Paper to be presented at DRUID21
Copenhagen Business School, Copenhagen, Denmark
October 18-20, 2021

Standing on the Parent's Shoulder or in its Shadow? Alliance Partner Overlap Between Employee Spinouts and Their Parents

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Abstract

Employee spinouts, startups founded by prior employees of existing industry firms, play a critical role in firm creation and knowledge transfer within and across industries. Their superior performance often arises from resources and knowledge accrued during employment in parent firms. An understudied question relates to whether prior employment in parent firms impacts an employee spinout's alliance formation, given that alliances are critical to the survival and commercial success of startups. This article examines when employee spinout's alliance partners overlap with their parent's partners. Drawing on alliance formation patterns of U.S. medical device spinouts founded between 1990 to 2013, we find that spinouts extending their parents' technologies tend to have more alliance partner overlap with their parents, whereas product market overlap leads to fewer overlapping partners.

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INTRODUCTION

Employee spinouts, defined as entrepreneurial startups founded by prior employees of existing industry firms, have attracted increasing scholarly attention due to their critical role in firm creation, industry emergence, and regional development (Agarwal, Audretsch & Sarkar, 2007; Klepper, 2007). Besides drawing on underexploited opportunities within parent firms, employee spinouts often draw on knowledge and routines from their employment context (Agarwal, Echambadi, Franco & Sarkar, 2004; Gambardella, Ganco & Honoré, 2015). Past studies have linked employee spinouts' superior performance to the pre-entry founder knowledge and experience accumulated in technological (e.g., Franco & Filson, 2006; Klepper & Sleeper, 2005), regulatory and market (e.g., Chatterji, 2009), and social capital dimensions (e.g., Burton, Sørensen & Beckman, 2002).

The knowledge gained by employee spinouts is not their only birthright. Their parent's alliances may also shape opportunities available to employee spinouts for subsequent alliance formation. Despite the importance of alliances for startups' survival and commercial success (Baum, Calabrese & Silverman, 2000; Gans & Stern, 2003; Ozcan & Eisenhardt, 2009), the existing literature has largely abstracted away from whether and when employee spinouts tap into their parent's alliance network. This study addresses this gap by examining the conditions under which an employee spinout's alliance partners overlap with its parent firm's alliance partners.

Entrepreneurial startups often face obstacles in alliance formation, as prospective partners have difficulty evaluating a newcomer startup with limited visible and reliable performance records (Pollock & Gulati, 2007; Rothaermel, 2002; Stern, Dukerich & Zajac, 2014). However, for employee spinouts, prospective partners can rely on information about the spinout through its founders' employment and affiliation with parent firms. Thus, this information and the link to a parent firm can expand a spinout's opportunities for alliance formation. Yet, a founder's prior employment in an existing firm does not come without a price for alliance formation. The relationship between employee spinouts and parents

can create competitive constraints for prospective partners. Firms tend to avoid alliances that escalate rivalrous conditions (Gimeno, 2004; Silverman & Baum, 2002). Thus, in case of competitive tension between spinouts and parents, prospective partners may avoid allying with employee spinouts.

When the prospective partner is one of the parent's alliance partners, the above two forces can intensify. Regarding information access for evaluating spinouts, parent's alliance partners are uniquely positioned to access and assess information about an employee spinout through their own affiliation with the parent firm. Regarding possible competitive considerations, parent's alliance partners are easier targets of a competitive reaction from a parent firm. Further, the consequence of a competitive response can be adverse for parent's alliance partners. By juxtaposing these forces, our hypotheses specify the conditions when a spinout's alliance partners overlap with its parent's alliance partners.

The first hypothesis looks at technology extension, defined as the degree to which an employee spinout introduces novel variations and extensions to its parent's technologies. When a spinout builds on its parent's technologies, the initial technological complementarities that attracted a partner to the parent firm continue to hold for a new alliance between the spinout and its parent's partner. Any novel extension to the parent's technologies boosts the value of a spinout's technologies for joint value creation with the parent's alliance partners. Further, due to familiarity with parent's technologies, parent's alliance partners can better evaluate a spinout's novel technologies. This improved insight regarding a spinout's technology can increase the attractiveness of an alliance between a spinout and a parent's alliance partners. Further, due to the attractiveness of a spinout's technologies, parent's alliance partners may discount rivalry avoidance with a parent firm in their considerations. Thus, the more a spinout extends its parent's technologies, the larger the alliance partner overlap with its parent.

The second hypothesis concerns product market overlap, defined as the degree to which an employee spinout competes in the same downstream markets as its parent firm. When a spinout occupies a similar product space as its parent firm, the initial market complementarities that brought

a partner to the parent firm persist for a new alliance between the spinout and its parent's partner. However, extensive product market overlap can weaken a spinout's attractiveness as an alliance partner, given that allying with such a spinout may not offer any enhanced complementarities relative to allying with a parent. Further, product market overlap can raise competitive tensions between an employee spinout and its parent, with the potential for any competitive reaction to spill over to their partners. This can underpin a rivalry avoidance mechanism that pushes parent's alliance partners away from forming an alliance with a spinout. Thus, the more a spinout overlaps with its parent's product markets, the lower the alliance partner overlap with its parent.

Using a dataset of medical device spinouts founded between 1990-2013, we find as a spinout's technology extension increases the overlap between spinout's partners and its parent's partners. However, in the presence of high product market overlap between an employee spinout and its parent firm, the overlap between spinout's partners and its parent's partners decreases.

This study contributes to the intersection of employee entrepreneurship and alliance literature streams. To the employee entrepreneurship literature, we note the conditions under which employee spinouts can tap into their parent's alliance network and break away from struggles impeding alliance formation by startups. In particular, if a spinout offers novel variations of its parent's technologies or differentiates itself in the product market, then alliance formation opportunities are realized. Thus, founders' past employment can both benefit and cast a shadow on subsequent alliance opportunities. Overall, this shows that spinout's inheritance from their parents goes beyond the knowledge accrued in their employment context. For the alliance formation literature, we add the importance of a founders' employment history in influencing the origin of startups' partnerships. Past literature has indicated the value of repeated alliances between the same partners in building relational capital and reducing information asymmetry (Dyer & Singh, 1998). Our study highlights the relational advantages that may spill over to an employee spinout due to the founders' experience at the parent firm.

BACKGROUND: ALLIANCE FORMATION BY EMPLOYEE SPINOUTS

Strategic Alliances in Entrepreneurial Contexts

Strategic alliances play a critical role for firms that seek to fill resource gaps by tapping into an external partner's complementary resources (Ahuja, 2000; Arora & Gambardella, 1994; Dussauge, Garrette & Mitchell, 2000). For entrepreneurial startups, the importance of alliances is amplified, given that startups' survival and commercial success often hinge on assembling the needed resources during the early years (Baum et al., 2000; Ozcan & Eisenhardt, 2009).

Past studies have shown the long-lasting implications of alliances for startups. Alliances can be a source of capital, shaping startups' subsequent venture capital rounds (Ozmel, Robinson & Stuart, 2013). Alliances with owners of complementary assets can aid startups' technology commercialization (Gans & Stern, 2003). Transitioning into an IPO is often more likely for startups with alliances (Gulati & Higgins, 2003), particularly when the startups' alliance portfolio exhibits diversity in partners (Hoehn-Weiss & Karim, 2014). After startups become public, market capitalization is often associated with alliance mode choices (Aggarwal & Hsu, 2009). Further, the performance consequences span into startups' long-term revenue growth (Singh & Mitchell, 2005). Importantly, early alliances position a startup in a connected network of industry firms that can pave the way for subsequent new alliances, thereby acting as an indirect feedback loop for augmenting the above performance benefits.

Notwithstanding the benefits of strategic alliances, entrepreneurial startups often face obstacles in forming alliances. In general, alliance formation hinges on a two-sided voluntary agreement that complementarities in partners' resources increase joint value creation (Mindruta, Moeen & Agarwal, 2016; Mitsuhashi & Greve, 2009). But the presence of resource complementarities is not a sufficient condition for alliance formation, as two other concerns often complicate the choice of whether and with whom to form an alliance. On the one hand, prospective partners may have ex-ante difficulty evaluating each other's resources and the resultant complementarities (Pisano, 1991). On the other

hand, prospective partners may be concerned about ex-post misappropriation, such as knowledge leakage or intense competition that can eclipse potential complementarities (Gulati & Singh, 1998). Both concerns are particularly pronounced when one of the partners is an entrepreneurial startup.

First, relative to established firms with long periods of activity, entrepreneurial startups' newness creates a relative dearth of information about them. Past direct interactions that often base prospective partners' evaluation of each other are primarily non-existent for startups. Further, startups have not yet had time to build a reliable and visible performance record. When in pioneering fields, a startup's valuation is additionally complicated by the difficulty in assessing its emerging technological trajectory. Under these conditions, past studies have shown that prospective partners often look at any available proxy such as patenting activity (Hsu & Ziedonis, 2013), hiring of high-status scientists (Stern et al., 2014), location in a technology cluster (Rothaermel, 2002), or prominent underwriters at the time of IPO (Pollock & Gulati, 2007). Nonetheless, prospective partners still find it difficult to evaluate startups. Startups face similar challenges. Absent informational and reputational benefits, they too may be unable to evaluate partners (Ahuja, Polidoro & Mitchell, 2009).

Second, relative to established firms with a secured competitive position, entrepreneurial startups are typically vulnerable to competition. Because startups often lack resources to withstand price wars or lawsuits, they tend to stay invisible from competitors (Katila, Chen & Piezunka, 2012). Further, because their core competence may come from technologies, startups are wary of knowledge leakage in alliances that can endanger their resources and create competitors. When forming alliances, startups often consider whether the prospective partner can turn into a competitor (Dushnitsky & Shaver, 2009) or has indirect ties to their competitors (Pahnke, McDonald, Wang & Hallen, 2015).

The above benefits and challenges describe the general environment for startups. We next turn to describe how the founding conditions of employee spinouts differently shape this environment.

Employee Spinout's Pre-entry Background and Alliance Formation

Employee spinouts are an important group of startups with a distinct pre-entry background. We define employee spinouts as startups founded by former employees of existing firms in an industry.[1] We refer to the founder's former employers as parent firms. Startups' pre-entry background can shape their strategic direction (Helfat & Lieberman, 2002) and alliance patterns (Hallen, 2008). Specifically, the employee spinout formation process impacts the above two aspects of alliance formation.

First, spinout founders' link to a parent firm can reduce information asymmetry with prospective partners. The spinout formation process often draws on employee's identification of underexploited opportunities in parent firms (Agarwal et al., 2004; Gambardella et al., 2015). When parent firms overlook opportunities (Gompers, Lerner & Scharfstein, 2005; Hellman, 2007) or disagree with them (Klepper & Thompson, 2010), employees may depart and found a startup. Past employment bestows an employee spinout with access to technologies (Elfenbein, Hamilton & Zenger, 2010; Franco & Filson, 2006), regulatory and market knowledge (Chatterji, 2009), and social capital (Burton et al., 2002; Phillips, 2002). Compared to other startups, these endowments improve spinout survival and performance (Agarwal et al., 2004; Cirillo, 2019). Before alliance formation, prospective partners' evaluation of employee spinouts can benefit from this information about the link to parent firms.

Second, the relationship between employee spinouts and parent firms may create competitive constraints for prospective partners. Parent firms can occasionally benefit from spinout formation if it leads to corporate realignment (McKendrick, Wade & Jaffee, 2009) or knowledge spill-ins (Kim &

[1] A few studies have used the term employee spinout in two other ways. First, some studies define user spinouts for founders employed in a downstream industry (Adams, Fontana & Malerba, 2016) and out-of-industry spinouts for founders employed in a related industry (Sakakibara & Balasubramanian, 2020). We are interested in spinouts founded in the same industry as their former employer. Second, some studies define corporate spinouts or spinoffs as startups founded with the support of a parent firm (Cirillo, Brusoni & Valentini, 2014). Our definition is agnostic about parent's support or encouragement, though we do not count corporate units that are divested or spun off.

Steensma, 2017). However, the evidence about the adverse impacts of spinouts on parent firms is mounting. From the parent's perspective, spinout formation leads to loss of human capital and routines (Campbell, Ganco, Franco & Agarwal, 2012; Phillips, 2002; Wezel, Cattani & Pennings, 2006) or the rise of a competitor (Bae & Lee, 2021). Thus, the adverse consequences can motivate parent's rivalrous reaction toward spinouts, regardless of whether disagreements precede spinout formation (Klepper & Thompson, 2010). Rivalrous reactions can include competitive salary offers for human capital retention (Carnahan, Agarwal & Campbell, 2012), patent infringement lawsuits (Agarwal, Ganco & Ziedonis, 2009), hostile attitude (Walter, Heinrichs & Walter, 2014), or non-compete clauses (Starr, Balasubramanian & Sakakibara, 2018). Thus, before alliance formation, prospective partners may need to consider the seriousness of these rivalrous tensions between spinouts and parents.

Building on this background, we next juxtapose employee spinouts' pre-entry conditions and the general obstacles in startups' alliance formation to examine the extent to which an employee spinout's alliance partners overlap with its parent firm's alliance partners.

HYPOTHESES: SPINOUT-PARENT ALLIANCE PARTNER OVERLAP

Our hypotheses focus on alliance formation between an employee spinout and a particular group of prospective partners, namely, the parent firm's alliance partners. Specifically, we examine the antecedents of spinout-parent alliance partner overlap, defined as the degree to which employee spinouts and their parent firms have common alliance partners. Our logic considers potential complementarity between partners as the primary precursor to alliance formation (Ahuja, 2000; Arora & Gambardella, 1990). The logic also accounts for how the shared link to a parent firm creates a unique position for parent's alliance partners and spinouts in assessing each other's value and the possibility of them being a target of the parent firm's competitive reaction.

We suggest two contingencies that shape the balance between these considerations before alliance formation, and in turn, influence spinout-parent alliance partner overlap.

Extending Parent's Technologies

Employee spinouts often have access to the technical knowledge accrued during their founders' former employment. Thus, parent's technologies can become building blocks for spinout's knowledge generation. Some spinouts introduce novel variations of their parent's technologies, whereas others do not directly incorporate their parent's technologies. We use "technology extension" to refer to the degree to which a spinout's technologies extend its parent's technologies and offer novel variations that build on its parent's technologies. We outline three reasons why technology extension increases spinout-parent alliance partner overlap.

First, potential technological complementarities can spur alliance formation between a spinout and its parent's partners. When a spinout's technologies build on its parent's technology for offering novel variations, the spinout probably continues to be active in the same technical domains as its parent. Thus, the initial technological complementarities that brought together a parent firm and its partner are likely to persist in a potential alliance between the spinout and its parent's partner. Moreover, the extensions to the parent's technologies boost the value of a spinout's technologies for joint value creation with the parent's partners, given that the prospective partner can potentially access upgraded and novel variations from the spinout. Based on these technological complementarities, an employee spinout and its parent's partners are likely to find each other attractive partners.

Second, the shared link with a parent firm can mitigate challenges pertaining to the ex-ante evaluation of partners' resources, specifically in assessing a spinout's novel technologies. Past studies have shown that prospective partners can become aware of each other's existence and gather reliable information through indirect firm-level (Gulati, 1995) or employee-level links (Rosenkopf, Metiu & George, 2001). From the perspective of a parent's partner, an alliance with a parent firm increases their attention to employee spinouts spawned from their partner. Further, knowledge of a parent's technologies can improve their absorptive capacity for effectively assessing spinout's technologies that

are novel variations of a parent's technologies. In particular, when assessing tacit and uncertain novel technologies proves difficult, past studies have shown that reliance on existing networks is common (Beckman, Haunschild & Phillip, 2004; Hoetker, 2005). Similar advantages hold from the perspective of a spinout. Spinouts can seek information about a parent's partner through their insider links.

Third, when novel technologies are at play, prospective partners may discount rivalry avoidance with a parent firm. In general, parent's alliance partners may worry that tension between employee spinouts and parents can jeopardize their alliance with a parent firm, as a parent firm may decrease its commitment to an alliance or terminate it. However, from the perspective of parent's alliance partners that seek spinout's technologies, the benefits of gaining access to the novel variations of technology can outweigh the costs of possible rivalrous reactions. Further, past studies have shown that parent firms may benefit from the technological sophistication of their spawned spinouts due to knowledge spill-ins (Kim & Steensma, 2017) or reputational effects in the labor market (McKendrick et al., 2009). As a result, in the presence of novel technologies that can benefit the parent firm, prospective partners may perceive that the likelihood of rivalrous reaction by a parent firm is low.

Overall, the strong pull effect of complementarity, the reduced information asymmetry, and the weak push effect of competition lead to more overlap across alliance partners. Thus, we suggest:

Hypothesis 1: The more an employee spinout extends its parent's technologies, the higher the spinout-parent alliance partner overlap.

Overlapping Product Markets

Employee spinouts can often draw on the knowledge of product markets in which their founders' former employment resided. Some spinouts use this market knowledge and offer products similar to their parents, whereas others focus on product markets that are distanced from their parents. We use "product market overlap" to refer to the degree to which an employee spinout competes in the same

downstream markets as its parent firm. We outline three reasons why product market overlap decreases spinout-parent alliance partner overlap.

First, although potential market complementarities can mobilize an alliance between a spinout and its parent's partners, product market overlap weakens its impetus. When a spinout occupies a similar product market space as its parent firm, the initial market complementarities between a parent firm and its partner can again bring together the spinout and its parent's partner. However, extensive product market overlap with a parent can make a spinout too similar to its parent. Thus, from the view of a potential partner, allying with a spinout may not offer any enhanced complementarities compared to allying with a parent.

Second, product market overlap can reduce the benefits of past interactions for ex-ante evaluation of partners. The shared link with a parent firm can provide a spinout and its parent's alliance partners a gateway for information collection, thereby reducing information asymmetry about each other's resources. In contrast to the usefulness of private information for evaluating novel technologies with tacit, uncertain, and difficult-to-evaluate attributes as in H1, evaluation of product market attributes may be possible from public information sources. A firm's product market transactions and activities are often visible to competitors and industry stakeholders. Thus, when an alliance is based on market complementarities, the value of the shared link with a parent firm for ex-ante evaluation is diminished.

Third, in the presence of high product market overlap, rivalry avoidance with a parent firm can be a central concern for parent's partners. Past studies have shown that a competing alliance can strain a firm's current alliances, and at the extreme, lead to termination (Vassolo, Anand & Folta, 2004). Thus, firms tend to avoid alliances that escalate rivalrous conditions (Gimeno, 2004; Silverman & Baum, 2002). In the context of employee spinouts, prospective partners are then likely to assess whether competitive tension between a spinout and its parent can spill over to them. For example, past studies have shown that competitive tension with a parent can even dissuade corporate

investment in a spinout (Bae & Lee, 2021). When a parent's alliance partners contemplate allying with a spinout, their link to a parent firm amplifies their tendency for rivalry avoidance, as a parent firm can retaliate through reduced alliance commitment or termination or exert pressure on them.

With this background, when do parent's alliance partners perceive a rivalrous reaction by a parent firm to be likely? Following seminal competitive dynamics assumptions (Hotelling, 1929), past studies have noted proximity in the product market space as a driver of rivalry between a spinout and its parent firm (Klepper & Sleeper, 2005). Specifically, based on the Census Bureau data across 30 U.S. states, spinout formation patterns imply that spinouts in a similar product market as their parents often anticipate aggressive competitive threats (Sakakibara & Balasubramanian, 2020). The rivalrous reaction can be partly due to the losses incurred by a parent (Campbell et al., 2012; Phillips, 2002; Wezel et al., 2006). Thus, as product market overlap between an employee spinout and its parent increases, the resulting intensity in rivalrous conditions may push the parent's alliance partners away.

Overall, the strong push effect of competition outweighs the weak pull effect of complementarity and information access, thereby leading to less overlap in alliance partners. Thus, we suggest:

Hypothesis 2: The more an employee spinout overlaps with its parent's product markets, the lower the spinout-parent alliance partner overlap.

DATA AND METHODS

Empirical Context: Medical Devices

The empirical context is the U.S. medical device manufacturing industry. Medical devices are instruments or components that, non-chemically and non-metabolically, affect a body's structure or function to diagnose, prevent, or treat a disease. Medical devices include imaging diagnostics, medical lab instruments, surgical devices, and other therapeutic devices. The importance of this industry is salient from social and economic aspects. Socially, through their integral role in healthcare delivery, medical devices increase society's health and well-being. Economically, U.S. expenditure on medical devices approaches $180 billion, with up to half a million employment opportunities (MedPac, 2017).

The medical device industry is an appropriate context for studying alliances by employee spinouts. First, established medical device firms are fountainheads of startup formation, making employee spinouts a common occurrence (Chatterji, 2009). Second, to overcome resource and regulatory requirements, medical device startups have increasingly pursued alliances. In terms of resources, distribution channels, relational capital with physicians and hospitals, and marketing expertise are essential for commercializing medical technologies (Chatterji, Cunningham & Joseph, 2019), despite startups' lack of ownership of these resources in early years (Mitchell, 1991). In terms of regulations, the U.S. Food and Drug Administration (FDA) approval is a critical step in selling a medical device. By contrast, the complexity, duration, and cost of the process can be prohibitive for startups.

Sample

The firm sample consists of employee spinouts in the medical device manufacturing industry founded between 1990-2013, received venture capital (V.C.) funding, and formed alliances. Multiple considerations guide our approach to sample creation. First, due to our interest in tracking spinout's alliances, patents, and medical device approvals for several years post-founding, we restrict the sample to spinouts founded until 2013. Second, to distinguish employee spinouts from other startups, we need a complete list of each startup's founders and their employment history. This information is more reliable and available for VC-funded startups. Third, to measure the dependent variable of alliance partner overlap, we include spinouts that have formed at least one alliance.

To construct the sample, we start with the list of U.S. medical device startups founded between 1990-2013 listed in the Venture Source database. The Venture Source database provides the names and employment history of founders in VC-funded startups, from which we identify whether a founder was previously employed in the medical device industry. Past studies using the Venture Source database have validated the reliability of its founder data (Chatterji, 2009). We further confirm its

accuracy. For a random list of startups, first, we check the founders' names on the startup's Pitchbook profile, and second, we review the self-reported employment history on founders' LinkedIn profiles.

The next step involves identifying whether founders' prior employers are medical device firms. We begin by eliminating universities, hospitals, research centers, financial institutions, and public agencies from the employer list. We then match employer names with the list of public medical device firms obtained from Compustat in SIC groups 3841 (surgical and medical instruments), 3842 (orthopedic, prosthetic, and surgical appliances), 3843 (dental equipment and supplies), 3844 (x-ray apparatus and tubes), 3845 (electromedical and electrotherapeutic apparatus), and 5047 (medical and hospital equipment). Lastly, we investigate the remaining employers' primary business through manual searches in Bioscan, Medtrack, Pitchbook, or other Internet sources.

We classify a startup as an employee spinout if any of its founders worked at a medical device firm preceding the founding year. This process leads to the identification of 804 employee spinouts out of the 1496 startups in the Venture Source database. Our definition of employee spinouts is consistent with seminal studies that consider founders' prior employment in the same industry (e.g., Agarwal et al., 2004; Klepper & Sleeper, 2005). Accordingly, our sample does not include user spinouts with founders employed in a downstream industry (Adams et al., 2016) or out-of-industry spinouts with founders employed in any other industry (Sakakibara & Balasubramanian, 2020).

As a final step, given our interest in employee spinouts' alliance activity, we triangulate across three databases of Medtrack, SDC Platinum, and Cortellis to create a list of alliances involving these 804 spinouts. The use of three databases increases our confidence in the completeness of alliance data. Consistent with past entrepreneurship research (Campbell et al., 2012; Sauermann, 2018), we use the first five years after a spinout founding as the focal time frame. This process results in a sample of 175 employee spinouts with alliance activity during the five-year window after their founding.

The unit of analysis is spinout-parent pairs. Because co-founders in the same spinout might have been employed by different medical device firms, some spinouts can have multiple parents. Further, some parent firms spawned more than one spinout during the study time period. Overall, these 175 employee spinouts were spawned by 300 parent firms, leading to 360 spinout-parent pairs.

Dependent Variable

The dependent variable is the number of spinout's alliance partners during the five-year window post-founding that overlap with any of its parent's alliance partners before that particular spinout alliance. To construct this variable, we repeat the triangulation process across three databases of Medtrack, SDC Platinum, and Cortellis to create a list of alliances involving parent firms. We then use fuzzy string comparison algorithms to identify overlapping alliance partners between spinouts and parents and manually confirm matches based on similarity scores. Our sensitivity analysis includes an alternative measure, that is, a binary variable equal to one if any of the spinout's alliance partners during the five-year window post-founding overlaps with any of its parent's alliance partners.

Explanatory Variables

Technology Extension. We measure technology extension as the (logged) number of times that patents filed by the spinout during the five-year window post-founding cite their parents' patents. We assemble patent data for spinouts and parents from the PatentsView platform at the USPTO. We use patents to gauge a firm's technical portfolio, as patents provide a traceable proxy for technological innovations. Further, technologies in a citing patent often advance the prior knowledge in a cited patent (Jaffe, Trajtenberg & Henderson, 1993) which is consistent with the use of patent citations in employee mobility studies (Agarwal et al., 2009; Rosenkopf & Almeida, 2003). Our sensitivity analysis includes an alternative measure, that is, the (logged) number of patents filed by the spinout during the five-year window post-founding that cites its parents' patents.

Product Market Overlap. We measure product market overlap as the ratio of shared medical specialties for which both a spinout and its parent have received FDA approvals during the five-year window post-founding, relative to the number of medical specialties for which a parent firm received FDA approval. To create the list of approved medical devices for spinouts and parents, we append two FDA databases that report medical devices authorized for sales in the United States across channels of the pre-market approval (PMA) and pre-market notification (510k). Depending on the scope of regulatory oversight, firms must go through either PMA or 510k process. The PMA process entails establishing the safety and effectiveness of a device anew, whereas the 510k process requires showing substantial equivalence to another approved device. For comprehensive coverage of authorized medical devices, we append the two databases.

This regulatory process assigns one medical specialty to each device, based on definitions in the Title 21 Code of Federal Regulations Chapter 1. The specialties are clinical chemistry, toxicology, hematology, pathology, immunology, microbiology, anesthesiology, cardiovascular, dental, ear, nose & throat, gastroenterology & urology, surgery, general hospital, neurology, gynecology, ophthalmic, orthopedic, physical medicine, and radiology. Our measure builds on the assumption that two medical devices approved for the same medical specialty have the highest level of overlap in serving the same customers, sales substitution, and market rivalry.

Defining market overlap based on FDA-assigned medical specialties has advantages over using SIC or NAICS codes. First, these medical specialties provide a more fine-grained distinction in medical device markets than broad SIC codes. Second, SIC codes are often available for public firms through self-disclosure, whereas FDA-assigned medical specialties are available for both private and public firms and are less impacted by strategic disclosure considerations. Third, unlike SIC codes that apply to the entire firm, FDA-assigned medical specialties pertain to products and signify the presence of a product on the market for which competition is salient.

Control Variables

As control variables, we include spinout, parent, and spinout-parent pair attributes that may have a bearing on alliance partner overlap and help us rule out alternative explanations.

First, two variables capture the extent to which each firm pursues alliances. Numerous alliances may increase the total number of partners that each firm connects with, thereby leading to overlapping alliance partners. We measure spinout alliances as the (logged) number of alliances involving the spinout during the five-year window post-founding. We measure parent alliances as the (logged) number of alliances involving the parent during the five-year window before and after spawning.

Second, two variables pertain to patents filed by spinout and parent firm. These variables seek to separate technology extension from the size of a patent portfolio, as the number of citations may increase for firms with large patent portfolios. Further, potential alliance partners may view patenting activity of spinouts and parents as a quality signal that can impact spinout's alliance opportunities (Hsu & Ziedonis, 2013). We measure spinout patents as the (logged) number of patents filed by the spinout during the five-year window post-founding. We measure parent patents as the (logged) number of patents filed by the parent firm during the five-year window before and after spawning. To cover medical patents, we focus on international patent class A61 (medical or veterinary science). Notably, spinouts in the sample rarely had patents outside of A61.

Third, four control variables capture facets of FDA-approved products. These four variables seek to separate market overlap from each firm's number and breadth of products, as larger and broader product portfolios may exhibit larger market overlap. Further, a startup's product pipeline can be a visible indicator of its progress in advancing its technologies to the market, thereby attracting alliance partners (Mindruta et al., 2016; Rothaermel, 2002). We measure spinout products as the (logged) number of spinout's approved medical devices during the five-year window post-founding. We measure parent products as the (logged) number of parent's approved medical devices during the five-

year window before and after spawning. We measure spinout market breadth as the (logged) number of distinct specialties for which spinout's medical devices were approved during the five-year window post-founding. We measure parent market breadth as the (logged) number of specialties for which parent's medical devices were approved during the five-year window before and after spawning.

Fourth, we include spinout attributes. We account for the size of the founding team as a count of the number of co-founders. We measure the presence of sibling founders as the number of co-founders that were previously employed by the same parent, considering that spinouts often move in teams (Agarwal, Campbell, Franco & Ganco, 2016). Because the presence of high-status founders may impact alliance formation (Stern et al., 2014), another control variable is a binary variable that is equal to one if any co-founder holds a Ph.D. degree. Further, due to the prevalence of user entrepreneurship in medical devices (Chatterji & Fabrizio, 2012), we account for the presence of physician co-founders. This binary variable is equal to one if any co-founder was employed in a hospital or healthcare setting. We measure spinout-parent co-location using a binary variable equal to one if the spinout is located in the same state as its parent. Co-location can raise competitive tensions between spinout and parent (Berchicci, King & Tucci, 2011). We measure spinout location in a medical technology cluster using a binary variable equal to one if the spinout is located in one of the medical clusters of California, Minnesota, and Massachusetts. Startups in technology clusters can have easier access to vital resources and garner alliance opportunities (Rothaermel, 2002). To capture variations in the spinout founding year, we include time trend variables dividing the study period into three windows.

Estimation Methods

The dependent variable is a count of the number of shared alliance partners. A suitable estimation strategy for count data is either Poisson or negative binomial model. However, a possible concern of using the Poisson model is the presence of overdispersion in the dependent variable. Hence, we utilize the negative binomial as our main estimation model. Post-estimation diagnostics in our models reveal

that the dispersion parameter is greater than zero, thereby suggesting that the negative binomial is suitable for our sample. To account for the possible correlation between spinouts in a medical specialty, standard errors are clustered accordingly. In sensitivity analysis, we use a Poisson estimation for the count dependent variable and a logit estimation for an alternative binary dependent variable.

EMPIRICAL FINDINGS

Descriptive Statistics

We first report general descriptive statistics for all 804 employee spinouts founded between 1990-2013. 41.2% of employee spinouts have solo-founders, with an average of 2.5 co-founders for the other 58.8%. Founding teams presented diversity in their expertise that went beyond the industry expertise of their employee entrepreneurs. In 32.6% of spinouts, at least one founder had a Ph.D. degree. In 16.7% of spinouts, another co-founder was previously employed in a hospital or healthcare setting. 22% of spinouts had academic co-founders who previously worked at a research department in a university. 61% of spinouts were located in medical technology clusters, with 355 in California, 89 in Massachusetts, and 44 in Minnesota. In terms of an exit strategy, 35.2% of spinouts got acquired, on average 11 years after their founding. But only less than 5% of acquisitions occurred in the first five years post-founding. By the end of 2019, 341 employee spinouts participated in a total of 1468 alliances. Their first alliance occurred on average 6.6 years after founding, pointing to the scarcity of alliances in the early years and difficulties in finding an alliance partner.

Table 1 presents variable definitions and summary statistics for the sample of 175 employee spinouts with alliances in the five-year window post-founding. Their founding attributes are generally similar to the above descriptions of all employee spinouts. 37.1% of them had solo-founders. When formed by multiple co-founders, they had an average of 2.5 co-founders. PhD-holder founders and physician co-founders were present in 34.8% and 17.14% of startups, respectively. 57% of them are located in one of the medical technology clusters. Although 41.7% of them got acquired on average

11.3 years after founding, only three acquisitions happened within the first five years. 3.4% of spinouts were acquired by their parent's alliance partners. In terms of alliances, by the end of 2019, these spinouts participated in a total of 1005 alliances, 27.5% of which were in the first five years after founding. It took on average 3.7 years for a spinout to establish its first alliance. 9.1% of spinouts formed alliances with a partner that was formerly their parent's partner.

Table 2 provides the correlation table. Consistent with the hypothesized relationships in H1 and H2, technology extension exhibits a positive correlation with alliance partner overlap, whereas product market overlap exhibits a negative correlation. Parent alliances, patents, and medical devices seem to correlate with each other, consistent with large medical device parents' activity in all three domains. Further, the number of approved medical devices and specialties breadth exhibit high correlation, possibly because they are constructed using the same FDA data source. Nonetheless, the model mean VIF is 3.28 and within the acceptable range. Further, stepwise dropping of these variables does not change the overall findings. We thus conclude the multi-collinearity is unlikely to impact our findings.

--- Tables 1-2 about here ---

Main Results

Table 3 reports the estimation results for the dependent variable of alliance partner overlap. Models 1-4 show the estimated coefficients and their p-values for a negative binomial model of the number of shared alliance partners between spinouts and parents. Model 1 includes control variables. The alliance partner overlap increases with an increase in alliance activity by either spinout (β=0.778; p=0.099) or parent (β=0.757; p=0.000). Further, as the number of sibling co-founders increases, the larger number of links to the parent firm increases alliance partner overlap (β=1.036; p=0.008). Co-location in the same state reduces alliance partner overlap (β= -0.971; p=0.000).

--- Table 3 about here ---

Models 2 and 3 contain two explanatory variables for the technology extension, and the product market overlap separately. Model 4 reports the complete model, for which the positive estimated dispersion parameter (alpha=4.374, p=0.000) supports the use of a negative binomial model. Based on Model 4, technology extension is positively related to alliance partner overlap (β=0.503; p=0.000), whereas product market overlap is negatively related to alliance partner overlap (β= -7.715; p=0.000). We next report the size of the effect while keeping other variables at observed values. Relative to a spinout that cited its parent's patents only once, there is a three-fold increase in the predicted number of shared alliance partners for a spinout with 20 citations to its parent's patents. Further, the predicted number of shared alliance partners is zero for complete market overlap with a ratio of one, while a switch from 0.3 to 0.4 in overlap ratio in medical specialties decreases the predicted number of shared alliance partners two-fold. These findings corroborate H1 and H2.

Sensitivity Analyses

Model 5 examines the robustness of findings for an expanded time frame of six years. Consistent with past entrepreneurship research (Campbell et al., 2012; Sauermann, 2018), our primary regressions focus on the first five-year window after a spinout's founding. Here, we recalculate all variables (i.e., alliance partner overlap, alliance counts, patents, medical device approvals) for a six-year window. The spinout-parent sample size also increases to 394, reflecting the addition of spinouts with alliance activity during the sixth year. The estimated coefficients for technology extension (β=0.438; p=0.000) and product market overlap (β= -5.637; p=0.055) remain consistent with H1 and H2.

Model 6 reports logit estimations of an alternative dependent variable that equals one if any of the spinout's alliance partners during the five-year window post-founding overlaps with its parent's partners. This model is also in line with H1 and H2, given the positive coefficient for technology extension (β=0.397; p=0.000) and a negative coefficient for market overlap (β= -6.138; p=0.080).

In unreported analyses, we conduct additional sensitivity analyses. First, the findings are robust to using a Poisson estimation model. Second, the findings are robust to an alternative measure for technology extension, that is, the (logged) number of patents filed by the spinout during the five-year window post-founding that cites its parents' patents. Third, the findings are robust to an alternative measure for patent counts that covers patents in any patent class instead of restricting them to IPC A61. Fourth, the findings are robust to alternative measures of co-founders and sibling founders as binary variables. Lastly, the findings are robust to replacing two geographic variables of spinout-parent co-location and spinout location in a medical technology cluster with a single variable that captures spinout's migration from its parent's state to a medical cluster.

Exploring Mechanisms

We next report supplementary analyses that explore the mechanisms behind our hypotheses. Table 4 reports negative binomial estimations of the number of shared alliance partners between parent and spinout, similar to Models 1-4 in Table 3.

--- Table 4 about here ---

In H1, parent's alliance partners gravitate towards the novel technological variations developed by a spinout. If technology seeking is a mechanism behind H1, we expect the relationship to strengthen for spinouts originating from technology leaders. When a parent firm is a technology leader, spinout's extensions to its technologies are not just new variations but also variations of a leading technology. Thus, prospective partners may find the technology more valuable. Model 1 adds an interaction term between parent's patents and technology extension, which shows a positive coefficient (β=0.126; p=0.027). Keeping other variables at observed values, the average marginal effect of technology extension on alliance partner overlap has a 34% increase if a spinout originates from a parent with 1000 patents compared to 200 patents.

In H2, rivalry avoidance with a parent firm pushes parent's alliance partners away from a spinout. If the rivalry avoidance mechanism prevails, we expect the relationship between product market overlap and alliance partner overlap to vary under different rivalrous conditions shown in Models 2-4: forming an alliance with the parent, parent's spawning intensity, and geographic co-location.

When a parent and its spinout form an alliance, this alliance can signal to external stakeholders that the spinout-parent relationship is less rivalrous. If rivalry avoidance is a mechanism behind H2, we expect the effect of market overlap on alliance partner overlap to weaken in the presence of an alliance between a spinout and its parent. Model 2 includes an interaction term between market overlap and parent as a partner. We measure the parent as a partner with a binary variable equal to one if the spinout and its parent formed an alliance during the five-year window post-founding. The interaction term is positive (β=10.872; p=0.032), implying a weaker negative relationship between market overlap and alliance partner overlap. Keeping other variables at observed values, the average marginal effect of market overlap is -0.905 in the absence of a spinout-parent alliance, whereas it weakens to -0.145 in the presence of an alliance.

When a parent firm spawns numerous spinouts, employee entrepreneurship may become acceptable for the parent. Further, the parent's marginal attention to subsequent alliances of each spinout can be diminished. Thus, potential partners may infer that the parent firm may be less rivalrous toward their alliances with a spinout originating from such a parent. Model 3 includes an interaction term between market overlap and intense parent spawning. During the period of study, 53% of parents spawned one employee spinout, and another 15% had two spinouts. Spawning four or more spinouts puts a parent in the top-80 percentile in spawning intensity. We measure intense parent spawning as a binary variable equal to one if four or more spinouts originated from a parent. The interaction term is positive (β=48.662; p=0.000), implying that the negative relationship between market overlap and alliance partner overlap is weakened. Keeping other variables at observed values, the average marginal

effect of market overlap on partner overlap is -3.821 when the parent does not have a history of spawning numerous spinouts. However, it weakens to -0.702 for parents with intense spawning.

For co-located spinouts and parents, overlap in their geographic market may lead to competition for talent and local resources. Thus, potential partners may infer an aggravation of rivalrous conditions between spinout and parent and hesitate more in alliance formation. Model 4 includes an interaction term between product market overlap and spinout-parent co-location. The interaction term is negative (β= -103.294; p=0.000), suggesting that the negative link between market overlap and alliance partner overlap is strengthened. Keeping other variables at observed values, the average marginal effect of market overlap on partner overlap is -0.895 for geographically distanced spinouts and parents, whereas it weakens to -4.266 for co-located pairs. In conclusion, these supplementary analyses are consistent with rivalry avoidance as a mechanism for H2.

Empirical Limitations

Two empirical aspects shape the interpretation of our findings. First, instead of establishing causality, the findings demonstrate a statistical association between variables. This may result from omitted variables, sample truncation, or assortative matching. In terms of omitted variables, despite our best efforts to control for numerous observable attributes of spinouts, parents, and spinout-parent dyads, other unobserved factors may be at play. In terms of sample truncation, because the dependent variable is available for spinouts with at least one alliance, unaccounted attributes that impact both the likelihood of a spinout's alliance formation (whether we observe the dependent variable) and partner overlap (dependent variable) can lead to sample truncation/selection bias. To mitigate this possibility, we add theory-driven control variables that correlate with whether the dependent variable is observed. Further, absent an ideal instrumental variable, we heed recommendations that discourage the use of a Heckman estimation (Bettis, Gambardella, Helfat & Mitchell, 2014; Wolfolds & Siegel, 2019). In terms of assortative matching, allying with a firm's preferred partner is constrained by the preferred partner's

other alliances. Thus, zero alliances between a spinout and its parent's partners may not necessarily arise from lack of fit or interest and may instead reflect assortative matching. Reduced form estimators may not capture the competition for partners.

Second, there may be limits to the generalizability of our findings due to a single industry design and a sample of VC-funded spinouts. Using a sample of VC-funded spinouts has the advantage of maintaining homogeneity in the quality perception of spinouts based on their funding (Blevins & Ragozzino, 2018). Further, it enables access to accurate data about founders' employment history. However, spinouts funded through other modes or without funding may differ in alliance patterns.

DISCUSSION AND CONCLUSIONS

This study examines the extent to which employee spinouts and their parent firms have common alliance partners. By drawing on insights in strategic alliances and employee entrepreneurship literature streams, we suggest that two forces shape this relationship. On the one hand, potential resource complementarities and the information available through a parent firm can pull spinouts and parent's partners toward each other. On the other hand, the potential rivalrous reaction by a parent firm may push spinouts and parent's partners away. The two contingencies of technology extension and product market overlap impact the balance between these two forces. Within the empirical context of medical devices, we find that spinouts extending their parents' technologies tend to have more alliance partners overlap with their parents, whereas product market overlap leads to fewer overlapping partners.

Implications for Strategy and Entrepreneurship Research

This study extends the employee entrepreneurship literature by showing that employee spinout's inheritance from their parents goes beyond the knowledge and routines accrued in their employment context. In particular, we note that prior employment in an existing firm privileges an employee spinout with access to its parent's alliance network. Past studies have focused on employee spinouts' access to their parents' technologies (e.g., Agarwal et al., 2004), regulatory and market knowledge (e.g.,

Chatterji, 2009), and social capital (e.g., Burton et al., 2002). Our focus on the parent's alliance network draws attention to another pre-entry source of heterogeneity for employee spinouts.

Another contribution is the attention to post-entry strategic trajectories of employee spinouts. Despite access to their parent's alliance network, not all employee spinouts benefit from it. By focusing on technology extension and product market overlap as antecedents of spinout-parent alliance partner overlap, our study points to the crucial role of spinouts' technology and product market strategies. Their pre-entry link with their parent firm can be a double-edged sword for alliance formation, as it both reduces information asymmetry with parent's partners and increases competitive tension. We show that it is a spinout's post-entry strategy that impacts whether they can tap into their parent's alliance network. If a spinout offers novel variations of its parent's technologies or differentiates itself in the product market, then these alliance formation opportunities are realized.

We also contribute to the strategic alliance literature in two ways. First, although past studies have noted the importance of alliances for startups' survival and commercial success (Baum et al., 2000; Gans & Stern, 2003), they have predominantly focused on obstacles faced by startups in this process. We suggest that the opportunities and challenges faced by employee spinouts can be different, as do the solutions available to them. Second, a major theme in past studies pertains to the role of relational capital and repeated alliances. Through previous alliances or indirect firm-level network ties, potential partners often reduce mutual information asymmetry before alliance formation (Dyer & Singh, 1998; Gulati, 1995). We emphasize that even though startups can rarely rely on these firm-level interactions, a founder-level link to its parent's partners can underpin a new type of relational capital that couple firm- and individual-level links.

Future Research Directions

The findings and limitations of our study provide avenues for future research. The first relates to a closer link between a spinout's alliance formation and founder-level interactions with a parent firm,

which limitations in our firm-level archival data preclude us from examining. For example, founders might have departed on friendly versus hostile terms, with implications for how prospective partners assess tension in founder-parent personal relationships. Another example is the possibility of founders maintaining personal connections within a parent firm after their departure, possibly channeling information and opportunities about potential alliance partners. Whether or not founders were previously employed in positions that could have built a personal relationship with parent's partners is another example of founder-level interactions worthy of future research.

Second, our study focuses on contingencies that inform spinout-parent alliance partner overlap while abstracting away from performance consequences. It is possible that tapping into a parent's alliance network may initially enable spinouts to find alliance partners. Future research can examine whether alliance partner overlap impacts spinout's survival, results in a successful IPO, or paves the way for acquisition as an exit strategy. Further, given that path dependency and relational capital often shape a firm's subsequent alliances, spinout-parent alliance partner overlap can have implications for the long-term composition of a spinout's alliance portfolio. Future research can address this question by assessing whether partner overlap with a parent firm locks a spinout in a narrow trajectory or whether it opens the path for attracting newer and diverse partners.

Third, the attributes of parent's partners who form an alliance with a spinout can be the subject of future research. The spinout-parent attributes of technology extension and product market overlap can inform the pull and push forces behind alliance partner overlap. However, different prospective partners may differently assign weights to these considerations. For example, parent's partners with strong bargaining power or secure competitive position may be less worried about rivalrous reactions by a parent firm. Alternatively, parent's partners with serious resource gaps that can be filled through collaborating with a spinout may again overlook possible rivalrous reactions. Some parent's partners

may consider terminating their alliance with a parent firm in case of unique complementarities with a spinout. Fine-grained data on parent's partners can enable exploring these questions.

Lastly, employee spinouts are not the only startups with a pre-entry background. Other founders' experiences can come from universities (Bercovitz & Feldman, 2008), personal use (Shah & Tripsas, 2007), or serial entrepreneurship (Dencker & Gruber, 2015). We lack studies about whether and how the prior employment context of these startups shapes their alliance formation patterns. Further, as indicated in our descriptive statistics and included control variables, several employee spinouts had hybrid founding teams consisting of scientists and physicians, another area worthy of future research.

Conclusions

This study begins to shed light on alliance formation patterns involving employee spinouts. Prior employment in an existing firm can link spinouts to the parent's network, but it does not guarantee alliances. When spinouts stand on their parent's shoulders to offer novel technologies, alliance opportunities may ensue. However, by standing in their parent's shadow to imitate its product market position, options for alliance formation may turn limited. When seeking alliances, entrepreneurial founders need to assess the costs and benefits of each technology and product market strategy.

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Table 1: Variable Definitions and Descriptive Statistics

Construct	Measurement	Mean	S.D.	Min	Max
Alliance partner overlap	# shared partners between spinout and parent, 5-yr window post-founding	0.079	0.469	0	5
Technology extension	# citations by spinout to its parent's patents, logged, 5-yr window post-founding	15.667	96.022	0	1171
Market overlap	Ratio of shared medical specialties in which both spinout and parent received FDA approval	0.075	0.216	0	1
Spinout alliances	# alliances involving spinout, logged, 5-yr window post-founding	2.201	1.774	1	11
Parent alliances	# alliances involving parent, logged, 5-yr window before and after spawning	27.393	67.592	0	469
Spinout patents	# patents filed by spinout in IPC A61, logged, 5-yr window post-founding	8.427	13.412	0	77
Parent patents	# patents filed by parent in IPC A61, logged, 5-yr window before and after spawning	199.610	613.753	0	5123
Spinout products	# FDA-approved medical devices for spinout, logged, 5-yr window post-founding	1.664	3.313	0	22
Parent products	# FDA-approved medical devices for parent, logged, 5-yr window before and after spawning	40.531	104.611	0	655
Spinout market breadth	# medical specialties in which spinout's devices are approved, logged, 5-yr window post-founding	0.486	0.699	0	3
Parent market breadth	# medical specialties in which parent' devices are approved, 5-yr window before and after spawning	1.989	3.319	0	16
Number of co-founders	# co-founders	2.127	1.000	1	5
Number of sibling founders	# founders that were previously employed by the parent	1.133	0.394	1	3
PhD-holder founder	Whether any founder holds a doctoral degree = 1	0.398	0.490	0	1
Physician founder	Whether any founder worked in a healthcare setting = 1	0.186	0.390	0	1
Co-location with parent	Whether spinout and parent are located in the same state = 1	0.492	0.501	0	1
Spinout in a medical cluster	Whether spinout is located in CA, MA, or MN = 1	0.579	0.494	0	1

- The unit of analysis is spinout-parent dyad.
- For logged variables, summary statistics are reported untransformed.

Table 2: Correlation Table

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Alliance partner overlap	1.00																
2	Technology extension	0.02	1.00															
3	Market overlap	-0.05	0.24	1.00														
4	Spinout alliances	0.13	-0.08	-0.07	1.00													
5	Parent alliances	0.20	0.11	-0.06	0.06	1.00												
6	Spinout patents	-0.14	0.36	0.23	-0.26	-0.07	1.00											
7	Parent patents	0.08	0.31	0.09	-0.12	0.66	0.29	1.00										
8	Spinout products	-0.10	0.24	0.41	-0.18	-0.05	0.51	0.18	1.00									
9	Parent products	0.08	0.33	0.16	-0.13	0.60	0.25	0.76	0.13	1.00								
10	Spinout market breadth	-0.10	0.22	0.42	-0.16	-0.04	0.51	0.21	0.90	0.14	1.00							
11	Parent market breadth	0.11	0.29	0.18	-0.10	0.62	0.22	0.75	0.11	0.95	0.14	1.00						
12	Number of co-founders	0.06	-0.05	-0.10	0.13	0.06	-0.02	0.02	-0.11	-0.06	-0.11	-0.08	1.00					
13	Number of sibling founders	-0.01	0.08	0.01	0.01	0.00	0.08	0.06	0.08	0.08	0.08	0.09	0.19	1.00				
14	PhD-holder founder	0.11	-0.02	-0.09	0.12	0.11	-0.27	-0.10	-0.26	-0.07	-0.26	-0.07	0.39	0.02	1.00			
15	Medical doctor founder	-0.03	-0.07	0.01	-0.17	-0.01	0.08	0.02	0.08	-0.05	0.05	-0.05	0.25	0.04	0.08	1.00		
16	Co-location with parent	-0.12	0.06	0.08	-0.10	-0.28	0.15	-0.14	0.13	-0.18	0.11	-0.19	-0.13	0.01	-0.11	0.02	1.00	
17	Spinout in medical cluster	0.00	0.18	0.08	-0.05	-0.01	0.22	0.08	0.16	0.09	0.20	0.06	-0.10	0.01	0.04	-0.05	0.30	1.00

- The unit of analysis is spinout-parent dyad.

Table 3: Main Results

Dependent variable	# shared partners, 5-yr window				6-yr window	binary =1 if shared partners
	(1)	(2)	(3)	(4)	(5)	(6)
Technology extension		0.503		0.503	0.438	0.397
		(0.000)		(0.000)	(0.000)	(0.000)
Market overlap			-7.709	-7.715	-5.637	-6.138
			(0.001)	(0.000)	(0.055)	(0.080)
Spinout alliances	0.778	0.518	0.826	0.538	1.835	0.348
	(0.099)	(0.310)	(0.075)	(0.304)	(0.000)	(0.384)
Parent alliances	0.757	0.768	0.748	0.754	0.656	0.685
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)
Spinout patents	-0.700	-0.909	-0.681	-0.879	-0.497	-0.672
	(0.010)	(0.001)	(0.007)	(0.000)	(0.016)	(0.012)
Parent patents	-0.174	-0.163	-0.153	-0.153	-0.159	-0.177
	(0.308)	(0.267)	(0.351)	(0.287)	(0.007)	(0.285)
Spinout products	-2.001	-1.853	-1.763	-1.573	1.447	-2.183
	(0.315)	(0.237)	(0.428)	(0.388)	(0.008)	(0.353)
Parent products	-0.340	-0.407	-0.351	-0.416	-0.106	-0.519
	(0.168)	(0.067)	(0.160)	(0.092)	(0.704)	(0.000)
Spinout market breadth	2.391	2.080	2.829	2.514	-2.871	3.963
	(0.380)	(0.341)	(0.335)	(0.290)	(0.000)	(0.143)
Parent market breadth	1.014	1.001	1.045	1.058	0.252	1.186
	(0.054)	(0.061)	(0.046)	(0.056)	(0.533)	(0.000)
Number of co-founders	0.088	0.217	0.073	0.201	0.610	0.352
	(0.728)	(0.459)	(0.778)	(0.505)	(0.005)	(0.180)
Number of sibling founders	1.036	0.938	1.005	0.881	-0.289	0.556
	(0.008)	(0.079)	(0.031)	(0.158)	(0.781)	(0.490)
PhD-holder founder	-0.041	-0.436	0.027	-0.347	-0.780	-0.361
	(0.926)	(0.330)	(0.953)	(0.450)	(0.016)	(0.109)
Physician founder	0.505	0.494	0.452	0.423	-0.088	0.513
	(0.641)	(0.660)	(0.673)	(0.707)	(0.942)	(0.635)
Co-location with parent	-0.971	-1.080	-0.949	-1.055	0.162	-0.591
	(0.000)	(0.000)	(0.000)	(0.000)	(0.354)	(0.091)
Spinout in a medical cluster	0.385	0.215	0.328	0.168	-1.009	-0.203
	(0.059)	(0.241)	(0.107)	(0.429)	(0.207)	(0.271)
Constant	-6.066	-5.512	-6.118	-5.492	-6.750	-5.367
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Time trends	Y	Y	Y	Y	Y	Y
N (spinout-parent dyads)	354	354	354	354	394	354
Pseudo R-squared	0.214	0.227	0.219	0.231	0.300	0.239
Log pseudo-likelihood	-63.69	-62.66	-63.27	-62.25	-68.20	-47.25

- *p*-values in parentheses, based on robust standard errors clustered on medical specialty.
- Models 1-5 report negative binomial estimations. Results are robust to Poisson estimation.
- Model 6 reports logit estimation.

Table 4: Exploring Mechanisms

	H1 mechanism: Technology seeking	H2 mechanism: Rivalry avoidance		
	(1)	(2)	(3)	(4)
Technology extension	-0.078	0.291	0.516	0.501
	(0.858)	(0.000)	(0.000)	(0.000)
Market overlap	-9.969	-11.690	-54.896	-7.097
	(0.000)	(0.000)	(0.000)	(0.000)
Technology extension x Parent patents	0.127			
	(0.027)			
Parent patents	-0.173			
	(0.232)			
Market overlap x Parent as partner		10.872		
		(0.032)		
Parent as partner		3.572		
		(0.008)		
Market overlap x Parent spawning intensity			48.662	
			(0.000)	
Parent spawning intensity			-0.051	
			(0.904)	
Market overlap x Co-location with parent				-103.294
				(0.000)
Co-location with parent				-1.018
				(0.000)
Control variables	Y	Y	Y	Y
Time trends	Y	Y	Y	Y
N (spinout-parent dyads)	354	354	354	354
Pseudo R-squared	0.237	0.252	0.232	0.232
Log pseudo-likelihood	-61.79	-60.63	-62.19	-62.18

- *p*-values in parentheses, based on robust standard errors clustered on medical specialty.
- Models 1-4 report negative binomial estimations.
- Included control variables are similar to Table 3: spinout alliances; parent alliances; spinout patents; parent patents; spinout products; parent products; spinout market breadth; parent market breadth; number of co-founders; number of sibling founders; PhD-holder founder; physician founder; co-location with parent; spinout in medical cluster.