Repeated Alliances Across Product Markets: The Formation and Performance Implications

A DISSERTATION
SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL
OF THE UNIVERSITY OF MINNESOTA BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

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2023

Acknowledgements

I am grateful to many people who provided a tremendous amount of support during my PhD program. I am greatly indebted to them. I would first like to thank my wonderful advisors, Aks Zaheer and Assem Kaul, for their constant support throughout the program. I am truly lucky to be their student. I am thankful that I met someone as advisors who are truly admirable and who I can proudly have as mentor and role model in this profession.

My committee members have also been a wonderful support. Russell Funk always provided great feedback and resources that greatly helped me throughout the process. David Knoke always encouraged me to step back and think more deeply about the contributions I make. I also greatly benefitted from the faculty members in the Strategic Management and Entrepreneurship department. In my earlier years in the program, I learned so much from the faculty members that I took classes from. Throughout my PhD journey, everyone in the department were always willing to provide constructive feedback and office doors were open for me to discuss anything.

In addition to the support that I received from my committee members and faculty members in my department, friends and family also provided infinite trust and encouragement. I met many wonderful peer PhD students during my program that I was able to learn from and grow together. I could not have finished this dissertation without love, caring, and encouragement from my friends. My family—my parents, brother, sister, and our little dog—has been always there for me during the difficult times I had during the process, always providing a place to find peace.

Abstract

This dissertation explores a phenomenon of market entry through cross-market repeated alliance, or market entry through repeated alliance with an existing partner from another product market. While it has been studied much how firms use its internal resources to enter a product market, relational resources have received little attention as valuable firm resources in market entry. Such lack of studies on the use of relational resources in market entry is surprising, considering that strategic alliance is an important strategic tool of firms. In this regard, in the first chapter, I examine when firms enter product markets through cross-market repeated alliances with existing partners rather than find new partners. Furthermore, the second chapter studies the performance implications of such cross-market repeated alliances in market entry. I study these questions in the context of the U.S. pharmaceutical industry where there are 15 distinct therapeutic areas. I configure a fine-grained dataset on alliance activities, drug development activities, and patents of firms in the U.S pharmaceutical industry from 1986 to 2019. I find that the cross-market repeated alliance is a salient phenomenon that bears attention. Firms use cross-market repeated alliances in market entry not only to successfully expand their corporate scope, but also to solidify their existing collaborations in other product markets. Cross-market repeated alliance is also a more efficient way to innovate compared to new partner alliance. These findings highlight the importance of relational resources in market entry and extend our understandings on repeated alliances by identifying the product markets of alliances.

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Overview

Firms, especially large conglomerates that have high impact on economy, are often diversified into many different markets with diverse portfolio of products. It is important to understand how firms, as influential actors shaping our economy, continuously enter new markets and expand their lines of businesses. In this regard, market entry into a product market has long been of interest to strategy scholars. In efforts to understand firms' market entries, it has been extensively studied how pre-entry internal resources of firms (e.g., facilities, managerial experience) can be useful in market entries. The characteristics of pre-entry internal resources of firms also shape market entry decisions of firms and strategies in managing firm activities across multiple product markets.

Despite our accumulated understandings on how firms use its existing internal resources to enter a market, one important type of firm resources remains yet unexplored in market entry and diversification: relational resources. Relational resources come from firm's existing collaborative relationships with other firms. While firm does not have relational resources or network of partners in entering market as new entrant, firm's previous alliance activities in other markets can be used for market entry. It is surprising that relational resources have not been examined as market entry resources, given that prior work highlights interfirm alliance as an important strategic tool used by firms to cooperate and achieve common goals that are hard to achieve in separate. In particular, one of the important insights from the literature is that firms often repeat alliances with the same partners and become embedded in interfirm relationships. However, while firms often operate in multiple product markets, it is assumed in prior studies that such repeated alliances occur in the same market as previous alliances. I propose and show

in my dissertation that firms may repeatedly collaborate with each other across multiple markets. More importantly, relational resources are distinctive from other internal resources of firms in that they exist at a dyad-level (between firms), spanning firm boundaries and posing distinctive benefits and challenges for firm that are different from internal firm resources and needs to be explained.

I explore this underexplored yet important phenomenon of cross-market alliances in the U.S. pharmaceutical industry. The industry is comprised of multiple distinctive, yet related, markets so that alliances in each market are distinguished, but at the same time, are expected to be relevant to each other. Many different drugs are developed in the industry to target different disease groups, and thus belong to different therapeutic areas.[1] I integrated several datasets from Cortellis database to configure fine-grained data on activities of 3,988 firms in pharmaceutical industry from 1986 to 2019, including alliance activities, drug development activities at each clinical trial stage, patenting, and intrafirm inventor networks at therapeutic area level. I also collected exceptionally detailed information for each R&D alliance of these firms, identifying partners involved, drugs developed in alliance, outcomes of alliances in terms of drug development stages and speed of development, and technologies used. Empirical data that I collected confirms that cross-market alliance and market entry with existing partner from other markets are salient phenomenon: 46% of the repeated R&D alliances were formed in a different market than previous R&D alliance. Among these cross-market R&D alliances, 40% were used

[1] There are total 15 distinct therapeutic areas in which firms develop drugs to target different diseases: cancer, cardiovascular, dermatologic, gastrointestinal, genitourinary, hematologic, immune, infection, inflammatory, metabolic, musculoskeletal, neurology, ocular, respiratory, toxicity.

for product market entry.[2] Furthermore, a significant proportion of market entries (40%) was through R&D alliances, comparable to the proportion of market entries through internal development, which was predominantly studied with mergers and acquisitions in prior studies. There was also a large variation across markets in the rate of market entries through R&D alliances.[3] All of these empirical facts further support the need to study the phenomenon of cross-market alliances and how they are used in firms' expansion into new markets.

To give one illustrative example from data on a market entry through cross-market repeated alliance, Perlegen Sciences entered the neurology market in 2004 through a cross-market repeated R&D alliance with Pfizer. Although it was the first time that Perlegen Sciences was entering the market, having neither internal resources or relational resources in the market, the firm already had an existing partner from the cardiovascular market—Pfizer—that was operating in the neurology market. In the cardiovascular market, Perlegen Sciences and Pfizer were collaborating to discover genetic contributions to cardiovascular diseases. In the neurology market, their additional R&D alliance was to analyze drug response in patients with depression disorder treatment. On the contrary, to give an example that a firm finds a new partner in market entry, The Genetics Company also entered the neurology market in 2004 through an R&D alliance with Morphochem. Unlike Pfizer that was an existing partner of Perlegen Sciences, however, Morphochem was a new partner of The Genetics Company. The Genetics Company and Morphochem collaborated to develop drugs for the Alzheimer's disease.

[2] The other 60% of cross-market alliances were used for growth in product markets, where partners formed repeated alliances to grow in a market they were already in.

[3] There were five therapeutic areas where firms do not enter the market through R&D alliance at all: cardiovascular, dermatologic, gastrointestinal, genitourinary, and inflammatory. An interview with an industry expert suggested that firms enter therapeutic areas alone, rather than with a partner, where risks in clinical trials are low, competition is high, and combinatory drugs are less needed. I confirmed that there is also enough variation in the rates of entries through alliance among the other 10 markets.

Focusing solely on the alliance activities of a firm in a single market, rather than looking at the alliance activities of a firm across markets, the existing theories on alliance partner choice and alliance performance cannot provide explanations to why Perlegen Sciences chose Pfizer (existing partner) while The Genetics Company chose Morphochem (new partner) as market entry partner. Furthermore, the existing literature on when and why repeated alliances may perform better than new partner alliances cannot explain whether and why cross-market repeated alliances may perform better than new partner alliances in market entries. The following two chapters of my dissertation seek to provide answers to each of these questions.

Chapter 1. The *formation* of cross-market repeated alliances

In the first chapter of my dissertation, I examine when and why firms choose existing partners than new partners in market entries. In other words, I explore when firms enter markets through cross-market repeated alliances—with their existing partners from old markets—than through new partner alliances. In doing so, I also compare these market entries through alliances with other modes of entries internal development, M&A (Mergers and Acquisitions). Answering this question expands our understandings how firms enter markets and diversify by considering a mode of entry that has been largely missed in strategy literature: cross-market repeated alliance. While the extant literature on strategic alliances show that firms often repeat alliances with their existing partners to grow and perform better, it has been implicitly assumed in the existing studies that firms look for alliance partners in the same market as before, limiting our understandings on the use of repeated alliances and relational resources to each market.

I suggest in the first chapter that firm's existing partners from old markets can be valuable relational resources that can be leveraged in product market entry context. In fact, on

top of the benefits of repeated alliances (compared to new partner alliances) that are documented in the existing studies—trust and partner-specific knowledge—cross-market repeated alliances provide one additional benefit to firms: potential for new knowledge recombination. While previous studies point out the diminishing returns to alliances as costs of repeated alliances, such limitation may not apply to cross-market repeated alliances as they take place in a different market than the previous alliance between the partners. Partners can potentially tap into knowledge repository of each other that has not been accessed yet as they move the market of interaction. At the same time, however, alliance experience in one market with a partner does not guarantee that the partner is also valuable in another market because each product market requires different capabilities and technological knowledge. Accordingly, I suggest that firms are more likely to choose existing partners from old markets than new partners when the existing partners have relevant product development experience or technological knowledge in new market. In addition, there can be positive spillovers effect from repeated alliances in new markets to the existing alliances. Thus, I argue that firms are more likely to enter new markets through repeated alliances when the existing alliances are valuable; partners have high levels of technological knowledge in the old markets of alliances.

Using data on therapeutic area entries in the U.S. pharmaceutical industry, I find support for the arguments. The findings from the first chapter suggest cross-market repeated alliances can have two different implications on firm corporate strategy. First, firms leverage relational resources from their old markets to enter new markets and diversify. Second, firms can also enter new markets with their existing partners to strengthen their ties with the partners in old markets. In other words, positive spillovers effect from new market to old market can also be drivers

behind firms' market entries. These findings confirm the main idea of my dissertation that alliance activities of a firm across multiple product markets are not independent but interrelated.

Chapter 2. The *performance implications* of cross-market repeated alliances

In the second chapter of my dissertation, I further explore the performance implications of cross-market repeated alliances by comparing the market entry performances of firms that enter through cross-market repeated alliances and those that enter through new partner alliances. There are existing studies comparing the performance of repeated alliances to that of new partner alliances. The results in the existing studies suggest that repeated alliances cannot be sources of new ideas to the focal firm, leading to less novel knowledge creation. However, implicit assumption behind the existing studies is that repeated alliances take place in the same market as before when in fact, as my dissertation suggests, repeated alliances can take place in a different market than before. Such assumption is problematic because, unlike repeated alliances in the same market as before, cross-market repeated alliances can be sources of two types of novel knowledge creation: new knowledge generation and an application of existing knowledge to a new setting. In a cross-market repeated alliance where firms collaborate with the same partner but in a different market than before, firms access each other's knowledge repository more broadly than before. Furthermore, even the same set of knowledge that was accessed in previous alliance can be sources of novel ideas as partners can seek new application of the existing knowledge in a different market than before.

I use the therapeutic area entries through alliances in the U.S. pharmaceutical industry to test my theory. I do not find evidence that firms entering markets through cross-market repeated alliances conduct more clinical stage trials in the markets, but I find that those firms report drug

developments faster after the market entries than firms entering markets through new partner alliances. The findings suggest that firms can create new knowledge well through both cross-market repeated alliance and new partner alliance. However, the difference may be mostly in the speed at which firms create new knowledge. Such difference in the speed of knowledge creation is important in the setting of market entry. Together, while both cross-market repeated alliance and new partner alliance can be good strategic tools for knowledge recombination with a partner, cross-market repeated alliance can be more efficient way to create new knowledge than new partner alliance that lacks trust or accumulated relational asset.

Chapter 1.
Existing Partner, but From Somewhere Else:

Market Entry Through Repeated Alliances

1.1 Introduction

The question of who partners with whom in strategic alliances has long been of interest to strategy scholars (Ahuja, Polidoro, & Mitchell, 2009; Gulati, 1995a; Li, Eden, Hitt, & Ireland, 2008; Li & Rowley, 2002) because of its implications on firm growth (Katila, Rosenberger, & Eisenhardt, 2008; Stuart, Hoang, & Hybels, 1999) and performance in the market (Ahuja, 2000; Baum, Calabrese, & Silverman, 2000; Powell, Koput, & Smith-Doerr, 1996). One of the main findings from the literature is that firms often repeat alliances with the same partners (Gulati, 1995b; Gulati & Gargiulo, 1999) because of trust created between them (Gulati, 1995b; Zaheer, McEvily, & Perrone, 1998) and partner-specific knowledge and routines (Zollo, Reuer, & Singh, 2002) that make the existing partners more reliable and reduce uncertainty (Beckman, Haunschild, & Phillips, 2004; Lavie & Rosenkopf, 2006). In line with this literature, the relational view of competitive advantage recognizes partnerships with other firms as sources of competitive advantage because they are unique and value creating to the firm (Dyer & Singh, 1998; Lavie, 2006). Existing partners are not always preferred over new partner, however. Compared to new partner alliance, repeating alliance with the same partner may provide redundant knowledge or resources to firm, leading to diminishing returns from alliances (Burt, 1992). In this sense, studies have explored when firms choose an existing partner over a new partner to expand in markets that they already operate (hereafter, old markets), implicitly assuming that firms repeat alliances in the same market as previous alliance.

What remains less explored are, however, the possibility that firms can also enter new product markets with existing partners, and accordingly, the question of when firms choose existing partners over new partners in market entry. This is an important gap because firms continue to grow by entering new markets to stay competitive (Penrose, 1959; Rumelt, 1974; Teece, 1980), and it is a core strategy question to understand how diversified firms share (e.g., Harrison, Hitt, & Ireland, 1991; Karim & Kaul, 2015; Panzar & Willig, 1981) or reallocate (e.g., Chatterjee & Wernerfelt, 1991; Folta, Helfat, & Karim, 2016; Helfat & Eisenhardt, 2004; Wu, 2013) their existing resources in market entry. The key drivers behind the formation of repeated alliance—the advantages and disadvantages of repeated alliances over new partner alliances—can be different for market entry than those behind the formation of repeated alliance in the same market as previous alliance, calling for a need to examine when firms form repeated alliances in the market entry context. In repeated alliances in new market entry, unlike repeated alliances in the same market as before, diminishing returns on alliances are less of a concern because existing partners bring in different set of knowledge than previous alliances. At the same time, however, an existing partner who is valuable to the focal firm in an existing alliance is not necessarily as valuable or knowledgeable in a new market. Because a key component in R&D collaboration is an access to novel knowledge (Burt, 1992; McEvily & Zaheer, 1999; Powell, Koput, & Smith-Doerr,1996), and relatedly a potential for knowledge recombination between firms (Burt, 2004; Davis, 2016; Rosenkopf & Almeida, 2003), it is important to examine when and why firms would prefer an existing partner over a new partner in the context of market entry.

The main argument of this paper is that firms enter market through *cross-market repeated alliances*, or repeated alliances with existing partners from old markets, than through new partner

alliances, for mainly two reasons. First, firms can leverage their relational resources from existing markets to enter new markets when the existing partners have prior market experience or relevant technological knowledge in the new markets. Second, firms also enter new markets with existing partners to strengthen the existing relationships with them when the existing partners have high level of technological knowledge in old markets of alliances and thus valuable (Granovetter, 1985; Gulati, 1995b; Uzzi, 1996). In other words, market entry with an existing partner not only changes a firm's corporate scope but also strengthens the relationship in old markets. However, firms avoid relying on the same partner too much in both new market and old market because of appropriation concerns. In other words, firms seek to benefit in either new or old market of alliance by entering new market through repeated alliance with existing partners with relevant knowledge in either new or old market of alliance.

I test these ideas in the U.S. pharmaceutical industry where there are 15 different therapeutic areas.[4] R&D activities to develop drugs are core to firms' success in this industry, and firms actively collaborate with each other to conduct R&D projects and codevelop drugs (e.g., Aggarwal, 2020; Diestre & Rajagopalan, 2012; Hoang & Rothaermel, 2005; Powell et al., 1996; Rothaermel, 2001). Empirical data of this study confirms that both cross-market repeated alliance and market entry through it are salient phenomena. 46% of the repeated R&D alliances were formed in a different market than the previous R&D alliances, and among these cross-market R&D alliances, 40% were used for product market entry.[5]

[4] There are total 15 distinct product markets: cancer, infection, neurology, immune, metabolic, cardiovascular, inflammatory, gastrointestinal, respiratory, dermatologic, hematologic, genitourinary, ocular, musculoskeletal, toxicity.

[5] The other 60% of the cross-market alliances were used for growth in the product market, where partners formed repeated alliances to expand in a market that they were already in.

Using detailed data on R&D alliance activities, clinical trials, and patents of 1,400 firms for each therapeutic area from 1986 to 2019, I find support for the argument that firms are more likely to enter new markets with their existing partners from old markets when the existing partners are already incumbents in new markets or when they have high level of technological knowledge in new markets. Furthermore, the results suggest that strengthening the existing relationships in firm's old markets can also be a motivation for firm to enter new market through cross-market repeated alliance. Firms are more likely to repeat alliances to enter new markets: when the existing partners have high level of technological knowledge in those markets and thus valuable. I also find support that the positive relationship between the incumbency of the existing partners and market entry through cross-market repeated alliance is mitigated by the technological knowledge of the partners in old markets.

The findings of this study contribute to both strategic alliance literature and corporate strategy literature. First, they expand our understandings on the repeated alliances by showing that firms form repeated alliances in a different market than the original alliance and that the drivers behind those alliances are different than those behind repeated alliances in the same market as before. Second, the notion of cross-market repeated alliance allows us to identify for which product market firms collaborate. While the prior literature argues that firms form alliances for various projects, it is in fact hard to tell if the repeated alliances occur for different projects or firms simply renew the original alliances to continue the same projects. Because this study identifies the product market of each alliance, it extends the existing literature on repeated alliances by better identifying the formation of another collaborative project by firms. Finally, the results of this study contribute to firm diversification and market entry literature. On top of

the firm internal resources that have been examined as important pre-entry market resources of multi-business firms, this study shows that relational resources of firms at interfirm level can also be leveraged to enter new markets and expand corporate scope.

1.2 Theory and Hypotheses

1.2.1 Repeated Alliance in the Same Market As Previous Alliance

The extant literature on the partner choice between an existing partner and a new partner has highlighted three mechanisms behind why firms may or may not choose an existing partner. First, compared to a new partner alliance, trust has likely been created between partners who have collaborated previously (Gulati, 1995b; Ring & Van De Ven, 1994). Trust formed with a previous partner can be a source of competitive advantage because it allows the partners to arrive at an agreement with less time and effort, requiring less contractual governance (Barney & Hansen, 1994; Zaheer et al., 1998). With a lowered risk of opportunistic behaviors towards each other in alliance, the contract does not need to specify all contingencies possible in the future (Williamson, 1985). Instead of restricting the interaction strictly to what is specified in contract, partners cooperate and share resources more freely with trust that the counterpart will not act opportunistically (Dyer & Chu, 2003), producing better collaboration outcomes (Zaheer et al., 1998).

Second, partner-specific experience and knowledge about partner makes interaction easier and facilitates learning in repeated alliances. Through alliance processes, partners develop their own language that enables smooth communication within the relationship (Nelson & Winter, 1982) and interfirm routines that make interaction easier (Zollo et al. 2002) and facilitate learning (Gulati, Lavie, & Singh, 2009; Koka & Prescott, 2002). On the other hand, lacking a

history of relationship, there is no pre-existing routines or understandings on each other in a new partner alliance. Without knowledge about a partner, the focal firm has hard time internalizing the partner firm's knowledge (Cohen & Levinthal, 1990). Therefore, partner-specific experience and knowledge can be sources of relational competitive advantage, not being fungible outside of the specific relationship with the partner (Dyer & Hatch, 2006).

While repeated alliances are potentially more beneficial with trust and partner-specific knowledge accumulated through previous collaboration experiences, the quality of collaborative outcomes from repeated alliances may be compromised as partners repeatedly work together. Firms form alliances to access valuable knowledge or resources of partners that they do not have on their own (Capron & Mitchell, 2012; Mowery, Oxley, & Silverman, 1996). Therefore, one important aspect of interfirm alliance is that firms acquire diverse and novel resources and knowledge (Ahuja, 2000; Rowley, Behrens, & Krackhardt, 2000). Partners each bring in complementary resources and recombine them to achieve goals (e.g., new product development, cost reduction) that are not possible otherwise (Dussauge, Garrette, & Mitchell, 2000). When firms repeatedly interact with the same partner, however, such benefits of access to new resources are likely to be reduced because firms access redundant information and combine the same set of resources repeatedly with the partner (Goerzen, 2007; Rothaermel, 2001; Rothaermel & Boeker, 2008) and firms' resources converge (Dyer, Singh, Hesterly, 2018).

1.2.2 Relational Resources and Market Entry

However, the implicit assumption behind the existing studies on alliance partner choice is that firms search alliance partners in the same market as previous alliances. Accordingly, the alliance activities and existing partners in each market have been atomized and analyzed in separate

(Granovetter, 1992). Such unitary market assumption for alliance activities does not align well with what we know from diversification literature that firms often operate in multiple product markets and expand their corporate scope by entering new markets (Penrose, 1959; Teece, 1980). Multi-business firms create value in market entry by allocating resources from old markets and coordinating activities across their businesses efficiently. One of the main findings is that firms tend to enter market and perform well when they have relevant pre-entry market resources (Helfat & Lieberman, 2002; Montgomery, 1994; Montgomery & Wernerfelt, 1988) that can be used in market entry, be those managerial experience or human resources (Capron, 1999; Chang, 1996), manufacturing input resources or facilities (Giarratana, Pasquini, & Santaló, 2021), or technological knowledge (Kaul, 2012; Kim & Kogut, 1996; Silverman, 1999).

The idea that the existing partners are valuable resources of multi-business firms that can be used in market entry is consistent with the relational view of competitive advantage. The relational view of competitive advantage proposes that the sources of competitive advantage of firm can lie not only within firm boundaries but also in partnerships *beyond* firm boundaries (Dyer & Singh, 1998). Interfirm resources at a dyad level can be sources of competitive advantage because partner-specific investments and experiences have little relevance outside of the specific relationship, distinguishing relational rents from economic rents generated with internal firm resources (Lavie, 2006). Because the relational resources between partners are sticky to the relationship, relational rents from the combination of resources between the focal firm and a specific firm can be obtained only through the alliance with the specific partner (Dyer & Hatch, 2006) or acquisition of a firm that has relationship with the firm (Hernandez & Shaver, 2019).

Relatedly, previous studies suggest that existing partners may be relevant in market entry. The classic social networks studies document that actors have overlapping relationships in multiple domains and that the overlapping relationships affect the actors' economic outcomes (Granovetter, 1992; Verbrugge, 1978). In this sense, studies have shown that business relationships are intertwined with kinship and political networks (Han, Shipilov, & Greve, 2017; Li & Piezunka, 2019; Padgett & Ansell, 1993). Furthermore, in strategy literature, existing relationships of a firm are shown to have informational and structural benefits in the market entry context. Firms obtain relevant information on emerging product markets from their existing partners, allowing them to enter those markets promptly (Lee, 2007). Relationships with central or prominent incumbents also help new entrants to survive and grow by conferring the new entrants with legitimacy and signal of quality (Stuart et al., 1999). For firm-client relationships, a few studies have also looked at how a firm establishes grounds in a new market by repeating transactions with an existing client from previous market where the firm provides services on behalf of the client (e.g., Byun, 2018; Jensen, 2003).

In this study, I examine when and why the relational resources accumulated in the existing alliances from old markets are transferred across market boundaries to be used for entry into a new market (i.e., market entry through repeated alliance). This question is worth investigating because the mechanisms behind firms' choices between an existing and a new partner elaborated in the earlier section differ in a new market where the partners have not collaborated before; the merits of trust and partner-specific experience are reinforced and the problem of diminishing returns on alliance is mitigated. Moreover, the formation of cross-market repeated alliance is unique in that partners will be collaborating in two different market domains;

being able to affect each other and know each other's knowledge and products, interdependence between partners increases and opportunistic behaviors are further deterred with retaliation concerns. The benefits of partner-specific knowledge and experience are also heightened in cross-market repeated alliance because the smooth communication and understandings on each other are especially important when partners collaborate in a different market than before. More importantly, cross-market repeated alliance suffers less from the problem of diminishing returns because the market of collaboration and the products they are developing have changed.

For the reasons illustrated above, repeated alliances are potentially even more preferrable than new partner alliances in market entry. At the same time, however, an existing partner from an old market is not necessarily a good partner for market entry because the partner's resources in the existing market of alliance are different from those in the new market. For example, a partner firm who was experienced or knowledgeable in the existing market of alliance (e.g., infection market) is not necessarily as experienced or knowledgeable in a new market (e.g., neurology market). Relational resources pertaining to partner firms' knowledge—complementary resources and capabilities—are also less transferrable across market boundaries and accordingly *market-specific*. Since developing products in each product market requires different sets of technologies and knowledge, it is important that the potential partner has relevant knowledge in the respective product market. Together, the stickiness of partner resources to each product market suggests that existing partners from old markets are more likely to be preferred in market entry when they have relevant experience or resources in a new market.

Product development experience of a partner firm in a new market is relevant market knowledge that can be valuable to the focal firm who is a new entrant to the market. For a new

entrant, an incumbent partner, or a partner firm with product development experience in the market, can be helpful in navigating the product development processes that are specific to each product market. By collaborating with an incumbent, a new entrant can receive guidance on product development and learn fast how to develop products in the market. In this sense, existing partners who are incumbents with product development experience in a new market are valuable pre-entry relational resources of a firm. Therefore, I suggest the following hypothesis.

Hypothesis 1a: A firm is more likely to enter a new market with an existing partner than a new partner when the firm has incumbent existing partner(s) in the new market.

In addition to the product development experience, technological knowledge of partner firms in the product market can also be valuable to the focal firm. The more the technological knowledge a partner has, the more likely that the focal firm will be able to access complementary knowledge that it does not have internally and recombine with its own knowledge in collaboration, leading to better collaboration outcome. The technological knowledge of a partner also provides learning opportunities for the firm. Because knowledge flows between partners during alliances, the more technological knowledge a partner has, the more private benefit (i.e., knowledge transfer from partner) the focal firm can potentially obtain from the alliance. Thus, firms are more likely to leverage their relational resources from their existing markets when their existing partners have high levels of technological knowledge in a new market.

Hypothesis 1b: The more technological knowledge that a firm's existing partners have in a new market, the more likely that the firm enters the market with an existing partner than a new partner.

1.2.3 Spillovers to Existing Alliances

I thus far focused on how firms can benefit from the existing partners in the new market, and accordingly the characteristics of the existing partners in the new market: product development experience and/or technological knowledge in the new market. In addition to the direct benefits in the new markets, another important benefit of market entries through repeated alliance comes from spillovers to the existing alliances with the partners. With collaborations in multiple product markets, better coordination between the partners is further assured and better understandings on each other can benefit the existing alliances in the old markets.

There are several mechanisms through which the repeated alliance in new market strengthens the existing collaborations. These mechanisms are relevant both to cross-market repeated alliances and same-market repeated alliances, but they are stronger for cross-market repeated alliances because partners collaborate in multiple product markets simultaneously. First, the partner firms are reliant on each other for the product development in multiple markets. Therefore, partners' behaviors in one market have implications on the exchange relationship not only in the respective market, but also in other markets that they are collaborating (Gimeno & Woo, 1996). Second, beyond the influence on partners in the immediate alliances with each other, partners can also potentially sanction the opportunistic behaviors of each other more effectively in multiple markets because they understand each other's knowledge stock and product portfolios in those markets through collaborations (Chen, 1996; Ryu, Reuer, & Brush, 2019). A partner's opportunistic behaviors in one market can be punished not only in the respective market, but also in another market of alliance. A similar mechanism of mutual forbearance has been suggested in the multimarket competition literature; when competitors

encounter each other in multiple product markets, they restrain competitive action towards each other in a market because of retaliation concerns in other product markets. Third, the reputation as alliance partner in each product market can also spillover across market boundaries (Coleman, 1988; Provan, 1993). Noncooperation or opportunistic behavior of a firm in an alliance can potentially harm the firm's reputation as alliance partner in both new and old market, as partners can spread the words in both markets. The third parties, or the other firms, will view the firm as untrustworthy and such evaluation discounts the firm's value as potential alliance partner.

Another spillovers effect from a new market alliance to an old market alliance comes from better understandings on the existing partner. Some of the knowledge on the partner that the focal firm learns through alliance in a new market can be applicable to old market alliance with the partner. As the focal firm taps into the knowledge repository of the partner in multiple product markets and interact more broadly than before, the focal firm becomes aware of the partner's knowledge or capabilities that can be utilized in their alliance in old market and tacit knowledge transfer is facilitated (Beckman & Haunschild, 2002; Uzzi & Gillespie, 2002). For example, the focal firm may learn from managers or scientists involved in a new market alliance about what their colleagues in an old market are capable of or what new technologies they are developing. General knowledge about each other (e.g., communication manner, intrafirm invention processes) can also be further accumulated. The learning benefits that spill over from new market to old market can rejuvenate the old market alliance and help maximizing its potential.

In sum, the existing alliance with a partner in old market can benefit from a new market entry with the partner; cooperation of the partner is further assured and the partners understand

each other better. Such spillovers benefits of market entries with existing partners will be greater when the existing alliances in old markets are expected to generate high value. As argued earlier for the benefits in new market, partner's technological knowledge is important in interfirm alliance for product development; there are more opportunities for the focal firm to learn from the partner and to recombine its own knowledge with partner's to develop new products. Thus, the more technological knowledge that partners have in old markets of alliance, the more likely that firms will enter new markets with the existing partners because of the high potential value of those old market alliances.

Hypothesis 2: The more technological knowledge that the firm's existing partners have in the existing (old) markets of alliances, the more likely that the firm enters a market with an existing partner than a new partner.

1.2.4 Benefitting in Either New or Old Market

Thus far I have argued that there are mainly two different ways that the focal firm can benefit from market entry through repeated alliance: benefitting from existing partner's relevant product development experience or technological knowledge in a new market or benefitting from existing partner's technological knowledge in old market alliance. It would be ideal for the focal firm to benefit in both new and old markets by entering a new market with an existing partner who has relevant experience or knowledge in new market, and at the same time, is valuable in old market of alliance. However, partner firm's characteristics that benefit the focal firm in either new or old market imply that the partner firm benefits the focal firm more than the focal firm benefits the partner firm. From the partner's perspective, if the partner has more experience and knowledge than the focal firm in both new and old markets of alliance, there is little benefit for

the partner firm in either market. Considering that the alliance formation is a two-way process where both partners should agree to collaborate with each other, not only the focal firm's but also the partner's incentives to form cross-market repeated alliance in (the focal firm's) new market matter. Therefore, it may be hard for the focal firm to capture benefits in both new and old markets at the same time. Instead, it is more likely that the benefits to the partner firms in two product markets (new and old) will be balanced out; the focal firm benefits in new (old) market but the partner firm benefits in old (new) market. Taking the partner firm's incentives into account, I argue that there are negative moderating effects of the benefits in old markets on the benefits in new markets. In other words, the positive relationship between the benefits in a new market to the focal firm and market entry through a repeated alliance reduce as the benefits in old markets to the focal firm increase, and vice versa, because it is unlikely that the focal firm can benefit more on both sides of the markets compared to its partner.

I first consider how the partners' level of technological knowledge in old markets moderate the positive relationship between the incumbency of the existing partners in a new market and the choice of an existing partner over a new partner. The logic behind the positive relationship between the incumbency of the existing partners in a new market and the choice of an existing partner (Hypothesis 1a) was that the focal firm will benefit from the existing partners' market experience in the new market. When the focal firm, as a new entrant, benefits in a new market by entering through an alliance with an incumbent existing partner, it is less likely that the focal firm can also benefit (more than the partner firm does) in the old markets of alliances. Instead, when the partner firm is an incumbent in a new market, I predict that the focal firm will have more technological knowledge than the partner firm so that the partner firm can

benefit in the old market and be incentivized to agree to collaborate with the focal firm in the new market. In other words, while the focal firm will benefit more from the partner firm in a new market than vice versa, the partner firm will benefit more from the focal firm in an old market than vice versa.

Hypothesis 3a: The technological knowledge of existing partners in old markets negatively moderates the positive relationship between the incumbency of existing partners in a new market and the choice of existing partner.

In a similar way, I consider how the partners' level of technological knowledge in old markets moderate the positive relationship between the partners' level of technological knowledge in a new market and the choice of an existing partner over a new partner. The logic behind the positive relationship between the partners' level of technological knowledge in a new market and the choice of an existing partner (Hypothesis 1b) was that the focal firm will benefit from the existing partners' technological knowledge in the new market. When the focal firm benefits from the technological knowledge of the partner firm in a new market more than the partner firm benefits from that of the focal firm, it is less likely that the focal firm can also benefit (more than the partner firm) in the old markets of alliances; the partner firm is less likely to be incentivized to form such cross-market repeated alliances where the partner firm benefits less than the focal firm in both markets. Rather, I expect the level of technological knowledge of the focal firm and the partner firm to balance out in new and old market.

Hypothesis 3b: The technological knowledge of existing partners in old markets negatively moderates the positive relationship between the technological knowledge of existing partners in a new market and the choice of existing partner.

Figure 1 summarizes the hypotheses in this study. The hypotheses in this study examine partner traits in new market or old market, or interaction between the two. Hypotheses are grouped together in a dotted line for either new market traits or old market traits.

Insert Figure 1 about here

1.3 Data and Methods

1.3.1 Context, Sample, and Data

I test my hypotheses in the U.S. pharmaceutical industry. The setting is appropriate to test my theory in several ways. First, it is comprised of multiple distinctive, yet related, markets so that alliances in each market are distinguished, but at the same time, are expected to be relevant to each other (e.g., Garg & Zhao, 2018; Ryu et al., 2019). Many different drugs are developed in the industry to target different disease groups, and thus belong to different therapeutic areas. Second, it is a knowledge-intensive industry where innovation is important to firm performance. Therefore, many of the mechanisms that I suggest, including knowledge in each product market, understandings on who knows what, are especially applicable in this setting. In this spirit, pharmaceutical industry has been studied much in both innovation literature and alliance literature. Last, my theory suggests that existing relationship can be utilized for firm's entry into another market and benefit the firm. Since previous studies have extensively examined alliances in pharmaceutical industry (e.g., Hoang & Rothaermel, 2005; Powell et al., 1996; Yang et al., 2015), it is useful to test my ideas in the same setting to see how disentangling alliances across markets can advance our knowledge on repeated alliances.

I combined two main data sources, Cortellis Deals Intelligence (CDI)[6] and Cortellis Competitive Intelligence (CCI), to configure fine-grained datasets on alliance activities, drug development activities, and patents of firms in each therapeutic area. CDI allows me to identify alliances in each therapeutic area from 1980 to 2019. The nature of alliance can vary depending on the type of alliance, and alliances of different types can be less relevant to each other. Therefore, R&D alliance, which is important to firm activities in the industry and involve high level of interaction and knowledge sharing, is main type of alliance that is analyzed. One of the prominent forms of R&D alliances in pharmaceutical industry is co-development of drugs where both parties in alliance actively involve in the process. I do control for other types of alliances (explained more in detail below). Using these data, as I described in the previous section, I was able to confirm that there is a variation in terms of where repeated alliances are formed and that repeated alliances across product markets are empirically significant phenomenon; about half of the repeated alliances take place in the same market as before, and about half of the cases take place in a different market than before. In addition to alliances, I also identify M&A (Mergers and Acquisitions) cases with the database 1) to identify ownership changes of firms and 2) to identify market entries through M&A.

With CCI, I collect data on drug development activities and patents of each firm for each year in the U.S. As in CDI, CCI also identifies therapeutic areas of each drug, allowing me to measure firm's operation in each product market (i.e., therapeutic area). Furthermore, I assign each patent to therapeutic areas, using the information on the disease indications of each patent, to identify the level of firm's technological knowledge in each product market.

[6] *Recombinant Capital database* has been merged into *Cortellis Deals Intelligence*.

The unit of analysis of this study is firm-year-therapeutic area. For each year-product market from 1986 to 2019, samples include firms that did not exist in the product market (i.e., no clinical trials or R&D alliances) in the last five years but entered the product market through R&D alliance. The sample includes all firms that had any kind of activities in pharmaceutical industry in the last five years. Firms without any existing partners are excluded from my final sample, because, by definition, those firms cannot form repeated alliances.

1.3.2 Variables

Dependent variable. The dependent variable is *Entry with an existing partner*, which is a dummy variable that takes the value of *1* when the market entry partner is firm's existing partner (i.e., market entry through repeated alliance) and *0* when the market entry partner is firm's new partner (i.e., market entry through new alliance). For each firm, I identify partner firms that the firm had R&D alliance with in the last five years as existing partners. By restricting existing alliances as those in the last five years, my measurement of repeated alliance is conservative, counting only those that are recent and relevant. Moreover, given that alliances usually last for several years, repeated alliances in this study are likely to be occurring simultaneously with the original alliances, consistent with my argument that one of the benefits of cross-market alliance is that it further strengthens relationship with the partner in old market.

Independent variables. The first variable of interest is *Incumbent existing partners exist*, which is a dummy variable that takes the value of *1* when there is at least one existing partner already operating in a new market and *0* when there is no existing partner in a new market. To measure *Partners' (relative) level of knowledge in new market*, I first count the number of patents that a partner has been granted in the last five years in the market. Then, to capture the

relative strength of the partner, I subtract the number of patents that the focal firm has in the market from this value. Then, I add this value of each existing partner of the focal firm. The variable is rescaled in thousands. To better illustrate, consider an example where a firm had three previous partners in new market. The first partner was granted 5 patents in the market in the last five years, the second partner 3, and the third partner 10. The focal firm was granted 2 patents in the market. In this example, Partners' (relative) level of knowledge in new market is {(5-2)+(3-2)+(10-2)}/1000=0.012.

Partners' (relative) level of knowledge in old markets of alliances is measured in a similar way. For each partner, I subtract the number of patents that the focal firm has in the market of alliance from the number of patents that the partner has in the market. Then, I add this value of each existing partner of the focal firm. The variable is rescaled in thousands. For example, consider an example where a firm has three existing partners, each in cancer market, dermatologic market, and neurology market. Partner in cancer market was granted 10 patents in the market in the last five years, partner in dermatologic market 3 patents, and partner in neurology market 20 patents. The focal firm's number of patents in each of these three markets are 5, 2, and 30, respectively. In this case, the measure is calculated as {(10-5)+(3-2)+(20-30)}/1000=-0.004.

Control variables. I include several firm characteristics as controls. First, I control for *Total number of existing partners* to control for the level of relational resources that the firm has. Second, *Total number of markets*, which is the number of product markets that the firm have either clinical trials or R&D alliances in the last five years, is also controlled for to account for the firm's level of diversification in pharmaceutical industry. In addition, I include dummy

variables for the type of firm. In my data, there are pharmaceutical firms, biotechnology firms, and other firms with activities in the pharmaceutical industry.[7] Third, I control for firm's number of clinical trials (*Total number of clinical trials*) (in thousands) and the level of technological knowledge across all product markets (*Total number of patents*) (in thousands). Fourth, *Market relatedness (all)* between firm's other markets and the entering market is controlled for, considering that market relatedness is related to firm's diversification into markets. To measure this variable, for each dyad of product markets, I calculate the proportion of patents that are applicable in both product markets (granted in the last five years). Then, I calculate the average of this value for all dyads of firm's other market and new market. I also include *Market relatedness (markets of old alliances)*. This variable is calculated in a similar way as *Market relatedness (all)*, but between firm's old markets of alliances and new market.

A few variables relevant to new market are also controlled for. I control for *Size of new market* (in ten thousand), measured as the average number of clinical trials in the therapeutic area during the last five years. *Growth rate of new market* is also controlled for. The measure is constructed followingly. The market growth rate of each market-year is calculated based on the total number of clinical trials in the market. For year *t*, the variable is calculated as $\frac{total\ number\ of\ clinical\ trials_t - total\ number\ of\ clinical\ trials_{t-5}}{total\ number\ of\ clinical\ trials_{t-5}}$. I then calculate the z-score of market growth rate using the mean and standard deviation of growth rates in each year, because the growth rates of the product markets follow similar time trends with less variation within each year. For the focal firm, I control for *Proportion of patents in new market*, or the number of

[7] For example, *Accenture*, which primarily provides accounting and consulting services to clients, is included in my sample because they had several alliances with pharmaceutical firms for consulting. *Accenture* is the last type of firm in the data. There are about 8% of this type of firm in the final sample.

patents that the focal firm has in new market divided by the total number of patents that the focal firm has across all therapeutic areas, to consider how much the focal firm has potentially been investing in the new market technologically before market entry. *Cumulative activities in new market* is also controlled for, which is a dummy variable that equals *1* if there were any type of activities (clinical trials, R&D alliances, other types of alliances) in any of the years preceding the entering year and *0* otherwise.

I also include a few variables relevant to the old markets of alliances. I include *Size of old markets of alliances* (in ten thousand), the average of the market sizes of therapeutic areas of old alliances. The market size of each therapeutic area is measured in the same way as *Size of new market*. I also control for *Proportion of patents in old markets of alliances*, or the number of patents that the focal firm has in the old markets of alliances divided by the total number of patents that the focal firm has across all therapeutic areas. In a similar way, I also control for *Proportion of clinical trials in old markets of alliances*.

1.3.3 Empirical Model Specification

There are possible selection effects of entering a market through alliance; it is an important firm decision to enter a market that is possibly influenced by many factors. Firms carefully choose an entry mode when they enter a market: internal development, M&A (Mergers and Acquisitions), and alliance, which is the focus of this study. Therefore, I use a two-stage Heckman selection model to control for firm's propensity to enter market through R&D alliance.[8]

[8] A different source of endogeneity may come from the fact that the alliance formation is a two-sided matching process; both parties in alliance should agree to form alliance. Mindruta and her colleagues (Mindruta, 2013; Mindruta, Moeen, & Agarwal, 2015) has introduced the maximum score estimator (Fox, 2010) to the matching problems in strategy literature. However, the two-sided matching model is not appropriate for this study for various reasons. In Appendix A, I explain more why the matching model is not appropriate for this study. I also provide the results of the possible matching model relevant to this study.

In the U.S. pharmaceutical industry, firms' propensity to enter market through R&D alliance varies a lot across product markets. In fact, there were no entries by firms through R&D alliances in several therapeutic areas in the entire study period. There were 5 therapeutic areas where firms did not enter the market through R&D alliance: cardiovascular, dermatologic, gastrointestinal, genitourinary, and inflammatory. An interview with an industry expert suggested that firms enter therapeutic areas alone, rather than with a partner, where risks in clinical trials are low, competition is high, and combinatory drugs are less needed. I confirmed that there is also enough variation in the rates of entries through alliances among the other 10 markets. Table 1.1 shows the number of entries by firms into each therapeutic area for each entry mode from 1986 to 2019 for the samples included in the first stage. Accordingly, I use the proportion of market entries through R&D alliances, the number of market entries through R&D alliances divided by total number of potential market entries, in the last five years at the market level (*Proportion of R&D alliance entries)* as an exclusion restriction of Heckman selection model. While factors that drives firms to enter the market through R&D alliances at a market level may be relevant to a specific firm's decision to enter a market through R&D alliance, there is little reason to believe that it directly affects firm's decision to choose an existing partner over a new partner.

Insert Table 1.1 about here

For each year-product market, the first stage probit regression includes firms that did not exist in the product market in the last five years and have at least one existing partner. I restrict my samples to the firms with at least one existing partner to make the samples more comparable. Firms that do not have any existing partners do not have an option of choosing an existing

partner over a new partner as market entry partner. The first stage predicts firm's propensity to enter the market through R&D alliance. In other words, the dependent variable in the first stage (*Entry through R&D alliance*) takes the value of *1* for R&D alliance market entry cases and *0* for all other cases (no market entry, market entry through internal development, M&A).[9] The first stage regressions include all control variables, year fixed effects, and product market dummies. I included the resulting inverse mills ratio from this first stage in the second stage models to account for the selection effects into R&D alliance market entry (Heckman, 1979).

The second stage main models are probit regression models with year fixed effects and product market dummies.[10] The second stage includes firms that entered a product market through alliance and had at least one existing partner.

1.4 Results

1.4.1 Main Results

Table 1.2 shows descriptive statistics and the bivariate correlation matrix for the variables used in the analyses.

Insert Table 1.2 about here

Table 1.3 includes the descriptive statistics on the number of existing partners of the firms in the final sample of the second stage. The number of final sample in the second stage is smaller than the total number of R&D alliance entries described in Table 1.1 because there were a few years with no variance in the dependent variable (i.e., partner choice) during the study

[9] There were very few cases of market entries through M&As in the final sample (first stage): 13 cases among total 5,637 market entries.

[10] I report results using logit regression models with year fixed effects and product market dummies in Appendix B, and the results are consistent.

period and all models include year dummies. While I control for the number of existing partners in models, the main variables are aggregated at the firm level when there is more than one existing partner.[11] To better illustrate the data, this table shows how many existing partners firms have in more detail. In Panel A, the table on the left shows that 500 samples (about 35% of the samples) have only one existing partner. In other words, for these cases, the main variables are calculated based on the traits of a single existing partner, and the single existing partner is chosen as the entry partner when the dependent variable equals *1*. Next, 312 samples (about 22% of the samples) have two existing partners. For these samples, the main variables are calculated based on the traits of the two existing partners of focal firm, and one of the two existing partners is chosen as entry partner when the dependent variable equals *1*. There are 203, 129, 274 samples (about 14%, 9%, 19% of the samples) with 3, 4, or 5 or more existing partners, respectively. On the right, I also show the number of samples for each number of existing partners by partner type: incumbent, non-incumbent. The type of existing partner, incumbent or non-incumbent, has important implications on the market entries of the firms. If an incumbent existing partner is chosen as entry partner, the focal firm enters a new market through an alliance with an incumbent who is already operating in the market. On the other hand, if a non-incumbent existing partner is chosen as entry partner, it implies that two new entrants formed an alliance to enter new market together. To investigate in more detail, I conduct supplementary analyses on the types of existing partners—incumbent and non-incumbent—later.

Panel B shows the summary statistics for each type of partner: all partners, incumbent partners, and non-incumbent partners. Panel C shows, for each type of existing partner

[11] As a robustness check, I later show the regression results using samples with only one existing partner to check if aggregating partner traits at the firm level affects the results.

(incumbent, non-incumbent), the total number of existing partners that the final sample of firms have and the number of existing partners that were chosen. The proportion of incumbent partners chosen among all incumbent partners that the final sample of firms had is 32.47%, while that for non-incumbent partners is 17.41%. In other words, the proportions suggest that an incumbent existing partner is more likely to be chosen than a non-incumbent existing partner.

Insert Table 1.3 about here

Table 1.4 shows the first stage probit regression results. The first stage estimates the likelihood that a firm enters a new market through an alliance (compared to no entry, entry through internal development or M&A) and calculate the inverse mills ratio from the estimation. The first stage model helps us controlling for the selection effects into market entries through R&D alliances. Model 1 includes all control variables that are included in the main models, main variables of interest, and the instrumental variable, *Proportion of market entries through R&D alliances*. The coefficient of *Proportion of market entries through R&D alliances* is positive and significant ($p<0.01$), confirming that firms are more likely to enter a market through R&D alliance when the market has high proportion of market entries through R&D alliances. As predicted, *Incumbent existing partners exist* is positively associated with market entry through R&D alliance ($p<0.01$); firms are more likely to enter market through R&D alliance when they have existing partner(s) in new market. The coefficients on *Partners' (relative) level of knowledge in old markets of alliances* is also positive and significant ($p<0.05$), suggesting that firms are more likely to enter market through R&D alliance when their existing alliances are valuable. This is consistent with the findings in alliance literature that firms with accumulated alliance experience are more likely to use alliance capabilities in the future (Kale & Singh,

2007). The coefficient on *Partners' relative level of knowledge in new market* is positive but not significant. The results in Model 2 are consistent with those in Model 1, but the significance on *Partners' (relative) level of knowledge in old markets of alliances* is reduced. It may be due to the multicollinearity problem as the two interaction terms added in the model include the variable. To account for the selection effects, the full model (Model 2) is used to calculate the inverse mills ratio to be included in the respective model in the second stage.

Insert Table 1.4 and 1.5 about here

Table 1.5 presents two alternative first stages. To examine if the main variables of interest also predict the market entry itself, Models 1 and 2 construct the dependent variable in a different way, estimating the likelihood that a firm enters a new market compared to not entering the market. In these models, the dependent variable equals *1* when a firm entered market and *0* when a firm did not enter market. In Model 1, all the main variables—*Incumbent existing partners exist, Partners' (relative) level of knowledge in new market,* and *Partners' (relative) level of knowledge in old markets of alliances*—are positive and significant ($p<0.01$, $p<0.05$, and $p<0.05$ respectively), suggesting that existing partners' previous experience, knowledge in new market, and knowledge in old markets of alliances increase the likelihood that the firm enters new market. These results suggest that the firms' alliance activities and partner characteristics not only affect firms' decision to enter new markets through R&D alliances (Table 1.4), but also affect market entry decisions themselves. Model 2 is a full model with two interaction terms, and the results are consistent.

To test if the main variables of interest also predict the choice of R&D alliance as entry mode over other modes of entry (internal development or M&A), Models 3 and 4 use a

subsample of firms that entered new markets and set dependent variable equal to *1* when a firm entered market through R&D alliance and *0* when a firm entered through internal development or M&A. *Proportion of R&D alliance entries (%)* in these models is calculated accordingly as the number of market entries through R&D alliances divided by total number of market entries. The models estimate the likelihood that a firm enters new market through R&D alliance compared to other modes of entry (internal development or M&A). None of the main variables of interest are significant, suggesting that firms' alliance activities and partner characteristics matter less for the choice of R&D alliance as entry mode over other modes of entry, given that firms have chosen to enter new market. The results are consistent in a full model (Model 4).

Table 1.6 presents the second stage probit models, where the dependent variable is whether a firm chooses its existing partner or a new partner as entry partner to a new market. Model 1 includes only control variables. Model 2 adds the first main variable, *Incumbent existing partners exist*. Hypothesis 1a predicted that firms are more likely to enter new market with an existing partner when there is one or more incumbent existing partner(s) in new market. The coefficient on *Incumbent existing partners exist* is positive and significant ($p<0.05$), supporting Hypothesis 1a. Specifically, holding all other variables at their means, the predicted probability of choosing an existing partner as entry partner is 8.9% for firms having incumbent partners in a new market, compared to a predicted probability of 0.7% for firms without incumbent partners in a new market. Model 3 includes control variables and *Partners' (relative) level of knowledge in new market*. The variable is positive and significant ($p<0.05$), supporting Hypothesis 1b: the more technological knowledge that the existing partners have in new market, the more likely that the focal firm will enter market through an alliance with an existing partner. The result is

economically significant as well. Holding all other variables at their means, the predicted probability of choosing an existing partner as entry partner is 1.4% for firms with *Partner's (relative) level of knowledge in new market* one standard deviation below its mean, compared to a predicted probability of 5.7% for firms with *Partner's (relative) level of knowledge in new market* one standard deviation above its mean.

Insert Table 1.6 about here

Model 4 tests the hypothesis on the spillovers to the existing alliances (Hypothesis 2). In Model 4, the coefficient on *Partners' (relative) level of knowledge in old markets of alliances* is positive and significant ($p<0.05$), supporting Hypothesis 2. The level of technological knowledge of partners in markets in old markets of alliances is positively related to firms' choice of existing partner over new partner for market entry. The result is economically significant as well. Holding all other variables at their means, the predicted probability of choosing an existing partner as entry partner is 1.8% for firms with *Partner's (relative) level of knowledge in old markets of alliances* one standard deviation below its mean, compared to a predicted probability of 5.3% for firms with *Partner's (relative) level of knowledge in old markets of alliances* one standard deviation above its mean.

Models 5 and 6 test the Hypothesis 3a and 3b where I suggested the interaction effect between partners' characteristics in new market and old markets of alliances. In Model 5, the interaction term between *Incumbent existing partners exist* and *Partners' (relative) level of knowledge in old markets of alliances* is negative and significant, suggesting that partners' level of knowledge in old markets of alliances is more important in forming cross-market repeated alliances for market entry when existing partners do not have prior market experience in a new

market (i.e., existing partners are non-incumbents). Thus, Hypothesis 3a is supported. In Model 6, the interaction term between *Partners' (relative) level of knowledge in new market* and *Partners' (relative) level of knowledge in old markets of alliances* is not significant. Hypothesis 3b is not supported.

Model 7 is a full model that includes all variables. The above results are consistent in this full model. The statistical significance of the coefficient on *Partners' (relative) level of knowledge in new market* reduces, but the direction of the coefficient is the same. It may be due to a multicollinearity issue associated with multiple interaction terms included in Model 7. Based on Model 7, Figure 2a plots the predicted probabilities of choosing an existing partner as entry partner for firms with and without incumbent partners in new market for varying levels of partners' (relative) level of knowledge in old markets of alliances from 5% quantile to 95% quantile of the variable, holding all other variables at their means. The figure shows that, when a firm's existing partners are weaker than the firm in old markets of alliances, the firm is more likely to choose an existing partner as entry partner when there are incumbent existing partners in new market than when there are no incumbent existing partners in new market. When a firm's existing partners are stronger than the firm in old markets of alliances, the firm is more likely to choose an existing partner as entry partner when there are no incumbent existing partners in new market than when there are incumbent existing partners in new market, though the difference is not statistically significant. Figure 2b plots the difference in the two predicted probabilities in Figure 2a. Because the dependent variable is binary and I use probit models accordingly, I use a simulation-based approach (Zelner, 2010) to plot both figures with the point estimates and 95% confidence intervals around each of them. Again, the plot suggests that the predicted difference

between firms with incumbent existing partners and firms without incumbent existing partners is significant when their partners are weaker in old markets of alliances. Relative to a firm with partners' (relative) level of knowledge in old markets of alliances at one standard deviation below mean, a firm with partners' (relative) level of knowledge in old markets of alliances at one standard deviation above mean is 7.4% more likely to choose an existing partner when it has incumbent existing partners in new market, but only 4% more likely to choose an existing partner when it does not have incumbent existing partners in the new market.

Insert Figure 2 about here

1.4.2 Robustness Checks

Although firm-year-therapeutic area is an appropriate level of analysis to examine partner choices in market entries, the results in the main analysis do not reveal who is ultimately chosen as entry partner when the focal firm has more than one existing partners. When firms have more than one existing partner to choose from, the theory in this study implies that firms will prefer 1) incumbent existing partner over non-incumbent existing partner (Hypothesis 1a), 2) partner with a high level of technological knowledge in a new market (Hypothesis 1b), and 3) partner with a high level of technological knowledge in old markets of alliances (Hypothesis 2). In addition, Hypothesis 3a and 3b suggest that firms will choose a partner who is strong either in new or old market. To inspect if this is the case, for the firms that chose an existing partner over a new partner, I look at the characteristics of the existing partners who are ultimately chosen as entry partners. In Table 1.7, the descriptive statistics on market entry partners in repeated alliances are consistent with the theory. Panel A reports the number of chosen partners for each of the four types of partners, considering the incumbency in new market and the relative strength in old

market. Panel A shows that more than half of the partners in repeated alliance market entries are incumbents in new markets (Hypothesis 1a). In addition, 85.6% of the chosen partners had more or the same amount of technological knowledge than the focal firm in old market of alliance (Hypothesis 2). Considering the traits of the chosen partners in new and old market together, more than half of the chosen partners was attractive in either new or old market; 42.3% of the chosen partners were non-incumbent with technological knowledge that is stronger than or equal to the focal firm in the old market of alliance, and 8.2% of the chosen partners were incumbent with technological knowledge that is weaker than the focal firm in the old market of alliance (Hypothesis 3a). Panel B reports the number of chosen partners for each of the four types of partners, considering the relative strength in new and old market. Panel B shows that, for about 85.6% of the cases, partners in repeated alliance market entries were stronger than or equal to the focal firm in new market (Hypothesis 1b). Considering the relative strength of the chosen partners in new and old market together, 9.3% of the chosen partner were stronger than or equal to the focal firm in old market but not in new market, and 8.2% of the chosen partners were stronger than or equal to the focal firm in new market but not in old market. In sum, consistent with the regression results in Table 1.6, the substitutive effect of the partner strength in new and old market seems to be more salient for the incumbency in new market than for the relative level of technological knowledge in new market.

Insert Table 1.7 about here

The second robustness check replicates the main analysis with a subsample of firms with only one existing partner. By restricting the samples to the firms with a single existing partner, the explanatory variables in Table 1.8 and 1.9 measure the characteristics of the existing partner

(i.e., potential market entry partner that is chosen), instead of aggregating the characteristics of multiple existing partners. Table 1.8 presents the first stage regression results with the subsample.

Insert Tables 1.8 and 1.9 about here

Table 1.9 reports the second stage regression results with the subsample. Model 1 is a baseline model with control variables. The results are mostly consistent with the results in the main analysis (Table 1.6), suggesting that the results in the main analysis is not affected by the aggregation of the characteristics of multiple existing partners at the focal firm level.

1.4.3 Supplementary analysis

In Table 1.10, I examine whether the two types of existing partners—incumbent existing partner and non-incumbent existing partner—and their traits matter in the choice of existing partner as entry partner in different ways. While incumbent existing partners have product development experience, non-incumbent existing partners are not in a new market as the focal firm. According to the argument that firms will benefit from partners either in new or old markets of alliances (Hypothesis 3a and 3b), important incentives behind the choice of existing partner as entry partner may be different for when choosing an incumbent existing partner and when choosing a non-incumbent existing partner. Firms may choose incumbent existing partners to benefit from them in new markets. On the other hand, market entries with non-incumbent existing partners may be driven more by the incentives to strengthen the existing alliances. To test this idea, I separate each of the two main variables of interest on partners' technological knowledge (*Partners' (relative) level of knowledge in new market* and *Partners' (relative) level of knowledge in old markets of alliances*) (in thousand) into incumbent partners' level of

knowledge and non-incumbent partners' level of knowledge. I expect the incumbent partners' level of knowledge in new market to have a stronger association with the choice of existing partner as entry partner than that of non-incumbent partners. In contrast, I expect non-incumbent partners' level of knowledge in old markets of alliances to have a stronger association with the choice of existing partner as entry partner than that of incumbent partners. The results in Table 1.10 are consistent with these predictions. Model 1 in Table 1.10 is the same as Model 2 in Table 1.6, including control variables and the main variable, *Incumbent existing partners exist*. In Model 2, *[Incumbent] Partners' (relative) level of knowledge in new market* is positive and significant (p<0.05), while *[Non-incumbent] Partners' (relative) level of knowledge in new market* is positive but not significant. The two coefficients are not significantly different from each other, however. In Model 3, *[Non-incumbent] Partners' (relative) level of knowledge in old markets of alliances* is positive and significant (p<0.05), while *[Incumbent] Partners' (relative) level of knowledge in new market* is positive but not significant. The coefficients are not significantly different from each other, however. Model 4 is a full model, and the results are consistent. The level of knowledge in old markets of alliances for incumbent partners and non-incumbent partners are significantly different from each other in Model 3 (p<0.1).

Insert Table 1.10 about here

1.5 Discussion

The findings of this study support my theory that the relational resources of firms can be used not only within a single product market, but across market boundaries for corporate advantage. In particular, the findings highlight that firms' existing partners from their old markets can be

used in market entry (i.e., market entry through repeated alliance). In examining the question of when and why firms choose an existing partner over a new partner for market entry, this study shows that a firm's collaborative relationships with its partners in one market are relevant to the firm's collaborations in other markets and that the firm leverage the existing relational resources to enter new markets. The results show that firms enter a new market through repeated alliance than a new partner alliance for mainly two reasons: to successfully enter new market and to strengthen the existing relationship in old market. The existing partners are valuable pre-entry relational resources when they possess relevant product development experience and technological knowledge in a new market. Moreover, the potential positive spillover effects of repeated alliances in new markets to the existing alliance in old market also drive firms to extend the existing relationship into new market by entering the market with an existing partner. Thus, firms are more likely to enter new markets through repeated alliances when the existing partners are valuable in old markets: when they have high levels of technological knowledge in those markets. I also find that firms try to balance the strength of the existing partners in new and old markets when they form cross-market repeated alliances and avoid relying on the same partner too much in both markets with appropriation concerns.

This study makes several contributions to both strategic alliance literature and corporate strategy literature. For strategic alliance literature, I suggest and show that firms can also choose an existing partner over a new partner in a new market, transferring their relational resources from old markets. By exploring the phenomenon of the market entry through cross-market repeated alliances, I extend the existing theories on strategic alliances in a single market to how alliance formation in new markets is affected by the alliance activities of the firm in its existing

markets. Furthermore, this study extends the prior literature on repeated alliance formation (e.g., Beckman et al., 2004; Gulati, 1995b; Hoang & Rothaermel, 2005; Li & Rowley, 2002) by considering the spillovers effects of repeated alliances to the existing alliances. While the existing studies highlight how a collaboration between partners leads to an additional alliance between the same partners, little attention has been paid to how the additional alliance can also reversely affect the original alliance. The results of this study suggest that not only direct benefits in a new market alliance but also indirect benefits in an old market alliance can be drivers behind repeated alliances. By considering how the original alliance and the additional alliance have influence on each other, this paper allows us to better understand the dynamics of alliances across product markets and have implications on how firms create and develop their alliance portfolios.

In addition, by identifying the product markets that each alliance takes place, this study better identifies repeated alliances. Because the product markets of the repeated alliances have not been identified or have been assumed to be the same markets as original alliances, it is hard to distinguish a repeated alliance for another project from a renewal or extension of the original collaboration. However, two (or more) separate alliances between the same partners for different products are closer to the notion of repeated partnerships between firms than a renewal or extension of the original alliance that lasts for a longer duration.

This study also contributes to the literature on market entry and diversification by proposing the relational resources of a firm that exist at interfirm level as important pre-entry market resources (Feldman, 2020) on top of the internal resources of a firm that have mostly been examined in prior studies (e.g., Capron, 1999; Giarratana et al., 2021; Silverman, 1999).

While the relational resources have received much attention in strategy literature as important source of competitive advantage (Hoehn-Weiss & Karim, 2014; Lavie, 2006), it has yet been examined whether and how the relational resources can be used across product market boundaries for corporate advantage. Building on and extending Dyer & Singh's (1998) notion on relational resources as competitive advantage of firm, the results of this study show that relational resources of a firm are fungible across market boundaries and that the firm can leverage its relational resources from its old markets to enter new markets.

This study also opens many directions for future research. To begin with, this study focused on the formation of repeated R&D alliance to enter market but did not look at the performance implications of such alliance. To further our understandings on the cross-market alliance and its implications on firm performance, we need to look the performance consequences of cross-market repeated alliances. In this study, I suggest that the formation of cross-market repeated alliance affects both new and old market of alliance. Future study can examine both the performance of the cross-market repeated alliance in new market and how the cross-market repeated alliance affects the existing alliance in old market. Furthermore, while this study provides initial evidence on the fungibility of relational resources across market boundaries, many of the characteristics of relational resources in market entry context are still unknown: if they are scale-free or non-scale free (Levinthal & Wu, 2010), if extending relationship with the same partner across markets generate synergy within the relationship or needs reallocation of resources (Helfat & Eisenhardt, 2004), and how the coordination among alliances can be well managed. Future research can further examine the nature of relational

resources and boundary conditions on their use across market boundaries for corporate advantage.

In conclusion, this paper sheds light on the underexplored phenomenon of cross-market repeated alliances and examine when firms leverage their relational resources from old markets to enter a new market. The findings from this study highlight that the cross-market repeated alliances not only function as pre-entry market resources in new market, but also strengthen the existing alliances in old markets. While cross-market repeated alliance can be potentially beneficial in both new and old market, firms benefit from either new or old market with the appropriation concerns. By showing how strategic alliances across markets co-evolve and how they play role in corporate actions across markets, such as market entry, I contribute to both strategic alliance literature and market entry literature.

Table 1.1
Market entry modes by therapeutic area

Therapeutic area	Total number of R&D alliance entries	Total number of entries through internal development	Total number of entries through Mergers and Acquisitions (M&A)
Cancer	370	301	4
Hematologic	80	251	3
Immune	185	379	2
Infection	267	294	3
Metabolic	159	326	0
Musculoskeletal	75	221	0
Neurology	269	314	0
Ocular	79	228	0
Respiratory	88	289	0
Toxicity	30	129	0
Total	1,602	2,732	12

Note. This table includes the samples in the first stage.

Table 1.2
Descriptive statistics and Correlation

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Entry with an existing partner	1																
2. Incumbent existing partners exist	0.03	1															
3. Partners' (relative) level of knowledge in new market	0.03	0.16*	1														
4. Partners' (relative) level of knowledge in old markets of alliances	0.06*	0.14*	0.36*	1													
5. Total number of existing partners	0.11*	0.26*	0.05*	0.13*	1												
6. Total number of markets	0.03	0.17*	-0.06*	-0.06*	0.47*	1											
7. Total number of clinical trials	-0.01	0.06*	-0.08*	-0.1*	0.25*	0.54*	1										
8. Total number of patents	-0.02	0.07*	-0.54*	-0.26*	0.17*	0.3*	0.23*	1									
9. Proportion of patents in new market	0	0	-0.04	0	-0.07*	-0.11*	-0.05	-0.01	1								
10. Proportion of clinical trials in old markets of alliances	0.03	0.12*	-0.04	0.08*	0.21*	0.2*	0.11*	0.08*	-0.04	1							
11. Proportion of patents in old markets of alliances	-0.01	0.14*	0.06*	0.14*	0.3*	0.18*	0.07*	0.02	-0.06*	0.23*	1						
12. Cumulative activities in new market	-0.02	0.04	-0.06*	-0.08*	0.02	0.13*	0.09*	0.09*	0.16*	-0.01	-0.04	1					
13. Market relatedness (all)	-0.02	0.12*	-0.05	0.02	0.15*	0.5*	0.21*	0.14*	-0.05*	0.63*	0.14*	0.07*	1				
14. Market relatedness (old markets of alliances)	-0.03	0.03	0.05	0.06*	-0.06*	-0.06*	-0.04	0	0.03	-0.01	-0.01	-0.01	0.1*	1			
15. Size of new market	-0.01	0.05	0.07*	0.01	-0.15*	-0.18*	-0.08*	-0.06*	0.17*	-0.07*	-0.11*	0.11*	-0.14*	0.23*	1		
16. Size of old markets of alliances	-0.06*	-0.01	0.04	0.11*	-0.02	-0.12*	-0.02	-0.05	0.02	0.08*	0.12*	-0.01	-0.03	0.31*	0.31*	1	
17. Growth rate of new market	-0.01	0.03	-0.01	-0.02	-0.02	-0.04	0	0.01	0.01	-0.04	-0.06*	0	-0.03	0.06*	0.23*	-0.14*	1
Mean	0.07	0.6	0.03	0.02	2.57	2.38	0.02	0.04	0.1	0.19	0.22	0.36	0.04	0.09	0.25	0.26	0.36
S.D.	0.25	0.49	0.14	0.12	2.89	2.25	0.09	0.17	0.19	0.34	0.27	0.48	0.06	0.04	0.23	0.21	0.92
Min	0	0	-2.56	-1.23	1	1	0	0	0	0	0	0	0	0.01	0.0005	0.0006	-1.89
Max	1	1	0.88	1.17	34	14	1.72	3.8	1	1	1	1	0.34	0.31	0.85	0.85	3.05

*$p < 0.05$

Table 1.3
Descriptive statistics on the number of existing partners

Panel A. Number of observations

Total number of partners	Number of observations	Number of partners by partner type	Number of observations
0	0	NA	
1	500	1 incumbent	165
		1 non-incumbent	335
2	312	2 incumbents	68
		1 incumbent & 1 non-incumbent	125
		2 non-incumbents	119
3	203	3 incumbents	13
		2 incumbents & 1 non-incumbent	57
		1 incumbent & 2 non-incumbents	75
		3 non-incumbents	58
4	129	4 incumbents	6
		3 incumbents & 1 non-incumbent	17
		2 incumbent & 2 non-incumbents	41
		1 incumbent & 3 non-incumbents	43
		4 non-incumbents	22
5 or more	274	others	274
Total number of observations	1,418	Total number of observations	1,418

Panel B. Summary statistics by partner type

	All partners	Incumbent partners	Non-incumbent partners
Mean	3.17	1.15	2.03
S.D.	3.5	1.52	2.63
Min	1	0	0
Max	36	12	29

Panel C. Number of all existing partners and chosen partners in repeated alliance market entries

	Incumbents	Non-incumbents
Total number of partners	154	270
Number of partners chosen	50	47
Proportion of partners chosen	32.47%	17.41%

Table 1.4
First stage models predicting R&D alliance entry

Dependent variable = 0	No entry, Entry through internal development or M&A	No entry, Entry through internal development or M&A
Dependent variable = 1	Entry through R&D alliances	Entry through R&D alliances
	Model 1	Model 2
Proportion of R&D alliance entries (%)	79.66*	79.39*
	(42.114)	(42.109)
Incumbent existing partners exist	0.10***	0.10***
	(0.021)	(0.021)
Partners' (relative) level of knowledge in new market	0.17	0.16
	(0.123)	(0.141)
Partners' (relative) level of knowledge in old markets of alliances	0.16**	0.27
	(0.064)	(0.479)
Incumbent existing partners exist X Partners' (relative) level of knowledge in old markets of alliances		-0.14
		(0.479)
Partners' (relative) level of knowledge in new market X Partners' (relative) level of knowledge in old markets of alliances		-0.18
		(0.194)
Total number of previous partners	0.05***	0.05***
	(0.005)	(0.006)
Total number of markets	0.03***	0.03***
	(0.009)	(0.009)
Total number of clinical trials	-0.92**	-0.92**
	(0.434)	(0.432)
Total number of patents	0.44***	0.45***
	(0.068)	(0.070)
Proportion of patents in new market	0.81***	0.81***
	(0.053)	(0.053)
Proportion of clinical trials in old markets of alliances	-0.13***	-0.13***
	(0.046)	(0.046)
Proportion of patents in existing old of alliances	-0.20***	-0.20***
	(0.035)	(0.035)
Cumulative activities in new market	0.42***	0.42***
	(0.023)	(0.023)
Market relatedness (all)	-0.01	-0.00
	(0.283)	(0.283)
Market relatedness (old markets of alliances)	0.90***	0.90***
	(0.270)	(0.270)
Size of new market	0.29**	0.28**
	(0.117)	(0.117)
Size of old markets of alliances	-0.03	-0.03
	(0.059)	(0.059)
Growth rate of new market	0.01	0.01
	(0.014)	(0.014)
Constant	-3.88***	-3.88***
	(0.102)	(0.102)
Therapeutic area dummies	Included	Included
Firm type dummies	Included	Included
Year dummies	Included	Included
Observations	333,407	333,407

Notes: All models are probit regression models predicting *Entry through R&D alliance.* The models include therapy area dummies, firm type dummies, and year dummies. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 1.5
Alternative first stage models

Dependent variable = 0	No entry	No entry	Entry through internal development or M&A	Entry through internal development or M&A
Dependent variable = 1	Entry (of any type)	Entry (of any type)	Entry through R&D alliances	Entry through R&D alliances
	Model 1	Model 2	Model 3	Model 4
Proportion of R&D alliance entries (%)			-1.91	-1.95
			(2.289)	(2.292)
Incumbent existing partners exist	0.10***	0.10***	0.03	0.04
	(0.012)	(0.012)	(0.048)	(0.049)
Partners' (relative) level of knowledge in new market	0.17**	0.19**	-0.00	-1.04
	(0.084)	(0.082)	(0.178)	(2.200)
Partners' (relative) level of knowledge in old markets of alliances	0.08**	1.04***	0.31	0.25
	(0.040)	(0.262)	(0.216)	(0.211)
Incumbent existing partners exist X		-0.97***		0.89
Partners' (relative) level of knowledge in old markets of alliances		(0.264)		(2.184)
Partners' (relative) level of knowledge in new market X Partners' (relative) level of knowledge in old markets of alliances		0.00		-0.27
		(0.022)		(0.239)
Total number of previous partners	0.01***	0.01***	0.10***	0.11***
	(0.003)	(0.003)	(0.014)	(0.014)
Total number of markets	0.07***	0.07***	-0.08***	-0.09***
	(0.003)	(0.003)	(0.014)	(0.014)
Total number of clinical trials	-0.40***	-0.40***	-0.50	-0.49
	(0.099)	(0.099)	(0.380)	(0.378)
Total number of patents	0.41***	0.44***	0.37**	0.34*
	(0.041)	(0.042)	(0.176)	(0.185)
Proportion of patents in new market	1.07***	1.07***	-0.13	-0.14
	(0.038)	(0.038)	(0.144)	(0.145)
Proportion of clinical trials in old markets of alliances	0.01	0.01	-0.43***	-0.44***
	(0.022)	(0.022)	(0.086)	(0.086)
Proportion of patents in existing old of alliances	-0.08***	-0.08***	-0.29***	-0.29***
	(0.020)	(0.020)	(0.087)	(0.087)
Cumulative activities in new market	0.30***	0.30***	0.30***	0.30***
	(0.015)	(0.015)	(0.049)	(0.050)
Market relatedness (all)	1.75***	1.75***	-3.43***	-3.42***
	(0.126)	(0.126)	(0.557)	(0.557)
Market relatedness (old markets of alliances)	0.99***	0.99***	0.35	0.34
	(0.153)	(0.153)	(0.685)	(0.685)
Size of new market	0.29***	0.30***	0.55**	0.57**
	(0.080)	(0.080)	(0.279)	(0.279)
Size of old markets of alliances	-0.16***	-0.17***	0.48***	0.49***
	(0.039)	(0.039)	(0.156)	(0.157)
Growth rate of new market	0.04***	0.04***	-0.04	-0.04
	(0.007)	(0.007)	(0.029)	(0.029)
Constant	-3.69***	-3.69***	0.14	0.13
	(0.063)	(0.063)	(0.287)	(0.287)
Therapeutic area dummies	Included	Included	Included	Included
Firm type dummies	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included
Observations	512,395	512,395	4,346	4,346

Notes: All models are probit regression models. Models 1 and 2 predict *Entry (of any type)*, and Models 3 and 4 predict *Entry through R&D alliance* among the samples of market entries. The models include therapy area dummies, firm type dummies, and year dummies. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 1.6
Main Results

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Incumbent existing partners exist		0.99**			0.87**		0.84**
		(0.404)			(0.370)		(0.359)
Partners' (relative) level of knowledge in new market			2.59**			1.72*	1.16
			(1.190)			(0.950)	(0.757)
Partners' (relative) level of knowledge in old markets of alliances				1.93**	8.37**	1.26*	8.49**
				(0.922)	(3.575)	(0.666)	(3.610)
Incumbent existing partners exist X Partners' (relative) level of knowledge in old markets of alliances					-6.64*		-7.33**
					(3.506)		(3.545)
Partners' (relative) level of knowledge in new market X Partners' (relative) level of knowledge in old markets of alliances						-0.65	-0.84
						(1.528)	(1.458)
Total number of existing partners	0.39**	0.40***	0.37**	0.37**	0.38**	0.38**	0.40**
	(0.152)	(0.149)	(0.148)	(0.159)	(0.156)	(0.162)	(0.162)
Total number of markets	0.27**	0.28**	0.25**	0.25**	0.26**	0.24**	0.25**
	(0.114)	(0.112)	(0.107)	(0.108)	(0.107)	(0.104)	(0.104)
Total number of clinical trials	-8.09**	-8.53***	-7.69**	-7.29**	-7.87**	-7.33**	-7.92**
	(3.278)	(3.306)	(3.189)	(3.169)	(3.198)	(3.143)	(3.201)
Total number of patents	0.80	1.04	1.73	1.49	1.76	1.98	2.15
	(1.053)	(1.109)	(1.379)	(1.311)	(1.327)	(1.525)	(1.520)
Proportion of patents in new market	5.02**	5.71**	4.86**	4.58**	5.28**	4.68**	5.33**
	(2.332)	(2.528)	(2.316)	(2.298)	(2.485)	(2.316)	(2.501)
Proportion of clinical trials in old markets of alliances	-0.15	-0.36	-0.13	-0.14	-0.32	-0.14	-0.32
	(0.364)	(0.422)	(0.366)	(0.376)	(0.429)	(0.377)	(0.429)
Proportion of patents in old markets of alliances	-1.48**	-1.75***	-1.48**	-1.46**	-1.73**	-1.48**	-1.74**
	(0.580)	(0.665)	(0.591)	(0.606)	(0.681)	(0.609)	(0.683)
Cumulative activities in new market	2.55**	2.90**	2.45**	2.34*	2.69**	2.36*	2.70**
	(1.245)	(1.335)	(1.229)	(1.230)	(1.316)	(1.233)	(1.319)
Market relatedness (all)	-3.54**	-3.66**	-3.49**	-3.52**	-3.73**	-3.46**	-3.65**
	(1.748)	(1.790)	(1.762)	(1.755)	(1.795)	(1.762)	(1.794)
Market relatedness (old markets of alliances)	4.18	4.76	3.79	3.70	4.47	3.65	4.45
	(3.042)	(3.180)	(2.981)	(3.014)	(3.156)	(3.003)	(3.155)
Size of new market	1.40	1.69*	1.22	1.27	1.56	1.21	1.50
	(0.931)	(1.008)	(0.895)	(0.926)	(0.998)	(0.905)	(0.985)
Size of old markets of alliances	-0.75*	-0.79**	-0.78**	-0.87**	-0.92**	-0.85**	-0.90**
	(0.391)	(0.392)	(0.394)	(0.409)	(0.409)	(0.404)	(0.404)
Growth rate of new market	-0.06	-0.05	-0.07	-0.07	-0.07	-0.07	-0.07
	(0.084)	(0.086)	(0.084)	(0.084)	(0.086)	(0.084)	(0.086)
Inverse mills ratio	6.85**	7.87**	6.57**	6.27*	7.29**	6.35**	7.34**
	(3.243)	(3.529)	(3.204)	(3.206)	(3.476)	(3.216)	(3.487)
Constant	-28.52**	-32.74**	-27.30**	-26.11**	-30.37**	-26.41**	-30.55**
	(13.162)	(14.350)	(12.971)	(12.987)	(14.109)	(13.029)	(14.166)
Therapeutic area dummies	Included	Included	Included	Included	Included	Included	Included
Firm type dummies	Included	Included	Included	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included	Included	Included	Included
Observations	1,418	1,418	1,418	1,418	1,418	1,418	1,418

Notes: All models are probit regression models predicting *Entry with an existing partner.* The models include therapy area dummies, firm type dummies, and year dummies. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 1.7
Traits of the chosen partners in repeated alliance market entries

Panel A. Traits by incumbency in new market and old market (relative) strength

		New market incumbency		
		Incumbent partner	Non-incumbent	Total
Old market (relative) strength	Partner is stronger than or equal to the focal firm	42	41	83
	Partner is weaker than the focal firm	8	6	14
	Total	50	47	97

Panel B. Traits by new market (relative) strength and old market (relative) strength

		New market (relative) strength		
		Partner is stronger than or equal to the focal firm	Partner is weaker than the focal firm	Total
Old market (relative) strength	Partner is stronger than or equal to the focal firm	74	9	83
	Partner is weaker than the focal firm	8	6	14
	Total	82	15	97

Table 1.8
First stage probit models predicting R&D alliance entry: Subsample of firms with one existing partner

Dependent variable = 0	No entry, Entry through internal development or M&A	No entry, Entry through internal development or M&A	No entry	Entry through internal development or M&A
Dependent variable = 1	Entry through R&D alliances	Entry through R&D alliances	Entry (of any type)	Entry through R&D alliances
	Model 1	Model 2	Model 3	Model 4
Proportion of R&D alliance entries (%)		104.12		2.36
		(67.384)		(4.653)
Incumbent existing partners exist	-0.03	-0.03	0.05**	-0.19**
	(0.037)	(0.037)	(0.021)	(0.085)
Partners' (relative) level of knowledge in new market	-1.28*	-1.28*	-0.62*	-1.21
	(0.677)	(0.676)	(0.366)	(1.455)
Partners' (relative) level of knowledge in old markets of alliances	1.33*	1.32*	1.81***	0.86
	(0.756)	(0.757)	(0.314)	(3.128)
Incumbent existing partners exist X Partners' (relative) level of knowledge in old markets of alliances	-0.46	-0.45	-1.35***	0.60
	(0.892)	(0.894)	(0.367)	(3.577)
Partners' (relative) level of knowledge in new market X Partners' (relative) level of knowledge in old markets of alliances	3.05	3.05	1.24	5.35
	(3.509)	(3.506)	(2.151)	(11.795)
Total number of markets	0.01	0.02	0.06***	-0.11**
	(0.025)	(0.025)	(0.008)	(0.044)
Total number of clinical trials	-2.45	-2.48	-0.68**	-1.12
	(1.772)	(1.767)	(0.303)	(1.954)
Total number of patents	0.44***	0.44***	0.51***	0.21
	(0.133)	(0.133)	(0.084)	(0.638)
Proportion of patents in new market	0.89***	0.88***	1.07***	0.10
	(0.072)	(0.072)	(0.051)	(0.193)
Proportion of clinical trials in old markets of alliances	-0.15*	-0.15*	-0.07**	-0.30*
	(0.082)	(0.082)	(0.036)	(0.159)
Proportion of patents in existing old of alliances	-0.17***	-0.17***	-0.05*	-0.36**
	(0.058)	(0.058)	(0.030)	(0.144)
Cumulative activities in new market	0.51***	0.51***	0.40***	0.32***
	(0.038)	(0.038)	(0.025)	(0.087)
Market relatedness (all)	0.82*	0.84*	2.40***	-3.36***
	(0.483)	(0.484)	(0.206)	(1.006)
Market relatedness (old markets of alliances)	0.58	0.60	0.64***	0.20
	(0.410)	(0.410)	(0.220)	(1.037)
Size of new market	0.29	0.31*	0.13	0.83*
	(0.184)	(0.184)	(0.120)	(0.498)
Size of old markets of alliances	-0.02	-0.02	-0.13**	0.44*
	(0.087)	(0.087)	(0.053)	(0.231)
Growth rate of new market	0.01	0.00	0.03***	-0.02
	(0.021)	(0.023)	(0.012)	(0.051)
Constant	-3.99***	-4.02***	-3.66***	-0.61
	(0.183)	(0.183)	(0.091)	(0.495)
Therapeutic area dummies	Included	Included	Included	Included
Firm type dummies	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included
Observations	196,108	196,108	300,290	1,550

Notes: All models are probit regression models predicting *Entry through R&D alliance* and use firm-year samples with only one existing partner. The models include therapy area dummies, firm type dummies, and year dummies. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 1.9
Subsample of firms with one existing partner

	Model 1	Model 2	Model 3	Model 4
Incumbent existing partners exist		-0.68		
		(0.629)		
Partners' (relative) level of knowledge in new market			-10.25	
			(7.003)	
Partners' (relative) level of knowledge in old markets of alliances				23.72**
				(9.470)
Incumbent existing partners exist X Partners' (relative) level of knowledge in old markets of alliances				
Partners' (relative) level of knowledge in new market X Partners' (relative) level of knowledge in old markets of alliances				
Total number of markets	3.40***	3.53***	3.39***	3.28***
	(0.770)	(0.771)	(0.799)	(0.770)
Total number of clinical trials	-577.32***	-591.50***	-557.85***	-548.69***
	(150.383)	(149.829)	(145.333)	(142.202)
Total number of patents	-4.77	-3.11	-5.60	-3.70
	(17.481)	(17.278)	(17.070)	(17.459)
Proportion of patents in new market	27.11***	27.56***	26.07***	26.92***
	(10.309)	(9.847)	(9.667)	(10.318)
Proportion of clinical trials in old markets of alliances	-1.24	-1.04	-1.10	-1.61
	(1.895)	(1.835)	(1.826)	(2.009)
Proportion of patents in old markets of alliances	-4.28**	-4.35***	-4.06**	-4.58**
	(1.720)	(1.664)	(1.626)	(1.847)
Cumulative activities in new market	15.42***	15.68***	14.84***	15.34***
	(5.889)	(5.620)	(5.545)	(5.920)
Market relatedness (all)	4.82	3.53	3.20	4.45
	(11.344)	(11.379)	(10.640)	(11.506)
Market relatedness (old markets of alliances)	2.55	3.53	2.20	3.08
	(8.615)	(8.619)	(8.367)	(8.728)
Size of new market	9.74**	9.73**	9.54**	9.87**
	(4.661)	(4.473)	(4.425)	(4.761)
Size of old markets of alliances	-1.23	-1.10	-1.29	-1.83
	(1.517)	(1.526)	(1.531)	(1.641)
Growth rate of new market	-0.53	-0.51	-0.59	-0.55
	(0.409)	(0.404)	(0.401)	(0.404)
Inverse mills ratio	34.41***	35.01***	33.15***	34.32***
	(12.830)	(12.230)	(12.100)	(12.913)
Constant	-131.86***	-134.17***	-126.98***	-131.23***
	(48.546)	(46.165)	(45.631)	(48.744)
Therapeutic area dummies	Included	Included	Included	Included
Firm type dummies	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included
Observations	351	351	351	351

Notes: All models are probit regression models predicting *Entry with an existing partne* and use firm-year samples with only one existing partner. The models include therapy area dummies, firm type dummies, and year dummies. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 1.9 (continued)

	Model 5	Model 6	Model 7
Incumbent existing partners exist	-1.29		-1.13
	(0.882)		(0.815)
Partners' (relative) level of knowledge in new market		-22.34*	-19.43*
		(12.181)	(11.654)
Partners' (relative) level of knowledge in old markets of alliances	78.38**	84.10***	100.25***
	(34.239)	(20.812)	(37.618)
Incumbent existing partners exist X Partners' (relative) level of knowledge in old markets of alliances	-49.86*		-18.15
	(30.219)		(27.767)
Partners' (relative) level of knowledge in new market X Partners' (relative) level of knowledge in old markets of alliances		-452.38***	-419.26***
		(151.284)	(140.398)
Total number of markets	3.60***	3.98***	3.97***
	(0.710)	(0.958)	(0.899)
Total number of clinical trials	-610.73***	-748.37***	-741.18***
	(144.086)	(248.001)	(230.069)
Total number of patents	1.14	-10.51	-8.55
	(17.951)	(22.062)	(21.524)
Proportion of patents in new market	28.92***	25.24***	25.85**
	(11.216)	(9.746)	(10.137)
Proportion of clinical trials in old markets of alliances	-1.60	-0.36	-0.45
	(2.176)	(2.230)	(2.305)
Proportion of patents in old markets of alliances	-5.16***	-4.96***	-5.09***
	(1.970)	(1.857)	(1.904)
Cumulative activities in new market	16.70***	14.67***	15.13***
	(6.370)	(5.607)	(5.840)
Market relatedness (all)	6.60	-3.90	-1.66
	(13.166)	(14.021)	(14.650)
Market relatedness (old markets of alliances)	6.05	6.70	7.80
	(9.015)	(9.016)	(9.472)
Size of new market	10.05**	10.44**	10.38**
	(4.666)	(4.541)	(4.537)
Size of old markets of alliances	-1.98	-3.08**	-3.20**
	(1.516)	(1.485)	(1.610)
Growth rate of new market	-0.43	-0.74*	-0.66
	(0.426)	(0.419)	(0.456)
Inverse mills ratio	37.21***	32.82***	33.68***
	(13.999)	(12.383)	(12.886)
Constant	-142.50***	-127.17***	-130.23***
	(52.595)	(46.458)	(48.215)
Therapeutic area dummies	Included	Included	Included
Firm type dummies	Included	Included	Included
Year dummies	Included	Included	Included
Observations	351	351	351

Notes: All models are probit regression models predicting *Entry with an existing partne* and use firm-year samples with only one existing partner. The models include therapy area dummies, firm type dummies, and year dummies. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 1.10
Distinguishing traits of incumbent and non-incumbent existing partners

	Model 1	Model 2	Model 3	Model 4
Incumbent existing partners exist	2.11**			1.75**
	(0.846)			(0.752)
Partners' (relative) level of knowledge in new market				
[Incumbent] Partners' (relative) level of knowledge in new market		6.42**		4.40**
		(2.618)		(1.928)
[Non-incumbent] Partners' (relative) level of knowledge in new market		2.42		-0.67
		(2.982)		(3.094)
Partners' (relative) level of knowledge in old markets of alliances				
[Incumbent] Partners' (relative) level of knowledge in old markets of alliances			3.18	0.11
			(2.020)	(1.627)
[Non-incumbent] Partners' (relative) level of knowledge in old markets of alliances			5.20**	6.33**
			(2.503)	(2.870)
Total number of existing partners	0.85***	0.77**	0.83**	0.87**
	(0.312)	(0.305)	(0.351)	(0.343)
Total number of markets	0.61***	0.55**	0.55**	0.54**
	(0.233)	(0.222)	(0.224)	(0.212)
Total number of clinical trials	-18.16***	-15.99**	-15.67**	-16.09***
	(6.688)	(6.300)	(6.416)	(6.158)
Total number of patents	2.63	3.32	3.74	4.66
	(2.311)	(2.884)	(2.851)	(3.213)
Proportion of patents in new market	12.61**	10.61**	10.36**	11.89**
	(5.264)	(4.786)	(4.841)	(5.164)
Proportion of clinical trials in old markets of alliances	-0.78	-0.29	-0.37	-0.75
	(0.873)	(0.758)	(0.786)	(0.883)
Proportion of patents in old markets of alliances	-3.86***	-3.22***	-3.26**	-3.78***
	(1.392)	(1.231)	(1.280)	(1.417)
Cumulative activities in new market	6.45**	5.40**	5.32**	6.07**
	(2.793)	(2.556)	(2.601)	(2.738)
Market relatedness (all)	-8.19**	-7.61*	-7.69*	-7.68*
	(3.977)	(3.934)	(3.927)	(3.962)
Market relatedness (old markets of alliances)	11.05	8.71	8.99	10.22
	(6.857)	(6.387)	(6.538)	(6.762)
Size of new market	3.70*	2.62	2.83	3.25
	(2.100)	(1.844)	(1.934)	(2.028)
Size of old markets of alliances	-1.81**	-1.84**	-1.99**	-1.98**
	(0.854)	(0.860)	(0.893)	(0.886)
Growth rate of new market	-0.05	-0.09	-0.09	-0.07
	(0.181)	(0.175)	(0.175)	(0.180)
Inverse mills ratio	17.38**	14.39**	14.19**	16.37**
	(7.383)	(6.663)	(6.778)	(7.246)
Constant	-71.67**	-59.07**	-58.42**	-67.32**
	(30.008)	(26.948)	(27.472)	(29.399)
Therapeutic area dummies	Included	Included	Included	Included
Firm type dummies	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included
Observations	1,418	1,418	1,418	1,418

Notes: All models are probit regression models predicting *Entry with an existing partner.* The models include therapy area dummies, firm type dummies, and year dummies. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Figure 1.1
Summary of the hypothesized relationships

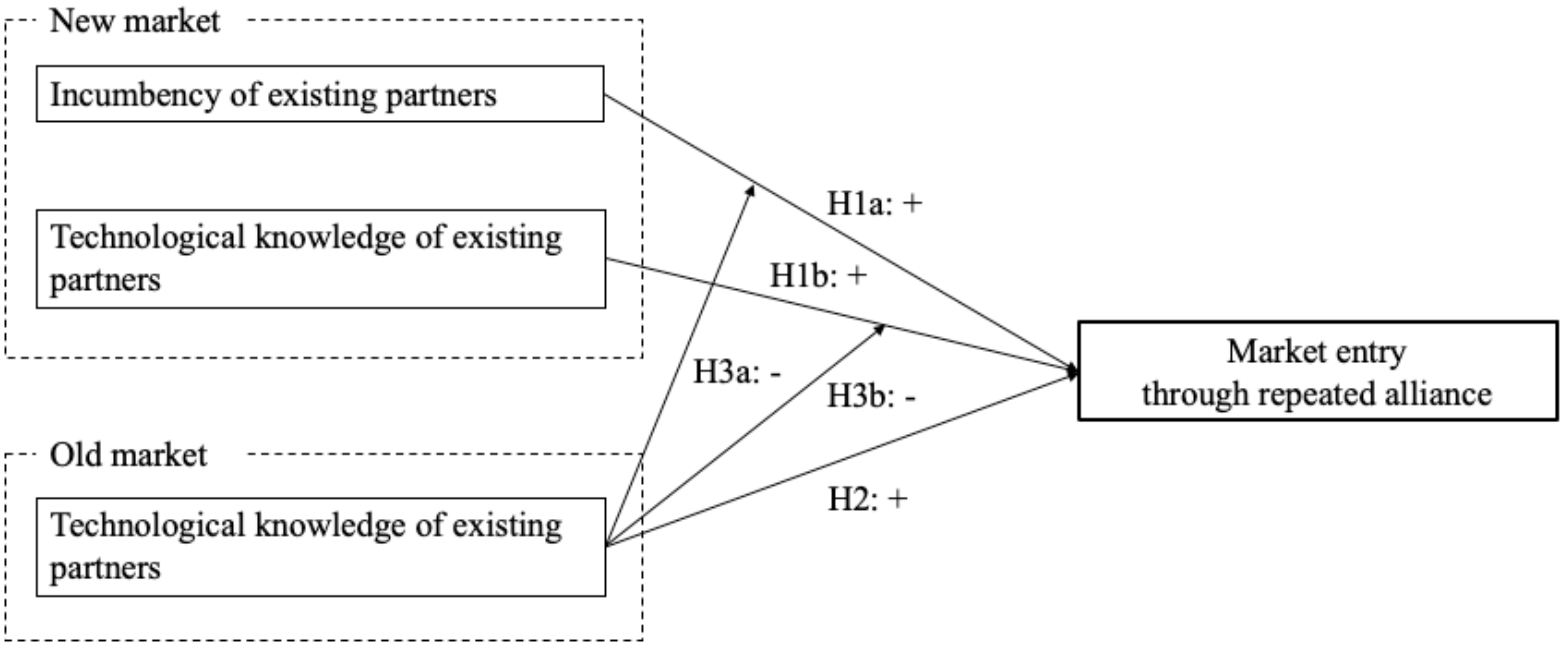
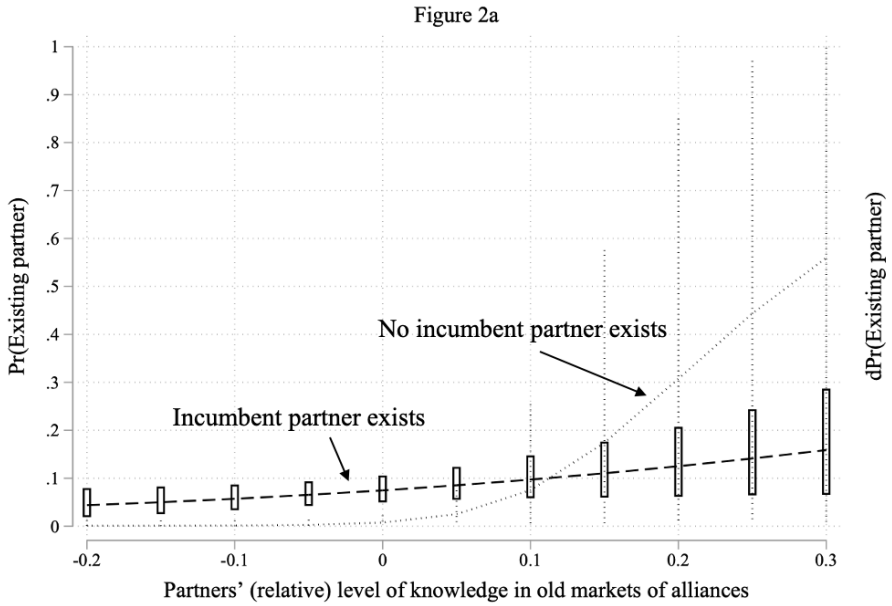
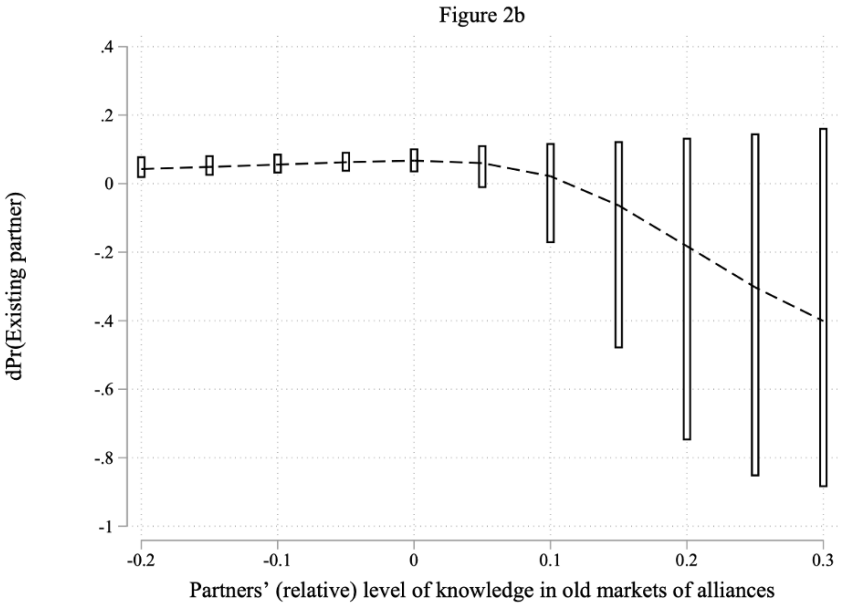


Figure 1.2
Predicted probabilities: Incumbent partner exists and no incumbent partner exists





Chapter 2.

Old Wine in a New Bottle? Performance Implications of Cross-market Repeated Alliances

2.1 Introduction

As an important strategic tool, interfirm alliance has been extensively studied by strategy scholars. Strategic alliances with other firms in a market provide informational advantages and allow firms to achieve goals that are hard to achieve on its own through resource recombination. In this regard, repeated alliances with the same partner can be valuable relational resources as they can be sources of valuable information. However, at the same time, existing studies also point out that repeated alliances may prevent firms from accessing diverse ideas.

The first chapter suggested that such disadvantage of repeated alliance might be limited to repeated alliance in the same market as before. The accumulated evidence in the alliance literature may be attributable to the fact that repeated alliance has been considered only in the same market as before. In contrast, cross-market repeated alliance, or repeated alliance with the same partner but in a different market than before, can potentially lead to novel knowledge recombination. Thus, I suggest in this chapter that cross-market repeated alliances outperform new partner alliance in new knowledge creation. My idea is tested in the context of market entries into product markets in the U.S. pharmaceutical industry. I examine both the knowledge creation itself and the speed of such knowledge creation because both are important performance outcomes in the market entry context.

The existing theories on repeated alliances do not explain whether cross-market repeated alliances perform better than new partner alliances in knowledge recombinations in the context of market entry. First, the existing theories suggest that firms access the same set of knowledge of the partner firm in repeated alliance, making it less likely that firms produce new knowledge through repeated alliances. Second, the knowledge creation in market entry context has not been considered because the existing studies have paid attention solely to repeated alliances in the same market as before, dismissing cross-market repeated alliances and market entries through repeated alliances.

In this paper, I examine whether firms that enter markets through repeated alliances perform better than firms that enter markets through new alliances in the U.S. pharmaceutical industry where there are 15 different therapeutic areas. I suggest that firms outperform in generating new knowledge in a new market when they enter the market with an existing partner from old market than with a new partner. While firms can benefit from trust and partner-specific knowledge accumulated in cross-market repeated alliances than in new partner alliances, cross-market repeated alliances provide opportunities for new knowledge creation as much as new partner alliances do, because the partners are collaborating in a different market than before. Furthermore, I expect firms to generate new knowledge faster when they enter new markets through cross-market repeated alliances than through new partner alliances because partner firms in cross-market repeated alliances can benefit from trust and partner-specific knowledge to collaborate more efficiently.

2.2 Theory and Hypotheses

2.2.1 New Knowledge Creation

One of the main findings on repeated alliances is that they are potentially less valuable in novel knowledge creation than new partner alliances, as partners recombine the same set of knowledge or resources in repeated alliances. Because firms collaborate with other firms to access each other's knowledge and resources that are not available otherwise and recombine, studies have pointed out that firms perform worse when they repeat alliances with the same partners than when they form alliances with new partners (e.g., Goerzen, 2007; Sorenson & Waguespack, 2006).

The performance disadvantage of repeated alliances in novel knowledge creation relies on the assumption that the repeated alliances take place in the same market as previous alliances. However, such assumption does not hold for cross-market repeated alliances. Unlike repeated alliances in the same market as before, partners access a different set of knowledge or resources of each other in cross-market repeated alliances, as they collaborate in a different market than before and seek to create new knowledge in a different domain than before.

New knowledge creation through cross-market repeated alliances can happen through two different mechanisms. First, partners can recombine their knowledge to create new-to-the-world knowledge. In other words, partners can create knowledge that did not exist neither in the respective product market nor in any other product markets. Second, partners can also find a new application of knowledge in a new market that has been used in other product markets. Although the knowledge already existed and has been used in other product markets, it is still a novel knowledge creation to find how to apply the existing knowledge to a new market. In fact, in the

pharmaceutical industry, firms often innovate by finding a new indication of an existing substance or drug. For example, fluorescence in situ hybridization technology is used not only for anticancer drug (cancer market) but also for AIDS (immune market).

A development of any drug goes through a series of development stages. In the drug discovery phase and preclinical research phase, firms select a drug to develop and conduct studies on animals. After these processes, a candidate drug goes through a series of clinical trials: Phase I, Phase II, and Phase III, where the safety (Phase I) and efficacy (Phase II) are validated and tested on a large number of human samples for efficacy and side effects (Phase III). Therefore, when partner firms in a cross-market repeated alliance innovate by finding a new indication of an existing drug from another market, it is possible that they go directly to Phase I or more advanced stages, not necessarily going through preclinical stages. A new partner alliance is less likely to be able to go directly to Phase I clinical trial because they lack understandings on each other's knowledge repository to be aware of opportunities to find a new application of an existing drug. In addition, firms are also not embedded in a relationship enough to expose their existing drugs from other markets to their partners for development in new markets.

On the other hand, when partner firms recombine their knowledge to create new-to-the-world knowledge, the drugs will go through preclinical stages, too. Such drugs, however, still need to go through clinical stages, if the drugs were successful in the preclinical stages and firms intend to develop the drugs to launch in the end. Therefore, I suggest that firms entering new markets through cross-market repeated alliances will conduct more clinical stage trials than firms entering through new partner alliances.

Hypothesis 1: Firms that enter new markets through repeated alliances do more clinical stage trials than firms that enter through new partner alliances.

2.2.2 Speed of New Knowledge Creation

Another important advantage of cross-market repeated alliance over new partner alliance is that partner firms collaborate more efficiently. Firms accumulate trust and partner-specific knowledge through collaborations, and such trust and partner-specific knowledge allow partners firms to transfer knowledge more smoothly and build interfirm routines. Previous studies show that repeated alliances are more reliable and efficient than new partner alliances. For example, Uzzi (1997) shows that relationship embeddedness and trust can facilitate efficient transactions. In this sense, firms form repeated alliances than find a new partner when faced with uncertainties (Beckman, Haunschild, & Phillips, 2004; Lavie & Rosenkopf, 2006). Therefore, firms can create new knowledge more efficiently through cross-market repeated alliances than through new partner alliance.

While previous studies have already explored the comparative efficiency of repeated alliances, it has been mostly discussed as the antonym of novelty or new knowledge creation. However, cross-market repeated alliance can benefit from both the new knowledge creation and efficiency, as partner firms are collaborating in a different market than before, while still benefitting from relationship-specific routines and knowledge. Efficiency or speed of new knowledge creation is as important as the new knowledge creation itself in market entry. It is important for a new entrant to develop new products in a new market as fast as possible after it enters the market.

Hypothesis 2: Firms that enter new markets through repeated alliances develop drugs faster than firms that enter through new partner alliances.

2.3 Data and Methods

The idea in this paper was tested in the U.S. pharmaceutical industry from 1986 to 2019. This setting is appropriate because firms frequently enter new product markets through both new partner alliance and cross-market repeated alliance as my first chapter has shown. The pharmaceutical industry is also a knowledge-intensive industry where innovation is important to firm performance. Furthermore, I can track various firm activities that allows me to measure both market productivity and knowledge production.

I configure the datasets for the second chapter using the same data sources as the first chapter: Cortellis Deals Intelligence (CDI) and Cortellis Competitive Intelligence (CCI). The unit of analysis of this study is firm-year-therapeutic area. For each product market, the final sample includes firms that 1) did not exist in the product market (i.e., no clinical trials or R&D alliances) in the last five years, 2) entered the product market through R&D alliance, 3) had any kind of activities in other product markets in the last five years, and 4) had one or more existing partners.

2.3.1 Variables

Dependent Variables. The first set of the dependent variable of this study is based on the *Number of clinical stage trials* that a firm has in a market for a given year. The execution of clinical trials in the pharmaceutical industry requires a formal application process after drug discoveries and involves trials in human subjects. There are three stages of clinical trials—Phase

I, Phase II, and Phase III—and I add the number of clinical trials in each stage to calculate *Number of clinical stage trials*. I create cumulative versions of this variable that adds all clinical stage trials of a firm up to 5 years after its market entry, up to 10 years after its market entry, and up to 15 years after its market entry. In addition, I also create binary dependent variables that measure whether there were any clinical trials for 5 years, 10 years, and 15 years periods (*Clinical stage trials (binary)*). Especially in the earlier years of market entry, there are many cases that did not have any clinical stage developments of drugs.

The second dependent variable is *Number of days it took until the first development of drug*. To measure this, I first track the date that a firm enters the market through alliance by using the date that it announces alliance with the partner firm. Then, I look at the date that the first date that the firm is reported to have any development of drug in the product market. I calculate the number of days that it took from the announcement of alliance (therefore market entry in this study) to have any drug in its pipeline in the product market.

Independent Variable. The main independent variable of this study is *Market entry through repeated alliance*, which is a dummy variable that takes the value of *1* when a firm enters a market through cross-market repeated alliance and *0* when a firm enters through new partner alliance.

Control Variables. I control for several firm characteristics. I control for *Number of patents*, measured as the number of patents granted to a firm in the last five years in a market, to control for a level of technological knowledge of the firm in the market. I also control for the total number of patents that a firm is granted to in the last five years across all therapeutic areas (*Total number of patents*) and the total number of clinical trials that a firm had in the last five years

across all therapeutic areas (*Total number of clinical trials*) to account for the level of technological knowledge and product development experience across all product markets. *Total number of markets*, measured as the number of therapeutic areas that a firm has either clinical trials or R&D alliances in the last five years, is also included.

The characteristics of the new market were also controlled for. *Market relatedness* between firm's other markets and the entering market is controlled for, considering that market relatedness is related to firm's diversification into markets. To measure this variable, for each dyad of product markets, I calculate the proportion of patents that are applicable in both product markets (granted in the last five years). Then, I calculate the average of this value for all dyads of firm's other market and new market. *Growth rate of new market* is also controlled for. The measure is constructed followingly. The market growth rate of each market-year is calculated based on the total number of clinical trials in the market. For year *t*, the variable is calculated as $\frac{total\ number\ of\ clinical\ trials_t - total\ number\ of\ clinical\ trials_{t-5}}{total\ number\ of\ clinical\ trials_{t-5}}$. I then calculate the z-score of market growth rate using the mean and standard deviation of growth rates in each year, because the growth rates of the product markets follow similar time trends with less variation within each year. I also control for *Size of new market*, measured as the average number of clinical trials in the therapeutic area during the last five years.

To account for the market entry partner's capabilities and knowledge, I control for whether the market entry partner had product development experience in the entering market by including a dummy variable (*Incumbent entry Partner*) that takes the value of *1* when the entry partner had product development experience in the last five years and *0* when the entry partner did not have any product development experience (i.e., a new entrant itself). *Entry partner*

technological knowledge is measured as the number of patents that the entry partner has been granted in the last five years in the market.

For models testing Hypothesis 2, I include dummy variables for the initial development status reported.

2.3.2 Empirical Model Specification

The findings from the first chapter suggest that there are reasons why firms would choose existing partners over new partners for product market entries. In other words, the choice of an existing partner over a new partner for market entry is not random, but rather a strategic decision. To reduce concerns on endogeneity that comes from such selection into cross-market repeated alliances and to ensure that my treatment group (i.e., firms entering markets through cross-market repeated alliances) and control group (i.e., firms entering markets through new partner alliances) are similar before treatment, I run a first stage to correct for selection and match treatment and control groups. I use propensity score matching approach. Specifically, I run a probit regression where I predict firm's likelihood of choosing an existing partner over a new partner for market entry with all variables (main explanatory variables and control variables) from my first chapter. This first stage regression also includes the inverse mills ratio that was included in my first chapter to correct for the selection into alliance (either cross-market repeated alliance or new partner alliance) as market entry mode. Then, I calculate propensity score from this regression and match each treated sample with four control samples with the nearest propensity score. The final sample includes 92 treated sample and 368 control sample. The kernel density distributions of treated and control group before and after matching are presented

in Figure 1. Before matching, the distribution of the propensity score of treated group was different from that of control group. After matching, however, they became quite similar.

Insert Figure 2.1 about here

Table 2.1 shows the descriptive statistics of the treatment and control groups before and after matching. The table also includes differences in the means of the two groups for each variable that they are matched on. While there were several variables that showed significant differences in means between treatment and control groups before matching, there were no variables that showed significant differences in means between the groups after matching.

Insert Table 2.1 about here

Table 2.2 shows the first stage probit regression results.

Insert Table 2.2 about here

All dependent variables in this study are count variables. For models predicting *Number of clinical stage trials*, I use negative binomial regression model because the dependent variables showed an overdispersion problem. For models predicting *Number of days it took until the first development of drug,* poisson regression model is used because there was a small difference between the mean and the variance of the dependent variable. Product market dummies and entry year fixed effects were included in all models. The models predicting *Number of days it took until the first development of drug* additionally included fixed effects of years that the first development of drug was reported.

2.4 Results

2.4.1 Main Results

Table 2.3 presents the main results for testing Hypothesis 1. Models 1, 2, and 3 use *Clinical stage trials (binary)* and Models 4, 5, and 6 use *Number of clinical stage trials* for different time periods (5 years, 10 years, and 15 years).[12] Hypothesis 1 predicted that firms entering new markets through cross-market repeated alliances will do more clinical stage trials than firms entering through new partner alliances. The coefficient on *Treated* is not significant in all models but Model 6, and it is negative and significant in Model 6. These results do not support Hypothesis 1, suggesting that there is no significant performance difference in terms of the number of clinical trials after market entry.

Insert Table 2.3 about here

Table 2.4 tests Hypothesis 2 that firms entering new markets through cross-market repeated alliances to report development of drug faster than firms entering through new partner alliances. The coefficient on *Treated* is negative and significant (p<0.01) in both Model 1 and 2, supporting Hypothesis 1b.[13]

Insert Table 2.4 about here

[12] Each model uses samples that had observations for the corresponding time periods after market entries. For example, Model 1 and 4 uses samples that I was able to track drug development activities for at least 5 years after market entries. Because my study period ends in 2019, I cannot track drug development activities for 5 years for firms that entered markets after 2014.

[13] There were many firms (64% of the samples) that did not report any drug development during the study period. For these cases, I calculated the dependent variable (*Number of days it took until the first development of drug*) as the max number of days (i.e., difference in days between the market entry date and December 31, 2019, which is the end of the study period) and included a dummy variable (*Tag*) that takes the value of *1* for these cases. Model 1 estimated without controlling for whether a firm reported any drug development during the study period, and Model 2 added *Tag* to control for it.

2.4.2 Robustness Checks

In Tables 2.5, 2.6, and 2.7, I test whether firms entering product markets through cross-market repeated alliances produce new knowledge less than firms entering product markets through new partner alliances by looking at the number of clinical trials at each stage (Phase I in Table 2.5, Phase II in Table 2.6, and Phase III in Table 2.7). In the same way as Table 2.3, Models 1, 2, and 3 use *Clinical stage trials (binary)* and Models 4, 5, and 6 use *Number of clinical stage trials* for different time periods (5 years, 10 years, and 15 years). The coefficient on *Treated* is negative in all models in Tables 2.5, 2.6, and 2.7, and in a few of the models, the coefficient is significant. The results are consistent with those in Table 2.3, not supporting Hypothesis 1.

Insert Tables 2.5, 2.6, and 2.7 about here

2.4.3 Supplementary Analysis 1: Predicting the Number of Preclinical Trials and Patents

The first supplementary analysis tests if firms entering new markets through cross-market repeated alliances conduct more preclinical trials (drug discovery and preclinical research) and produce more patents. My theory predicted that firms conduct more clinical trials when they enter new markets through cross-market repeated alliances for two reasons: 1) they produce more new-to-the-world knowledge and 2) they are more efficient in innovating by finding new applications of existing knowledge. Accordingly, Hypothesis 1 predicted that firms entering new markets through cross-market repeated alliances do more clinical trials because both mechanisms would result in more clinical trials. To test the first mechanism more directly—producing more new-to-the-world knowledge—I test if firms entering through cross-market repeated alliances conduct more preclinical trials where new-to-the-world knowledge are produced and are granted more patents.

Table 2.8 uses the versions of dependent variable based on the *Number of preclinical stage trials* that a firm has in a market for a given year. *Number of preclinical stage trials* includes drug development activities in drug discovery stage and preclinical research stage. The cumulative versions of this variable that adds all preclinical stage trials of a firm up to 5 years after its market entry, up to 10 years after its market entry, and up to 15 years after its market entry are used in Models 4, 5, and 6, respectively. Models 1, 2, and 3 use binary variables that measure whether there were any preclinical stage trials for 5 years, 10 years, and 15 years periods (*Preclinical stage trials (binary)*). Table 2.9 uses the versions of dependent variable based on the number of patents that were granted to a firm in the new markets (*Number of patents*). Both (cumulative) binary and count versions of the variable were used in the same way as Table 2.8.

The coefficient on *Treated* is negative in all models in Tables 2.8 and 2.9, and in a few of the models, the coefficient is significant. The results suggest that firms entering new markets through cross-market repeated alliances do not conduct more preclinical stage trials or produce more patents than firms entering through new partner alliances, not supporting my theory that firms entering new markets through cross-market repeated alliances produce more new-to-the-world knowledge than new partner alliances.

Insert Tables 2.8 and 2.9 about here

2.4.4 Supplementary Analysis 2: Testing the Moderating Role of Partners' Strength in New and Old Markets of Alliances

In the second supplementary analysis, I test the moderating roles of partners' strength in new and old markets of alliances to examine if the suggested mechanisms in the first chapter have impacts

on performances. In the first chapter, I suggested that firms choose existing partners over new partners for mainly two reasons: to leverage relational resources and successfully enter new markets or to strengthen existing relationships in old markets. To test my theory, I argued and showed that, for the first reason, a firm chooses an existing partner over a new partner when its existing partners have product development experience or high levels of technological knowledge in the market that it is entering. If firms indeed choose existing partners over new partners to successfully enter new markets, I expect the positive performance outcomes of market entries through cross-market repeated alliances (i.e., doing more clinical stage trials and having the first development of drug faster) to be pronounced.

Table 2.10 tests the moderating role of the entry partner's incumbency (*Incumbent entry partner*) and the entry partner's level of technological knowledge in the new market (*Entry partner technological knowledge*). Models 1 to 6 predicts whether firms conduct clinical stage trials in 5 years, 10 years, and 15 years. Model 7 and 8 predicts the number of days it took for firms to report the first drug development. The coefficients on the interaction terms (*Treated X Incumbent entry partner* and *Treated X Entry partner technological knowledge*) are not significant in Models 1 to 6. *Treated X Incumbent entry partner* is negative and significant in Model 7 ($p<0.01$) and *Treated X Entry partner technological knowledge* is positive and significant in Model 8 ($p<0.01$). These results suggest that the entering partner's incumbency or the level of technological knowledge in the entering market do not strengthen the positive relationship between cross-market repeated alliance entry and the likelihood of conducting clinical stage trials. While firms entering through cross-market repeated alliances can develop drugs faster when their entry partners are incumbents, the technological knowledge of the entry

partners slows down the first drug development. Overall, the results imply that firms seem to be unable to benefit from the entry partner's strength (incumbency or technological knowledge), contrary to what they may have anticipated when entering markets with the partners.

For the second reason in the first chapter, I argued and showed that a firm chooses an existing partner over a new partner when its existing partners have high levels of technological knowledge in the old markets of alliances. If firms indeed choose existing partners over new partners to strengthen their existing relationships in other markets, I expect the positive performance outcomes of market entries through cross-market repeated alliances (i.e., doing more clinical stage trials and having the first development of drug faster) to be mitigated.

Table 2.11 tests the moderating role of the entry partner's level of technological knowledge in the old markets of alliances. Models 1 to 6 predicts whether firms conduct clinical stage trials in 5 years, 10 years, and 15 years. Model 7 and 8 predicts the number of days it took for firms to report the first drug development. I use a split sample approach where I first calculate the (average) number of patents that the entry partner had in the old markets of alliances. Note here that such variable can be calculated only for cross-market repeated alliances (*Treated* = 1), but not for new partner alliances (*Treated* = 0) since they do not have previous alliances. Then, I split samples into two groups: firms whose partners were strong (i.e., have many patents) in old markets of alliances and firms whose partners were weak (i.e., have few patents) in the old markets of alliances. I assign control samples into the same groups as their treated samples, as the control samples were already matched with their treated samples.

The coefficient on Treated is negative and significant ($p<0.1$) in Model 1, but not in Model 2, suggesting that a firm entering through cross-market repeated alliance is less likely to

do clinical trials in 5 years after the market entry when its entry partner was weak in the old markets of alliances, but not when the entry partner was strong in the old markets of alliances. In a similar way, Models 7 and 8 suggest that the speed of the drug development after the market entry is faster (the coefficients on *Treated* in Models 7 and 8 are significantly different from each other) for firms entering through cross-market repeated alliances when their entry partners were strong in old markets of alliances. These results are opposite to what I expected based on my theory from the first chapter, implying that firms perform better in new market when their entry partners are strong in the old markets of alliances.

Insert Tables 2.10 and 2.11 about here

2.5 Discussion

This study examined the performance implications of cross-market repeated alliances compared to new partner alliance in the market entry context. I predicted that firms entering through cross-market repeated alliances do more clinical trials and develop drugs faster than firms entering through new partner alliances. However, I do not find a significant difference in the number of clinical trials conducted by firms entering through cross-market repeated alliances and firms entering through new partner alliances. I find that firms entering through cross-market repeated alliances develop drugs faster than firms entering through new partner alliances after the market entry. Together, the results suggest that cross-market repeated alliances enable firms to have an earlier start in new markets they are entering, but not necessarily enable them to produce more new knowledge. The results seem to suggest that the difference between new partner alliance and cross-market repeated alliance lies mostly in the speed at which firms develop new knowledge.

In the setting of market entry, the speed at which firms develop drugs after the market entry is important. In other words, while both cross-market repeated alliance and new partner alliance are good strategic tools for new knowledge creation, cross-market repeated alliance also benefits from the accumulated trust and relationship-specific assets (e.g., partner-specific knowledge) so that cross-market repeated alliance is more efficient way to innovate than new partner alliance.

To test the suggested mechanisms in the first chapter, I also tested the moderating effects of the entry partner's strength in new and old markets of alliances (Supplementary analysis 2). Overall, I did not find strong evidence to support the theory that firms benefit more from cross-market repeated alliances when the entry partner is resourceful (in terms of incumbency or technological knowledge) in the new market and when the entry partner is not resourceful (in terms of technological knowledge). One possible explanation is that while firms choose entry partners to benefit from either new or old markets based on the partners' incumbency and the level of technological knowledge (first chapter), such knowledge of partners or intentions of the focal firms do not necessarily result in the performance outcomes in the new market. Rather, it is possible that firms collaborate and find opportunities for new knowledge creation only after they enter new markets together. Another possible explanation is that the level of analysis is different in the first chapter and the second chapter. In the first chapter, I calculated the partners' characteristics at the focal firm level by aggregating each firm's partners. In the second chapter, on the other hand, I calculated the entry partner's characteristics for both new and old markets of alliances. Firms may choose cross-market repeated alliance or new partner alliance based on the characteristics of their existing partners (i.e., alliance portfolio), but they may not be able to enter markets with the best partner or the most preferred partner among their existing partners.

Table 2.1 Descriptive statistics of treatment and control groups before and after matching

Panel A. Before matching

	Treatment (N=97)				Control (N=1,321)				diff	Std err.	t value	p value
	Mean	Std. Dev.	min	max	Mean	Std. Dev.	min	max				
Incumbent existing partners exist	.649	0.480	0	1	.595	0.491	0	1	-.055	.052	-1.05	.291
Partners' (relative) level of knowledge in new market	.043	0.134	-.322	.788	.024	0.139	-2.563	.879	-.019	.015	-1.3	.195
Partners' (relative) level of knowledge in old markets of alliances	.049	0.129	-.073	.906	.019	0.116	-1.233	1.168	-.03	.013	-2.4	.017
Total number of existing partners	3.113	4.523	1	30	2.077	2.031	1	31	-1.036	.24	-4.3	0
Total number of markets	2.598	2.581	1	14	2.366	2.220	1	14	-.233	.237	-1	.326
Total number of clinical trials	.013	0.049	0	.408	.017	0.091	0	1.722	.004	.009	.45	.654
Total number of patents	.029	0.066	0	.467	.044	0.171	0	3.803	.016	.018	.9	.379
Proportion of patents in new market	.103	0.223	0	1	.102	0.184	0	1	-.001	.02	-.05	.961
Proportion of clinical trials in old markets of alliances	.232	0.391	0	1	.188	0.339	0	1	-.044	.036	-1.25	.217
Proportion of patents in old markets of alliances	.207	0.266	0	1	.219	0.272	0	1	.012	.029	.4	.685
Cumulative activities in new market	.33	0.473	0	1	.365	0.482	0	1	.035	.051	.7	.489
Market relatedness (all)	.039	0.059	0	.23	.045	0.063	0	.339	.005	.007	.8	.412
Market relatedness (old markets of alliances)	.08	0.038	.016	.211	.085	0.039	.008	.308	.005	.004	1.3	.196
Size of new market	.244	0.242	0	.845	.255	0.229	.001	.845	.011	.024	.45	.649
Size of old markets of alliances	.21	0.189	.001	.797	.259	0.216	.001	.845	.049	.022	2.2	.03
Growth rate of new market	.337	0.837	-1.814	2.546	.357	0.928	-1.893	3.049	.02	.097	.2	.836

Samples were also matched on the therapeutic area dummies, entity type dummies, and year dummies. The statistics on those variables are not presented here. No variables were significantly different in treatment and control groups after matching.

Panel B. After matching

	Treatment (N=92)				Control (N=368)				diff	Std err.	t value	p value
	Mean	Std. Dev.	min	max	Mean	Std. Dev.	min	max				
Incumbent existing partners exist	.641	0.482	0	1	.63	0.483	0	1	-.011	.057	-.2	.847
Partners' (relative) level of knowledge in new market	.043	0.136	-.322	.788	.031	0.085	-.295	.508	-.012	.012	-1.1	.283
Partners' (relative) level of knowledge in old markets of alliances	.039	0.097	-.073	.544	.028	0.078	-.116	.539	-.011	.009	-1.15	.25
Total number of existing partners	2.467	2.587	1	18	2.239	1.833	1	13	-.229	.234	-1	.33
Total number of markets	2.391	2.253	1	11	2.28	1.931	1	12	-.112	.233	-.5	.633
Total number of clinical trials	.008	0.028	0	.187	.008	0.025	0	.312	0	.003	0	.996
Total number of patents	.029	0.068	0	.467	.026	0.056	0	.348	-.003	.007	-.4	.676
Proportion of patents in new market	.108	0.228	0	1	.109	0.206	0	1	.001	.025	.05	.97
Proportion of clinical trials in old markets of alliances	.216	0.381	0	1	.22	0.370	0	1	.005	.044	.1	.92
Proportion of patents in old markets of alliances	.202	0.261	0	1	.193	0.259	0	1	-.009	.03	-.3	.778
Cumulative activities in new market	.348	0.479	0	1	.323	0.468	0	1	-.025	.055	-.45	.656
Market relatedness (all)	.039	0.060	0	.23	.041	0.060	0	.223	.002	.007	.25	.788
Market relatedness (old markets of alliances)	.08	0.039	.016	.211	.081	0.038	.012	.216	.001	.005	.2	.826
Size of new market	.251	0.246	0	.845	.25	0.236	.001	.845	-.001	.028	-.05	.971
Size of old markets of alliances	.207	0.191	.001	.797	.217	0.196	.001	.845	.009	.022	.4	.672
Growth rate of new market	.339	0.846	-1.814	2.546	.31	0.899	-1.893	3.049	-.03	.104	-.3	.775

Samples were also matched on the therapeutic area dummies, entity type dummies, and year dummies. The statistics on those variables are not presented here. No variables were significantly different in treatment and control groups after matching.

Table 2.2 First stage results

	Model 1
Incumbent existing partners exist	0.76**
	(0.349)
Partners' (relative) level of knowledge in new market	1.24
	(0.767)
Partners' (relative) level of knowledge in old markets of alliances	1.37*
	(0.703)
Total number of existing partners	0.38**
	(0.152)
Total number of markets	0.25**
	(0.105)
Total number of clinial trials	-7.74**
	(3.184)
Total number of patents	1.96
	(1.444)
Proportion of patents in new market	5.21**
	(2.466)
Proportion of clinical trials in old markets of alliances	-0.30
	(0.420)
Proportion of patents in old markets of alliances	-1.69**
	(0.674)
Cumulative activities in new market	2.65**
	(1.302)
Market relatedness (all)	-3.55**
	(1.789)
Market relatedness (old markets of alliances)	4.14
	(3.116)
Size of new market	1.47
	(0.977)
Size of old markets of alliances	-0.88**
	(0.405)
Growth rate of new market	-0.06
	(0.086)
Inverse mills ratio	7.16**
	(3.441)
Constant	-29.77**
	(13.957)
Therapeutic area dummies	Included
Firm type dummies	Included
Year dummies	Included
Observations	1,418

Note: Probit regression model predicting *Market entry through repeated alliance*. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 2.3 Predicting the number of clinical stage trials

	Binary			Count		
	5 years	10 years	15 years	5 years	10 years	15 years
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Treated	0.07	-0.23	-0.11	-0.19	-0.84	-1.10*
	(0.493)	(0.607)	(0.734)	(0.571)	(0.547)	(0.614)
Number of patents	0.05	0.12	0.09	0.08	0.15***	0.10**
	(0.037)	(0.076)	(0.092)	(0.052)	(0.045)	(0.050)
Total number of patents	-0.01	-0.00	0.01	-0.01	-0.01*	0.00
	(0.005)	(0.006)	(0.007)	(0.006)	(0.005)	(0.007)
Total number of clinical trials	-0.02	-0.04	0.03	-0.08**	-0.06	-0.07
	(0.017)	(0.043)	(0.066)	(0.032)	(0.048)	(0.047)
Total number of markets	0.18	0.37	-0.03	0.77***	0.64**	0.49*
	(0.170)	(0.287)	(0.333)	(0.271)	(0.288)	(0.295)
Market relatedness	8.64**	5.73	7.15	2.34	-3.71	-8.24
	(3.944)	(5.254)	(6.304)	(4.812)	(4.436)	(5.367)
Growth rate of new market	-0.99***	-1.01**	-1.62**	-1.41***	-0.98***	-1.23***
	(0.319)	(0.402)	(0.634)	(0.377)	(0.329)	(0.460)
Size of new market	-0.00	-0.00	0.00	-0.00	0.00	0.00
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.002)
Incumbent entry partner	0.43	-0.39	-0.67	0.35	-0.04	-0.33
	(0.455)	(0.551)	(0.769)	(0.590)	(0.516)	(0.649)
Entry partner technological knowledge	-0.00	-0.01	-0.01	-0.01	-0.01	0.00
	(0.012)	(0.018)	(0.028)	(0.017)	(0.017)	(0.011)
Constant	-5.50***	-3.70	-27.41	-4.49***	-19.44	-5.83
	(1.566)	(2.523)	(29.446)	(1.716)	(607.001)	(28.769)
Therapeutic area dummies	Included	Included	Included	Included	Included	Included
Entry year dummies	Included	Included	Included	Included	Included	Included
Observations	291	174	140	333	189	140

Note: Models 1, 2, and 3 are logit regression models. Models 4, 5, and 6 are negative binomial regression models. Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 2.4 Predicting the number of days it took until the first development of drug

	Model 1	Model 2
Treated	-0.05***	-0.05***
	(0.003)	(0.003)
Number of patents	-0.00***	-0.00***
	(0.000)	(0.000)
Total number of patents	0.00***	0.00***
	(0.000)	(0.000)
Total number of clinical trials	-0.00***	-0.00***
	(0.000)	(0.000)
Total number of markets	0.02***	0.02***
	(0.002)	(0.002)
Market relatedness	-0.42***	-0.42***
	(0.034)	(0.034)
Growth rate of new market	-0.01***	-0.01***
	(0.002)	(0.002)
Size of new market	-0.00***	-0.00***
	(0.000)	(0.000)
Incumbent entry partner	-0.03***	-0.03***
	(0.003)	(0.003)
Entry partner technological knowledge	-0.00**	-0.00**
	(0.000)	(0.000)
Tag		-0.80***
		(0.019)
Constant		5.97***
		(0.025)
Therapeutic area dummies	Included	Included
Entry year dummies	Included	Included
The first year of development dummies	Included	Included
Initial development status reported	Included	Included
Observations	460	460

Note: Model 1 is poisson regression model. Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 2.5 Predicting the number of Phase I clinical stage trials

	Binary			Count		
	5 years	10 years	15 years	5 years	10 years	15 years
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Treated	0.22	-0.36	-0.84	0.36	-1.46*	-2.24***
	(0.678)	(0.713)	(0.801)	(0.819)	(0.770)	(0.730)
Number of patents	0.05	0.03	-0.04	0.09	0.10*	0.04
	(0.045)	(0.057)	(0.076)	(0.061)	(0.057)	(0.054)
Total number of patents	-0.00	0.01	0.03***	-0.01	0.00	0.02**
	(0.007)	(0.007)	(0.010)	(0.009)	(0.007)	(0.008)
Total number of clinical trials	-0.03	-0.10	-0.11	-0.09	-0.07	-0.08
	(0.032)	(0.066)	(0.080)	(0.063)	(0.083)	(0.058)
Total number of markets	0.13	0.69	0.53	0.93*	0.93*	0.66*
	(0.267)	(0.458)	(0.487)	(0.504)	(0.556)	(0.378)
Market relatedness	12.33**	1.47	0.04	2.07	-5.95	-10.29*
	(5.128)	(6.151)	(7.270)	(5.974)	(6.249)	(5.950)
Growth rate of new market	-0.86**	-0.86*	-1.16**	-2.13***	-1.25**	-1.33***
	(0.424)	(0.443)	(0.574)	(0.692)	(0.543)	(0.446)
Size of new market	-0.00	0.00	0.00	-0.00	0.00	0.00
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Incumbent entry partner	-0.54	-0.70	-0.84	-0.28	-0.85	-1.21*
	(0.643)	(0.621)	(0.760)	(0.862)	(0.727)	(0.656)
Entry partner technological knowledge	-0.03	-0.01	-0.01	-0.02	-0.01	0.01
	(0.037)	(0.024)	(0.031)	(0.032)	(0.027)	(0.016)
Constant	-4.41**	-5.09*	-40.91	-21.06	-39.44	-42.45*
	(2.028)	(2.802)	(31.294)	(959.894)	(1,507.104)	(25.187)
Therapeutic area dummies	Included	Included	Included	Included	Included	Included
Entry year dummies	Included	Included	Included	Included	Included	Included
Observations	228	149	125	333	189	140

Note: Models 1, 2, and 3 are logit regression models. Models 4, 5, and 6 are negative binomial regression models. Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 2.6 Predicting the number of Phase II clinical stage trials

	Binary			Count		
	5 years	10 years	15 years	5 years	10 years	15 years
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Treated	-0.53	-1.04	-0.95	-0.22	-0.79	-0.83
	(0.662)	(0.666)	(0.713)	(0.781)	(0.664)	(0.721)
Number of patents	0.10**	0.20**	0.14	0.12*	0.15**	0.11*
	(0.050)	(0.100)	(0.130)	(0.070)	(0.065)	(0.056)
Total number of patents	-0.01	-0.00	0.01	-0.01	-0.00	0.00
	(0.009)	(0.007)	(0.009)	(0.012)	(0.007)	(0.008)
Total number of clinical trials	-0.04	-0.08	-0.08	-0.10	-0.17**	-0.17**
	(0.032)	(0.056)	(0.069)	(0.065)	(0.068)	(0.072)
Total number of markets	0.39	0.47	0.55	0.41	0.94**	0.88**
	(0.251)	(0.315)	(0.409)	(0.414)	(0.377)	(0.392)
Market relatedness	3.28	2.26	-4.39	11.16	-2.60	-9.11
	(5.094)	(5.179)	(6.613)	(7.441)	(5.639)	(6.486)
Growth rate of new market	-0.98**	-1.34***	-1.49***	-1.21**	-1.04***	-1.07**
	(0.406)	(0.466)	(0.549)	(0.495)	(0.395)	(0.487)
Size of new market	-0.00	-0.00	0.00	-0.00*	0.00	0.00
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.002)
Incumbent entry partner	0.50	-0.30	0.04	0.17	-0.54	-0.54
	(0.541)	(0.568)	(0.665)	(0.719)	(0.547)	(0.753)
Entry partner technological knowledge	0.01	0.01	0.01	0.00	0.01	0.00
	(0.012)	(0.011)	(0.010)	(0.019)	(0.012)	(0.011)
Constant	-4.09***	-4.72*	-45.90	-3.81*	-19.38	2.58
	(1.560)	(2.844)	(30.805)	(1.983)	(705.211)	(33.749)
Therapeutic area dummies	Included	Included	Included	Included	Included	Included
Entry year dummies	Included	Included	Included	Included	Included	Included
Observations	269	166	133	333	189	140

Note: Models 1, 2, and 3 are logit regression models. Models 4, 5, and 6 are negative binomial regression models. Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 2.7 Predicting the number of Phase III clinical stage trials

	Binary			Count		
	5 years	10 years	15 years	5 years	10 years	15 years
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Treated	0.73	-1.30	-1.90*	-1.69	-3.96**	-3.24**
	(1.278)	(1.105)	(1.133)	(1.487)	(1.732)	(1.301)
Number of patents	0.34***	0.28**	0.29*	0.32**	0.28***	0.21*
	(0.121)	(0.108)	(0.161)	(0.132)	(0.108)	(0.107)
Total number of patents	-0.03**	-0.01*	-0.00	-0.02*	-0.01	0.01
	(0.012)	(0.008)	(0.011)	(0.012)	(0.010)	(0.010)
Total number of clinical trials	0.00	-0.02	0.12	-0.02	-0.11	0.04
	(0.027)	(0.057)	(0.078)	(0.052)	(0.109)	(0.081)
Total number of markets	0.96**	0.39	-0.21	1.25**	1.12*	-0.01
	(0.395)	(0.378)	(0.412)	(0.544)	(0.675)	(0.556)
Market relatedness	-9.18	2.67	5.41	-8.04	-9.37	10.56
	(12.158)	(7.809)	(7.416)	(13.097)	(10.199)	(8.519)
Growth rate of new market	-1.38	-0.77	-1.37*	-1.51	-1.88**	-1.39*
	(0.979)	(0.648)	(0.746)	(1.007)	(0.927)	(0.808)
Size of new market	0.00	-0.00	0.01*	-0.00	-0.00	0.02**
	(0.001)	(0.002)	(0.007)	(0.001)	(0.002)	(0.007)
Incumbent entry partner	2.31*	1.20	0.35	2.94**	1.83	1.32
	(1.244)	(0.888)	(0.956)	(1.404)	(1.423)	(1.329)
Entry partner technological knowledge	-0.07	-0.02	-0.00	-0.05	-0.00	0.01
	(0.071)	(0.050)	(0.043)	(0.069)	(0.082)	(0.042)
Constant	-6.32	-2.46	-255.68	-43.59	-11.92	-58.92
	(5.248)	(3.085)	(458.741)	(2,307.093)	(704.096)	(142.661)
Therapeutic area dummies	Included	Included	Included	Included	Included	Included
Entry year dummies	Included	Included	Included	Included	Included	Included
Observations	131	114	121	333	189	140

Note: Models 1, 2, and 3 are logit regression models. Models 4, 5, and 6 are negative binomial regression models. Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 2.8 Supplementary analysis 1: Predicting the number of preclinical trials

	Binary			Count		
	5 years	10 years	15 years	5 years	10 years	15 years
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Treated	-0.05	-0.56	-0.31	0.25	-1.12	-1.22
	(0.431)	(0.552)	(0.631)	(0.499)	(0.714)	(0.762)
Number of patents	0.04	0.10*	0.18*	0.08	0.12**	0.11**
	(0.039)	(0.055)	(0.102)	(0.053)	(0.057)	(0.055)
Total number of patents	-0.01**	-0.01*	-0.01*	-0.02**	-0.01*	-0.00
	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
Total number of clinical trials	0.01	-0.02	-0.02	0.01	0.02	-0.02
	(0.009)	(0.043)	(0.065)	(0.008)	(0.050)	(0.045)
Total number of markets	0.26*	0.50	0.52	0.13	0.05	0.27
	(0.138)	(0.316)	(0.386)	(0.158)	(0.345)	(0.310)
Market relatedness	6.08*	4.56	2.26	8.97**	4.85	-2.49
	(3.593)	(4.878)	(6.075)	(4.537)	(5.114)	(5.697)
Growth rate of new market	-0.24	-0.16	-0.40	-0.17	-0.15	-0.44
	(0.237)	(0.295)	(0.350)	(0.289)	(0.342)	(0.355)
Size of new market	-0.00	-0.00*	0.00	0.00	-0.00**	-0.00
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)
Incumbent entry partner	1.16***	1.06**	1.37**	1.09**	-0.01	-0.02
	(0.372)	(0.508)	(0.658)	(0.428)	(0.508)	(0.585)
Entry partner technological knowledge	-0.01	-0.00	-0.00	-0.00	0.01	0.02
	(0.008)	(0.008)	(0.007)	(0.009)	(0.012)	(0.016)
Constant	-4.08***	-4.40*	4.34	-3.11**	-16.60	9.36
	(1.470)	(2.282)	(23.308)	(1.572)	(7,161.160)	(20.622)
Therapeutic area dummies	Included	Included	Included	Included	Included	Included
Entry year dummies	Included	Included	Included	Included	Included	Included
Observations	325	186	140	333	189	140

Note: Models 1, 2, and 3 are logit regression models. Models 4, 5, and 6 are negative binomial regression models. Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 2.9 Supplementary analyses 1: Predicting the number of patents

	Binary			Count		
	5 years	10 years	15 years	5 years	10 years	15 years
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Treated	-0.18	-0.16	-25.49*	-0.21	-0.31	-0.63**
	(0.403)	(0.983)	(13.356)	(0.215)	(0.276)	(0.323)
Total number of patents	0.13***	0.21***	1.85**	0.02***	0.02***	0.02***
	(0.026)	(0.064)	(0.755)	(0.002)	(0.002)	(0.002)
Total number of clinical trials	0.01	-0.14**	-3.47**	-0.02***	-0.04	-0.05*
	(0.017)	(0.060)	(1.418)	(0.005)	(0.022)	(0.027)
Total number of markets	-0.14	0.79*	24.53**	0.12*	0.24	0.40**
	(0.197)	(0.448)	(10.095)	(0.070)	(0.148)	(0.160)
Market relatedness	5.96	0.01	-163.27**	-2.50	-3.37	-5.37**
	(4.363)	(7.379)	(67.284)	(1.853)	(2.390)	(2.647)
Growth rate of new market	-0.23	-0.79*	-1.34	-0.34***	-0.54***	-0.43**
	(0.229)	(0.417)	(3.440)	(0.131)	(0.148)	(0.170)
Size of new market	-0.00	-0.00*	0.00	-0.00***	-0.00	-0.00***
	(0.000)	(0.001)	(0.012)	(0.000)	(0.000)	(0.000)
Incumbent entry partner	0.33	-0.65	-2.08	0.40**	0.29	0.38
	(0.351)	(0.681)	(2.691)	(0.185)	(0.254)	(0.297)
Entry partner technological knowledge	0.00	0.01	0.60**	0.00	0.00	0.01
	(0.006)	(0.010)	(0.297)	(0.004)	(0.005)	(0.005)
Constant	-1.15	-0.37	-573.08	-0.41	-0.79	-18.93*
	(1.088)	(3.631)	(18,945.397)	(0.607)	(1.390)	(10.719)
Therapeutic area dummies	Included	Included	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included	Included	Included
Observations	333	166	90	333	189	140

Note: Models 1, 2, and 3 are logit regression models. Models 4, 5, and 6 are negative binomial regression models. Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 2.10 Supplementary analysis 2: Testing the moderating role of partners' strength in new market

	Clinical stage trials (binary)						Number of days	
	5 years		10 years		15 years			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Treated	-0.05	0.13	-0.08	0.04	0.11	0.25	-0.03***	-0.05***
	(0.605)	(0.522)	(0.578)	(0.517)	(0.585)	(0.512)	(0.004)	(0.003)
Treated X Incumbent entry partner	0.38		0.58		0.67		-0.06***	
	(1.068)		(1.070)		(1.065)		(0.008)	
Treated X Entry partner technological knowledge		-0.01		0.01		0.01		0.00***
		(0.026)		(0.030)		(0.030)		(0.000)
Number of patents	0.06	0.05	0.07*	0.06*	0.05	0.05	-0.00***	-0.00***
	(0.037)	(0.037)	(0.036)	(0.036)	(0.037)	(0.036)	(0.000)	(0.000)
Total number of patents	-0.01	-0.01	-0.01	-0.00	-0.00	-0.00	0.00***	0.00***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.000)	(0.000)
Total number of clinical trials	-0.02	-0.02	-0.02	-0.02	-0.03	-0.03	-0.00***	-0.00***
	(0.017)	(0.017)	(0.020)	(0.020)	(0.020)	(0.021)	(0.000)	(0.000)
Total number of markets	0.19	0.18	0.34*	0.33*	0.32*	0.32*	0.02***	0.02***
	(0.171)	(0.169)	(0.183)	(0.184)	(0.186)	(0.188)	(0.002)	(0.002)
Market relatedness	8.54**	8.77**	6.95*	6.88*	7.03*	6.94*	-0.43***	-0.41***
	(3.946)	(3.964)	(3.939)	(3.940)	(3.994)	(3.992)	(0.034)	(0.034)
Growth rate of new market	-0.99***	-0.99***	-1.07***	-1.06***	-1.15***	-1.14***	-0.01***	-0.01***
	(0.319)	(0.318)	(0.311)	(0.311)	(0.324)	(0.324)	(0.002)	(0.002)
Size of new market	-0.00	-0.00	-0.00*	-0.00*	-0.00**	-0.00**	-0.00***	-0.00***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Incumbent entry partner	0.37	0.40	0.03	0.11	0.18	0.29	-0.03***	-0.03***
	(0.484)	(0.463)	(0.454)	(0.436)	(0.460)	(0.437)	(0.003)	(0.003)
Entry partner technological knowledge	-0.00	0.00	-0.02	-0.02	-0.02	-0.03	0.00*	-0.00***
	(0.013)	(0.022)	(0.018)	(0.024)	(0.018)	(0.025)	(0.000)	(0.000)
Tag							-0.80***	-0.79***
							(0.019)	(0.019)
Constant	-5.49***	-5.51***	-4.78***	-4.76***	-4.67***	-4.65***	5.97***	5.97***
	(1.567)	(1.565)	(1.370)	(1.366)	(1.356)	(1.351)	(0.025)	(0.025)
Therapeutic area dummies	Included	Included	Included	Included	Included	Included	Included	Included
Entry year dummies	Included	Included	Included	Included	Included	Included	Included	Included
The first year of development dummies	Included	Included	Included	Included	Included	Included	Included	Included
Initial development status reported	Included	Included	Included	Included	Included	Included	Included	Included
Observations	291	291	318	318	318	318	460	460

Note: Models 1-6 are logit regression models. Models 7 and 8 are poisson regression models. Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

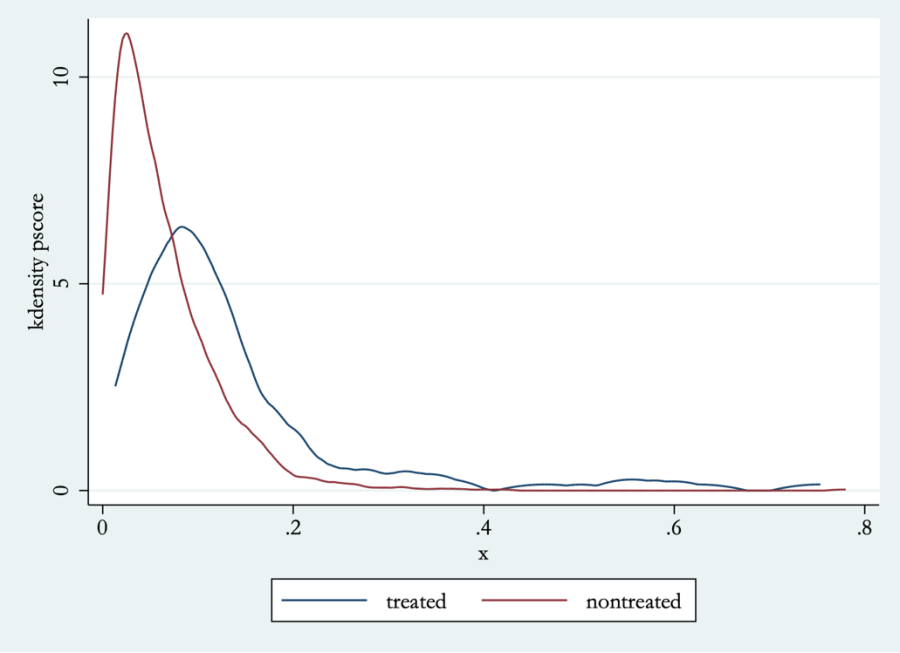
Table 2.11 Supplementary analysis 2: Testing the moderating role of partners' strength in old markets of alliances

	Clinical stage trials (binary)						Number of days	
	5 years		10 years		15 years			
Entry partner technological knowledge in old markets of alliances	weak	strong	weak	strong	weak	strong	weak	strong
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Treated	-1.52*	1.27	-0.77	1.21	-0.42	1.21	-0.01***	-0.18***
	(0.884)	(1.174)	(0.795)	(1.298)	(0.738)	(1.298)	(0.005)	(0.008)
Number of patents	0.01	0.07	0.02	0.11	0.01	0.11	-0.00***	-0.00***
	(0.069)	(0.108)	(0.055)	(0.135)	(0.056)	(0.135)	(0.000)	(0.001)
Total number of patents	-0.01	-0.00	0.00	-0.00	0.00	-0.00	0.00***	0.00***
	(0.011)	(0.012)	(0.008)	(0.013)	(0.008)	(0.013)	(0.000)	(0.000)
Total number of clinical trials	-0.03	-0.06	-0.07*	-0.07	-0.07*	-0.07	0.00***	-0.01***
	(0.062)	(0.059)	(0.041)	(0.067)	(0.042)	(0.067)	(0.000)	(0.000)
Total number of markets	-0.00	0.59	0.58	0.70	0.61	0.70	-0.05***	0.04***
	(0.439)	(0.520)	(0.371)	(0.595)	(0.399)	(0.595)	(0.003)	(0.004)
Market relatedness	11.58	11.69	10.92	12.98	7.88	12.98	0.39***	0.50***
	(7.454)	(8.748)	(6.906)	(9.937)	(6.967)	(9.937)	(0.054)	(0.090)
Growth rate of new market	-2.06***	-0.11	-1.92***	-0.96	-1.88***	-0.96	-0.01**	-0.07***
	(0.673)	(0.841)	(0.548)	(0.837)	(0.564)	(0.837)	(0.002)	(0.004)
Size of new market	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00***	-0.00***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
Incumbent entry partner	-1.26	1.93**	-1.67**	2.48**	-1.17	2.48**	0.03***	-0.12***
	(0.855)	(0.865)	(0.814)	(1.027)	(0.745)	(1.027)	(0.004)	(0.005)
Entry partner technological knowledge	0.03	-0.03	0.03	-0.04	0.01	-0.04	-0.00***	0.00***
	(0.022)	(0.028)	(0.022)	(0.040)	(0.022)	(0.040)	(0.000)	(0.000)
Tag							-0.65***	-0.62***
							(0.028)	(0.041)
Constant	-3.66*	-2.02	-3.57**	0.13	-3.69**	0.13	5.67***	5.77***
	(2.109)	(2.334)	(1.667)	(2.614)	(1.703)	(2.614)	(0.035)	(0.049)
Therapeutic area dummies	Included	Included	Included	Included	Included	Included	Included	Included
Entry year dummies	Included	Included	Included	Included	Included	Included	Included	Included
The first year of development dummies	Included	Included	Included	Included	Included	Included	Included	Included
Initial development status reported	Included	Included	Included	Included	Included	Included	Included	Included
Observations	145	84	158	90	152	90	255	405

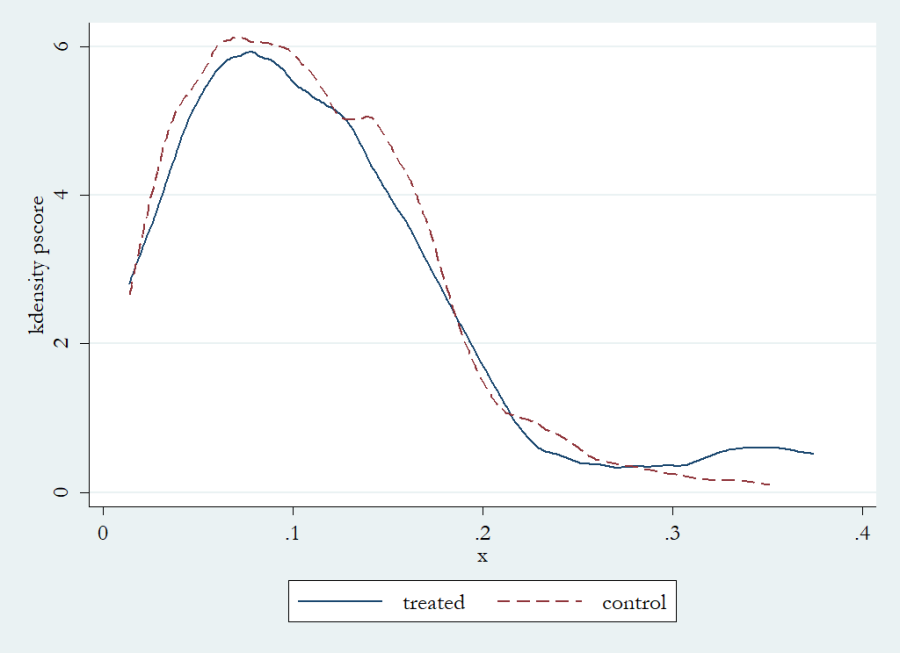
Note: Models 1-6 are logit regression models. Models 7 and 8 are poisson regression models. Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Figure 2.1 Kernel density distributions of treated and control groups before and after matching

Panel A. Before matching



Panel B. After matching



General Conclusion and Discussion

The existing literature on interfirm alliance has shown that firms often repeat alliances and that such repeated alliances have performance implications. Despite the significance of the multi-business firms, however, it has not been explored much yet whether firms also repeat alliances across market boundaries, when and why firms would form such cross-market repeated alliance, and the performance implications of such cross-market repeated alliance. To answer these questions, my dissertation empirically tested these questions in the context of therapeutic area entries in the U.S. pharmaceutical industry from 1986 to 2019. I find that cross-market repeated alliance is indeed a salient phenomenon that is worthy of attention, being almost 1 out of 2 among all repeated alliances. Furthermore, the results show that firms enter new markets through cross-market repeated alliances to either successfully enter new markets or strengthen the existing alliances. Cross-market repeated alliances also enable firms to enjoy an early development of drug after the market entry, but not necessarily lead to a larger number of clinical trials.

My dissertation advances our existing knowledge on interfirm alliances and corporate strategy in several ways. First, the results of my dissertation suggest that alliance activities of firms in one market is related to those in another market—both in terms of formations and performances of alliances, calling for a need to take more holistic view on the alliance activities of firms, rather than atomizing alliance activities of firms in each market. In addition, my dissertation suggests and empirically shows that there are two different types of repeated alliances—repeated alliance in the same market as before and cross-market repeated alliance—

which calls for a need to revisit some of the suggested mechanisms and findings on the formation and performance implications of repeated alliance.

While my dissertation focused on the firm- or dyad-level outcomes, the phenomenon of cross-market repeated alliance has important implications on the third parties in alliance network, too. Given that a firm can bring in their existing partners from one market to another and that alliance activities across market boundaries are relevant to one another, not only the firm's partners and relationships among them in a market but also the firm's partners and relationships among them in another market should matter for the firm's partners. The network of firms in a market can also be reconsidered, considering that relationships among firms often spillover from one market to another.

Furthermore, the findings from my dissertation suggest that relational resources, or existing partners, of a firm can be valuable pre-entry market resources on top of the internal resources of a firm. Not only do firms have relational resources to leverage when they enter new markets, but firms can also potentially benefit from such relational resources by enjoying faster product development after market entry.

My dissertation also has important implications to managers. The prevalence of cross-market repeated alliance and their strategic value suggest that managers can consider expanding their relationships with partners into multiple markets, especially when they already know each other well and value the partnership. At the same time, my dissertation delivers a message that managers should be also aware of the relationships among competitors not only in the given market but also in other markets, to prevent coalitions among them across markets or to prevent unwanted knowledge leakage across product markets through them.

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Appendices

Appendix A. The application of a two-sided matching model to this study

The maximum score estimator (Fox, 2010) has been increasingly used in the field of strategy recently for research questions relevant to matching games between two sides. For example, Mindruta and her colleagues (2016) introduce the matching model to the problem of alliance partner selection and study how the complementarities in different attributes between upstream (biotechnology firms) and downstream (pharmaceutical firms) affect the partner choice and compare how important each factor is in the process. Kamal and her colleagues (2021) use two-sided matching model to estimate how each alliance partner's network centrality contribute to the alliance performance in the context of Thoroughbred horse industry where nurseries (buyers) and stud farms (suppliers) make foal-sharing contracts. While the two-sided matching model can solve the endogeneity problem in partner selection problem by considering the competition on each side for the best partner on the other side, a few conditions need to be met for the model to run, and relatedly, the model is useful for answering specific research questions, but not others. Both the research question of this study (when and why firms choose an existing partner over a new partner for market entry) and the empirical context to test the theory (i.e., market entry into new product markets through R&D alliances in the U.S. pharmaceutical industry) are not suitable for the use of the matching model. Below, I explain why the two-sided matching model is not appropriate for this study. Then, I present the results from the potential two-sided matching model that can be applied to this study with cautions.

Most importantly, the matching model requires that there are two clearly defined set of firms with heterogeneous attributes and preferences. In other words, all firms in one market look for partners in another market, and vice versa. Thus, the two-sided matching model is appropriate for matching problems of two sides, including those between suppliers and buyers, acquirers and targets in mergers and acquisitions, job candidates and employers. However, this study focuses on the formation of R&D alliances where both parties take responsibilities in and collaborate for the development of new products. I deliberately focus on R&D alliances because the theory of this study emphasizes the recombination of knowledge of firms in product development and collaborative process. There are no clear two sides for R&D alliances where both parties actively engage in the collaboration. Instead, all firms in the market are potential partners to all other firms. Furthermore, the two-sided matching model requires that all candidates in at least one side of the market are connected to candidates on the other side at least once. This condition makes it harder for the matching model to be applied to R&D collaboration, where many firms do not engage in R&D alliance with any firms in a product market in a year.

It may seem at first that the two sides can be defined at least for R&D alliance for market entry, which is the focus of this study. However, the two sides of the market are still hard to be defined because the choice set on each side of market can be defined in many ways and each of those definitions has underlying assumptions. Table A1 illustrates a few of those possible set-ups for the two sides of market and assumptions underlying each of them. In addition, in any of these cases in Table A1, R&D alliance entry by two new entrants (i.e., non-incumbents) cannot be considered. However, as the main results showed, there are considerable amount of market entries through R&D alliances between two new entrants. Together, because there are no clear

two sides for the question and empirical set-up of this study, alternative definitions of two sides each has problems.

Appendix A Table 1. A few possible set-ups for the two sides of market and underlying assumptions

Side 1: Entrants	Side 2: Incumbents	Underlying assumptions
Firms that entered a market through alliances with incumbents	Incumbent firms that were matched with new entrants	1) Among potential entrants, firms that did not enter a market through alliance with incumbent did not look for incumbent partner in market, 2) Among incumbent firms, only certain firms looked for alliances with new entrants
Firms that entered a market through alliances with incumbents	All incumbent firms in a market	1) Among potential entrants, firms that did not enter a market through alliance with incumbent did not look for incumbent partner in market, 2) All incumbent firms looked for alliances with new entrants
Firms that entered market through alliances, either with incumbent or with non-incumbent	Incumbent firms that were matched with new entrants	1) Among potential entrants, firms that did not enter a market through alliance did not look for incumbent partner in market, 2) Among incumbent firms, only certain firms looked for alliances with new entrants
Firms that entered market, either through alliance or internal development	Incumbent firms that were matched with new entrants	1) Among potential entrants, firms that did not enter a market did not look for incumbent partner in market, 2) Among incumbent firms, only certain firms looked for alliances with new entrants

Furthermore, the two-sided matching model can be used to examine what attributes of the partners maximize the joint value and thus drive firms to choose each other as partners. However, the research question of this study is to examine when and why *firms* would choose an existing partner over a new partner when they enter new markets. Thus, the two-sided matching model is inadequate to answer the research question of this study for several reasons. First, this study takes the *focal firm's point of view* and focuses on when and why firms leverage their relational resources from old markets to enter new markets. Second, this study compares the choice between repeated alliance (i.e., use of relational resources) and new partner alliance, not the choice of partner among potential partners. Third, the two-sided matching model assumes that all actors on market look for the best partner that will create the most value for alliance. While it may be reasonable assumption in many cases, the theory of this study suggest that a firm

may choose a partner for market entry not because the partner is the best one in the new market, but because the partner is valuable in an old market of alliance (relevant to Hypothesis 2).

Nonetheless, I ran the two-sided matching model with the data of this study to see how it works. Each product market in each year is defined as a separate market. There are 263 markets in total. I adopted the last definition of the two sides of market in Table A1 because it assumes that all potential entrants look for alliance partner among incumbents, consistent with this study's view of existing relationships with incumbents from old markets as valuable pre-entry resources and that firms will leverage such relational resources to enter new markets. In a similar way, the last definition in Table A1 also restricts potential partner firms in market to certain firms (Side 2: Incumbents), suggesting that the unmatched incumbents were not in competition to be matched with new entrants, or were not interested in allying with new entrants.

I applied the code developed and shared by Mindruta and her colleagues (2016) that was initially developed and shared by Fox and Santiago (2014). Table 2A presents results on the maximum score estimation, using Differential Evolution routine for the estimation of coefficients. The confidence intervals in the parentheses are obtained using the subsampling procedure (Politis, Romano, & Wolf, 1999) across 100 subsamples with four markets at a time. The matching game is modeled as one to one alliance with transfers (Fox, 2018).

Appendix A Table 2. Matching model estimations of complementarities in partner attributes for market entry R&D alliances

Relationship	Relationship description	Model
Entrant total number of drugs in development X Incumbent total number of drugs in development	Total number of drugs in development of entrant in the last five years across all product markets multiplied by that of incumbent	1
Previous R&D alliance between entrant and incumbent	A Dummy variable that takes the value of *1* when there is an existing R&D alliance between entrant and incumbent and *0* otherwise	**1380.74** (292.62, 2468.86)
Entrant number of patents in the entering market X Incumbent number of patents in the entering market	Number of patents of entrant granted in the last five years in the entering market multiplied by that of incumbent	**237.78** (164.15, 311.4)
Entrant total number of R&D alliances X Incumbent total number of R&D alliances	Total number of R&D alliances of entrant formed across all product markets in the last five years multiplied by that of incumbent	**110.23** (65.77, 154.68)
Number of correctly predicted inequalities		506,564
Total number of inequalities		598,626
Proportion of correctly predicted inequalities		84.62%

Notes: 95% confidence intervals in parentheses. Bold values indicate coefficient estimates within the 95% confidence intervals that do not include zero.

The proportion of correctly predicted inequalities is 84.62%. In other words, the joint production function in the above model correctly predicts, for 84.62% of all possible combinations, the two pairs that create greater value than the counterfactual pairs (switching partners). Following the findings from the previous studies that firm sizes are complementary in partner selection (Mindruta et al., 2016) and that firms prefer large firms as alliance partners for resource needs (Katila et al., 2008; Stuart et al., 1999), the complementarities between the size of entrant and incumbent in terms of the number of drugs in their pipelines is set as the baseline variable. The second relationship, whether there is an existing R&D alliance between entrant and incumbent, is positive and significant, implying that firms are more likely to choose each other as partner if there were existing collaborations between them. The result is consistent with one of the main findings of this study that the existing alliances of potential entrants can be valuable relational resources for them to enter new markets through alliances with incumbents. The third relationship, the complementarities between the level of technological knowledge of entrant and incumbent, is included in the model because the theory of this study suggested that the technological knowledge of both entrants and their existing partners in new market matter in market entry through R&D alliances. Last, consistent with the prior findings in alliance literature that general alliance experience of firms increases the likelihood of alliance success (Hoang & Rothaermel, 2005; Kale & Singh, 2007), there are complementarities in the R&D alliance experience of entrant and incumbent; an entrant with a lot of R&D alliance experience will be matched with an incumbent with a lot of R&D alliance experience.

Appendix A References

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Appendix B. Main results using logistic regressions

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Incumbent existing partners exist		2.11**			1.85**		1.73**
		(0.846)			(0.772)		(0.747)
Partners' (relative) level of knowledge in new market			5.68**			3.85**	2.78*
			(2.422)			(1.932)	(1.552)
Partners' (relative) level of knowledge in old markets of alliances				4.02**	15.51**	2.73*	14.54**
				(1.995)	(6.029)	(1.496)	(5.992)
Incumbent existing partners exist X Partners' (relative) level of knowledge in old markets of alliances					-11.94**		-11.91**
					(5.900)		(5.908)
Partners' (relative) level of knowledge in new market X Partners' (relative) level of knowledge in old markets of alliances						0.51	0.51
						(3.320)	(2.938)
Total number of existing partners	0.84***	0.85***	0.78**	0.80**	0.82**	0.77**	0.80**
	(0.321)	(0.312)	(0.310)	(0.337)	(0.327)	(0.326)	(0.323)
Total number of markets	0.61**	0.61***	0.56**	0.54**	0.57**	0.53**	0.55**
	(0.239)	(0.233)	(0.223)	(0.225)	(0.222)	(0.220)	(0.220)
Total number of clinical trials	-17.35***	-18.16***	-16.28**	-15.65**	-16.77***	-15.35**	-16.51**
	(6.658)	(6.688)	(6.415)	(6.450)	(6.473)	(6.341)	(6.454)
Total number of patents	2.12	2.63	4.09	3.49	4.05	4.34	4.65
	(2.203)	(2.311)	(2.853)	(2.751)	(2.758)	(3.100)	(3.058)
Proportion of patents in new market	11.22**	12.61**	10.72**	10.19**	11.65**	10.13**	11.49**
	(4.890)	(5.264)	(4.802)	(4.817)	(5.175)	(4.804)	(5.177)
Proportion of clinical trials in old markets of alliances	-0.36	-0.78	-0.28	-0.33	-0.69	-0.28	-0.62
	(0.759)	(0.873)	(0.754)	(0.783)	(0.887)	(0.772)	(0.875)
Proportion of patents in old markets of alliances	-3.29***	-3.86***	-3.26***	-3.22**	-3.80***	-3.21**	-3.75***
	(1.221)	(1.392)	(1.235)	(1.277)	(1.428)	(1.269)	(1.422)
Cumulative activities in new market	5.76**	6.45**	5.44**	5.24**	5.97**	5.15**	5.85**
	(2.626)	(2.793)	(2.565)	(2.588)	(2.748)	(2.574)	(2.746)
Market relatedness (all)	-7.89**	-8.19**	-7.82**	-7.75**	-8.31**	-7.78**	-8.27**
	(3.915)	(3.977)	(3.948)	(3.935)	(4.013)	(3.965)	(4.029)
Market relatedness (old markets of alliances)	9.82	11.05	8.83	8.76	10.33	8.30	9.87
	(6.586)	(6.857)	(6.404)	(6.516)	(6.779)	(6.429)	(6.728)
Size of new market	3.09	3.70*	2.65	2.79	3.37	2.56	3.15
	(1.940)	(2.100)	(1.857)	(1.931)	(2.076)	(1.881)	(2.048)
Size of old markets of alliances	-1.75**	-1.81**	-1.82**	-2.01**	-2.08**	-1.98**	-2.05**
	(0.847)	(0.854)	(0.854)	(0.892)	(0.893)	(0.884)	(0.888)
Growth rate of new market	-0.08	-0.05	-0.09	-0.09	-0.09	-0.10	-0.09
	(0.176)	(0.181)	(0.175)	(0.175)	(0.179)	(0.174)	(0.179)
Inverse mills ratio	15.33**	17.38**	14.49**	13.96**	16.09**	13.75**	15.76**
	(6.833)	(7.383)	(6.680)	(6.744)	(7.263)	(6.701)	(7.247)
Constant	-63.13**	-71.67**	-59.53**	-57.46**	-66.32**	-56.46**	-64.90**
	(27.718)	(30.008)	(27.042)	(27.315)	(29.464)	(27.126)	(29.409)
Therapeutic area dummies	Included	Included	Included	Included	Included	Included	Included
Firm type dummies	Included	Included	Included	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included	Included	Included	Included
Observations	1,418	1,418	1,418	1,418	1,418	1,418	1,418

Notes: All models are logit regression models predicting *Entry with an existing partner.* The models include therapy area dummies, firm type dummies, and year dummies. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$