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When do spinouts benefit from market overlap with parent firms?

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ABSTRACT

We examine how market overlap with parent organizations impacts the performance of startups founded by the former employees of these incumbent firms. Building on knowledge inheritance and competitive dynamics theories, we propose that the degree to which the operating markets of spinouts overlap with their parent organizations has a curvilinear relationship with their likelihood of survival. Market overlap is beneficial to spinouts because it reduces uncertainty during the early stages of new venture development. However, substantial market overlap may spark hostile actions by the parent organizations, thereby creating disruptive competition that may lower the likelihood of spinouts' survival. Furthermore, we hypothesize that the previous hierarchical position of founders in parent organizations moderates the overlap–performance relationship. Using a sample of European biotech spinouts and their parent firms, we find support for our hypotheses.

1. Introduction

A vibrant stream of literature investigates how the pre-entry resources and capabilities of new entrants shape their performance outcomes (Helfat and Lieberman, 2002). Spinouts[1] are independent startups founded by the former employees of incumbent firms in the same industry, which by their very nature, benefit from the knowledge and resources accumulated by their founders while employed in incumbent firms (Agarwal et al., 2004; Klepper and Sleeper, 2005; Phillips, 2002). When turning to entrepreneurship, employees carry with them considerable "blueprints" in the form of organizational routines, technical expertise, and market-related knowledge to formulate the early strategies and structure of their ventures (Adams et al., 2016; Cirillo et al., 2014; Franco and Filson, 2006; Gompers et al., 2005; Klepper and Thompson, 2010). Potential founders may also bring with them colleagues (Agarwal et al., 2016), ties to customers and suppliers (Phillips, 2002; Shane and Stuart, 2002) and management practices (Feldman et al., 2019) developed by their previous employers (i.e., parent firms). Therefore, given their initial resource endowment, spinouts are found to perform better than other de novo entrants (Agarwal et al., 2004; Burton et al., 2002; Chatterji, 2009; Dahlstrand, 1997; De Figueiredo et al., 2013; Eriksson and Kuhn, 2006).

A few recent studies examining the relationship between spinouts and their parent organizations, however, allude to the potential

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[1] Also referred to as intra-industry spinoffs (Klepper, 2002), employee spinouts (Adams et al., 2016), or entrepreneurial spinouts (Kaul et al., 2021), we use the same definition of spinout as Agarwal et al. (2004). Unlike corporate spinoffs, spinouts are independent startups that do not have ownership ties with incumbent firms (Agarwal et al., 2004; Campbell et al., 2012; Honoré, 2022; Kim and Steensma, 2017).

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drawbacks of knowledge legacy for the performance of spinouts. In particular, these studies suggest that spinouts may face the risk of retaliation and suffer from the hostile attitude of the parent firms in the form of intellectual property litigation (Klepper and Sleeper, 2005), enforcement of noncompete clauses (Starr et al., 2018), or dissemination of negative information about spinouts (Walter et al., 2014), especially when they offer products or services similar to those of the parent firms (Agarwal et al., 2004; Klepper and Sleeper, 2005; Wezel et al., 2006).

Accounting for the inheritance of knowledge and the competitive tension between spinouts and their parent firms, the central research question of this study is whether there exists an optimal distance from the parent firm's knowledge domains that allows a spinout to benefit from the knowledge legacy, while maintaining some degree of differentiation to mitigate the risk of the parent firm's hostile actions. In particular, while earlier studies have examined the relationship between technological overlap with parent firms and the outcomes of spinouts (e.g., Bae and Lee, 2021), limited attention has been devoted to the effects of market overlap between spinouts and parent firms. Addressing this gap is important for three reasons. First, anecdotal evidence suggests that spinouts often capitalize on technological knowledge that parent firms are reluctant to exploit commercially and deliberately shelve owing to constraints in the exploitation process (Cassiman and Ueda, 2006; Chesbrough, 2003; Hellmann, 2007; Gompers et al., 2005). Thus, a spinout could pursue a shelved business opportunity in the same or outside the parent firm's market, with different implications for the competitive tension between the two firms. Second, compared to technological knowledge that firms can protect from misappropriation through formal means of intellectual property protection such as patents, it is more challenging to insulate market-related knowledge (e.g., customer lists, distribution channels, and consumer research methods and information) from imitation, which makes parent firms particularly concerned about spinouts' entry into their core markets (Oxley and Sampson, 2004; Rumelt, 1984; Teece, 2010). Finally, entering markets similar to the parent firm creates visibility for a spinout and increases the parent firm's awareness of the spinout initiative, which impacts the level of perceived competitive threat (Chen, 1996) and may lead the parent firm to retaliate to protect its competitive position in the market (Klepper and Sleeper, 2005; Walter et al., 2014).

Building on knowledge inheritance and competitive dynamics theories, we propose that the degree to which a spinout's operating market overlaps with its parent organization has a curvilinear relationship with its likelihood of survival. By choosing a limited overlap, a spinout gives up the opportunity to benefit from the knowledge legacy that could otherwise be leveraged to reduce uncertainties at the time of entry into the market (Phillips, 2002; Winter et al., 2007). However, a high level of overlap with the parent firm's market domains increases the risk of retaliation and direct confrontation with the parent firm, which in turn can lower the spinout's likelihood of survival (Klepper and Sleeper, 2005; McKendrick et al., 2009; Sakakibara and Balasubramanian, 2020; Walter et al., 2014). Thus, the reason why some spinouts may be "*spawned with a silver spoon*" (Chatterji, 2009) while "*other spinouts may spawn with a rusty spoon, having to cope with parental sanctions*" (Walter et al., 2014: 2040) depends on the level of market overlap with the parent firms. Furthermore, we hypothesize that the nature of the market overlap–performance relationship is contingent on the founders' previous rank in the parent firms. The basis of our argument is that the volume of resources and knowledge transferred to spinouts is a function of their founders' hierarchical position in the parent organizations (Phillips, 2002). In particular, unlike codified knowledge embedded in organizational routines and patents, market knowledge is often tacit and embodied in individuals who have been involved in the development and use of that knowledge (Nelson and Winter, 1982; Szulanski, 1996), which is the case for employees occupying a high-ranking position in the parent organizations (Freeman, 1986; Phillips, 2002).

We test our predictions using data from the European biotech industry, an empirical setting characterized by a high rate of startups (Rothaermel and Deeds, 2004), many of which have been founded by the former employees of incumbent firms (Mitton, 1990; Stuart and Sorenson, 2003). We also conducted several interviews with founders of spinouts in our sample to validate our theoretical arguments and gain a deeper understanding of the knowledge inheritance process as well as the nature of interactions between spinouts and their parent firms.[2] Supporting our hypotheses, we find that market overlap with parent organizations has an inverted U-shaped relationship with spinouts' survival, and this relationship is moderated by the founders' previous hierarchical position, such that the curve is significantly flattened for spinouts launched by employees who have held high-ranking positions in the parent firms.

This study contributes to the large body of work linking the transfer of knowledge through inheritance to spinout performance. Specifically, while prior research has predominantly assumed that knowledge transfer from parent organizations is advantageous and beneficial to spinouts, we provide a more nuanced view of knowledge legacy by integrating knowledge inheritance and competitive tension perspectives, which are typically separated in the extant body of research. Moreover, we extend prior research by highlighting the effect of the founders' previous position in the parent firms as a moderating factor in the market overlap–performance relationship. Finally, this study contributes to competitive dynamics theory by extending the study of interfirm rivalry among established firms to parent–spinout market interactions (Chen and Miller, 2012; Markman et al., 2009; Markman and Phan, 2011). In particular, from the perspective of new entrants, our findings support the argument that by reducing the degree of market commonality, spinouts can obscure their visibility (or parent firms' awareness) and mitigate the parents' motivation to undertake hostile actions (Chen, 1996). Further, our results suggest that because of their higher level of initial endowment which shapes the parents' capability of taking action, spinouts launched by high-ranked employees can mitigate the competitive risks associated with parent firms' potential hostile attitude by negotiating more favorable exit conditions at the time of establishment.

[2] We interviewed the founders of six spinouts in our sample: three were high-ranked employees and others held low-ranking positions in their previous employers. Interviews lasted between 45 and 90 min and were conducted in a semi-structured manner with open-ended questions that have proven to provide higher accuracy in retrospective reports (Miller et al., 1997). Following previous studies (Souitaris et al., 2020; Vanacker et al., 2020), we used these exploratory interviews only as complementary material to substantiate and bring life to our theoretical arguments. Therefore, we do not claim that we have followed a formal qualitative methodology in this study.

2. Literature review

A distinctive feature of spinouts is that they possess various types of resources and capabilities prior to their establishment (Agarwal et al., 2004). As noted by Freeman (1986) and highlighted by Helfat and Lieberman (2002), this is because individuals who found new organizations have histories and are "*constrained by their organizational experiences, and, consequently, the new organizational forms are constrained by the characteristics of the founders' previous organization, population, and employment*" (Phillips, 2002: p. 475). In particular, knowledge inheritance theory posits that parent organizations' resources and knowledge transfer to spinouts in a manner similar to the reproduction and transmission of biological genes (Klepper and Sleeper, 2005; Phillips, 2002; Winter, 1991). Such parental knowledge and resources that serve as the initial endowment of spinouts include not only the knowledge of functional capabilities, such as R&D (Roberts, 1991) and regulatory processes (Chatterji, 2009) but also the knowledge of technology (Agarwal et al., 2004; Basu et al., 2015) and product markets (Adams et al., 2016; Klepper and Sleeper, 2005). In addition, through their founders, spinouts inherit tacit knowledge (Bae and Lee, 2021), a critical component of an organization's knowledge that is not codified in organizational routines, formulae, and manuals, but partly embodied in human capital (Szulanski, 1996). Moreover, while working in parent firms, potential founders gain access to social and financial networks that can help them mobilize the resources necessary for establishing new firms (Sørensen and Fassiotto, 2011). Overall, employees represent the conduit through which spinouts inherit knowledge and resources from their parent firms, which can provide favorable conditions for new ventures' growth (Dahlstrand, 1997), timely access to financing (Chatterji, 2009), and the likelihood of survival (Agarwal et al., 2004; Franco and Filson, 2006; Eriksson and Kuhn, 2006).

The majority of the earlier studies on the relationship between knowledge inheritance and spinout performance assumes that parent organizations adopt a neutral (Klepper and Sleeper, 2005) or even positive and favorable (Dahlstrand, 1997) position toward their employees starting new firms. However, as emphasized by Walter et al. (2014), parent firms may develop a hostile attitude and take aggressive actions toward their spinouts as a response to the loss of important human capital (Campbell et al., 2012), the disruption of organizational routines that can impact ongoing activities (Phillips, 2002), and the competitive threat to their market position (Klepper and Sleeper, 2005; Ioannou, 2014; McKendrick et al., 2009; Wezel et al., 2006). The hostile attitude of parent firms toward spinouts is consistent with competitive dynamics theory, which claims that competitive tension or "*the strain between a focal firm and a given rival*" (Chen et al., 2007: p. 102) increases with the degree of "*strategic similarity*" between the two firms (Gimeno and Woo, 1996).

Against this backdrop, only a few recent studies have examined the consequences of parent firms' potential aggressive actions on the performance of spinouts. For instance, Walter et al. (2014, p. 2034) found that spinouts facing parent hostility (i.e., "*the degree to which an incumbent firm disapproves the spawning of a spinout from within its ranks*") experienced a longer time to break even. Bae and Lee (2021) explored the effect of technological overlap with parent firms on the likelihood of corporate investors investing in spinouts. These authors argued that the competitive risks arising from potential hostile actions by parent firms could transfer to spinouts' relationships with third parties, as third parties may refrain from allying with a spinout involved in a competitive confrontation with its parent company. Under these conditions, third parties prefer parent firms to spinouts because the liabilities of newness and smallness make spinouts, like other startups, uncertain partners (Bae and Lee, 2021; Walter et al., 2014). Contributing to this stream of research, Vaznyte et al. (2021) examined the forces driving parent firm hostility and found that spinouts' post-entry strategies, such as offering substitute products, recruiting staff from the parent, and attempting to exploit ideas generated inside the parent, shape the perception of the competitive threat posed by spinouts and trigger more hostile actions by their parent organizations.

Our study extends (but departs from) prior research by focusing on the effects of market overlap with parent organizations on spinouts' likelihood of survival. Market overlap, a key dimension of our theoretical framework, describes the firms' relative positioning or the extent to which two firms compete in the same product market (e.g., Park et al., 2014) with similar understandings of functionalities, technologies, and customers (Bouncken et al., 2020; Chen, 1996).[3] We also focus on spinouts' likelihood of survival since longevity, rather than profitability or other measures of performance, is the greatest concern in the early stages of a startup (Agarwal et al., 2016). Unsurprisingly, survival is the key performance metric used in earlier studies on the effects of knowledge inheritance on spinout performance (e.g., Agarwal et al., 2004; Wezel et al., 2006), although various studies on the consequences of interfirm rivalry more generally use survival as well (e.g., Baum and Korn, 1996; Boeker et al., 1997).

3. Hypotheses development

As mentioned above, we develop our theoretical arguments in two parts. We start by bridging knowledge inheritance theory with competitive dynamics theory to argue that market overlap with parent firms has contrasting effects on spinout survival. In particular, we argue that, while knowledge and resources inherited from parent firms shape the benefits of market overlap (Lane and Lubatkin, 1998; Sapienza et al., 2004; Winter et al., 2007), competitive tension is a contrasting latent mechanism underlying the nonlinear relationship between market overlap with parent firms and spinouts' survival (Klepper and Sleeper, 2005; McKendrick et al., 2009). The second part of our theoretical framework focuses on the profile of spinouts' founders and, in particular, their previous ranks in the parent organizations. Founders are the primary channel of knowledge transfer, especially the tacit knowledge that they have accumulated while working in parent firms (Agarwal et al., 2004; Agarwal et al., 2016; Klepper and Sleeper, 2005; Phillips, 2002). As the

[3] For example, firms operating in different biotechnology markets like human health applications and industrial processing applications have a low level of market overlap, while firms operating in the same biotechnology sub-market such as diagnostics (a subset of environment human health biotechnology applications) have a high level of market overlap.

amount of knowledge, resources, and social capital acquired and transferred by founders directly shape the spinouts' level of initial endowment and the nature of competitive relationships with the parent firms, we further argue that the relationship between market overlap and spinouts' survival is conditioned by the volume of the parent–spinout transfer, which is a function of founders' previous position in the parent organizations (Phillips, 2002).

3.1. Market overlap with parent firm and survival of spinout

New entrants typically have limited resources and knowledge (Bhide, 2003; Yli-Renko et al., 2001), which makes their life chances highly uncertain. However, as discussed above, spinouts are in a privileged position compared to other new firms because they inherit knowledge and resources acquired by their founders during prior work employments (Helfat and Lieberman, 2002). In addition to technical expertise (Franco and Filson, 2006), potential founders often transfer blueprints of parent firms' routines, practices, and market-related knowledge to formulate their ventures' early resources and organizational structures (Adams et al., 2016; Agarwal et al., 2004; Klepper and Sleeper, 2005). In fact, Chatterji (2009) reports that the superior performance of spinouts compared with other entrants is primarily driven by knowledge related to regulatory matters (e.g., new drug approval process and the Medicare system) and marketing capabilities (e.g., identifying new market opportunities) inherited from parent firms. The importance of market-related knowledge is evident from the report of the founder of one of our sample firms, as the following quote illustrates:

> After my PhD, I worked in two large companies, and then, I joined [name of the parent company]. This company was very innovative back in time, which was the first reason I was attracted to them. However, I also learned how to bring innovation to the market while working there and through the more experienced people I worked with. I also learned from them about how to run a company and manage a small business in this sector.

We propose that the impact of inherited knowledge on the performance of spinouts is likely to decrease with the market distance from the parent firms. This is because the knowledge acquired by founders in the market where the parents operate may not be applicable and very useful in other fields (Carroll et al., 1996; Helfat and Lieberman, 2002; Sakakibara and Balasubramanian, 2020). Studies from other streams of research have similarly pointed out that factors lose value when transferred to markets that are different from those where they originated (Montgomery and Wernerfelt, 1988). Therefore, by positioning themselves close to the market domains of the parent firms, spinouts can leverage valuable market-based resources and routines (which have proven to be effective in the past) to reduce early-stage uncertainties or cut upfront development costs that new entrants typically face (Basu et al., 2015; Phillips, 2002; Winter et al., 2007). For example, spinouts can more easily absorb knowledge about "*what works in marketing*" (e.g., a new payment scheme) when their founders have practiced pricing strategy during their tenure in the parent organizations (Sapienza et al., 2004: 813).

However, a high degree of overlap with the market domains of parent organizations entails potentially significant costs, as it can increase the risk of retaliation and direct confrontation with the parent firms. In particular, according to competitive dynamics theory, two constructs jointly determine the competitive relationship between a focal firm and a given competitor. First, market commonality or "*the degree of presence that a competitor manifests in the markets it overlaps with the focal firm*" (Chen, 1996: 106), and second, resource similarity or "*the extent to which a given competitor possesses strategic endowments comparable, in terms of both type and amount, to those of the focal firm*" (Chen, 1996: 107). Subsequently, these two factors influence the three antecedents of a firm's competitive action: awareness, motivation, and capability to act (Chen, 1996). In particular, market commonality affects a firm's awareness of a given competitor's moves and its motivation to act, whereas resource similarity influences the firm's capability to take action against a rival (Chen and Miller, 2012). Thus, firms are more likely to initiate a competitive attack against rivals with similar resource profiles operating in overlapping markets (Baum and Korn, 1996).

By their very nature, spinouts inherit various types of knowledge and resources from parent organizations; thus, they possess resources and capabilities comparable in type and quality, if not in volume, to those of their parents (Agarwal et al., 2004). Spinouts that leverage these resources to operate in product markets very close to those of their parent firms can jeopardize their parent firms' market positions, threaten their competitive advantage, and compromise their existing revenue streams (Ganco et al., 2015; Klepper and Sleeper, 2005; McKendrick et al., 2009; Phillips, 2002; Wezel et al., 2006). Thus, parent firms may prevent the negative consequences of direct competition by enforcing noncompete clauses (Starr et al., 2018; Thompson and Chen, 2011). Moreover, they may retaliate and adopt a hostile attitude toward their spinouts and transaction partners by offering similar products at lower prices (Sakakibara and Balasubramanian, 2020), filing intellectual property lawsuits (Klepper and Sleeper, 2005; Klepper and Thompson, 2010), or disseminating negative information about the spinouts (Walter et al., 2014). For example, to protect its market position, Agilent Technologies, an analytical instrumentation development and manufacturing company, filed a lawsuit in 2016 against Twist Bioscience, a company engaged in manufacturing synthetic DNA and DNA products. In this lawsuit, Agilent Technologies claimed that the founder and CEO of Twist (a former employee of Agilent) violated Agilent's trade secrets and took 10 colleagues from Agilent to start the new venture. In 2020, Twist agreed to pay Agilent US$ 22.5 million to settle the lawsuit.[4] The negative consequence of the parent firms' hostile action driven by market commonality is also reflected in the following statement from an interview with the founder of a spinout in our sample:

[4] https://www.biospace.com/article/twist-bioscience-settles-legal-dispute-with-22-5-million-payment-to-ceo-s-former-employer-agilent-technologies/

> One year after I started my company, they (the parent company) spun off a new company called [name of corporate spinoff] in the same diagnostic area and asked me to support them with some projects by providing assets for three years…They got an enormous amount of investment, and then, the investors realized that the intellectual property rights in the diagnostic field belonged to my company and not [name of the parent company]. Therefore, they started to put pressure, and the management (of the parent firm) became hostile, which was a very difficult period for me. It was basically a crash, and we had to move in a different direction.

Conversely, when spinouts target markets that do not overlap with their parent organizations, the spawning event can even be beneficial to the parents, which favors a collaborative attitude toward the spinouts. In particular, the parent firms can benefit from their spinouts' entry into non-overlapping markets for two reasons. First, spinouts that capitalize on parental knowledge to enter a new market may increase the parents' corporate coherence, and in turn, their performance, as the spawning activity enables the parent firms to refocus resources on their core competencies and businesses (Ioannou, 2014). Second, spinouts' entry into non-overlapping markets favors the dissemination of parental knowledge in other sectors, which may engender legitimacy for the parent firms or provide parents with knowledge spill-ins or the potential to learn from their spinouts (Cirillo, 2019). To summarize, two latent forces drive the relationship between market overlap with parent organizations and spinouts' survival: the benefits of market overlap represented by spinouts' knowledge legacy and the costs of market overlap arising from the competitive tension and potential hostile actions by the parent firms.

Hypothesis 1. The relationship between market overlap with the parent organization and a spinout's survival will be inverse U-shaped.

3.2. Role of the founder's hierarchical position in parent firm

Employees hold different positions before leaving parent organizations to start their new firms. By performing their assigned tasks, employees may acquire various skills and access valuable resources and knowledge, thus underscoring the role of incumbent firms as training grounds for prospective entrepreneurs (Franco and Filson, 2006; Sørensen and Fassiotto, 2011). Nevertheless, as highlighted by Phillips (2002:476), "*the volume of resources and routines transferred to the new entity is likely to be a function of founder's position in the parent organization.*" This is because employees' hierarchical position determines the extent to which they have accessed (and obtained) valuable resources and capabilities during their course of employment in parent organizations. High-ranked employees are then likely to transfer a more substantial level of firm- and industry-specific knowledge, a significant share of which is tacit (Freeman, 1986). In particular, unlike technological know-how, which is more easily codified and embedded in patents, blueprints, and manuals, market knowledge (e.g., customer lists, distribution methods, and consumer research methods and information) is typically tacit and embodied in the minds of individuals who have learned that knowledge primarily by observing and interacting with the parent firm's stakeholders (Nelson and Winter, 1982; Szulanski, 1996). Thus, spinouts by employees who have held a high-ranking position in their parent firms possess a higher level of initial endowment in terms of market-related knowledge compared to those who have held a low-rank position (Freeman, 1986; Phillips, 2002; Sakakibara and Balasubramanian, 2020).

However, the transfer of an excessive volume of knowledge and resources from parent organizations may have detrimental effects on spinouts' performance. In particular, a higher level of knowledge transfer is likely to become a source of rigidity (Ferriani et al., 2012), and this increases the risk of getting stuck in a "*competency trap*" (Levinthal and March, 1993; Levitt and March, 1988; Simon, 1993), which locks spinouts into the knowledge and resources of their parent firms, thus hindering their ability to acquire new resources or develop new routines that are more suitable for their targeted markets (Dencker et al., 2009; Hashai and Zahra, 2022; Lawrence, 2018).[5] The following statement by a founder who has previously held a high-rank position supports our argument:

> When you work for a company, you learn a lot; you really get to understand both the mechanisms and the market and how customers react … Also, you get a good understanding of the business. But then, once you have been deeply involved, you get stuck there, and you find it very hard to adapt, and you do not have the flexibility of mind to do things very differently.

As the amount of knowledge and volume of resources transferred to spinouts increase with the founder's previous position and an excessive level of knowledge transfer is likely to increase the risk of getting stuck in competency traps, we further hypothesize that the effect of market overlap on a spinouts' survival is contingent on the founders' hierarchical positions in their parent organization.

At low levels of market overlap with parent organizations, as discussed above, spinouts have limited opportunities to leverage the parent firm's knowledge. However, spinouts founded by higher-ranked employees can benefit from a more substantial level of industry-specific resources (e.g., knowledge of industry rules and norms, financing, and general management experience), which can be applied more broadly across different settings in the same industry as the parent firms (Helfat and Lieberman, 2002). By increasing the level of market overlap, however, spinouts launched by higher-ranked employees may face a higher risk of falling into competency traps (Levinthal and March, 1993; Levitt and March, 1988; Simon, 1993) or core rigidities (Leonard-Barton, 1992) compared to spinouts launched by lower-ranked employees because of the higher volume of knowledge transfer. In particular, as highlighted by Hashai and Zahra (2022, p. 7), a competency trap occurs when "*the specific routines that improved the chances of success of the parent firm*

[5] The literature on organizational learning defines competency trap as the condition that occurs "when favorable performance with an inferior procedure leads an organization to accumulate more experience with it, thus keeping experience with a superior procedure inadequate to make it rewarding to use." (Levitt and March, 1988: 322).

and the industry as it used to be before establishing the startup, are no longer appropriate for the startup and its current industry setting." Therefore, competency traps are more likely to exacerbate at moderate levels of market overlap, where the resources and capabilities of the parent firms may falsely appear to be relevant and also applicable to "nearby" markets, while in practice, they are not appropriate outside the parent firms' operating markets (Dencker et al., 2009; Hashai and Zahra, 2022; Lawrence, 2018).

Instead, at high levels of market overlap with parent organizations, spinouts can benefit from the previous hierarchical position of their founders for the following reasons. First, relative to low-ranked employees, those who have held higher-ranked positions can leverage a more substantial level of firm-specific resources (e.g., knowledge of the process or product design), which are particularly useful and appropriate when spinouts operate in the same markets as the parent firms (Phillips, 2002). More specifically, when spinouts enter the same markets as the parent firms, the knowledge and resources developed by the parents and transferred to spinouts remain valuable, while the negative effect of competency traps on survival is not an issue, since as emphasized by Lawrence (2018, p. 3), parental knowledge and resources "*are more likely to generate competency traps or core rigidities in firms and teams facing the need to adopt new practices*." Second, high-ranked employees possess a higher level of social capital (e.g., ties with suppliers, buyers, and investors), and such access to different resource holders in the market enables them to better deal with the parent firms' hostile actions that impede the transactions of spinouts with their parents' partners (Phillip, 2002; Sørensen and Fassiotto, 2011; Walter et al., 2014). Moreover, because of their higher levels of inherited knowledge, high-ranked employees possess greater bargaining power (Campbell et al., 2012), which allows them to negotiate more favorable exit conditions with the parent firms.

To summarize, the relationship between market overlap with parent organizations and spinouts' survival is contingent on the founders' previous position. In particular, while spinouts may benefit from industry- and firm-specific resources embodied in their founders at low and high levels of market overlap with their parent firms, respectively, the constraints imposed by the inheritance of their parents' resources are greatest for spinouts established by higher-ranked employees at intermediate levels of market overlap.

Hypothesis 2. The hierarchical position of a spinout founder within the parent firm moderates the curvilinear relation between market overlap with the parent and spinout's survival, such that the inverted U-shaped curve becomes flatter for the spinouts founded by high-ranked employees of the parent firms.

4. Methodology

4.1. Empirical setting: the biotech industry

We tested our hypotheses in the context of the European biotech industry. Biotechnology is the "*application of science and technology to living organisms, as well as parts, products, and models thereof, to alter living or non-living materials for the production of knowledge, goods, and services*" (OECD, 2005). This definition includes companies that use modern biological techniques to serve different product segments, including human and veterinary health, agriculture, natural resources, environment, and industrial processing. In this regard, the biotech industry is an ideal empirical setting and a "test bed" for our analysis because it blends various technological fields, whose applications create several niches or submarkets, thereby generating opportunities for spinouts to use similar technologies to enter overlapping or non-overlapping markets compared to their parent firms. Thus, we can exclude that technology fully determines the boundaries between downstream market applications in this setting. For example, recombinant DNA technology can be used to produce large-molecule medicines in the pharmaceutical sector, create new crop varieties in the agricultural sector, or design microorganisms used to produce industrial enzymes for the chemical sector (OECD, 2005).

4.2. Data and sample

Data were collected using five major sources: 1- ThomsonOne (VentureXpert) database, 2- Bureau Van Dijk's ORBIS database, 3- European Patent Office (EPO) database, 4- Companies' websites and annual reports, and 5- LinkedIn, Crunchbase, and two business directories (Bionity and Biocentury).

The core data used in this study were obtained from the ThomsonOne database. This database delivers a wide range of financial information covering ventures, buyouts, private equity funds, portfolio companies, and limited partners worldwide (Kaplan and Lerner, 2017). Furthermore, ThomsonOne contains the names of directors and managers, some firm-level data (e.g., business sector), and financial information, including the funding rounds, the amount of financing, and the investors involved in each financing round. Using this database, we identified 925 European VC-backed biotech ventures established over a 25-year period, from 1990 to 2014. We implemented the following three steps to identify spinouts among these ventures. First, ThomsonOne includes information about the founding team members of only 256 out of 925 companies. Therefore, we resorted to company websites and other data sources (e.g., Bloomberg, Crunchbase, and RelSci) to collect data on the founders of the remaining firms and verify the data available in ThomsonOne. Second, we collected information on the career history of all founders by performing a rigorous search using LinkedIn and the aforementioned data sources. We found this information for 717 firms. Following previous studies, we considered a VC-backed firm as a spinout when at least one founder worked for an incumbent firm in the focal industry during the preceding year (Agarwal et al., 2004;

Ioannou, 2014; Walter et al., 2014). Third, we collected information about the history of ownership of these firms using the ORBIS database to ensure that they had no ownership links with the parent companies (Agarwal et al., 2004; Campbell et al., 2012; Honoré, 2022; Kim and Steensma, 2017). This sampling procedure resulted in a total of 127 spinouts.[6]

Next, we gathered information about parent firms and spinouts' core businesses, pipeline projects, and products using the companies' websites and two business directories: Bionity and Biocentury. Furthermore, we collected patent data on parent firms and spinouts using the EPO database. Finally, we searched for the parent firms in the ORBIS database to obtain other firm-level information, such as the date of incorporation, operating sectors, and status at the time of spinout entry. After combining these data, we constructed a final sample of 117 spinouts spawned by 103 parent firms.

4.3. Measures

4.3.1. Dependent variable

Survival is the primary objective of newly founded firms and a key dimension of their performance (Agarwal et al., 2016). Following prior studies (Agarwal et al., 2004; Honoré, 2022; Phillips, 2002; Wezel et al., 2006), we focused on lifespan to measure the performance of spinouts. Using data available in the ORBIS database, we constructed a dummy variable (*failure*) with a value equal to 0 in any year the spinout was alive and 1 for the year the spinout failed and exited the market. If a spinout was acquired, it was treated as a right-censored observation: the last year observed as an independent firm was coded as 0, and the observation on the spinout was excluded after the year of acquisition (Honoré, 2022). In total, seventeen spinouts (14.5 % of the sample) failed during our analysis period.

4.3.2. Independent variable

The most widely used measures of industry relatedness in the literature are based on the Standard Industrial Classification (SIC) system. The grounding of these measures is that two industries are more closely related if the lower the level of aggregation of their shared industrial class (Neffke and Henning, 2013). However, a shortcoming of this approach is that much of the SIC system reflects the logic of vertical structure and raw material input (Bryce and Winter, 2009). Therefore, the hierarchical structure of the SIC system does not capture commonalities across industries in the use of resources and know-how across different functionally similar products. In this study, we followed a similar logic based on the hierarchical distance within the SIC structure (e.g., Chatterjee and Wernerfelt, 1991). However, instead of using the SIC system, we relied on a classification system for biotechnology applications developed by the OECD (2005) to assess the extent to which two firms operated in the same application area (Karim and Meder, 2019). More specifically, one of the authors and a research assistant independently text-analyzed all spinouts' and parent firms' business descriptions (including the operating sectors, product pipelines, and undergoing research projects) and hand-matched them according to the OECD classification system.[7]

This classification provides a three-level (broad, intermediate, and detailed) grouping of biotechnology market application areas. The highest level of classification encompasses six areas: human health, veterinary health, agriculture, natural resources, environment, and industrial processing. The intermediate level encompasses 9 sub-areas, while the lower level of classification comprises 26 finer-grained application areas (see Appendix I). Drawing on the abovementioned procedure, we constructed the market overlap variable such that it took the value of 1 for spinout–parent dyads operating in the same 3rd (detailed) level application area. The variable is equal to 0.66 when a spinout and its parent firm operate in the same 2nd (intermediate) level, but different 3rd (detailed) level application areas. Market overlap is equal to 0.33 for spinout–parent dyads operating in the same 1st (broad) level, but different intermediate and detailed levels of application areas, and the variable is equal to 0 when the two firms operate in completely different 1st (broad) level application areas.

To illustrate this coding procedure, let us consider the following example. A spinout in the sample was a biopharmaceutical company engaged in the development of drug candidates for the treatment of cancer and other life-threatening diseases.[8] The company had several drug candidates in late-stage clinical development designed to strengthen the human body's immune response to cancerous antigens and prevent tumor recurrence (source: company's website). Tracing the employment history of its founders, we found that this spinout was spawned by an industry incumbent that was active in the field of in-vitro diagnostics. More precisely, the parent firm had several clinical diagnostic products in the areas of sepsis, infections, tuberculosis, biomarkers, and cardiovascular diseases. After analyzing the description of the core businesses, products, or drug candidates and the ongoing research projects, we hand-matched the extracted information with the description of different application areas available within the proposed classification

[6] Of the remaining firms excluded from the sample, 57 ventures were founded by established firms (i.e., parent spinoffs), 457 ventures were founded by faculties or research staffs in academic institutions (i.e., academic spinouts), and 76 ventures were founded by individuals with no prior employment or financial relation with incumbent firms in the industry (i.e., other de novo entrants).

[7] To assess the consistency of our measure, two researchers met, discussed, and reconciled disagreements over firms matched in different application areas.

[8] To precisely measure market overlap, we collected information about spinouts and their parent firms' business activity at the time of spinout entry using the Wayback Machine internet archive.

system for biotechnology applications (OECD, 2005) and assigned the parent firm and the spinout to one detailed level application field.[9] In this example, we assigned the spinout and its parent firm to "other therapeutics, drug delivery technologies" and "diagnostics," respectively (see Appendix I). Therefore, the market overlap took a value of 0.66 because the two firms operated in the same intermediate but in different detailed level application areas.

4.3.3. Moderator

To test the second hypothesis, we collected information on the hierarchical position of spinout founders within the parent firms using LinkedIn and Crunchbase. We constructed a dummy variable with a value of 1 if the spinout was founded by a high-ranked employee (president, vice president, executive director, or manager), and 0 otherwise (Phillips, 2002). In our sample, 49.6 % (58 out of 117) of the spinouts were founded by only one individual. In the case of multiple founders, prior work assumes that the core founder is the individual with the highest rank in the parent organization (Phillips, 2002; Rajan and Zingales, 2001; Wezel et al., 2006). In addition to considering the prior ranks of all the founding team members, we collected information about their main tasks and responsibilities in the previous company. Prior research suggests that an individual with past managerial (i.e., knowledge of business operations) or industrial (i.e., knowledge of technology and product development in the focal industry) experience is more likely to start a new firm, as these experiences are particularly valuable in the pursuit of new opportunities in the external environment (Shepherd et al., 2021). The information about the founding team members' previous rank and experiences was served to identify the "ringleader" who originated and led the spinout formation (Shah et al., 2019) and to construct the moderator.

4.3.4. Control variables

We included several control variables at the individual, team, organizational, and sectoral levels to control for other factors that may affect spinouts' performance. First, drawing on prior research (Agarwal et al., 2004; Gompers et al., 2005; Honoré, 2022; Sakakibara and Balasubramanian, 2020), we controlled for various factors that might correlate with survival and spinout founding team characteristics. In particular, we included, as controls, the variables *number of founders* and *number of founders transitioning from the same parent firm.* We also controlled for the lead founder's *cumulative experience* in the industry and level of *education*. The latter is a binary variable equal to 1 if the founder has held a PhD or MD degree at the time of spinout formation. Finally, we included two dummy variables that accounted for the presence of serial entrepreneurs and university affiliates in the founding team. Second, we controlled for the level of *technological overlap* between a spinout and its parent firm, the spinout's *number of patents*, and the number of *operating sectors at the* four-digit SIC aggregation level (Bae and Lee, 2021). To measure the level of *technological overlap,* we calculated the share of the spinout's first-year patents in the same four-digit IPC technological classes as its parent firm (Sears and Hoetker, 2014). Third, we controlled for the effects of VC financing on spinouts' survival by including three variables: *time to the first round of financing, the number of financing rounds, and the total amount of funding* (Chatterji, 2009). Fourth, we included four variables to control for the effects of parent firms on spinouts' performance. More specifically, we controlled for parent firms' *number of patents* and the number of *operating sectors* (Bae and Lee, 2021). We also controlled for the parent firms' *age* and *operating status* (whether active or dissolved) at the time of spinout entry (Agarwal et al., 2016). Earlier works suggest that older firms are more likely to be structurally inert (Hannan and Freeman, 1984) or possess "suboptimal" and "outdated" routines (Phillips, 2002) that negatively impact the performance of their spinouts. Moreover, older parent firms have a larger network of partners (e.g., suppliers, customers, and collaborators) in the market, which enhances their ability to impose sanctions. Thus, spinouts from older parent firms face a higher barrier to making transactions with resource holders in the market (Walter et al., 2014). Finally, to capture the attractiveness of the sector (four-digit SIC level), we follow Ioannou (2014) and include, as controls, the variable *density/100,* which is the total number of VC-backed firms in the sector in the entry year for each spinout (Hannan and Carroll, 1992).

4.4. Estimation method

Our two hypotheses relate to the impact of market overlap with parent firms on the performance of spinouts measured in terms of survival and the moderating effect of the founders' previous position. To test these hypotheses, we transform the data into event history data and use a parametric survival model with a log-logistic specification, which is suitable for modeling nonmonotonic survival functions (Bennett, 1983). This is because, unlike other specifications of the hazard function, such as Weibull, in the log-logistic model, the hazard function can be monotone decreasing or it can increase and then decrease over time (Cleves et al., 2008), which is typical for new entrants.

5. Results

Table 1 presents the descriptive statistics and correlation matrix. The average lifespan of spinouts is 11.6 years. Of the spinouts in our sample, 54 % were founded by high-ranked employees, and 35.9 % targeted the same market as their parent firms (42 out of 117). The average number of founders was 1.7 individuals who had worked for 8.8 years on average in the industry before starting their own firms. Most correlation coefficients are below 0.5, except for the correlation between variables that are naturally correlated (e.g., the

[9] If the parent firm or the spinout was active in various biotech fields, we identified the primary application area, and constructed the variable market overlap based on that information. However, it should be noted that parent firms and spinouts in our sample had a quite high degree of market focus – 81 % of parent firms (83 out of 103) and 95 % of spinouts (111 out of 117) were active in only a single detailed level application area.

Table 1
Descriptive statistics and correlation matrix.

	Mean	Std. Dev.	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. Failure (dissolved = 1; active = 0)	0.15	0.35	0	1	1.00																				
2. Time to Failure (#years)	11.60	4.99	3	27	−0.04	1.00																			
3. Market Overlap	0.49	0.43	0	1	−0.16	−0.05	1.00																		
4. Founder Position (Director/ Manager = 1; others = 0)	0.54	0.50	0	1	−0.10	−0.02	0.03	1.00																	
5. Number of Founders	1.70	0.83	1	4	−0.06	−0.11	0.10	0.12	1.00																
6. Number of Founders from Same Parent	1.32	0.55	1	3	−0.10	−0.07	0.05	0.03	**0.70**	1.00															
7. Founder Cumulative Experience (#years)	8.80	5.53	1	38	**−0.21**	0.00	0.12	0.15	**0.23**	**0.24**	1.00														
8. University Affiliate (Yes = 1; No = 0)	0.06	0.24	0	1	0.00	−0.02	−0.04	0.09	**0.31**	0.05	−0.05	1.00													
9. Serial Entrepreneur (Yes = 1; No = 0)	0.26	0.44	0	1	−0.02	−0.13	0.13	**0.50**	0.12	0.09	**0.20**	0.02	1.00												
10. Founder Education (PhD or MD = 1; Other = 0)	0.67	0.47	0	1	−0.07	0.10	−0.13	0.00	−0.15	**−0.25**	−0.08	0.10	0.04	1.00											
11. Technological Overlap	0.65	0.44	0	1	−0.15	−0.02	0.06	0.01	0.11	**0.20**	0.14	0.09	−0.08	0.08	1.00										
12. Number of Patents	13.49	15.20	1	89	−0.18	**0.35**	0.10	0.13	0.13	0.14	0.00	0.01	−0.08	0.07	0.08	1.00									
13. N. Operating Sectors	1.38	0.77	1	5	0.05	0.04	**−0.26**	−0.02	0.00	0.02	0.13	−0.08	−0.03	−0.03	−0.20	−0.03	1.00								
14. Time to First Financing	30.09	31.11	0	180	−0.04	**0.30**	0.01	−0.09	**−0.28**	−0.16	0.04	−0.14	−0.01	−0.04	−0.15	−0.16	0.07	1.00							
15. Number of Financing Rounds	3.69	2.89	1	16	−0.05	**0.27**	0.04	−0.03	0.14	0.07	−0.18	**0.30**	−0.16	−0.06	0.07	**0.45**	−0.11	**−0.19**	1.00						
16. Total Funding	24.10	40.30	0	260.32	−0.17	0.05	0.11	0.02	**0.29**	0.14	−0.06	**0.42**	−0.02	0.07	**0.24**	**0.32**	−0.18	**−0.20**	**0.55**	1.00					
17. Parent N. Patent before Spawning (log)	4.97	3.11	0	10.563	**−0.24**	−0.09	0.07	−0.12	**0.21**	0.16	**0.25**	0.05	**−0.25**	0.17	**0.58**	0.13	−0.10	−0.13	0.06	**0.23**	1.00				
18. Parent N. Operating Sectors	1.92	1.86	0	14	−0.14	0.12	−0.04	0.02	0.04	0.00	0.02	−0.13	−0.08	**−0.21**	0.08	0.00	0.09	−0.09	−0.06	−0.04	0.02	1.00			
19. Parent Age at the Spawning Time	24.51	35.29	0	158	−0.08	−0.06	−0.06	**−0.30**	0.03	0.00	0.06	−0.06	**−0.27**	−0.05	0.13	0.03	0.00	−0.03	−0.03	0.04	**0.44**	0.05	1.00		
20. Parent Status (Active = 1; Dissolved = 0)	0.85	0.36	0	1	0.11	0.05	**−0.25**	−0.06	−0.04	−0.06	−0.08	0.01	−0.08	0.05	−0.04	−0.11	0.02	0.11	−0.01	−0.10	−0.06	0.10	0.04	1.00	
21. Density/100	0.59	0.66	0	2.33	−0.11	**−0.41**	**0.22**	0.02	0.02	−0.01	−0.03	0.04	**0.20**	0.10	−0.03	**−0.18**	**−0.28**	−0.13	−0.17	0.13	−0.01	−0.12	−0.18	−0.03	1

Bolded pairwise correlations are significant at the 0.05 level (two-tailed tests of significance). $N = 117$.

Table 2
Parametric estimation of spinouts' survival.

	(1)	(2)	(3)	(4)	(5)
Spinout–Parent Market Overlap		0.119	2.193***	2.102***	3.119***
		(0.178)	(0.741)	(0.772)	(0.897)
Spinout–Parent Market Overlapˆ2			−2.047***	−2.039***	−3.134***
			(0.715)	(0.735)	(0.902)
Spinout–Parent Market Overlap × Founder Position				0.185	−3.537***
				(0.301)	(1.247)
Spinout–Parent Market Overlapˆ2 × Founder Position					3.818***
					(1.258)
Founder Hierarchical Position (Director/Manager = 1; Other = 0)	0.291	0.306	0.374**	0.317*	0.404**
	(0.194)	(0.197)	(0.167)	(0.191)	(0.170)
Number of Founder	−0.316**	−0.348**	−0.350**	−0.335**	−0.247*
	(0.146)	(0.158)	(0.137)	(0.141)	(0.129)
Number of Founder from Same Parent	0.421	0.470*	0.457**	0.426*	0.309
	(0.258)	(0.270)	(0.228)	(0.235)	(0.216)
Founder Cumulative Experience (#years)	0.0344**	0.0335*	0.0296**	0.0321**	0.0369***
	(0.0175)	(0.0178)	(0.0138)	(0.0147)	(0.0135)
University Affiliate (Yes = 1; No = 0)	0.491*	0.536*	0.511**	0.543**	0.440*
	(0.293)	(0.308)	(0.248)	(0.258)	(0.246)
Serial Entrepreneur (Yes = 1; No = 0)	−0.0804	−0.0827	−0.0744	−0.0891	−0.136
	(0.204)	(0.209)	(0.176)	(0.177)	(0.148)
Founder Education (PhD or MD = 1; Other = 0)	−0.0782	−0.0615	−0.195	−0.228	−0.229
	(0.173)	(0.179)	(0.159)	(0.167)	(0.157)
Technological Overlap	−0.115	−0.120	−0.177	−0.166	−0.113
	(0.189)	(0.189)	(0.155)	(0.156)	(0.148)
Number of Patents	0.0199**	0.0209**	0.0261***	0.0264***	0.0249***
	(0.00997)	(0.0107)	(0.00920)	(0.00958)	(0.00876)
N. Operating Sectors	0.0477	0.0712	0.0583	0.0454	0.00620
	(0.0855)	(0.0931)	(0.0733)	(0.0766)	(0.0638)
Time to First Financing	0.00706***	0.00686***	0.00537**	0.00530**	0.00626***
	(0.00253)	(0.00251)	(0.00213)	(0.00211)	(0.00202)
Number of Financing Rounds	−0.0265	−0.0315	−0.0589**	−0.0601**	−0.0584**
	(0.0304)	(0.0318)	(0.0274)	(0.0277)	(0.0242)
Total Funding	0.0116**	0.0123**	0.0106***	0.0104***	0.00956**
	(0.00507)	(0.00576)	(0.00412)	(0.00394)	(0.00395)
Parent N. Patent before Spawning (log)	0.0431	0.0455	0.0369	0.0384	0.0265
	(0.0373)	(0.0386)	(0.0301)	(0.0304)	(0.0287)
Parent N. Operating Sectors	0.234***	0.237***	0.201***	0.203***	0.156***
	(0.0776)	(0.0774)	(0.0621)	(0.0625)	(0.0588)
Parent Age at the Spawning Time	−0.00246	−0.00277	−0.00344**	−0.00349**	−0.00241
	(0.00208)	(0.00220)	(0.00169)	(0.00172)	(0.00153)
Parent Status at the Spawning Time (Active = 1; Dissolved = 0)	−0.111	−0.0764	0.0293	0.0482	0.0682
	(0.223)	(0.235)	(0.197)	(0.199)	(0.174)
Density/100	0.264	0.250	0.117	0.105	0.137
	(0.224)	(0.225)	(0.193)	(0.190)	(0.182)
/ln_gam	−1.746***	−1.740***	−1.965***	−1.967***	−2.148***
	(0.198)	(0.198)	(0.207)	(0.206)	(0.206)
Constant	1.568***	1.452***	1.640***	1.695***	1.714***
	(0.452)	(0.494)	(0.376)	(0.381)	(0.325)
Time at risk	1357	1357	1357	1357	1357
N. Firms (failed)	117 (17)	117 (17)	117 (17)	117 (17)	117 (17)
Log-likelihood	−18.71	−18.47	−14.70	−14.51	−10.84
Chi-square	48.74***	49.21***	56.75***	57.14***	64.47***

Standard errors are in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$ (Two-tailed test of significance).

number of founders and the number of founders from the sample parent firm). Therefore, multicollinearity is not a particular concern in our analysis.

Table 2 reports the results of the survival models considering spinouts' exit due to failure. Model 1 is the baseline model with all the controls. The variable *market overlap* with the parent firm and its squared form were individually included into Models 2 and 3. The coefficient for the linear effect of market overlap ($\beta = 2.193, p < 0.01$) is positive, suggesting a significant increase in the likelihood of survival. However, the coefficient for the squared term ($\beta = -2.047, p < 0.01$) is negative, implying a significant increase in the hazard

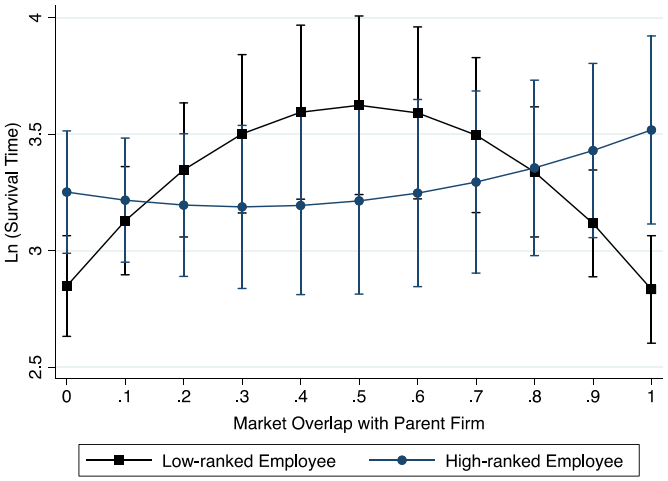

Fig. 1. Predictive margins of founder's hierarchical position by market overlap.

rate. Taken together, the results support our first hypothesis that the relation between market overlap with the parent firm and spinout's survival is curvilinear, such that the likelihood of a failure is lowest at intermediate levels of market overlap.[10] For example, our model predicts that spinouts operating in the same 2nd (intermediate) level but different 3rd (detailed) level application area (i.e., *market overlap* = 0.66) have a 39 % higher survival time compared to spinouts operating in the same 3rd (detailed) level segment (i.e., market overlap = 1). However, the difference in survival time increases to 63 % when we compare spinouts that are active in the same intermediate but different detailed level area (i.e., *market overlap* = 0.66*)* with spinouts operating in a different 1st (broad) level application area relative to their parents (i.e., *market overlap* = 0).

Hypothesis 2 explores the moderating effect of the founder's hierarchical position in the parent firm on the relationship between market overlap and spinout survival. The variable *position* is a dichotomous variable equal to 1 for spinouts founded by former senior managers or unit directors of the parent firms and 0 for other employees. The interactions of *position* with *market overlap* and *market overlap squared* were included in Models 4 and 5, respectively, in a hierarchical order. Supporting the second hypothesis, the coefficient of the interaction with the linear term ($\beta = -3.537, p < 0.01$) is negative, while the coefficient of the interaction with the squared term ($\beta = 3.818, p < 0.01$) is positive, indicating that the founder's position in the parent firm moderates the market overlap and survival relationship. Therefore, the inverted U-shaped curve becomes flatter when a high-ranked employee of the parent firm launches a spinout.

To supplement the previous analysis and facilitate the interpretation of these coefficients and cross-partial derivatives, Fig. 1 displays the predictive margins of the founder's hierarchical position in the parent firm at different levels of market overlap between the two firms. The slopes are "sufficiently steep" at both ends of market overlap, and the turning points are located well within the data range and around the mean, thus establishing a quadratic relationship (Lind and Mehlum, 2010). Spinouts launched by high-ranked employees of parent firms have a higher likelihood of survival at both very low and very high levels of market overlap. As discussed previously, this is because high-ranked employees possess greater industry- and firm-specific knowledge and resources than low-ranked staff. Moreover, high-ranked employees have higher levels of social capital, thus enabling them to obtain financial resources and access other resource holders in the market (Phillips, 2002), thereby allowing them to better deal with the parent firms' hostile actions. Conversely, at intermediate degrees of market overlap with parent firms, spinouts launched by high-ranked employees have a lower likelihood of survival than those launched by low-ranked employees of parent firms due to the risk of falling into competency traps, as suggested by a "significant flattening" of the curve (Haans et al., 2016). Therefore, although the optimal level of market overlap where the probability of survival is maximized is at intermediate degrees of market overlap for spinouts launched by low-ranked employees, the same levels of market overlap may lead to the worst performance for spinouts founded by high-ranked employees in the parent firms.

To determine the exact value of the moderator at which the shape of the curve flips from an inverted U-shape to a U-shape, we set the first derivative of our quadratic equation with interactions between the moderator, the independent variable, and its square (Eq. (1)) with respect to X to zero. Then, from the first-order condition ($dY/dX = 0$), we derive the turning point X^*, which depends on the moderator (Eq. (2)):

$$Y = \beta_0 + \beta_1 X + \beta_2 X^2 + \beta_3 XZ + \beta_4 X^2 Z + \beta_5 Z \tag{1}$$

$$X^* = \frac{-\beta_1 - \beta_3 Z}{2\beta_2 + 2\beta_4 Z} \tag{2}$$

[10] We used Cox proportional hazard model as an alternative specification of survival analysis and the results were in line with those reported here.

Following Haans et al. (2016), we calculate the value of Z by setting the denominator of Eq. (2) to zero, and we find that the "shape-flip" occurs when the moderator is equal to 0.82, which is within the range of the moderator variable in our study.[11] Thus, the results suggest that the fundamental nature of the relationship between market overlap with parents and the survival of spinouts depends on the hierarchical position of the founders when employed in parent firms.

6. Robustness checks

We perform two robustness checks. First, our results indicate that while market overlap with parent firms has a positive but diminishing impact on spinout survival, the technological overlap between the two firms (one of our control variables) has no direct effect on spinout longevity. To further test the robustness of our results, we constructed an alternative measure of technological overlap based on the co-occurrence of the spinout's five first patents in the same IPC class as the parent's patents. These results also suggest a non-significant effect of technological relatedness between the spinout and its parent firm. One reason is that patenting on the part of spinouts makes it easier for parent firms to detect any illegal or questionable intellectual property expropriation, thereby possibly triggering legal actions or other forms of retaliation. Given the strength of the appropriability regime in the biotech sector, some spinouts might decide against patenting in the same technological fields as their parents or directly citing their parent firms' patents to limit the risk of their parents' aggressive actions (Corsino et al., 2019).

Second, approximately 15 % of the spinouts in our sample were established when the parent firms were already dissolved. We took this opportunity to analyze whether our theoretical mechanisms (the competitive tension and parent hostility in particular) hold across these two sub-samples. Restricting our analysis to the sample of spinouts spawned by active parent firms, we found similar results that were consistent with those reported in Table 2. However, we did not find any significant effect of market overlap with parent firms on the survival of spinouts originating from dissolved parent firms. On the one hand, this result may reflect that the benefits of market overlap with parent firms are limited by the low quality of knowledge and resources inherited by a poor performing parent firm. On the other hand, spinouts of dissolved parents do not face the risk of retaliation and parent hostility when they enter markets similar to their parent firms. We found that 61 % of spinouts from dissolved parent firms (11 out of 18) entered the same third-level application area as their parent firms (M = 0.74, S.D. = 0.37). In contrast, only 31 % of spinouts from active parent firms target overlapping markets as their parents (M = 0.45, S.D. = 0.42), which is a significantly smaller proportion than the other subset ($t = 2.73$, df = 115, $p < 0.001$). These findings confirm the role of competitive tension mechanism as a driver of the association between market overlap and spinout survival.

7. Discussion and conclusions

Previous studies addressing the performance heterogeneity of firms suggest that historical antecedents in the form of pre-entry resources and capabilities shape the outcomes of new entrants (Helfat and Lieberman, 2002). As Huber (1991, p. 91) noted, this is because "*what an organization knows at its birth will determine what it searches for, what it experiences, and how it interprets what it encounters*." Spinouts' access to the knowledge and resources transferred from parent organizations can place them in a privileged position compared to other de novo entrants (Phillips, 2002). However, when founders leverage this initial resource endowment to position their new ventures close to the parent firm's market domains, spinouts may face the risk of retaliation and direct confrontation with their parent organizations, which may lower the likelihood of survival (Klepper and Sleeper, 2005). The central theoretical motivation of our research is to determine whether an optimal level of market overlap exists with the market served by the parent organization. Thus, we examined how close a spinout can stay in the market domains of its parent firm to benefit from its knowledge legacy, while differentiating sufficiently to reduce the risk of its parent's hostile actions. Building on knowledge inheritance and competitive dynamics theories, we propose that the degree to which spinouts' operating markets overlap with their parent organizations has a curvilinear relationship with their survival. Furthermore, we hypothesize that the shape of this curvilinear relationship is contingent on the hierarchical position of the founders when employed in parent firms. The results support our predictions. We find that market overlap with parent organizations has an inverted U-shaped relationship with spinout survival, and this relationship is moderated by the founders' previous hierarchical position in parent firms. More specifically, our findings suggest that by heavily fishing in the parent firms' knowledge pool, spinouts take the risk of getting stuck in a competency trap (Levitt and March, 1988), which reduces their likelihood of survival, and this effect is stronger for spinouts founded by high-ranked employees positioned at intermediate levels of market overlap with parent organizations. To the best of our knowledge, this is the first study to examine how a founder's position in the parent firm and the choice of market positioning jointly affect a spinout's survival.

7.1. Theoretical contributions and managerial implications

This study responds to the call for further research on the consequences of "*knowledge spillovers and legacy effects*" on the performance of recipient organizations (Agarwal et al., 2010; p. 277). While the received view of spinout formation and performance suggests that spinouts predominantly benefit from the transfer of knowledge and resources from the parent organizations (Agarwal et al., 2004; Chatterji, 2009; Phillips, 2002), only recently has the spinout literature started to underline the conditions under which

[11] At this value of Z, no turning point exits, and therefore, the X–Y relationship is linear. However, as the value of Z increases further, the curve changes shape from an inverted U-shape to a U-shape (Haans et al., 2016).

spinouts' knowledge legacy may become a source of liability and have an adverse impact on their performance (e.g., Walter et al., 2014).

We contribute to the literature on spinout performance by providing a more nuanced view of knowledge inheritance and the parent–spinout relationship, which considers both the benefits of market overlap in terms of resource endowment and the costs of market overlap resulting from rising competitive tension with parent firms. By combining two different theoretical perspectives, knowledge inheritance and competitive dynamics, our study provides a novel explanation for the curvilinear shape of the relationship between market overlap and spinout survival. More specifically, we primarily contribute to this body of research in two ways. First, prior studies have either examined the effects of technological overlap with parent organizations on the financing and technological performance of spinouts (Bae and Lee, 2021; Basu et al., 2015) or distinguished technological overlap from market overlap without investigating the implications of competition with the parent firms and the survival of spinouts (Sapienza et al., 2004). Firms face the greatest competitive tension from rivals that compete directly in the same product markets (Chen et al., 2007) or imitate their innovations (Giachetti et al., 2017). Hence, although technological overlap is an important driver of competitive tension (Bae and Lee, 2021), firms are more likely to take competitive action against rivals (with similar resources) that attack their vital markets (Chen, 1996; Chen et al., 2007). Second, we extend this stream of research by accounting for an important boundary condition—the hierarchical position of founders in the parent firms—in the relationship between market overlap and spinout performance. Spinouts by higher-ranked employees have access to a more substantial volume of knowledge and resources compared to those founded by lower-ranked employees, which can provide the spinouts with more favorable conditions for their survival. However, an excessive volume of routines, business practices, and knowledge acquired while working in parent organizations may reinforce the risks of getting stuck in the past experience, particularly for spinouts positioned in markets adjacent to the parent firms. This is because the practices and routines that have proven to be effective in parents' markets may inaccurately appear to be appropriate and applicable, with little or no modification, to partly overlapping markets (Helfat and Lieberman, 2002; Ferriani et al., 2012; Semadeni and Cannella Jr, 2011). Thus, spinouts founded by former higher-ranked employees and operating in overlapping markets have a limited ability to differentiate themselves from their parents, which reduces their chances of survival. From this perspective, our results highlight an important source of resource heterogeneity across spinouts due to founders' varied work experiences and business perspectives. This result also has important implications for the broader entrepreneurship literature. In particular, the extant literature highlights the role of founding team composition in explaining startup performance (e.g., Bantel and Jackson, 1989; Hambrick et al., 1996). However, to the best of our knowledge, no previous study has pointed out how the experience and knowledge acquired by the main founders from their previous employer organization may exacerbate the risk of falling into competency traps and affect spinouts' survival. In this respect, our findings highlight an important source of performance heterogeneity among startups.

Moreover, this study contributes to the competitive dynamics theory by extending the study of inter-firm rivalry among established firms to a different setting, where entrepreneurial ventures launched by ex-employees of incumbent firms may face the risks of retaliation and competitive actions by the parent firms. Applying the awareness, motivation, and capability framework (Chen, 1996), we examine when the parent organizations are more likely to retaliate and undertake hostile actions toward spinouts. More specifically, we identify two conditions under which spinouts may face a lower competitive threat imposed by the parents' potential hostile actions (Chen and Miller, 2012; Markman et al., 2009). First, our main findings and those obtained from the robustness checks support the argument that by reducing the degree of market commonality, spinouts can obscure their visibility (or parent firms' awareness) and mitigate the parents' motivation to undertake hostile actions (Chen, 1996). Second, even in the case of high market commonality, our results suggest that spinouts launched by high-ranked employees that benefit from more substantial level of initial endowment can diminish the parent firms' capability to retaliate and negotiate a negotiate more favorable exit conditions at the time of establishment (Campbell et al., 2012).

Our results have important implications for prospective entrepreneurs. Spinout founders face an important decision regarding the extent to which to leverage the resources gained while working in the parent organizations or relinquish their legacy to pursue business opportunities in other fields (Basu et al., 2015). In this study, we showed that while positioning close to the parent firms' market domains might reduce uncertainty at the time of market entry, it could also spur hostile actions by the parent firm. Thus, spinout founders need to be aware of the contrasting forces at work in searching for the right balance between the risk entailed by entering a new market domain different from their parent organization and the risk of dealing with the parent firm's hostile actions. Moreover, our analysis of founders' hierarchical positions in parent firms hints at another potential drawback of knowledge legacy for the performance of spinouts. High-ranked founders need to be aware of the risk of falling into competency traps when they choose to position their ventures in a new market that only partly overlaps with that of their parent organizations. Even close markets in the same industry may differ in relevant resources and capabilities (Dencker et al., 2009; Hashai and Zahra, 2022), and high-ranked founders should avoid the information filter that focuses organizational attention only on data relevant to the "dominant logic" learned in the parent organization. Instead, they should try to unlearn the old logic (Bettis and Prahalad, 1995) to innovate and differentiate themselves from their parent organizations. From the parent firms' perspective, understanding the positioning of their spinouts in the market can guide managers in their decision to either accommodate entry or respond aggressively (Walter et. 2014).

7.2. Limitations and future research

This study has some limitations that offer opportunities for future research. First, the biotech industry is knowledge-intensive and characterized by a high degree of patenting activity. Thus, the strength of the appropriability regime in this setting and aggressive IP protection by incumbent firms may affect the strategic positioning of spinouts in the market to a different degree compared with other industries, which may limit the generalizability of our findings. While acknowledging this limitation, we believe that the results of this

study will still hold in other settings for two reasons. First, prior research suggests that spinouts manage to circumvent strong IP protection mechanisms by capitalizing on the tacit knowledge inherited from their parent firms (Agarwal and Shah, 2014). Second, evidence suggests that intellectual property enforcement by parent firms does not necessarily lead spinouts to set foot in non-overlapping markets. For example, Klepper and Sleeper (2005) found that spinouts initially targeted niches that overlapped with their parent firms' markets, and only over time they moved to related but different market niches than their parents. Nevertheless, future work may investigate the extent to which the results of this study hold in other industries that have weaker intellectual property protection regimes.

The second limitation of this study relates to the measure of market overlap between a spinout and its parent firm. In particular, we used spinouts and parent firms' business descriptions to identify their primary application area, and we relied on a classification system for biotechnology applications to measure market overlap between the two firms. However, future research should consider multi-market competition when examining the degree of competitive tension between spinouts and their parent firms (Gimeno, 1999). Another interesting issue to consider in future research is the role of the geographical proximity between firms. For example, Kilduff et al. (2010) state that physical proximity and prior competitive interactions increase the intensity of competition between rivals. Therefore, future research may consider the joint effects of market commonality and geographical proximity on the intensity of the rivalry between spinouts and their parent firms.

In this study, we focused on the core founders' position in the parent organizations and controlled for other characteristics, including their level of education and general and entrepreneurial experiences prior to founding spinouts. However, our data do not allow for a direct observation of their social capital. We also account for the number of founders and those from the same parent firms. However, our data prevented an in-depth analysis of the composition of the founding team. Future research could benefit from a finer-grained analysis of founders' social capital and founding team characteristics.

Finally, we examined the effects of early-stage market overlap with parent firms on the likelihood of spinout survival. However, over time, founders may decide to exploit new market opportunities that can eventually alter the level of market overlap between spinouts and their parent firms. Moreover, the returns from market overlap with the parent company, which depend on the actual behavior of the parent company, may affect the level of overlap between the two firms over time. The cross-sectional nature of our data does not allow us to uncover the dynamics of these relationships. However, future research based on longitudinal data may build on these preliminary findings to determine how these variables covary over time.

CRediT authorship contribution statement

Aliasghar Bahoo-Torodi: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Salvatore Torrisi:** Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing.

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Appendix I

Classification for Biotechnology Applications
(Source: A Framework for Biotechnology Statistics. OECD,2005)

Broad	Intermediate	Detailed
Human Health	Large molecule therapeutics and monoclonal antibodies (MABs) produced using rDNA technology	–
	Other therapeutics, artificial substrates, diagnostics and drug delivery technologies, etc.	Other therapeutics, drug delivery technologies, etc. Substrates (artificial bone, skin etc.) Diagnostics
Veterinary health	As above, for veterinary uses	As above
Agriculture	New varieties of genetically modified (GM) plants, animals, and micro- organisms for use in agriculture, aquaculture, and silviculture	GM plants, including fruit trees, flowers, horticultural crops, grains, etc. GM animals for agriculture GM fish GM tree varieties for forestry GM micro-organisms for agriculture (including bio pest control) Non-GM plants, including fruit trees, flowers, horticultural crops, grains, etc.

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Classification for Biotechnology Applications (Source: A Framework for Biotechnology Statistics. OECD,2005)		
Broad	Intermediate	Detailed
	New varieties of non-GM plants, animals, and micro-organisms for use in agriculture, aquaculture, silviculture, bio pest control and diagnostics developed using biotechnology techniques (DNA markers, tissue culture, etc.)	Non-GM animals for agriculture Non-GM fish Non-GM tree varieties for forestry Non-GM micro-organisms for agriculture (including bio pest control) Diagnostics
Natural resources	Applications for mining, petroleum/energy extraction, etc.	Mining: extraction using micro-organisms, etc. Petroleum/energy: extraction using micro-organisms Other resource applications
Environment	Diagnostics, soil bioremediation, treatment of water, air, and industrial effluents using micro-organisms, clean production processes	Diagnostics Soil bioremediation, including phytoremediation Effluent treatment Clean production processes
Industrial processing	Bioreactors to produce new products (chemicals, food, ethanol, plastics, etc.), biotechnologies to transform inputs (bioleaching, biopulping, etc.)	Detailed list of specific biotechnologies that are relevant to the firm's sector of activity3
Non-specific applications	Research tools, etc.	–
Other		–

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