, acquisition, alliance portfolio; nearest neighbor exact-match variables: Joint venture governance, alliance duration; \* p<0.1, \*\* p<0.05, \*\*\* p<0.01

#### 4.5.2. Exploration of alliance and firm conditions

Prior research has discussed several alliance-specific and firm-specific conditions that could influence our analysis. Thus, in order to test the robustness, and explore the heterogeneity of our results, we subsequently investigated several important potential moderating conditions:<sup>29</sup>

<sup>29</sup> JV governance, geographic proximity, and partner competition were constructed as binary variables. JV: 1=JV, 0=contract alliance (e.g. Phene and Tallman, 2012). Geographic proximity: 1=same country or state in US (except New York, New Jersey, Connecticut, and Pennsylvania combined one region), 0=different country/state (e.g. Rosenkopf and Almeida, 2003) and robustness test on distance between the partners in

*Alliance portfolio size.* To understand the knowledge and innovation effects from a more dynamic perspective, it is important to incorporate the broader alliance strategy by considering firms' alliance portfolios. Given the limitations of firm resources and attention, firms cannot continue collaborating with an increasing number of partners. If some alliances are not terminated to form new partnerships, the firm would develop an increasingly broad and complex alliance portfolio that leads to decreasing returns (Laursen and Salter, 2006; Wassmer et al., 2017). However, having a larger alliance portfolio may help protect against the shifts in knowledge building and innovation arising from the termination of an individual alliance as firms will have continued access to diverse and external knowledge. Furthermore, the additional partners might provide complementarities to previously acquired knowledge. Thus, we might expect a larger alliance portfolio to reduce the effects of alliance terminations.

*Internal R&D.* Several studies have explored the complementarity and substitutivity of internal R&D innovation strategies and external knowledge sourcing and find the activities to be substitutes under certain conditions (Cassiman and Veugelers, 2006; Hagedoorn and Wang, 2012). Overall, research shows that firms improve innovation performance by increasing external R&D activities up to a certain threshold, after which there is a decline in innovation outcomes (Berchicci, 2013). Furthermore, the substitution effect is larger for firms with greater internal R&D capacity, suggesting that the opportunity cost of forming additional alliances is higher for firms with a superior knowledge stock. Likewise, Hagedoorn and Wang (2012) show internal and external R&D are employed as complementary inputs at higher levels of internal R&D but as substitutes at lower levels of internal R&D. In the context of R&D alliance termination, the substitution or complementarity effects of internal and external R&D are

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kilometers (km) and the logarithmic of km. Partner competition: 1=same four-digit SIC code, 0=different four-digit SIC code (e.g. Mowery et al., 1996).



important for determining the available inputs for knowledge recombination. More specifically, with more internal R&D, firms may become more internally oriented after an alliance termination and experience less of an impact on innovation as these firms are potentially better able to compensate for the alliance termination due to their internal R&D base. Furthermore, extant research would predict that firms with high internal R&D capacity may benefit from reducing the complexity of their alliance portfolio (Berchicci, 2013; Hagedoorn and Wang, 2012).

*JV governance.* JV governance has often been shown to affect the knowledge building and innovation capabilities of firms in alliances. Studies often highlight interorganizational integration through closer contact and deeper collaboration as key factors fostering knowledge exchange and innovation outcomes during the alliance life (e.g., Gomes-Casseres et al., 2006; Kogut, 1988; Mowery et al., 1996). Thus, terminating alliances based on JV governance could lead to a greater impact on knowledge building and innovation for firms. However, separating the alliance through JV governance may protect the firm from unintended spillover of knowledge unrelated to alliance activities (Oxley and Wada, 2009) and help isolate the firm from the disruption and changes in the post-alliance trajectory.

*Geographic proximity.* Studies also frequently address how geographic proximity interacts with the knowledge outcomes of alliances (e.g., Gomes-Casseres et al., 2006; Hohberger, 2014; Rosenkopf and Almeida, 2003) and conclude that proximity accentuates the positive effect of alliance formation on knowledge flow and recombination. Thereby, the main argument is that if knowledge is embedded in the local context, geographic proximity facilitates access and the interaction between alliance partners needed to support the exchange of tacit knowledge. Further, termination of a local alliance may have less impact on the loss in the diversity of

knowledge sourced since the reduced access is to the same context in which the focal firm remains, and thus mitigate the change in firm knowledge building and innovation outcomes<sup>30</sup>.

*Same-industry alliance.* Alliances between firms in the same industry may be the most threatening to leave as such collaborations are more likely competitive in nature (Hamel, 1991), and thus more likely to result in a decline in knowledge building as firms seek to protect knowledge from ex-partners. However, research also suggests firms competing in the same industry have greater ability to understand and absorb partner knowledge —i.e., increased absorptive capacity (Lane and Lubatkin, 1998) —which would indicate interfirm knowledge building may persist post-termination. The decline in innovation performance may be accentuated if competition intensifies and knowledge is more redundant. In a similar vein, alliances with partners outside the firm’s industry may lead to more diverse knowledge inputs. Thus, premature termination might reduce knowledge diversity and drive the focus of knowledge building to internal knowledge.

We found relatively strong support for a possible heterogeneous effect of the alliance portfolio size and the impact of alliance termination (Table 6, Panel A). The interaction effect is negative and significant for technological diversity (Model 2a and 2b), internal knowledge building (Model 3a and 3b), and innovation performance (Model 4a and 4b). However, we found only limited evidence of a moderating effect of the size of internal R&D activities and any of the proposed alliance-specific conditions. The findings for the alliance-specific conditions showed only very limited and inconsistent influence on knowledge building and innovation outcomes post-termination. In the case of geographic proximity, we found negative interaction effects for interfirm and internal knowledge building but only in the case of the models without control

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<sup>30</sup> It should also be noted that geographic proximity can also increase the competitive nature of alliances.

Table 6. Exploration heterogeneous effects

Dependent variable	Interfirm knowledge building		Firm knowledge building				Innovation performance		
	Model	1a	1b	Techn. diversity		Self approp.		4a	4b
				2a	2b	3a	3b		
<i>Panel A: Alliance portfolio</i>									
Alliance terminated	-0.261	-0.049	-0.059**	-0.062*	0.036	-0.043	-0.072*	-0.112**	
	0.163	0.232	0.023	0.034	0.055	0.107	0.040	0.049	
Alliance terminated x treatment	0.043	0.271	-0.330***	-0.267***	-1.467***	-1.063***	-0.408***	-0.248**	
	0.281	0.327	0.043	0.053	0.125	0.176	0.092	0.102	
Alliance portfolio x alliance terminated	0.046**	0.014	0.009***	0.007***	-0.009	0.005	0.007	0.007	
	0.022	0.024	0.003	0.003	0.007	0.009	0.004	0.005	
Alliance portfolio x alliance terminated x treat.	-0.014	-0.030	0.017***	0.012***	0.069***	0.052***	0.023***	0.022***	
	0.037	0.031	0.004	0.004	0.012	0.013	0.007	0.007	
<i>Panel B: Internal R&amp;D</i>									
Alliance terminated	-	-0.099	-	-0.028	-	-0.029	-	-0.068	
	-	0.177	-	0.028	-	0.105	-	0.046	
Alliance terminated x treatment	-	0.254	-	-0.233***	-	-0.981***	-	-0.026	
	-	0.301	-	0.048	-	0.167	-	0.080	
Internal R&D x alliance terminated	-	0.250*	-	0.018	-	0.034	-	0.018	
	-	0.130	-	0.020	-	0.087	-	0.033	
Internal R&D x alliance terminated x treat.	-	-0.156	-	0.021	-	0.431***	-	-0.028	
	-	0.112	-	0.021	-	0.106	-	0.042	
<i>Panel C: JV governance</i>									
Alliance terminated	-0.113	-0.020	-0.020	-0.014	0.032	-0.035	-0.052	-0.041	
	0.155	0.164	0.019	0.023	0.044	0.081	0.046	0.035	
Alliance terminated x treatment	-0.158	0.150	-0.311***	-0.206***	-1.149***	-0.761***	-0.511***	-0.058	
	0.243	0.281	0.036	0.044	0.105	0.145	0.087	0.075	
JV governance x alliance terminated	1.580***	3.195***	0.023	-0.015	0.021	0.181	0.095	-0.085	
	0.550	1.218	0.067	0.093	0.135	0.151	0.119	0.103	
JV governance x alliance terminated x treat.	-1.184	-2.285	-0.081	-0.057	0.146	-0.073	-0.137	0.010	
	0.901	1.582	0.116	0.150	0.286	0.345	0.233	0.178	
<i>Panel D: Geographic proximity (KM ln)</i>									
Alliance terminated	-0.544	-0.037	-0.023	0.023	0.125	0.066	0.056	0.132	
	0.430	0.470	0.052	0.075	0.126	0.313	0.141	0.129	
Alliance terminated x treatment	1.689***	0.865	-0.335***	-0.265**	-1.621***	-1.050**	-0.708***	-0.141	
	0.579	0.647	0.099	0.123	0.298	0.440	0.260	0.173	
Geo. location x alliance terminated	0.070	0.001	0.001	-0.005	-0.013	-0.012	-0.014	-0.024	
	0.054	0.062	0.007	0.010	0.016	0.039	0.018	0.017	
Geo. location x alliance terminated x treat.	-0.268***	-0.105	0.005	0.010	0.068*	0.042	0.029	0.013	
	0.077	0.087	0.013	0.016	0.038	0.056	0.033	0.024	
<i>Panel E: Same-industry alliance</i>									
Alliance terminated	0.258	0.127	-0.021	0.000	-0.053	-0.160	-0.004	-0.025	
	0.188	0.193	0.030	0.039	0.069	0.125	0.078	0.061	
Alliance terminated x treatment	-0.283	-0.033	-0.324***	-0.224***	-1.158***	-0.830***	-0.728***	-0.240**	
	0.295	0.334	0.055	0.066	0.168	0.189	0.129	0.108	
Same-industry alliance x alliance terminated	-0.491*	-0.178	0.006	-0.021	0.131	0.201	-0.055	-0.031	
	0.291	0.324	0.038	0.047	0.086	0.155	0.094	0.073	
Same-industry alliance x alliance terminated x treat.	-0.011	0.456	0.004	0.014	0.046	0.127	0.302*	0.258*	
	0.465	0.540	0.071	0.084	0.207	0.259	0.164	0.139	

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1; included control variables: Techn. distance, R&D expenditures, employees, sales, advertising, cash flow, R&D alliances, non R&D alliances, acquisition, alliance portfolio; counterfactual based on "sign of life". JV governance, geographic proximity, and partner competition were constructed as binary variables. JV: 1=JV, 0=contract alliance; geographic proximity measured in Ln of kilometers, but results are robust to specification of kilometers without Ln and same state dummies; Same industry: 1=same four-digit SIC code, 0=different four-digit SIC code (Mowery et al., 1996)

variables (Panel D; Model 1a and 3a) and only relatively weak in the case of the internal knowledge building model ( $p < 0.1$ ). We also found a weak ( $p < 0.1$ ) positive effect for same-industry competition but only in the case of innovation performance (Panel E, Model 4a and 4b).

#### **4.6. Discussion**

This study provides a test and exploration of knowledge building and innovation following the premature termination of R&D alliances. While previous research provides ample empirical evidence on the effects of alliance formation, we knew little about the implications of alliance termination, and even less about the impact on knowledge building and innovation although these goals often drive alliance formations. Overall, our findings show that alliance termination has an impact on knowledge building and innovation performance. However, the results show that the effects of termination are not always the opposite of alliance formation effects. Therefore, this study allows us to build a more complete and nuanced understanding of alliance activity, the associated innovation implications, and the underlying assumptions in the context of the KBV of the firm.

The results of our analysis show that premature termination of an R&D alliance reduces innovation performance post-termination (Hypothesis 3). This result is in line with previous research on the role of alliances as drivers or enablers of innovation activities (e.g., Baum et al., 2000; Jiang and Li, 2009; Stuart, 2000) and the idea that termination leads to the opposite effect. Furthermore, our more detailed analysis also suggests the rate of decay accelerates the more years that have passed since termination, and we found no

pre-trend in innovation performance indicating that a decline in innovation was not driving the termination. Our results also show that premature termination of an R&D alliance decreases the technological diversity underpinning the innovation inputs of a firm (Hypothesis 2a). Again, this result is in line with the KBV's theoretical expectation and previous empirical research on alliances. It supports the notion that R&D alliances are tools for accessing and acquiring external knowledge that is distinct from that of the firm (Grant and Baden-Fuller, 2004). Thus, removing the alliance reduces the diversity of knowledge inputs.

However, contrary to our expectation in Hypothesis 2b, the decline in the use of the firm's own internal knowledge base post-termination suggests knowledge building becomes more externally oriented. Thus, our results show firms integrate relatively more external knowledge inputs after premature termination. This may be unexpected given explanations of alliance termination related to partner knowledge absorption that may reduce the need to source knowledge externally (Hamel, 1991), and the reversal of the idea that alliances are a mechanism to broaden the knowledge base of a firm as supported in Hypothesis 2a. Hamel's (1991) learning race explanation for alliance termination suggests terminating an agreement would indicate a shift toward more internal knowledge building. He proposes that firms often terminate an alliance when they have absorbed partner knowledge, rendering it redundant and, potentially, reducing the need to draw externally. One possible explanation is that the familiarization with external knowledge during the previous alliance is sustained as it does not rely as heavily on the alliance context, thus allowing the firm to build even more on external knowledge pools once the focus on the partner has been removed (Yang et al., 2010). Another possible explanation may be that alliances in the life science industry are often used to specialize in certain

areas. Thus, partner firms might provide complementary knowledge without necessitating its integration. However, we explore this possibility through the analysis of the heterogeneous effects of the same-industry alliance interaction. This analysis assumes that firms within the same industry are more likely to provide similar knowledge than firms from other industries. However, the interaction was not significant.

Finally, we found weak and mixed results for the decline in interfirm knowledge building following premature alliance termination suggesting there is no clear reduction in building on partner-related knowledge post-termination. A possible explanation is that knowledge building is more subject to the individual and firm-level mechanisms that may drive continued knowledge access and integration such as individual-level relationships (Hohberger et al., 2015). The lack of decline in interfirm knowledge building post-termination confirms concerns of spillover (Park and Ungson, 2001) but suggests useful former partner knowledge may be available for recombination (Yang et al., 2010) without the costly alliance structure.

While we found no consistent impact of alliance conditions on knowledge building or innovation performance post alliance termination, the importance of firm-level conditions is supported by our analysis of the heterogeneity effects. The results suggest that firm-level innovation strategies may have a positive moderating effect on the relationship between premature termination and knowledge building and innovation, especially in the case of alliance portfolios. This supports the argument from previous alliance research that the alliance portfolio is an important resource for firm knowledge sourcing and innovation outcomes since size seems to help protect against declines in innovation and enhance the extent of external knowledge orientation post-termination. Moreover, firms

with alternative partners are more likely to have continued access to diverse and external knowledge, as well as to additional previously acquired complementary knowledge from a larger alliance portfolio.

Our findings also inform other related areas of alliance research. For example, we offer a nuanced exploration of why alliance termination might impact firm performance and survival (Singh and Mitchell, 1996) based on knowledge and innovation outcomes that are often instrumental for firm performance. In line with research showing the reciprocal influence of alliance termination on future alliance formation (Zhelyazkov and Gulati, 2016) and termination (Heimeriks, Bingham, and Laamanen, 2014; Pangarkar, 2009), we show that less diverse and more external knowledge building paths are forged following termination. These new knowledge building paths are not only likely to influence subsequent firm evolution but also the direction of new collaborative activity. Our results also extend research on innovation and knowledge building outcomes in R&D alliances by uncovering long-term effects and offering further evidence of the positive impact of alliances, ironically, by studying the death of these alliances.

Finally, our study supports the KBV by offering empirical investigation into the tenets of the theory and demonstrating the breakdown of knowledge fostering mechanisms. We explain how the mechanisms proposed by the theory to promote knowledge building and innovation are hindered in the context of premature alliance termination, reversing knowledge diversity and innovation outcomes. The revealed changes in knowledge building patterns and innovation performance, including the unexpected increase in external knowledge building, evidence the impact of both alliance formation and termination. Aligned with the theory, we also show that alliance outcomes influence firm-

level knowledge, although alliance conditions do not appear to have much impact on the reversal of alliance formation effects. This is an important boundary condition as it shows that creating external paths for knowledge building and innovation are more fine-grained processes requiring specific dyadic conditions for success, whereas the removal of and changes to these paths depends on the larger firm context. On the other hand, the heterogenous effects of firm-level characteristics, particularly alliance portfolios, corroborates the contingent relationship of termination outcomes and the importance of the portfolio lens for alliance research.

#### *4.6.1. Managerial implications*

Alliances have long been seen an important managerial mechanism to achieve strategic ends, especially those linked with knowledge building and innovation. Managers need evidence on the outcomes of termination to fully understand the value and impact of alliances and to better inform management decisions at formation and throughout alliance and innovation management (e.g., Das and Teng, 2000). For instance, our study not only shows the negative effect of the termination event on innovation but also a non-finding for the decline in interfirm knowledge building post-termination. This suggests that prematurely terminating an alliance agreement may not necessarily reduce knowledge building opportunities across the partner firms. Alliances have been viewed as social mechanisms (Rosenkopf and Almeida, 2003) with the relationships between employees of the allied firms facilitating the interfirm flow of knowledge and potentially persisting post-termination (van Burg, Berends, and van Raaij, 2014). Thus, managers must be aware of this potential ‘leakage’ across firm boundaries and take steps to limit this if desired.



Similarly, while previous research may lead to the prediction that alliance characteristics determine the degree of spillover and innovativeness post-termination (Mowery et al., 1996; Oxley and Wada, 2009), we did not find these characteristics had a strong impact. For example, JV governance did not protect firms from the decline in innovation performance post-termination. Thus, these insights help to further reduce the uncertainty firms face when terminating alliance agreements and when designing initial agreements. Specifically, when selecting partners and alliance design, firms should be aware that knowledge and innovation fostering characteristics are largely constrained to the alliance life. Furthermore, it would be advisable to more closely consider the overall internal and external innovation strategy, rather than individual alliance characteristics, to reduce the effects of premature alliance termination.

#### *4.6.2. Limitations*

This study has several limitations that point to avenues for future research. For example, our unique data collection efforts provide rare insight into the prevalent issue of premature alliance termination on which there is a dearth of previous empirical research (often due to data availability). Despite our data collection efforts being comparable to the limited number of related studies, our sample is not only relatively small, it does not cover all relevant termination events due to missing information. Furthermore, it would be worth exploring more fine-grained alliance termination and knowledge-related variables to shed further light on the implications of termination on knowledge building and innovation and to advance organizational theory. As with most archival alliance research, we cannot capture alliance formation motives or alliance strategies. We tried to

account for this by focusing on R&D alliances within the life sciences, which are largely focused on knowledge access or exchange, and we explicitly excluded downstream, marketing, distribution, and manufacturing alliances without an R&D component from our analysis. While this allowed us to make a more credible assumption that organizational learning is a significant motive of the alliances in our sample, it would be interesting to explore specific alliance motives and strategies and link these to the implications of premature termination. However, this more fine-grained analysis relies on more micro-level firm data — something that is difficult to obtain within an archival study and often requires survey or case study research approaches.

Related to the previous points, the relatively small sample size and specific focus of the study meant that we had to exclude several interesting conditions in our analysis (e.g., multi-partner alliances and alliance internalization). For example, existing multi-partner alliance research makes the credible claim that these alliances behave differently to dyadic relationships (J. P. Davis, 2016; Heidl et al., 2014) raising the issue for future research of whether these effects hold in a multi-partner setting. The focus on premature dissolution also puts forth the questions of whether the effects of planned alliance dissolution and internalization may show opposing effects given the distinct shift in firm boundaries.

From a methodological perspective, patent data provides one of the most accepted and reliable sources of innovation and knowledge building measures for large scale archival studies. However, there are also some inherent weaknesses to the approach that are frequently discussed in the innovation and patent literature (Alcácer and Gittelman, 2006; Gittelman, 2008). While we chose industries in which patenting is a particularly reliable

indicator, our study potentially underestimates the overall knowledge building and innovation activities. Additionally, given the prominence of patent officer citations, it is important to highlight that patent citations can only be seen as indirect measures of knowledge transfer and building and not as direct knowledge inputs. Finally, although the application of the DID and conditional DID estimation (in combination with lead-and-lag analysis and fixed effects) significantly reduces the risk of misidentification and increases the confidence in causal interpretation of the results, the procedure cannot completely rule out the possibility that time variant alliance-specific effects influenced our results. Notwithstanding these limitations, our study demonstrates the importance of managing the temporal aspect of alliances to ward off any decline in innovation and undesired shifts in knowledge building that accompany premature termination.

## Appendix

**Table A1: Indicator matching quality**

Indicator	Kernel matching		Nearest Neighbor mat.	
	Unmatched	Matched	Unmatched	Matched
R2	0.053	0.005	0.097	0.006
$\chi^2$	119.89	8.42	340.18	6.37
p > $\chi^2$	0.00	0.394	0.00	0.606
MeanBias	14.4	5.1	19.7	6.6



# 5

## **When transitional governance transitions: a review of evidence on alliance internalization drivers**

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A conceptual extension of this article will be submitted for publication to the *Academy of Management Annals* or the *Journal of Management*.

## 5.1. Abstract

Although alliances are often conceptualized as transitional governance forms and real options preceding the transition to internal organization, fragmented research is yet to reach an understanding of alliance internalization. Given the dismal performance of alliances and acquisitions and the potential value of alliance internalization as an alliance exit route and acquisition strategy, internalization may hold important performance implications for firms. This systematic review takes a comprehensive view of the evidence to identify salient relationships and discern the likelihood and performance outcomes of internalizing alliance partners and ventures. The studies reviewed suggest that alliance strength, learning motives, and equity share foster the transition to internalization. Environments with high knowledge intensity, market growth, and industry concentration are found to increase alliance internalization, whereas uncertainty shows a negative relationship with internalization. The influence of alliance partner proximity in geography, technology, and competition, and organizational-level conditions are less clear and highlighted as areas for future research. A conceptual map is inductively built from the evidence to illustrate these relationships. The findings also support a positive performance effect of alliance internalization conditional on alliance, organizational, and environmental features. This review contributes to the literature on alliances and acquisitions, as well as connecting these research domains.

*Keywords:* Alliance exit; M&A; internalization; buy-out; systematic literature review

## 5.2. Introduction

Extensive research exposes the challenges firms face when selecting and executing successful alliances (Schilling, 2009) and acquisitions (Haleblian et al., 2009; Schweizer, 2006; Steigenberger, 2016). Both activities have high failure rates that can be attributed to theoretical questions of information asymmetry (Reuer and Ragozzino, 2008), adverse selection (Balakrishnan and Koza, 1993), moral hazard (Arend, 2004), and interfirm integration (Steigenberger, 2016). Interestingly, these are many of the same challenges proposed to be eradicated by forming alliances prior to acquisition. Although performance is highly uncertain, alliances and acquisitions are important tools for firm growth and knowledge diversification (Christoffersen, 2013; Phene et al., 2012; Stettner and Lavie, 2014). Thus, scholars have dedicated substantial inquiry to the superior performance of these activities individually, and, more recently, to combining these strategies to achieve superior organizational performance (Stettner and Lavie, 2014). Similarly, knowledge may be advanced through closer examination of the use of alliances and acquisitions as complementary strategies *across time*. Given the temporal nature of alliances and poor performance of alliances and acquisitions, firms may gain from a more complete understanding of the transition from alliance to internal organization.

This review uses the term alliance internalization to refer to the transition from interfirm alliance to internal organization resulting from merger or acquisition of alliance partners or resources. Over the past 25 years, a substantial number of studies have tested theoretical predictions on the transition from alliance to internal organization (Hagedoorn and Sadowski, 1999; Kogut, 1991; Yang et al., 2011). Theoretical arguments propose alliances facilitate the transition to internal organization based on the assumption that firms learn and gather information throughout alliance evolution. Research has separately



examined the acquisition of alliance partners (PI) and the acquisition of JVs or alliance resources (VI). The demarcation of PI and VI and the multiple perspectives and disciplines examining alliance internalization has led research to develop in a fragmented way that leaves the cumulative state of knowledge unknown. The debate on alliance internalization is often dismissed because of the lack of prevalence of PI. Past studies reveal under 10% (Porrini, 2004; Ragozzino and Moschieri, 2014; Zaheer et al., 2010) of alliance exits and M&A activity are cases of PI. Yet, the evidence from the limited occurrences of PI offers some initial support for theoretical claims of a performance advantage (Higgins and Rodriguez, 2006; Porrini, 2004). Research also reveals that firms commonly exit alliances with one partner internalizing alliance resources (Dussauge et al. 2000; Reuer 2000), particularly in the case of JVs. Thus, aggregate and synthesized insight on alliance internalization could be particularly relevant for alliance, acquisition, and overall firm performance.

Recent reviews on interfirm alliances examine performance (Christoffersen, 2013; Niesten and Jolink, 2015), dynamics (Majchrzak et al., 2014), and knowledge management (Meier, 2011). Extant M&A reviews take an overall view of the field (Cartwright and Schoenberg, 2006; Haleblian et al., 2009) or focus on post-acquisition integration (Graebner et al., 2017; Steigenberger, 2016). The topic of alliance internalization is yet to reach the same aggregate understanding. Further reflecting the diverse intertemporal and theoretical perspectives, no coherent body of literature exists on alliance internalization. Thus, the aim of this paper is to take stock of the current knowledge on alliance internalization and build connection across the scattered empirical and conceptual research. By identifying salient relationships that drive and enhance alliance internalization, firms may be better equipped to manage the transition to internal

organization. A conceptual map is built to organize preliminary evidence on alliance internalization and posit interaction effects. The study outlines gaps in current understanding and suggests promising avenues for future work. For example, the impact of organizational-level knowledge and partner proximity are mixed and likely moderate the effect of several of the dimensions shown to drive and enhance alliance internalization outcomes such as learning motives. Given the interaction of firm alliance and acquisition activity over time (Gullander, 1976) and the lack of a unified research domain, a systematic examination of the evidence is needed to provide a platform to advance knowledge. This review proceeds with an overview of the methodology, general findings, internalization drivers and outcomes, directions for future research, and conclusions.

### **5.3. Methods**

#### *5.3.1. Delineating alliance internalization*

This study defines alliances as voluntary interfirm collaborative arrangements that involve exchange, sharing, and co-development of resources (Gulati, 1995a; Meier, 2011). Studies examining both JVs and alliances in line with this definition were included. Williamson's transaction cost economics (TCE) was the first to refer to interfirm alliances as intermediate organizational forms on the continuum from market to internal organization (1979). The unstable nature of alliances and real options reasoning (Kogut, 1991) further led scholars to refer to alliances as transitional organizational forms (Folta, 1998; Williamson, 1988). Transitional refers to the potential for interfirm alliances to foster the transition of firm activities from market organization to internal organization. Figure 1 illustrates the transition of interfirm alliance governance to internal organization.

This study uses the phrase transitional strategy to refer both to firms forming alliances with the goal of future internalization and to firms favoring internalization as an alliance exit strategy. The former is often referred to as a sequential investment strategy in extant M&A research (Chen and Hennart, 2004; Dalziel, 2009). The frequencies of different terminology used to describe the transition from alliance to internal organization are presented in Table 1. The diverse terminology demonstrates the lack of a consistent definition to unite knowledge on alliance internalization.

Figure 1. Alliance internalization as governance transition

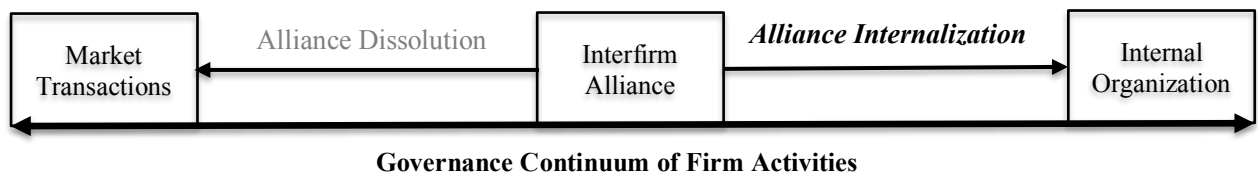


Table 1. Alliance internalization terminology

<b>Terminology</b>	<b>PI</b>	<b>VI</b>
(Alliance/CVC) Takeover	2	1
Acquire Venture Equity	-	1
Alliance Acquisition	1	-
Encroachment Thesis	1	-
First Step Toward M&A	1	-
IJV Internalization	-	3
JV Sale/Selloff	-	2
(IJV/Venture Acquisition/Buyout	-	9
Move Toward Hierarchy	-	1
Partner Acquisition	1	-
Partner Buyout	2	3
Pre-Acquisition Alliance	3	-
Prior Alliance (with target/to M&A)	7	-
Sequential Acquisition/Investment	2	-
Staged Investment	1	-
Successive Integration Strategy	1	-
Transitional Governance Mechanism	1	-

Following research on JV buyouts (Reuer, 2000; Reuer and Miller, 1997; Steensma et al., 2008), this review uses the term internalization to describe the transition from interfirm alliance to internal organization. Alliance internalization refers to a merger between partners, the acquisition of an alliance partner by another, or the acquisition of the venture or alliance resources by one partner. Alliance internalization is further demarcated as PI to refer to a full acquisition or merger of partner firms, and VI to refer to the acquisition of the venture stake or alliance resources by one of the partners. This study excludes the internalization of an alliance by a third party not involved in the alliance since the acquiring firm was not engaged in the transitional alliance activities. Alliance internalization suggests removal of interfirm boundaries and integration of familiar external resources within firm boundaries. The study exclusion and inclusion criteria focus on isolating studies examining the transition from interfirm alliance to internal organization (Table 2).

Table 2. Study inclusion and exclusion criteria

<b>Inclusion</b>	<b>Exclusion</b>
1. Studies examining alliances prior to acquisition and of acquisitions post alliance	1. Studies examining only the modification or dissolution of alliances
2. Studies examining the internalization (buyout) of an alliance partner, venture, stake, resource or activity	2. Studies examining only the divestment (selloff) of alliances
3. Empirical studies (quantitative and qualitative methods); conceptual and review articles	3. Studies examining the choice between alliance and acquisition/internalization
4. International and domestic alliances; JV, equity, and contract alliances; multi-partner alliances	4. Studies examining the effect of non-partner specific alliance/acquisition experience on acquisition performance
5. Minority equity stakes (partial acquisitions and CVC investments) defined by authors as alliance relations that transition to majority control	5. Industry-university alliances, R&D consortia

### 5.3.2. Search strategy

This systemic literature review covers scholarly peer-reviewed journal articles published from January 1976 to May 2017. The search period commences with 1976 as the year the first study exploring alliance internalization was published (Gullander, 1976). Following recent reviews in management (Christoffersen, 2013; Niesten and Jolink, 2015), an extensive search was conducted using the EBSCO (Business Source Premier) database. The EBSCO database has broad coverage of the 25 highest impact factor journals in business and management and includes 98% of the journals' bibliographic records from the past 20 years (Christoffersen, 2013). The purpose of this review is to connect and synthesize the fragmented knowledge on alliance internalization. Thus, the prevalence of acquisition research in the fields of finance and economics also influenced the choice of the EBSCO database. It covers top journals in these domains and permits an interdisciplinary view. The search was further confined to quality journals in these fields in line with the position of the *International Journal of Management Reviews* as offering authoritative statements on research in the fields of business and management (Armstrong and Wilkinson, 2007). Following previous systematic reviews (Meier, 2011), the Social Science Citation Index (SSC) was used to identify the journals to be included in the survey. Journals listed in the subject categories of business, finance, economics, and management of the ISI Web of Knowledge with a 5-year-Impact-Factor above 1.5 were included.

The keyword list was built based on influential articles identified on the topic in past research and conversations with other scholars. The inventory included articles containing *any of* the alliance keywords: alliance(s), joint venture(s), JV(s); AND *any of* the internalization keywords: internal\*, buyout (buy out), selloff (sell off), merge\*,

acqui\*, liquid\*, divest\*. A second set of search terms included the combination of either of the terms transition\*, intermediate, sequential; AND governance. The search strings were used to search the title and abstract of the articles and resulted in a total of 1,062 hits. A total of 351 unique articles were retrieved from journals meeting the impact factor cutoff requirement. The titles and abstracts of the 351 articles were reviewed against the criteria developed to delineate research on alliance internalization. The initial screening resulted in a sample of 85 articles that were downloaded for further analysis. After reviewing the full text of the 85 studies, a sample of 41 studies remained adhering to the exclusion and inclusion criteria. Following these criteria, a further effort was made to identify missing literature by reviewing the forward and backward citations of the articles identified in the first step. This snowball search resulted in drawing insight from of an additional two articles.

The sample includes 43 studies covering 23 different journals. The diversity of outlets reflects the heterogeneity typical of research in M&A (Steigenberger, 2016) and the interdisciplinary approach of this review. The most frequent outlets for research on alliance internalization were strategy and general management journals, particularly the *Strategic Management Journal*. None of the studies on PI were published in specialized international business journals, whereas 5 of 14 of the empirical studies on VI appeared in these outlets. Table 3 presents the distribution of studies by journal according to the type of study: PI empirical, VI empirical, formal model, conceptual. The 32 empirical studies are grouped based on examination of PI or VI. No empirical or formal modeling studies explore both types of internalization. Conceptual work less clearly delineates alliance internalization by the acquisition of partner or venture resources (Das and Teng, 2000b; Gullander, 1976; Krychowski and Quélin, 2010).

Table 3. Distribution of reviewed studies across journals

<b>Journal</b>	<b>PI Empirical</b>	<b>VI Empirical</b>	<b>Formal Model</b>	<b>Conceptual</b>
Academy of Management Journal	1	-	-	-
Academy of Management Perspectives	1	-	-	-
British Journal of Management	1	-	-	-
European Management Journal	-	-	-	1
Financial Management	1	-	-	-
International Business Review	-	1	-	-
Journal of Economic Behavior and Organization	1	-	2	-
Journal of Engineering and Technology Management	1	-	-	-
Journal of Financial Economics	2	-	-	-
Journal of High Technology Management Research	-	1	-	-
Journal of International Business Studies	-	3	-	-
Journal of Management	2	1	-	-
Journal of Management Studies	1	-	-	-
Journal of World Business	-	-	-	1
Long Range Planning	-	-	-	1
Management International Review	-	1	-	-
Management Science	-	2	-	-
Organization Science	2	1	-	1
Review of Financial Studies	-	-	2	-
Scandinavian Journal of Economics	-	-	1	-
Scandinavian Journal of Management	1	-	-	-
Strategic Management Journal	3	4	1	-
Strategic Organization	1	-	-	1
<b>TOTALS</b>	<b>18</b>	<b>14</b>	<b>6</b>	<b>5</b>

The first study uncovered in the review was published in 1976 by Gullanger and points out that alliances and mergers are substitutes at a given point in time but complementary in an intertemporal context. Empirical studies did not follow until Kogut's (1991) seminal work on VI offered evidence of the use of JVs as real options for subsequent expansion. Of the 14 empirical studies conducted on VI, 12 were published between 1995 and 2005. Theorizing on PI was not tested until Hagedoorn and Sadowski in 1999. A steady stream of empirical research followed from 2002 to 2014 totaling 18 studies. The six studies rooting propositions in formal modeling were published between 1999 and 2008, while

the five conceptual studies span 1976 to 2015. Many of the studies that were discarded based on the inclusion and exclusion criteria looked at the likelihood of choosing transitional alliance governance over acquisition (Chen and Hennart, 2004; Folta, 1998; Krychowski and Quélin, 2010) rather than the actual likelihood and outcomes of a transition from alliance to internal organization.

In the content analysis, a descriptive review of the theoretical perspectives, sample characteristics, and research designs was completed (Chen and Hennart, 2004; Folta, 1998; Krychowski and Quélin, 2010). All the empirical studies reviewed employ a quantitative research design, and only two studies utilize primary data with the remaining 30 relying on secondary data. A spreadsheet with summaries of the study findings (and non-findings) and conclusions related to internalization was built to identify key topics, relationships, and links across topics. A division arose between results related to the drivers and outcomes of internalization. Numerous conditions driving alliance internalization emerged through the iterative review of the evidence. The conditions representing similar concepts were aggregated and later categorized as residing at the alliance, organizational, or environmental level. Following this procedure, the map of the drivers of alliance internalization was inductively built. The outcomes of alliance internalization were delineated by PI and VI. Any insight or prediction offered by the theoretical papers on the drivers and outcomes of alliance internalization was also incorporated in the model and discussion. Table 4 presents an overview of the empirical evidence classified by PI or VI, category of internalization driver (alliance conditions, organizational condition, environmental conditions), and internalization outcome. The findings are presented in three sections corresponding to a general overview of research



on alliance internalization, internalization drivers, and the outcomes of partner and venture internalization.

Table 4. Classification of empirical evidence

Study	PI	VI	Alliance Conditions	Organizational Conditions	Environmental Conditions	Outcomes
Agarwal et al. (2012)	*					*
Al-Laham et al. (2010)	*					*
Benson and Ziedonis (2010)	*					*
Bierly and Coombs (2004)	*		*			
Champagne and Kryanowski (2008)	*		*			
Dalziel (2009)	*					
Dussauge et al. (2000)		*	*			
Folta and Ferrier (2000)		*	*			
Folta and Miller (2002)	*		*		*	
Hagedoorn and Sadowski (1999)	*		*		*	
Hennart and Zeng (2002)		*	*		*	
Hennart et al. (1998)		*	*			
Higgins and Rodriguez (2006)	*					*
Kogut (1991)		*	*		*	
Kumar (2005)		*				*
Mata and Portugal (2015)		*	*		*	
Meschi and Métais (2013)	*					*
Park and Russo (1996)		*	*			
Porrini (2004)	*					*
Ragozzino and Moschieri (2014)	*		*		*	
Reuer (2000)		*				*
Reuer (2001)		*				*
Reuer (2002)		*	*	*		
Reuer and Miller (1997)		*				*
Reuer and Ragozzino (2008)	*					*
Reuer and Tong (2005)		*				
Schildt and Laamanen (2006)	*		*			
Steensma et al. (2008)		*	*			
Vanhaverbeke et al. (2002)	*					
Vassolo et al. (2004)	*		*		*	
Yang et al. (2011)	*		*			*
Zaheer et al. (2010)	*					*

## 5.4. General findings

### 5.4.1. Theoretical perspectives

In line with the theoretical underpinnings of transitional governance, 26 of the empirical studies are rooted in a theoretical perspective or combination of two or three clearly defined theories. The remaining six empirical studies draw on a multitude of views and empirical evidence to support the hypotheses and findings. Although numerous theories predict the transition from alliance to internalization, most empirical work builds on classic economic and finance theory reflecting the roots of M&A research. Specifically, real options theory, information economics, and TCE (for VI) are prevalent. Organizational learning is another a dominant theory used in alliance internalization research. The frequency of the different theoretical arguments applied (Table 5) and a brief overview of the most prominent views follows.

Table 5. Frequency of theories applied (note: categorization is not mutually exclusive)

<b>Theory</b>	<b>PI</b>	<b>VI</b>	<b>FM</b>	<b>Concept</b>
Agency Theory	1	1	4	-
Behavioral Theory	1	-	-	-
Culture Differences	-	2	-	-
Game Theory	1	-	-	-
Information Economics	6	-	1	-
New/Multiple Perspectives	3	3	2	4
Network Theory	2	-	-	-
Organizational Learning	5	1	-	-
Real Options Theory	4	5	1	-
Resource-Based View	-	2	-	-
Signaling Theory	-	-	1	-
Transaction Cost Economics	-	4	1	1

Prior to studies applying classic economic theory, Gullander (1976) argued alliances are complements to acquisitions. He proposed alliances prepare the ground for subsequent internalization and acknowledge the uncertainties involved in strategic decisions by offering flexibility. Information asymmetry, real options and transaction cost theories propose different conceptions of uncertainty firms face when exploring growth through alliances and acquisitions as drivers of transitional strategy. Information economics posits an advantage to alliance internalization through the reduction of buyer information asymmetry. Buyer information asymmetry results from private information the seller holds (i.e., unknown to the buyer) regarding the quality of assets. Accordingly, firms can realize due diligence on targets during the alliance period to reduce uncertainty related to the quality of partner assets (Arend, 2004). Firms can gradually pool resources together while experimenting directly with partner assets (Reuer and Ragozzino, 2008).

Studies based on real options reasoning refer to the seller's private information unknown to the buyer as endogenous uncertainty (Dalziel, 2009; Folta, 1998; Folta and Ferrier, 2000). Real options theory proposes that alliances create options for future growth a firm holds to later decide whether to exercise or divest. The value of waiting to take the option comes in the resolution of uncertainty related to the target (i.e., endogenous uncertainty) and environment (i.e., exogenous uncertainty) that occurs over the alliance evolution. Information economics and real options theory predict an advantage to forming prior alliances for valuing intangible assets since quality is more difficult to determine (Higgins and Rodriguez, 2006; Reuer, 2001; Vassolo et al., 2004). Real options theory would also propose an advantage in dynamic and complex environments where exogenous uncertainty makes present value hard to ascertain.

TCE is prominent in VI research as internal organization is an alternative to market transactions and sustaining an active alliance. As transaction costs evolve over the life of the alliance, firms may choose to internalize (or dissolve) an alliance as it responds to new lower transaction costs offered by an alternative governance mode (Williamson, 1988). TCE considers uncertainty but offers a contrasting prediction to real options theory (Folta, 1998). Both endogenous uncertainty related to the private information of the firm and exogenous uncertainty such as technological change may motivate transitional strategies by increasing the value of commitment deferral. TCE would predict that high uncertainty and high asset specificity enhance the incentive for immediate internal organization. Real options theory predicts that high exogenous uncertainty and high asset specificity would increase the incentive to engage in interfirm alliances prior to internal organization.

Organizational learning and knowledge-based arguments emphasize the benefits of post-internalization integration. Knowledge views propose that prior alliances may ease the difficulties of transferring and integrating intangible assets post internalization through mechanisms built during the alliance period such as joint routines and social relationships (Folta, 1998). Further, firms may generate partner-specific absorptive capacity and capabilities during the alliance that lead to and enhance internalization outcomes by easing integration (Vanhaverbeke et al., 2002; Zaheer et al., 2010). Partner-specific absorptive capacity refers to a firm's ability to recognize and integrate valuable knowledge from a partner firm in an interfirm relationship (Dyer and Singh, 1998). As a result, learning goals, synergies, and knowledge recombination may be realized more easily with alliance internalization compared to acquisition as firms are already familiar with partner knowledge and routines. Organizational learning further discusses the use of

interfirm alliances as mechanisms to explore the value of new technologies prior to committing to internal organization reminiscent of the uncertainty reduction proposed by other views.

#### *5.4.2. Rates of internalization*

This review shows a substantial difference in the incidence of PI and VI. Research on VI agrees that a prevalent exit route for JVs is for one partner to acquire the venture resources. The sample of studies focuses on equity JVs and finds between 20% (Dyer and Singh, 1998) and 80% (Reuer, 2000) end with one partner internalizing the venture. Of the 12 studies examining JVs, seven studies look exclusively at international joint ventures (IJVs). Only two studies included non-JVs and found a lower rate of VI. Folta and Ferrier (2000) examined equity collaborations and found 17% end in VI, similar to the 20% uncovered by Dussauge et al. (2000) in a study on alliances in manufacturing industries.

Regarding PI, the numbers are much more dismal. The general consensus is that PI is uncommon in practice since the first large scale empirical study uncovered only 2.6% of strategic alliances transitioned to internal organization (Hagedoorn and Sadowski, 1999). More recent research in business and management supports the low incidence of PI with numbers ranging from 1.26% (Ragozzino and Moschieri, 2014) to nearly 7% (Porrini, 2004; Reuer and Ragozzino, 2008; Zaheer et al. 2010). However, this interdisciplinary review of the evidence exposes a contrary statistic in finance and economics. Higgins and Rodriguez (2006) report that 67% of firms in the sample engaged in prior alliances with acquisition targets. Furthermore, Vanhaverbeke et al. (2002) found that alliances are more

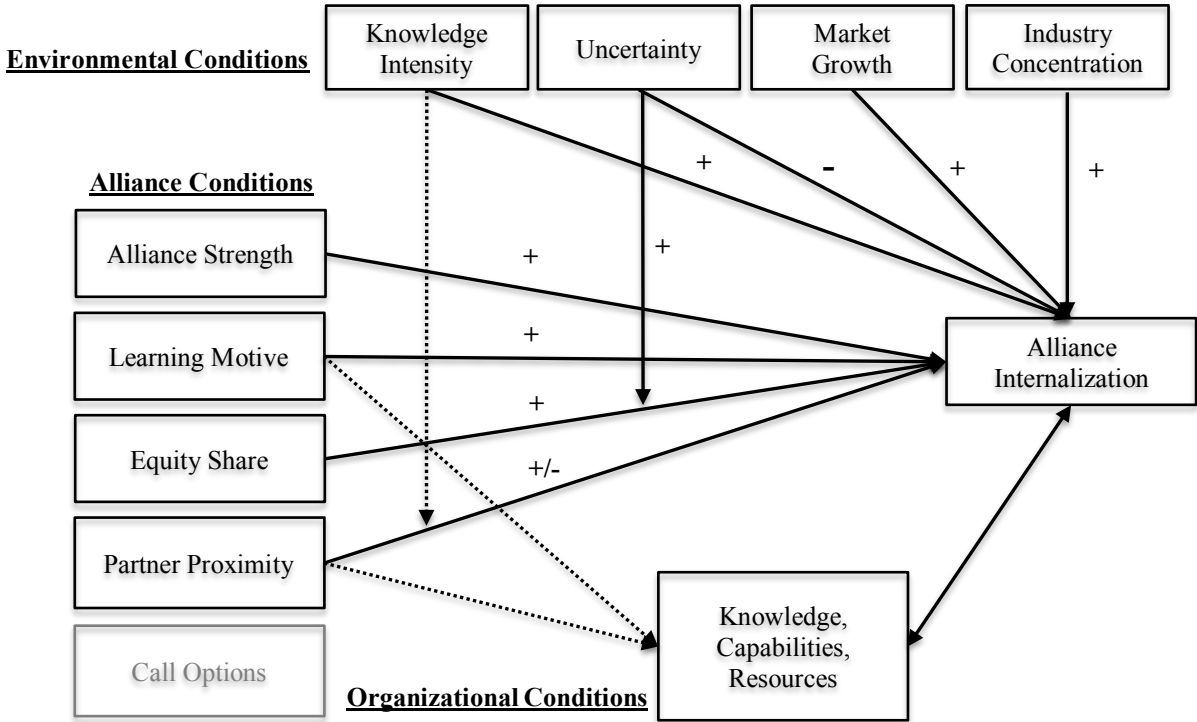
likely to be followed by PI than by another alliance, suggesting that firms select governance modes based on partner-specific experience. Evidence uncovered in the snowball search of research cited on the topic also reports higher rates of PI. For example, Bleeke and Ernst (1995) caution practitioners of hazard rates of internalization of up to 80%. Nevertheless, the rigor of recent research offers some confidence that a minority of alliances end with one partner internalizing the other, and a minority of M&A activity is the result of PI.

### **5.5. Internalization drivers**

The internalization drivers were first classified as residing at the alliance, organizational, or environmental level of analysis. The iterative analysis of the evidence resulted in five prominent alliance-level drivers theoretically derived and tested throughout the literature: alliance strength, learning motives, equity share, partner proximity, and call options. The organizational-level drivers received scarce attention and remain aggregated in this review as organizational knowledge, capabilities, and resources. At the environmental level, knowledge intensity, uncertainty, market growth, and industry concentration are identified as key drivers of alliance internalization. An illustration of the driving conditions is presented in Figure 2. The solid lines represent relationships evidenced in the empirical literature reviewed, and the dotted lines represent theorized moderation and mediation relationships. The synthesis of the evidence suggests a positive effect of alliance strength, learning motives, and equity share on alliance internalization, while the effect of partner proximity is less evident given mixed results and moderating conditions. The effect of call options received limited support in empirical research. Knowledge intensity in the environment is modeled to increase the likelihood of alliance

internalization whereas uncertainty displays a baseline negative effect. Increased market growth and industry concentration may also drive alliance internalization (Kogut, 1991; Marjit and Chowdhury, 2004). Knowledge, capabilities, and resources at the organizational level are proposed to have a recursive relationship with alliance internalization and to partially mediate the relationship between alliance conditions and the likelihood of internalization. The model also posits moderation effects between environmental and alliance conditions. Specifically, Folta and Miller (2002) found a contingent effect of uncertainty on equity share with high uncertainty leading to internalization for multi-partner alliances. A theorized positive moderation effect is also mapped between knowledge intensity and alliance conditions, particularly learning motives and partner proximity as knowledge-intense environments may increase the importance of prior alliance learning. A summary of research related to each driving condition follows.

Figure 2. Map of conditions driving alliance internalization



### 5.5.1. Alliance conditions

*Alliance strength.* Theory and preliminary evidence suggests that alliance partners with stronger relations such as those that form multiple partnerships may be more likely to internalize alliance partners and ventures (Mollgaard and Overgaard, 1999; Reuer, 2001). Das and Teng's (2000) review and conceptual analysis of alliance instability proposes alliances with a long-term orientation and dominance of cooperation are most likely to be internalized. One study empirically tests the effect of the strength of alliance relations on the likelihood of internalization (Champagne and Kryzanowski, 2008) and finds the odds of two lenders merging increases when prior syndicated loan alliances are intense and exclusive. Referred to as intense alliances, the study's proxy for alliance strength is the presence of multiple prior alliances between the firms. Alliance research demonstrates the prevalence of repeat partnering (Dyer and Singh, 1998; Hagedoorn and Duysters, 2002; Zollo et al., 2002), proposing that partner-specific learning, interorganizational routines, and trust accrue that fosters subsequent alliance formations and performance. The same forces would also support alliance internalization by mitigating exchange hazards and integration challenges. The evidence from Higgins and Rodriguez (2006) also corroborates the claim that alliance strength in the form of multiple partnerships fosters the transition to internal organization, as the acquiring firms in the sample had formed an average of four prior alliances with the target firms. Other research classified strong alliances as those with R&D activities but focused on the relationship with internalization performance rather than its likelihood (Porrini, 2004; Zaheer et al., 2010).

*Learning motive.* The alliance formation motive may also influence the likelihood of transition to internal organization. Organizations use alliances for both exploration in new



domains and to exploit existing knowledge (Lavie and Rosenkopf, 2006; Rothaermel and Deeds, 2004). Alliances of an exploratory nature have greater inherent uncertainty that may increase the benefit of taking the transitional step from alliance to internal organization. Moreover, exploitation alliances may already be an effective recombination of existing partner resources (Grant and Baden-Fuller, 2004). Drawing on behavioral learning and network perspectives, Yang et al. (2011) offer evidence that exploration alliances are more likely to end in PI. In the study, exploration alliances represent upstream alliances with R&D activities while exploitation alliances involved downstream activities for the commercialization and utilization of existing knowledge such as marketing and licensing deals. Regarding VI, Kogut (1991) found that alliances in R&D or marketing and distribution were the most likely to be internalized compared to production alliances. Alliance motives may also be inferred from other design features such as link-scale and sequential-integrative dichotomies. For example, Park and Russo (1996) found that link alliances are more likely to end in VI than scale alliances. Link alliances consist of partners contributing to distinct activities, whereas scale alliances are those where each partner engages in the same activities (R&D, manufacturing, or marketing). Overall, the evidence suggests alliances with an R&D component and those undertaken to combine capabilities and knowledge may be most conducive to alliance internalization. This aligns with the theoretical rationale for transitioning from alliance to internalization for uncertainty reduction and pre-emptive learning. Accordingly, alliances formed for learning motives are proposed to increase the likelihood of alliance internalization in the model.

*Equity share.* Studies examining the presence of equity to determine the likelihood of transition to PI do not support the accepted wisdom that equity alliances are more likely

to end in internalization (Bierly and Coombs, 2004; Hagedoorn and Sadowski, 1999). An equity stake in an alliance partner may be envisioned as a transitional strategy, although equity JV design may serve to isolate alliance activities from the rest of the business (Oxley and Wada, 2009), making PI less likely. Interestingly, one study's robustness test isolating non-JV equity alliances found no effect of alliance equity on the likelihood of PI (Hagedoorn and Sadowski, 1999). Bierly and Coombs (2004) also found no significant effect of minority equity alliance structure on PI. For VI, the equity arrangement of JVs is shown to influence the likelihood of transition. An unequal equity split fosters VI (Hennart et al., 1998) where the partner with a larger equity share is more likely to internalize (Mata and Portugal, 2015). The influence of multiple alliance partners on VI is inconclusive. Hennart and Zeng (2002) found a negative effect of multiple partners on the likelihood of VI while Park and Russo (1996) found an insignificant effect. It appears the existence of an equity governance structure has a stronger effect on the likelihood of VI. Theoretical arguments and logic still support the prediction of a positive relationship between equity share and both PI and VI, while the alliance design of equity structure may only affect the likelihood of VI.

*Call option.* Although intuitive, the contract terms are one predictor of the likelihood of alliance internalization that receives limited support. Research on IJVs involving U.S. firms found that only around 1% of venture agreements contain an explicit option to acquire the JV (Reuer and Tong, 2005). Dalziel (2009) further demonstrates that, even in the case of equity alliances, firms often do not explicitly regard the alliance as an option to internalize the partner firm. In the sample, only 10% of contracts gave the larger firm an explicit option to acquire the equity alliance partner. After five years, 24% of firms had acquired the alliance partner. Hence, although deal conditions as specified ex ante by

the contract may be one determinant of alliance internalization, the transition is often an emergent outcome. Further, Vassolo et al. (2004) found that buyout clauses in equity alliances may actually decrease the likelihood of PI. Nonetheless, the evidence from Reuer and Tong (2005) suggests firms negotiate call options strategically as they are more prevalent in IJVs in core areas to the firm and countries with weak intellectual property right regimes where growth options are likely more valuable. In line, call options were less common in countries with political turmoil where contracts hold less value

*Partner proximity.* Studies examine the relative characteristics of the partner organizations' partners in several domains including geography, technology, and competitive positions. PI research takes an interest in the influence of geographic proximity as a driver of internalization by examining the influence of international alliances. The argument follows that the formation of an international alliance influences the likelihood of internalization given the amount of learning that takes place during the alliance relative to the need and availability of this knowledge outside the alliance. Thus, alliance partners and ventures may be more attractive internalization opportunities in an international context where flexibility and prior alliance learning are particularly valuable. However, the empirical evidence on the effect of international alliances is mixed. Champagne and Kryzanowski (2008) offered evidence that the positive effect of past alliances on the likelihood of acquisition is stronger for international M&As. To the contrary, Schildt and Laamanen (2006) found that the positive impact of prior alliances on the likelihood of acquisition did not differentiate between domestic and international deals. In a similar vein, Hagedoorn and Sadowski (1999) found that international alliances were no more likely to transition to PI than domestic alliances. The influence of geographic proximity receives scarce attention in research on VI, reflecting the often

exclusive focus on IJVs. The one study exploring geographic conditions found that cultural similarity between the firm and the host country fostered VI (Reuer 2002).

The studies examining the effect of partner similarity in technological domains on the likelihood of internalization also leave the debate open. Schildt and Laamanen (2006) found pharmaceutical firms are more likely to internalize technologically dissimilar biotech partners. The study also found that the firms are more likely to internalize technologically similar foreign firms and suggests that proximity in the two search contexts (technology and geography) serve as substitutes for one another. Vassolo et al. (2004) found that lower technological distance between a pharmaceutical firm and biotech partner led to greater likelihood of internalization of the biotech firm. In other words, more similar partners were more likely to transition to internal organization. The study explains that the fungibility of a resource reduces the acquisition cost of the resource. Fungibility means a resource can be shared without physical movement (Anand and Singh, 1997; Capron et al., 1998) and is facilitated by common technology. Therefore, firms would have more incentive to internalize alliances partners with more similar technology, as the cost of exploiting the acquired resources would be lower. Ragozzino and Moschieri (2014) corroborate this view with evidence that preceding alliances are more common in intra-industry acquisitions.

Finally, partner proximity in terms of size, power, and competitive realms is frequently explored. The effect of partner size balance is not supported in PI (Hagedoorn and Sadowski, 1999), while VI research shows that parent size is positively related to the likelihood of internalization (Hennart et al., 1998). A power imbalance between partners is also supported as fostering VI (Steensma et al., 2008). Competition between the partner

firms was shown to increase the likelihood of PI (Yang et al., 2011) but received no support in the case of VI (Park and Russo, 1996). Thus, empirical evidence suggests size and power imbalance may drive VI while direct competition is a better predictor of PI.

In a conceptual study, Habib and Mella-Barral (2007) model the conditions driving internalization, identify the internalizing partner, and incorporate the influence of time. The authors propose that the partner with higher profitability of use of an alliance asset will internalize those assets. Profitability of asset use depends on a partner's costs and knowhow. According to the model, the high-cost partner must compensate higher cost with more knowhow to be the superior user of the asset, which may be more likely early in the JV life cycle. Thus, heightened partner proximity (i.e., being more proximate) in terms of cost structure and knowhow is predicted to drive VI. Overall, partners who are proximate on some dimensions while distant on others may be the most likely to transition to internal organization.

#### *5.5.2. Organizational conditions*

Limited empirical work exists on the influence of organizational level conditions on the likelihood of alliance internalization. Research on the choice between acquisition and transitional interfirm governance (Chen and Hennart, 2004) suggests that firms with superior knowledge and capabilities may rely less on transitional strategies. However, firms with superior knowledge, capabilities, and resources may be better equipped to internalize alliance partners and ventures. Reuer (2002) corroborates this notion, finding firms with more financial slack were more likely to internalize ventures. Madhok et al. (2015) offer a dynamic view where new costs and opportunities are revealed when

resources deployed in an alliance undergo transformation. The resource transformation results in a new incentive structure that may motivate dissolution, modification, or a change in alliance ownership. Accordingly, VI is likely to occur when one partner has more attractive resource deployment options outside the alliance. The remaining partner may retain the alliance resource combination by internalizing the alliance resources. Overall, the effects of organizational-level conditions are likely mixed and dependent on prior alliance conditions and environmental conditions.

### *5.5.3. Environmental conditions*

*Knowledge intensity.* Studies agree that firms are more likely to internalize alliances in knowledge-intensive industries where there is a considerable need to resolve information asymmetries and explore diverse options for future growth (Mata and Portugal, 2015; Ragozzino and Moschieri, 2014). Mata and Portugal (2015) found JVs in knowledge-intensive industries were more likely to end in VI. Ragozzino and Moschieri (2014) corroborate the finding with evidence that PI is more common in R&D-intensive industries. Arend (2004) proposes that alliance internalization is more likely when underlying resources are tacit and causally ambiguous in the industry, as is commonly the case in knowledge-intensive industries.

*Uncertainty.* One of the fundamental conditions motivating transitional governance as an intermediate step to internal organization is uncertainty. Gullander (1976) proposes alliance internalization as a strategy that acknowledges uncertainty by offering the opportunity to resolve uncertainties and avoid acquisitions that are later deemed undesirable. Regarding empirical research and the likelihood of internalization once

transitional governance is selected, Folta and Miller (2002) found that PI is less likely with high uncertainty arguing there is increased incentive to delay committing to the investment to internalize in these environments. A second empirical study found an insignificant effect of industry uncertainty on the likelihood of PI (Vassolo et al., 2004). Arend (2004) uses real options theory and formal modeling to show that PI is more likely when the chance of detrimental shocks in the environment is low, aligning with the prediction that uncertainty has a negative relationship with alliance internalization.

*Market growth.* In high growth industries, firms may favor a transitional strategy because the direction of future growth is less certain and the alternative opportunities for acquisition and growth more abundant. Marjit and Chowdhury (2004) model the likelihood of VI versus the alternative of exiting a JV by opening a wholly owned subsidiary. The model suggests that if market demand is large enough, internalization always occurs because it avoids the inefficiencies of subsidiary formation. A reduction in demand would lead to JV stability, hence market forces such as demand and liberalization that determine growth opportunities are proposed to have a positive relationship with alliance internalization. Kogut (1991) offers further empirical evidence that increases in industry market growth aid the likelihood that a venture is internalized.

*Industry concentration.* Kogut (1991) found increased VI in concentrated industries and when industry concentration increased. Thus, industry concentration once transitional governance is selected, likely has a positive relationship with the likelihood of internationalization. Arend's (2004) computational theorizing proposes that partners remain interested in sustaining alliances as future options for internalization as long as the number of desirable targets is sufficiently large. He suggests this is more likely when

an industry is not highly fragmented. In line, high industry concentration or increases in concentration would also have positive relationship with PI since concentration reduces the proportion of target. Less desirable targets would drive firms to exercise rather than hold options. The value of waiting to reduce uncertainties and easing transitions likely declines when the M&A market is more competitive. With more competition among buyers for targets, delaying internalization may result in missed acquisition opportunities.

## **5.6. Internalization outcomes**

### *5.6.1. Partner internalization performance*

The empirical evidence on PI is rooted in M&A research and focuses on performance outcomes relative to acquisition without prior transitional governance. Several studies explore the effect of prior alliances on M&A performance but only partially support theoretical predictions of a performance advantage of making the intermediate step from alliance to internal organization. Porrini (2004) found that a prior alliance between an acquirer and a target correlated positively with the change in return on assets (ROA) post internalization. Higgins and Rodriguez (2006) revealed that forming alliances with targets prior to acquisition positively impacted the magnitude of abnormal returns. On the other hand, Zaheer et al. (2010) found no general positive effect of prior alliances on abnormal returns. However, they discovered that alliances preceding international acquisitions and stronger forms of prior alliances did enhance market performance. The robustness tests showed that weak alliance forms (licensing agreements) had a negative impact on returns and diluted the positive impact of stronger alliance forms. Porrini's (2004) analysis also excluded licensing agreements, suggesting the positive influence of PI may only be



present when partners collaborate in a stronger sense. In the context of corporate venture capital, Benson and Ziedonis (2010) failed to find a positive effect of prior equity alliances on internalization performance of new ventures. Acquisition of non-portfolio firms outperformed internalization of portfolio firms. The authors explain that the contrasting results to Higgins and Rodriguez (2006) may be due to conditions specific to the management and performance of corporate venturing programs such as venture capitalists acting as intermediaries. Meschi and Métais (2013) discovered that prior alliances actually increase the likelihood of acquisition failure (future divestment). However, they found that alliance duration had a significant negative effect on the probability of failure, aligning with the idea that only stronger collaborations offer the proposed performance advantages of PI.

Although the debate on the performance effect remains open for further empirical testing, some agreement surrounds the conditions moderating the PI performance relationship. Alliance strength measured as the type of alliance activity (Porrini, 2004; Zaheer et al., 2010) and alliance longevity (Meschi and Métais, 2013) are likely to enhance any performance advantage of PI. Also, in international settings, the potential performance advantage of PI is likely greater (Zaheer et al., 2010). The previous studies measure dimensions of organizational market performance largely disconnected from the micro-foundations of prior interfirm learning often proposed as the drivers of the performance advantage of alliance internalization. Using an experimental design, Agarwal et al. (2012) examined the mechanisms that may explain the mixed results on the performance implications of internalization. The study found that the performance effect of PI is dependent on the communication and routines created during the prior alliance period. The results demonstrate that routines created in the prior transitional organizational

structure may be inert and transfer to the new hierarchical organizational context (Gulati and Puranam, 2009). The study highlights the importance of communication to foster positive routines that can reduce task and behavioral uncertainty in the post-internalization period. Thus, successful alliance performance, particularly with regard to interfirm coordination and cooperation, is likely another contingency for achieving high internalization performance.

Although most research examines broad measures of organizational performance such as cumulative abnormal returns (Higgins and Rodriguez, 2006; Zaheer et al., 2010) and ROA (Porrini 2004), there are two exceptions. Al-Laham et al. (2010) offer empirical evidence that the speed of innovation is enhanced with PI as compared to acquisition with no prior alliance. As an organizational learning lens would predict, the faster post-internalization firm patenting activity found in the study suggests that learning during the alliance period supports faster absorption and utilization of knowledge. Reuer and Ragozzino (2008) offer further empirical support for theoretical predictions on the effects of forming alliances prior to internal organization. The study found the presence of a prior alliance between an acquirer and a target reduced the likelihood that the deal was financed with stock and the proportion of stock used. Since stock options tend to be used in acquisitions when prices are difficult to determine, the reduction in stock payment corroborates the predictions of information economics. Information asymmetries appear to be reduced during the transitional governance period as firms tend more toward cash transactions. Interestingly, they found no significant effect of equity alliance design on this relationship.

### *5.6.2. Venture internalization performance*

Empirical research on the outcomes of VI is limited to four studies exploring the effect of internalization on firm market performance. The findings on the effect of VI on shareholder valuation are mixed, but several conditions are identified that help explain diverse market reactions. Reuer (2000) discovered the market reacts positively to internalization announcements of IJVs that received a positive market reaction at formation and reacts negatively to internalization of ventures that received a negative reaction at formation. Further, he found that the market reaction was negative for VI in noncore business areas of the firm. Reuer and Miller (1997) found mixed effects of VI on market performance with abnormal returns positively related to the ownership percentage of the internalizing firm of the IJV. Reuer (2001) did not find support for a significant main effect of JV internalization announcements on shareholder wealth. The study found that abnormal returns are positively related to firm R&D intensity and multiple alliance ties between the partners and negatively related to partner cultural distance. JV longevity and environmental factors including industry conditions and political risk were shown to have no effect on the relationship. Kumar (2005) also failed to find a significant main effect of VI on abnormal returns. However, the study found that internalizing ventures creates less value in uncertain and concentrated industries.

A common theme in research on VI is the comparison to performance implications of alternative alliance exit options. Given the asymmetric nature of internalization with one firm expanding and one firm divesting in a business area, scholars have taken an interest in the presumed asymmetric performance effects. For example, Kumar's (2005) study includes venture selloffs and found the market responds positively to JV divestments

completed to refocus the firm's portfolio. Meschi (2005) found a positive market reaction to divestment undertaken for refocusing, while those that were involuntary or motivated by failure or debt reduction had no significant effect. Taken together, the evidence suggests that market performance is enhanced by internalizing alliances in core areas and divesting more peripheral alliances. This evidence hints that alliances undertaken to explore in new domains may actually be more difficult to internalize and better utilized for knowledge access rather than internalization (Grant and Baden-Fuller, 2004).

Theoretical literature also addresses the issue of performance and value creation in VI. Chi's (2000) game-theoretic approach looks at the role of uncertainty and equity splits in determining the partner that will generate more value by internalizing the venture. He predicts the value of VI will vary depending on whether buyout options are negotiated ex ante or ex post. Ex ante negotiations will create more value if the option holder has greater uncertainty or growth expectations than the issuer, while ex post negotiations generate more value for the partner with higher growth and lower initial equity. Also focusing on buyout options, Sinha (2008) suggests that a multinational corporation's (MNC) payoff is strictly greater under a pooling buyout contract than a separation contract. The study concludes that it is worthwhile for an MNC to acquire info on a host firm's true private info by forming alliances prior to internal organization. Further exploring problems of adverse selection, Mollgaard and Overgaard (1999) suggest that licensing deals may be the result of a stronger incentive to temporarily fool investors since they require less upfront investment than JVs. This aligns with the notion that licensing deals are less likely to lead to high performing internalization. However, the authors suggest that if an investor has complementary assets then the investment should be undertaken, as the value of the partner firm will increase throughout the alliance evolution.

## **5.7. Future research and conclusions**

### *5.7.1. Extending current research*

Theoretical work agrees that interfirm alliances are a useful step in the transition from market to internal organization. Gullander (1976) argues alliances are complements to acquisitions that prepare the ground for subsequent internalization, thus minimizing organizational problems. He suggests that the successive integration path acknowledges uncertainties since the anticipated M&A need not be undertaken if proven undesirable. Smit and Moraitis (2010) propose JVs are one type of platform investment that can be a key component in a serial acquisition strategy by creating new paths for follow-on investment opportunities. Garette and Dussauge (2000) advise that (European) firms must use alliances in a more offensive way, not as substitutes for M&A, but in combination. They suggest alliances help avoid the culture and organizational shock associated with acquisition by proceeding step-by-step and gradually adapting the structure and content of agreements.

Yet, empirical studies examining the internalization-performance relationship fail to reach consensus. Thus, the direct and conditional effects of internalization on firm outcomes remain an important area for further inquiry. To extend the debate, additional dimensions of performance could be considered. Current research has examined broad measures of organizational performance without much regard for the goal of internalization. For example, outcomes such as the pace and degree of integration could be examined against firm desired levels. Additional dimensions of innovation performance are also worthy of examination given the probable influence of learning and

familiarity accrued during the alliance period. For example, one challenge of M&As is the lack of results in fostering exploratory innovation (Phene et al., 2012). The transition from the exploratory alliances phase may allow firms to continue generating new knowledge when the alliance is brought within organizational boundaries. If routines for exploration are established when the firms are collaborating (Agarwal et al., 2012), perhaps they would survive the transition to internal organization. Another prominent issue in firm acquisitions is the difficulty of maintaining valuable human capital post acquisition (Al-Laham et al., 2010; Meschi and Métais, 2013). Since the knowledge held by workers is part of the value of an acquisition, it is important for firms to retain part of this knowledge base. Theorizing on the challenges of integration may predict that firms are better able to retain the target's key talent with successful prior alliances. Particularly, if the alliance fostered the development of an interorganizational identity and routine convergence, the transition to a new combined entity may be less disruptive for employees. Furthermore, the acquiring organization would have more information on the capabilities, relationships, and fit of employees when alliances are formed prior to internalization, and thus may experience less *undesired* outbound mobility.

The flexibility offered by an alliance is another consideration when evaluating performance outcomes. Although firms may remain in alliances and extend agreements, the unstable nature of transitional governance may eventually lead to internalization or dissolution (Williamson, 1979). Different exit alternatives are embedded in alliance formation that may be triggered over the alliance evolution (Reuer, 2002). Research on alliance exit has primarily focused on the dissolution and withdraw from alliance agreements (Dussauge et al., 2000). Yet, research supports the prevalence of internalization as an alliance exit route with more distinct drivers and implications than

alliance dissolution (Hennart et al., 1998; Kogut, 1991; Park and Russo, 1996). Thus, future research could explore additional performance implications of internalization compared to dissolving an alliance, or to holding options by sustaining an active alliance (Ragozzino and Moschieri, 2014). For example, firms may dissolve alliances to change learning trajectories without considering the effect on employee mobility that may be distinct in an internalization event. Reputations may also accrue to firms that favor specific exit strategies that could influence the flow of new partners and targets for future organizational growth. For example, companies known for dissolving alliances (Zhelyazkov and Gulati, 2016) or internalizing partners may have fewer alliance formation opportunities.

Some distinctions exist in the conditions fostering PI compared to VI. For example, equity alliance design was shown to have a significant impact on VI while not PI. Partner size (Hennart et al., 1998) and power imbalance (Hennart et al., 1998) were shown to foster VI while direct partner competition drove PI (Steensma et al., 2008). Yang et al. (2011) offer a synthesis of the inherent differences between PI and VI and propose the decomposability of the target's knowledge base as one central factor determining the viability of both alliance exit options. They suggest the less separable the partner resources, the more likely the firm will select PI. Folta (1998) distinguishes between JVs only encompassing a portion of a target's technological capability and minority investments such as an alliance with an equity stake. He suggests the growth option in a JV is partially diminished since there is likely an opportunity cost related to owning an option on a venture rather than the partner firm. As a result, the opportunity cost may mitigate the incentive to defer acquisition and differentiate the value of a JV option and non-JV equity alliance option. Hence, the results herein suggest partner knowledge

overlap, resource overlap, and equity ownership structure may all influence the path toward PI or VI. Including both types of internalization as possible alliance outcomes can shed light on inconclusive results regarding the effect of partner proximity and further the debate on how alliances serve as transitional organizational forms.

### *5.7.2. Extending research approaches*

The exclusive use of quantitative methods hinders understanding of the internalization process and the underlying causal mechanisms of the proposed relationships. Given the interaction of various levels of analysis and events across time present in alliance internalization, grounded theory and in-depth case studies could help reveal the key mechanisms and tipping points for alliance internalization. For example, research could explore how boundary spanners influence the decision to internalize versus divest alliance activities. Studies could examine how joint decision-making processes during the alliance period influence the resilience of old routines upon internalization. Qualitative research could also help reveal process dimensions of alliance internalization such as the changes the relationship undergoes related to coordination and conflict.

Past studies tend to focus on a few driving conditions and rarely connect the driving conditions to the outcomes of internalization. Except for two studies (Champagne and Kryzanowski, 2008; Folta and Miller, 2002), research focuses on factors residing at one level of analysis. However, it is likely that alliance, organizational, and environmental conditions interact. Structural equation modeling would be well-suited to model the numerous recursive relationships between the driving conditions and internalization performance. Future research designs could also follow set-theoretic approaches (e.g.,



qualitative comparative analysis) to reveal the combination of factors across levels of analysis that leads to successful alliance internalization. For example, research could explore alternative evolutionary paths that result in high performing alliance internalization.

Finally, only two studies use primary data in the analysis. Primary data could help elucidate social challenges firms undergo during the transition and the associated performance effects. Following Steensma et al. (2008), more studies combining the use of survey instruments and secondary data may offer insight on the inconsistent relationships outlined in this review. For example, alliance goals and performance form part of a greater organizational strategy, which may not be explicit to the market or scholars. Thus, collecting primary data on alliance and acquisition strategy and the links to firm strategy could help untangle the performance implications of alliance internalization.

Alliances may be conceptualized as organizational forms that are inherently unstable (Madhok et al., 2015; Steensma et al., 2008). Alliance internalization is one exit path that may emerge during alliance evolution. The evidence herein shows it is difficult to predict alliance internalization at the time of formation because the outcome depends on alliance, organizational, and environmental conditions that evolve over the life of the alliance. Given the complexity of the phenomenon with interactions at various levels of analysis and across time, perspectives rooted in systems thinking, particularly complex systems theory and network theory, could receive more attention. From a complex systems lens, an alliance can be considered a system at the edge of chaos. Chaotic phenomena are difficult to explain with positivist methods (Boisot and McKelvey, 2010), but scalable

abduction helps identify general laws. Scalable abduction refers to anticipating rare outcomes from many lower-level small initiating events. For example, research could ask what are the sources of change that lead to alliance internalization. This approach would be useful in solidifying a model of conditions driving system adaptation (via alliance internalization) to the complexity, evolution, and tensions of interfirm alliance governance.

Network theory also offers the potential to examine factors at the level of interfirm ties, firm network position, and overall network features. The evidence from Yang et al. (2011) suggests that firms with superior network positions are less likely to internalize partners. Firms were more likely to internalize partners when the acquirer's network was less central relative to the targets. One may argue that firms with inferior positions select well positioned targets among alliance partners to absorb the partner's network rather than in hopes of gathering prior knowledge on the firm. Furthermore, firms with less central networks may have fewer alternatives, both less information on potential acquisitions and fewer alliance exit options. The limited evidence on alliance exit implications suggests alliance dissolution is particularly detrimental when partners are not replaced (Mitchell and Singh, 1996). Hence, network features such as the availability of alternative partners may play a role in the likelihood and performance of alliance internalization (Greve et al., 2013) as an exit option and acquisition strategy.

Although considerable research applies organizational learning to explore alliance internalization, additional work rooted in the foundations of firm learning and search is needed given the relevance of internalization for firm innovation and knowledge building. Substantial work is dedicated to the selection of sourcing modes in organizational

learning research (Rothaermel and Deeds, 2004; Stettner and Lavie, 2014). March (1991) proposes that firms must balance exploration and exploitation (i.e., be ambidextrous) to achieve high performance. The call for ambidexterity has received significant scholarly attention since the skills to develop new knowledge and to refine existing knowledge are quite distinct (Levinthal and March, 1993). Although some suggest that balance can be achieved within a single organizational unit (Gibson and Birkinshaw, 2004), most scholars call for separating exploration from exploitation. One approach consists of temporal separation where firms manage transitions between exploration and exploitation over time (Brown and Eisenhardt, 1997). Using an exploration-exploitation lens to alliance internalization may allow scholars to gain insight on the timing of these activities. In the case of internalization of an exploration alliance, one could test the effect of removing organizational boundaries on the sustainability of new knowledge creation output, or the transition to knowledge refinement. Past inconsistent results on the positive performance effects of balancing exploration and exploitation (He and Wong, 2004; Lavie et al., 2011; Lin et al., 2007; Sidhu et al., 2007) may be the result of focusing on balance within one particular mode: alliance, acquisition, or internal development. In line with recent studies looking at how firms simultaneously explore and exploit via multiple modes (Stettner and Lavie, 2014), the transition across modes of operation could be examined to uncover further implications of balancing exploration and exploitation.

### *5.7.3. Conclusion*

As a reflection of the research area, this review leaves many questions on the theory and practice of alliance internalization. A systematic look at alliance internalization is timely given the dispersed nature of work across time and disciplines. The limited occurrence of

alliance internalization discovered in PI research places doubts on the theoretical conception of alliances as transitional, intermediate, or sequential solutions leading to internal organization. To the contrary, research shows VI is a common end to alliances. The evidence also suggests that internalizing alliance partners and ventures may be a useful strategy for improving acquisition and alliance exit performance. The findings indicate that stronger forms of alliances and alliances preceding international acquisitions improve performance. PI was also shown to increase the pace of innovation post acquisition (Al-Laham et al., 2010) and decrease the amount of stock used in transactions (Reuer and Ragozzino, 2008), indicating that meaningful learning and information gathering occurs during the alliance. Given these potential benefits, scholars must take a more in-depth look at the effects of alliance internalization to understand when delay or other drawbacks of waiting for internal organization override potential benefits (Ragozzino and Moschieri, 2014).

Whether prolific or rare, recent calls are encouraging organizational scholars to take note of the outliers (Mohrman and Lawler, 2012). The cases of outstanding performance are the stars, unicorns, and gazelle organizations strive to be. The unanswered questions on the drivers and outcomes of alliance internalization must continue to be explored to determine how the potentially underutilized transitional strategy may influence superior performance under diverse conditions. Rather than receiving less scholarly attention in light of mixed findings, the debate deserves more empirical research to revise theory and guide practice. Given the unique opportunity to observe the progressive shift of organizational boundaries and test predictions put forth by a wide range of theoretical views, alliance internalization is highly relevant for academic inquiry. Beyond strategy, finance, and economics, the evidence on the performance implications of internalization

of international alliances underlines the importance for international business research and support for the premises of internationalization theory of staged entry (Johanson and Vahlne, 1977). Entrepreneurship research could also gain insight from the perspective of the internalized alliance partner. For example, Mathews (2007) models alliances with equity stakes as an optimal mechanism to extract surplus from bidders without prior relations with the target. Clearly, the avenues for future research on alliance internalization are abundant and diverse.

# 6

## Conclusion

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This chapter contains an integrated discussion of the findings, academic contributions, managerial implications, limitations, and future research opportunities of the research area and articles that compose Chapters 3, 4, and 5.

## **6.1. Overall findings and implications**

This PhD thesis focuses on advancing understanding of organizational alliance exit implications and explores conditions that could affect these outcomes. This is an important addition to alliance research as the findings reveal meaningful fluctuations in firm and innovation performance associated with alliance exit (summarized in Table 1) and thus demonstrates the importance of shifting interfirm boundaries. Specifically, removing organizational boundaries through internalization (Table 1: Exit Mode) may have a positive effect on short-term firm performance (Chapters 3 and 5) whereas resurrecting boundaries by dissolving alliances tends to have a negative effect (Chapters 3 and 4). Thus, the empirical exploration of this PhD thesis evidences the detrimental effects of premature alliance dissolution presumed by most theoretical accounts (e.g., Bruyaka et al., 2018; Hamel, 1991; Park and Ungson, 2001; Simonin, 1999). Furthermore, Chapter 4 found the disruption of the exit to influence firm trajectories as firms tend to build more heavily on external knowledge following exit (Table 1: Outcome – Internal focus KB) but not to meaningfully change interfirm knowledge building behavior (Table 1: Outcome – Interfirm KB). This demonstrates how organizational path-dependency is conditionally influenced by a major event in firm history and that interfirm knowledge building may persist beyond formal collaboration (van Burg et al., 2014). Thereby, the thesis offers empirical evidence that changes in interfirm boundaries affect future opportunities for firm growth and learning (Table 1: Outcome).

Table 1. Integrated summary of empirical findings

<b>Outcome</b>	<b>Exit Mode</b>	<b>Finding</b>	<b>Hypothesis Supported</b>	<b>Key moderators</b>
Interfirm KB	Dissolution	Non-finding	No	Geographic proximity (-)
Internal focus KB	Dissolution	Negative	No	Alliance portfolio size (-)
Tech diversity KB	Dissolution	Negative	Yes	Alliance portfolio size (-)
Innovation performance	Dissolution	Negative	Yes	Alliance portfolio size (-)
Stock market performance	Dissolution	Negative	Yes	Exit motive: external change (+)
Stock market performance	Venture internalization	Positive	Yes	Exit motive: growth (+) refocusing (+) external change (-)

The empirical evidence presented, taken together with the insight from Chapter 5 on alliance internalization, suggests theory on strategic alliances may revert to early views of alliances as transitional governance mechanisms with the objective of future internal organization or sale of the alliance activity (Folta, 1998; Kogut, 1991). Although data limitations inhibited exploration of the effect of internalization on knowledge building and innovation (Chapter 4), the extant empirical evidence and theory reviewed in Chapter 5 suggests that internalization may be a particularly useful strategy in high technology areas where learning motives are key (Reuer, 2001). Thus, scholars could seek to advance theory on using strategic alliances to temporarily access external knowledge (Grant and Baden-Fuller, 2004) and conceptualizing alliances as temporal agreements with definitive exit strategies that could mitigate the dissolution decline.

The integrated findings of the empirical chapters also reveal important distinctions in the conditional effects of alliance exit (Table 1: Moderators). Although, the individual articles examine different dimensions of organizational performance, some commonalities emerged. Interestingly, both Chapters 3 and 4 revealed limited influence of JV governance on the effects of premature exit. Chapter 4 further illuminates the minimal impact of different additional alliance-level variables such as same-industry



alliances. On the other hand, Chapter 3 suggests that alliance-level conditions specific to the exit event, namely, the exit mode and motive, are relevant moderators of firm stock market performance. For example, the results revealed firms exiting alliances for growth and refocusing experience more favorable stock market performance, but upon more detailed analysis, this only held true in the case of exit via internalization. This may suggest a limit to the value of resource commitment deferral and flexibility afforded by strategic alliances. Although fewer upfront resources are committed than in alternative growth modes, alliances that fail to develop resources valued by the partners for subsequent internalization hurt firm value even when they suggest more efficient use of firm resources by exiting non-performing activities. While Chapter 4 exclusively focuses on exit via dissolution, the extant evidence uncovered in Chapter 5 focusing on internalization and highlighting its proposed benefits, helps support this conclusion for additional organizational outcomes such as learning.

Regarding firm-level factors, Chapter 4 shows that alliance portfolio size, had a significant moderating effect on the knowledge building and innovation outcomes of alliance exit. Interestingly, the firm internal R&D intensity did not appear to influence outcomes. Along the same lines, the stock market reactions examined in Chapter 3 offer limited support for an influence of a firm's additional alliance formations on short-term firm performance. Nonetheless, the evidence compiled in Chapter 5 suggests a firm's existing resource base may influence the performance outcomes of alliance internalization. For example, Reuer (2001) found returns to JV internalization announcements to be positively related with firm R&D intensity. These overall findings suggest that firms and scholars should continue to investigate exit conditions and a firm's

portfolio of resources and alternative opportunities to further advance understanding of alliance exit implications.

## **6.2. Contributions to theory and practice**

This thesis makes an important contribution to alliance research by furthering understanding of the alliance life cycle. Most accounts of alliance evolution cease at the time of exit from the agreement. This thesis looks beyond exit from the agreement to determine the post-exit implications for the surviving organizations. The content analysis herein focuses on press releases at the time of exit events. However, the studies introduce a longitudinal element by tracking and recording summaries of other relevant news events that occurred during the alliance life cycle. This aids in a better understanding of the unfolding and features of alliance exit than merely counting exit rates (Yan and Zeng, 1999). Thus, this research highlights the importance of cumulative alliance outcomes, particularly at the firm level, as opposed to measuring alliance performance at a specific point in the active alliance period. Furthermore, this work answers the call for alliance research to further differentiate between exit modes (Dussauge et al., 2000; Park and Russo, 1996) and reveals distinct effects on firm performance.

This work also contributes to advancing interdisciplinary research practice by integrating insight from research and methodological approaches rooted in economics and finance to organizational theory. This is important given the broad scope of interest across academic disciplines in strategic alliances and acquisitions. Moreover, research on exit via internalization originating in economics and finance has been largely overlooked by organizational scholars. This is demonstrated by the finding from Chapter 5 that the

majority of papers published in business and management journals cited an average of only two of the 25 papers uncovered in the economics and finance outlets. This thesis is among limited research in organizational theory and strategic management that connects alliance and M&A research (Chapter 5). The links between alliances and acquisition are one area of recent increased scholarly interest (Castañer and Ioannis, 2017), particularly in light of the substantial theoretical relevance and limited empirical research. More specifically, this thesis details how acquiring or divesting alliance activities (Chapters 3 and 5) relates to different measures of firm performance, illuminating one important connection, the transition from alliance to acquisition.

In addition, chapters three and four offer some insight to the specific theories applied. Chapter 3 tests the boundary conditions of the RBV in the context of strategic alliances by demonstrating that the reconfiguration of shared resources effects the value of the overall bundle of firm resources. Overall, the results confirm the predictions of the RBV for the value of resource reallocation, although less value may be interpreted by the market for exiting non-performing activity than may be anticipated. The non-findings of Chapter 4 are particularly insightful for the KBV and raise questions on interorganizational social communities. By providing some evidence of the persistence of interfirm knowledge building following exit, the findings hint at the resilience and sustainability of the informal aspects of alliances. The results also demonstrate the potential influence of routines and persistence in knowledge-sourcing tendencies aligned with the building blocks directing firm coordination described in the KBV (Kogut and Zander, 1996). The thesis also highlights opportunities to further understanding of the exploitation and exploration paradigm rooted in organizational learning (chapter four and five). The results from Chapter 4 suggest that firm exploration is enhanced by alliance

exit (i.e., less building on internal knowledge). Interestingly, extant research has found exploration also drives alliance exit, particularly internalization (Yang et al., 2011). Thus, the overall findings highlight the need for further research on the relationship between alliance exit and exploration.

This PhD thesis provides coverage of the alliance phenomenon beyond formation, evolution, and even exit, to include the subsequent repercussions and benefits to firms (Larsson, Bengtsson, Henriksson, and Sparks, 1998). These insights may prove very useful to managers given the practical reality of alliance exit. For example, the insights from this thesis inform alliance formation decisions by demonstrating how the net value of strategic alliances may depend on exit conditions. This adds another dimension to consider when forming strategic alliances, particularly when choosing between alternative growth and knowledge sourcing modes such as acquisition, internal development, and individual level mechanisms (e.g., Garrette, Castañer, and Dussauge, 2009; Hohberger, 2016; Hohberger et al., 2015; Lungeanu, Stern, and Zajac, 2016; Rosenkopf and Almeida, 2003). Although the alliance performance challenges have been highlighted in past research (e.g., Ariño, 2003; Christoffersen, 2013; Lavie, Haunschild, and Khanna, 2012; Lokshin, Hagedoorn, and Letterie, 2011; Lunnan and Haugland, 2008), this work further illuminates the difficulties in attaining alliance gains when collaboration ends in premature dissolution.

Managers can also draw on the insight offered in this thesis when selecting partners and alliance governance. For example, the lack of effect of JV alliance governance on learning and firm performance measures is insightful when selecting alliance governance. Abundant research presents the distinctions between alliance governance (e.g., Gulati,

1995b; Mowery et al., 1996; Oxley and Wada, 2009; Phene and Tallman, 2012; Zaheer et al., 2010) but rarely discusses how these different forms of alliances often result in distinct exit paths. Chapters 3 and 4 demonstrate that while alliance governance leads to distinct evolutionary paths that favor exit via internalization (JVs) or dissolution (non-JVs), governance has limited effects on exit implications. This offers some evidence that the increased commitment and embeddedness of JVs does not result in greater penalty to exit, which may support the case for selecting JV governance since enhanced performance outcomes such as focused knowledge transfer (Gomes-Casseres et al., 2006; Mowery et al., 1996; Oxley and Wada, 2009) are not undermined by less flexibility at exit.

This PhD thesis also contributes to practice by revealing distinct implications of alliance exit conditions. Specifically, new insight is offered on alliance exit modes. Particularly, exit by internalization is shown to reduce losses in firm value incurred by alliance exit, even when the alliance has non-equity governance. Thus, managers may see organizational benefits to steering alliance exit toward internalization. Internalization may also be a particularly useful strategy in high knowledge intensity environments like the life science industry studied in this thesis. However, the findings also indicate that firms are best to dissolve poor performing alliances and under adverse external conditions (chapter three) rather than attempting to embed alliance resources or preempt competition (Folta, 1998) through alliance internalization.

This aligns with logic on corporate restructuring and informs practitioners that strategic alliance exit is part of resource allocation decisions just like alliance formation. This also illustrates how managers may draw on experience from past *business* exits when analyzing potential resource reallocation from alliance portfolios, and to some extent,

when anticipating organizational outcomes. In a similar way, this PhD thesis contributes to M&A practice by nuancing the understanding of forming strategic alliances prior to acquisition (Chapter 5). Hopefully, managers will be better equipped to see connections between the firm M&A activity and alliance portfolio and to be mindful of the exit implications when choosing among these distinct growth and knowledge sourcing modes.

### **6.3. Limitations and future research**

There are several general limitations to this PhD thesis largely related to the challenges of data collection and limited extant knowledge on alliance exit. As mentioned in Chapters 3 and 4, although above or in line with recent exit studies (Cui et al., 2011; Heidl et al., 2014; Pangarkar, 2009), our sample size is quite restricted in comparison to general alliance research. Although reflective of the scarce data on alliance exit (Schilling, 2009), the limited sample size is particularly problematic for extending understanding on intended alliance exits and alliance internalization. Although scholars have underlined that many alliance exits are intended by the firms (Ariño, 2003; Kogut, 1991; Makino et al., 2007; Sadowski and Duysters, 2008) coinciding with the completion of alliance objectives (Reuer and Zollo, 2005) or contract expiration (Bakker and Knobens, 2015), we found scarce evidence of intended exit applying the described research methodology. Perhaps these intended exits constitute the alliance exits that go unreported, and thus, are difficult to expose empirically using large-scale secondary data. Future research could employ alternative research methods, such as survey and qualitative techniques, to delve deeper into the implications of intended alliance exits and how they differ from premature exits. We also uncovered limited but meaningful evidence of venture and partner alliance internalizations indicating this may be a ripe area for further research as highlighted in

Chapter 5. Expanded knowledge on alliance internalization is important for extending theory on interfirm boundaries and organizational evolution and for practice given the implications for firm growth and knowledge sourcing strategies, particularly related to M&A and alliance activity.

Our empirical setting and strategy present additional limitations and opportunities to extend the current research program. Specifically, as with any single industry study, the findings must be interpreted in the context of the life science industry, potentially limiting the generalizability of our results. The life science industry is characteristic of other knowledge-based industries (i.e., high investments in R&D, low-success rates, high alliance activity, etc.); thus, we could expect our findings to hold in similar industries. Nevertheless, future research could expand our findings by examining other knowledge-based or traditional industries. Non-knowledge-based industry studies are particularly important for improved understanding of the implications of exit for firm performance as the effects may differ for alliances in industries with lower alliance activity and where interfirm knowledge sharing is less relevant. Still, given today's knowledge-based economy where even more traditional industries feel the knowledge and collaboration imperative, we may expect the results to be similar. The generalizability of the results of this thesis could also be extended by incorporating non-U.S.-based data (Chapters 3 and 4). Specific to chapter four, although most international firms patent in the U.S., including data on patents in the EU and Japan, particularly in the context of the life science industry, would offer a more complete view of knowledge building given the international context of the industry. Furthermore, Chapter 3 focuses on U.S. publicly traded firms given the availability of data and need for a tightly controlled research design. Still, future research could examine how markets in other regions react to alliance exit announcements similar to recent research on IPO research (e.g., Bell, Filatotchev, and Aguilera, 2014). This could

offer important insight on the interaction between context and firm change and resource reconfiguration. Finally, further research is needed to reveal the effects of alliance exit on other metrics of firm and innovation performance beyond stock market valuation and patent measures such as changes in cash flow and publications.

Regarding the second point about the limited extant knowledge on alliance exit, particularly surrounding exit modes and implications, our choice of a primarily quantitative design restricts the depth of the insight provided. As stated above, the use of secondary data limits the ability to expose intended alliance exits, narrowing the scope of this thesis to premature exits. The use of large-scale archival data also inhibited exact replication of the Gioia method and only allowed analysis of reported rather than underlying exit motives (Chapter 3). Accordingly, and given the early state of research on alliance exit modes and implications, qualitative research may be best suited to further advance current understanding. Qualitative research is also appropriate to unearth theoretical insight on the exit process and how it relates to firm evolution, particularly the growth and changing boundaries of the firm. Process research questions approached through analysis of rich qualitative data could also offer important practical implications on the best practices, modes, and timing of exit, and for the management of alliance portfolios and the post-alliance phase. For example, the combination of company interviews and analysis of company archives could help answer the question of how firms manage the exit decision and post-exit interfirm relationships as well as the implications on micro-level outcomes such as employee identification and knowledge-sharing practices. The latter may be particularly interesting in the context of alliance internalization as the firms shift from hybrid to hierarchical governance (Williamson, 1979).



Related to the need for further research on the micro-level outcomes of alliance exit, this thesis is limited by its primary reliance on macro-level measures. Although an important first step in understanding the firm-level implication of alliance exit, the examination of the individual-level processes of exit could help explain the observed results and aid in advancing current knowledge. For example, future research could explore how employee mobility (e.g., Corredoira and Rosenkopf, 2010) relates to alliance exit and how this may differ with intended versus premature exits and dissolution versus internalization. Furthermore, individual scientific collaborations, star scientists, and personal networks (e.g., Hohberger, 2016; Hohberger et al., 2015) could be examined in interaction with diverse firm and environmental conditions connected to alliance exit. Moreover, the individual alliance exits could be connected to a global view of firm alliance portfolios. Examining how individual exits explain the level of dynamism of a firm's portfolio would shed additional light on the exit process and how firm's balance alliance formation and exit (e.g., Greve et al., 2013). In addition, as more alliance research seeks to extend beyond dyadic collaboration to include more multi-partner alliances (e.g., Heidl et al., 2014; Li et al., 2012) mirroring current firm practices, exit research could benefit from new studies addressing the effects of these shifts in interfirm boundaries. Similar to the distinction between exiting multi-partner, future research may also consider the nuances of exiting other types of collaboration such as industry-university partnerships to understand if and when the revealed effects may differ.

In summary, alliances are a strategic tool for organizations that are best utilized with knowledge of their temporal nature. Advancing the temporal view of strategic alliances guides research to offer deeper understanding of the process and implications of alliance exit. Future scholarly work on alliance exit must aim at empirical examination with clear

exit constructs following extant frameworks and theory. The balance of research should shift to continue to fill gaps on exit motives outside the dyad, exit modes beyond dissolution, exit implications, and process. More empirical studies taking exit as an explanatory variable and exploring venture and partner internalization from different perspectives will advance current knowledge on both exit modes and implications. The exit process must be further explored to guide firms on how, when, and why to end alliances. Comparing the effects and management of different exit modes, of exiting different forms of alliances or continuing in non-value creating alliances, can offer important insights for scholars and managers. Overall, alliance exit is a probable outcome with organizational implications that warrants more dedicated scholarly attention. By surveying the current state of knowledge and empirically examining alliance exit performance implications in the life science industry, we hope to have contributed to this research agenda and an integrative view of the strategic alliance life cycle.

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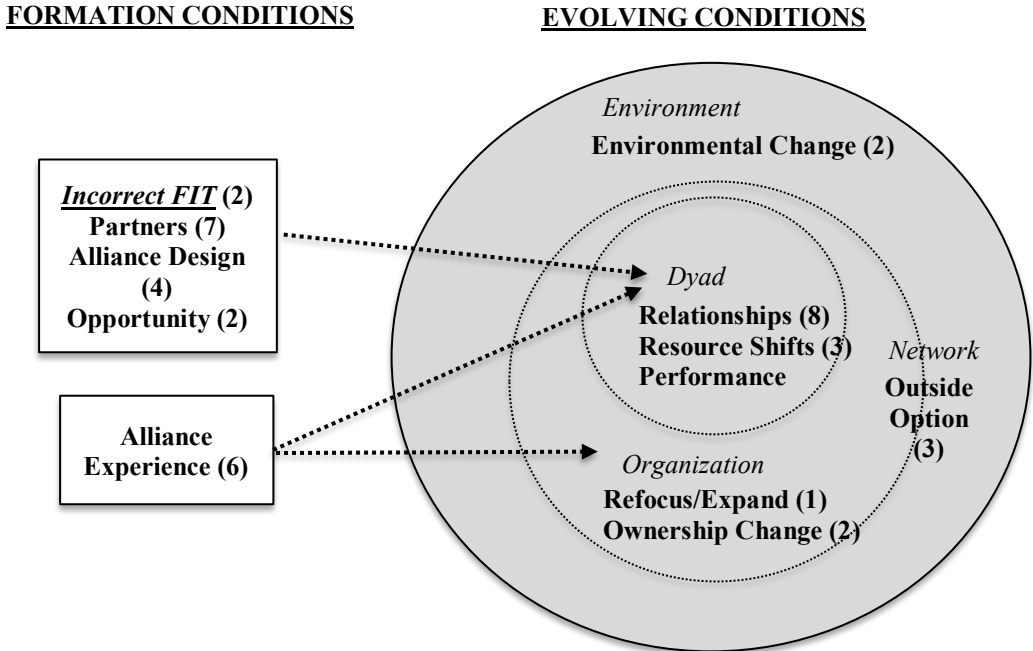
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# Appendix

Figure 1. Model of alliance exit motives



\*(N) after motive indicates the number of studies examining the motive; categorization is not mutually exclusive

Figure 2. Example alliance exit vignettes with exit motive and mode coding

