How Knowledge Contexts Influence Entrepreneurial Strategy, Evidence from IPO Firms

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Founders inherit valuable expertise from their previous employers, which they subsequently apply in their new ventures. This study examines the differences in strategic leadership and capital allocation between academic and industry spinouts, emphasizing the impact of knowledge context on entrepreneurial strategy. Utilizing hand-collected data on all IPO firms in life sciences and computer programming, we find that academic spinouts are less likely to retain a founder as CEO compared to industry spinouts, and academic spinouts allocate more resources to R&D than industry counterparts. Furthermore, we explore how founder-CEO moderates the relationship between academic spinouts and their resource allocation to R&D.

Keywords: entrepreneurship, knowledge context, founding teams, strategic leadership, innovation

INTRODUCTION

It is well-established that founders inherit traits and expertise from their prior employers and put them to use in their newly formed businesses. Prior research indicates technological and organizational capabilities (Agarwal and Shah, 2014; Basu et al., 2015; Clarysse and Moray, 2004), operational know-how (Chatterji, 2009), and market-related knowledge (Klepper & Sleeper, 2005) to be especially beneficial informational advantages endowed to founders. The setting where founders develop knowledge-based advantages is their knowledge context (Agarwal & Shah, 2014).

The two most studied knowledge contexts that regularly seed the formation of new ventures are university laboratories and industry incumbents (Lazar et al., 2020). A growing body of work documents how differences in these institutional backdrops relate to new firm formation and performance variations. New ventures formed in the academic knowledge context are commonly known as "academic spinouts." At the core of all academically founded firms is a deep well of technical knowledge, which empowers academics to pioneer and cultivate groundbreaking innovations. Yet academics often grapple with challenges beyond their technical expertise, such as commercializing innovations and managing customer relationships (Wennberg, Wiklund, & Wright, 2011). This gap frequently results in a slower growth trajectory, as the intricacy of advanced technology necessitates extended development time (Doutriaux, 1987), and a propensity to fail prematurely due to their shortcomings in market-oriented competencies. Conversely, "industry spinouts," generated by ex-employees of industry incumbents, leverage their familiarity with business process and market dynamics when forming startups. Not surprisingly, ventures

developed in the context of high-performing incumbent firms survive longer than startups created in other settings (Franco & Filson, 2006; Golman & Klepper, 2016). The industry knowledge context provides founders, also known as employee entrepreneurs, with the critical market, operations, and technological know-how necessary to sustain viability (Agarwal & Shah, 2014).

Despite substantial research on what founders inherit from their knowledge context and its performance implications, few studies document how this knowledge impacts their entrepreneurial strategy. Moreover, research directly comparing academic and industry spinouts' behavior is rare. For example, how knowledge contexts influence future strategic leadership choices is unclear. Additionally, it is not well understood how academic and industry spinouts differ regarding capital allocation, a critical component of entrepreneurial strategy. Given the importance of these choices to the success of emerging growth companies, determining how a new venture's knowledge context influences its strategic decision-making is critical. We address these voids in the literature by documenting how the strategic choices of teams formed entirely in the academic knowledge context differ from teams wholly formed within the industry knowledge context.

The theoretical mechanism that differentiates firms spawned from industry and academia is that they inherit different types of knowledge from their organizational parents (Klepper & Sleeper, 2005; Lowe & Ziedonis, 2006). Differences in knowledge inheritance affect startup decision-making, which later impacts their future trajectory (De Cuyper, Clarysse, & Phillips, 2020; Marquis & Tilcsik, 2013). For example, research on industry and university spinouts in Belgium suggests these settings produce firms with vastly different knowledge bases (Clarysse, Wright, & Van de Velde, 2011). They show that industry spinouts grow fastest when formed using a narrow technology distinct from their organizational parent. In contrast, academic spinouts grow fastest when created using comprehensive technology developed in university laboratories.

We compare and contrast the entrepreneurial strategy of firms started in either academic or industry settings in three ways. First, we test whether academic and industry spinouts differ in their strategic leadership choices. Specifically, we compare their likelihood of retaining a founder as CEO. Replacing a founder-CEO with a hired executive is one of the critical strategic decisions new ventures must make as they grow and firm complexity increases (Wasserman, 2006). Our results show that academic founders are significantly less likely than industry spinouts to retain a firm founder as the firm's CEO. Second, we test whether academic spinouts differ from industry spinouts regarding capital allocation decisions. In particular, we compare how much human and financial capital they dedicate to R&D. Strategically allocating human and financial capital to the different functions within a firm is critical to an effective entrepreneurial strategy. While founder teams from academic settings may prefer to allocate more resources to R&D, comparable firms from industry settings may choose to prioritize sales and marketing or finance. That is indeed what our findings indicate; academic spinouts dedicate much more of their human and financial capital to the R&D function than industry spinouts. Finally, we present competing theories on how a founder-CEO may moderate the relationship between knowledge contexts and resource allocation. Surprisingly, we show that when academic spinouts have a founder-CEO, this reduces the amount of human capital they allocate to R&D. Finally, we conduct a post hoc analysis to uncover the complex and conditional relationships between a firm's knowledge context and its entrepreneurial strategy. An analysis of conditional indirect effects reveals a significant first-stage moderated mediation relationship between the strategic choices explored in this study. To conduct our analyses, we use hand-collected data on every de novo IPO firm in the context of two knowledge-intensive industries; life sciences and computer programming. We study knowledge-intensive industries because 1) new entrants emerge from both industry and academic settings and 2) the founders of new industry entrants are often the scientists responsible for the innovation that serves as the basis of the firm.

This research is one of the few studies directly comparing the entrepreneurial strategy of academic and industry spinouts. Consequently, this study makes several relevant theoretical and practical contributions. First, we provide compelling evidence regarding how the strategic choices of academic and industry spinouts differ with respect to strategic leadership. Despite their deep technical knowledge, academic spinouts are unlikely to retain a founder as CEO. Given the importance of university-based innovations to the advancement of several industries, this finding is practically important to stakeholders of academic

spinouts (e.g., universities, technology transfer offices, and entrepreneurial scientists) and IPO firms (e.g., venture capitalists, institutional investors, early employees). Second, we demonstrate that industry spinouts place less emphasis on R&D than academic spinouts. Even though employee entrepreneurs in the life sciences are often the star scientists themselves, their firms are much less dedicated to generating innovations "in-house" than academic spinouts. Finally, we make a surprising discovery and show that when an academic spinout is led by a founder-CEO, it reduces how much capital they allocate to R&D. Together, these findings contribute theoretically to the following literature, entrepreneurial strategy, academic and employee entrepreneurship, spinout generation, knowledge inheritance, strategic leadership, and the corporate governance of entrepreneurial firms.

THEORETICAL DEVELOPMENT AND HYPOTHESES

The setting where founders develop informational advantages that serve as the basis for launching a new venture is known as their knowledge context (Agarwal & Shah, 2014). Prior work in the strategy, innovation, and entrepreneurship literature has paid close attention to how the employment affiliation of entrepreneurs relates to the micro-underpinnings of new venture formation and performance. In particular, research examining employee mobility into entrepreneurship from incumbent firms and universities has increased in recent years. The systematic differences between firms originating from these two knowledge contexts are central to this empirical study.

The mechanism by which knowledge contexts become salient in spinout ventures' behavior is founder imprinting. Imprinting theory posits that founders bear a lasting stamp from their founding context that they impress upon their newly launched ventures (Marquis & Tilcsik, 2013). In other words, founders act as "carriers," bringing elements of their prior work experience and founding context into crucial decision-making processes about the direction of their startup (De Cuyper et al., 2020). These choices then create distinct organizational "blueprints" which act as hard wiring for future strategic decision-making, permanently impacting the firm's trajectory (Baron & Hannan, 2002; Fern, Cardinal, & O'Neill, 2012). For example, numerous studies show that the organizational models imprinted by founders have an enduring effect on managerial intensity within the firm (Baron, Burton, & Hannan, 1999; Baron, Hannan, & Burton, 1999). Additionally, Beckman and Burton (2008) show that the initial conditions of IPO firms constrain subsequent strategic decisions via path dependency.

Academic Knowledge Context

Innovations in universities or research-based settings are the knowledge context for academic entrepreneurship, defined as new ventures formed by university students, staff, or faculty (Fryges & Wright, 2014). These firms, known collectively as university spinoffs or academic spinouts, are typically founded to exploit knowledge and innovations discovered in research laboratories by scientists with substantial domain-specific expertise (Shane, 2004). Therefore, a deep well of technical knowledge is fundamental to all firms formed in the academic knowledge context.

The academic knowledge context has two main characteristics relevant to this study. First, the discoveries made in university settings are generally not ready for immediate commercialization, thus requiring the continued involvement of their inventor. Typically, these discoveries are of novel product innovations rather than innovations in production processes (Agarwal & Shah, 2014; Shane, 2004). Research-based innovations are usually still in the form of lab-scale prototypes needing substantial further incubation (Jensen & Thursby, 2001). Furthermore, when discoveries represent only a "proof of concept," much of the knowledge necessary to commercialize (or even comprehend) them remains embedded within the faculty inventor (Lowe & Ziedonis, 2006). Therefore, the continued involvement of the scientists responsible for the breakthrough technology is often required to advance their discovery out of the embryonic phase (Clarysse & Moray, 2004).

Second, scientists employed in the academic knowledge context differ substantially from their industry counterparts. A key driver of this difference is the conflicting intuitional logic of industrial and academic research (Agarwal & Ohyama, 2013; Partha & David, 1994). For example, university scientists pursue basic

and applied research, while industry scientists overwhelmingly conduct applied research exclusively (Agarwal & Ohyama, 2013). Additionally, academic scientists have a strong "taste for science" (Sauermann & Stephan, 2013), often sacrificing career earnings for nonmonetary preferences (i.e., flexibility to select among different research projects). This results in an academic research culture with different norms of behavior, goals, and incentive structures than industry settings. Kaiser, Kongsted, Laursen, and Ejsing (2018, 1939) note that conflicting institutional logic between industrial and academic research makes the inward mobility of academics into an established firm a "non-trivial challenge" for employers. In research-friendly professional settings, university scientists are less frustrated and more productive (Mudambi & Swift, 2009). Furthermore, while industry scientists enter entrepreneurship with operational and technical know-how, academic scientists lack process knowledge driven by a dearth of applied/industry experience (Agarwal & Shah, 2014). Consequently, university scientists typically pursue a resource-seeking strategy when forming an entrepreneurial team to find co-founders with complementary skills and capabilities, such as process or market knowledge (Lazar et al., 2020).

The extant literature shows that academic spinouts form to nurture nascent technologies, requiring the continued involvement of the faculty innovator. Additionally, academic founders are typically biased toward basic research and lack process knowledge, market familiarity, or managerial acumen.

Industry Knowledge Context

Incumbent firms are the knowledge context for employee entrepreneurship, defined as new firms founded by the ex-employees of industry incumbents (Klepper & Sleeper, 2005). These firms, known as industry spinouts, corporate spinoffs, or spawns, are typically formed to exploit technical and marketing know-how developed as employees of high-performing incumbent firms (Agarwal & Shah, 2014). Therefore, a thorough knowledge of the market and business operations is fundamental to firms formed in the industry knowledge context. Unsurprisingly, firms formed by experienced industry veterans achieve superior performance in numerous industries. For example, industry spinouts in the medical device industry had higher performance than other entrants because of tacit operational knowledge for navigating regulatory processes (Chatterji, 2009). Additionally, in the semiconductor (Moore & Davis, 2004) and disk drive industry (Agarwal et al., 2004; Franco & Filson, 2006), firms founded by ex-employees demonstrated better managerial insight and ability to pioneer new product markets than other entrants.

The industry knowledge context has two main characteristics relevant to this study. First, process innovations are commonly at the heart of employee entrepreneurship. Unlike academic spinouts, industry spinouts often form new ventures to exploit an operational discovery since industry veterans also have domain-specific operational knowledge and technological know-how. For example, Sorenson and Audia (2000) show in a comprehensive longitudinal history study of employee entrepreneurs in the footwear industry that most innovations that were the basis for forming a new venture were advances in production processes. Similarly, in a study of the semiconductor industry, Ganco (2013) demonstrates that complex operational knowledge flows to startups via employee entrepreneurship.

Second, industry spinouts are more likely to compete with established firms rather than collaborate. Typically, entrepreneurial teams that spin out of industry incumbents do so to exploit technology or markets overlooked by the parent firm (Agarwal et al., 2004) or because of strategic disagreements with management (Klepper, 2002, 2007). For those reasons, industry spinouts often employ many of the same strategies as their parent firm and compete in the same or similar markets. For example, Sahaym, Howard, Basu, and Boeker (2016) show that biotech firms compete directly with their parent firm by mimicking their technology. Unlike academic spinouts, firms formed by employee entrepreneurs are less likely to collaborate or share expenses with other companies by forming strategic alliances (Agarwal & Shah, 2014).

Prior research shows that industry spinouts form to exploit both product and process innovations overlooked by their parent firm and often compete with them directly. Although industry spinouts face intense competition, their unique knowledge makes them the highest-performing type of entrant in most industries.

Founder-CEOs

Interest in founder-CEOs has exploded over the past several decades. Beginning with the highly influential work of Wasserman (2003), scholars have made several scientific findings about the strategic choice to retain or replace a founder-CEO. For example, as firms grow older, achieve equity financing, and develop their products, the likelihood of a founder-CEO replacement increases (Wasserman, 2003, 2017). Additionally, the size of the founding team, the founder's functional experience, and the firm's size affect the strategic choice to replace the founder-CEO (Jain & Tabak, 2008). Understanding how spinouts from the academic and industry knowledge context differ in their strategic choice to replace a founder-CEO is highly relevant to the entrepreneurship literature. For example, an influential review by Lazar et al. (2020) suggests that future work should explore how the founder team's knowledge context influences the firm's advanced phases, explicitly mentioning "founder-CEO succession."

We claim that teams formed in the academic knowledge context are less likely to appoint a founder-CEO than similar firms from the industry knowledge context. As mentioned above, academic founders are often the scientists responsible for the innovation serving as the basis of the firm. Not only do academic entrepreneurs prefer to focus on R&D, but their creations may also still require their hands-on involvement. In other words, academic spinouts are unlikely to have the "bandwidth" necessary to develop the new technology and serve as CEO. In most instances, academic entrepreneurs also lack the managerial skill to serve as CEO effectively. While employee entrepreneurs likely have the experience necessary to build a company, academic founders lack the experience to overcome the day-to-day challenges of leading an entrepreneurial venture. Therefore, we propose the following:

Hypothesis 1: *Academic spinouts are less likely than industry spinouts to have a founder-CEO.*

Research and Development

Effective resource allocation is a critical component of strategic management (Maritan & Lee, 2017). It is even more essential in entrepreneurial environments, where resources are constrained and uncertainty is high. In knowledge-intensive industries, where innovation is paramount, apportioning human and financial capital to R&D is a pivotal investment decision with far-reaching consequences for the firm (Honoré, Munari, & de La Potterie, 2015). For example, sustained investments in innovation can ensure that firms remain productive and have a roster of new technologies in development, thus ensuring the firm's long-term health. Accordingly, numerous studies have explored the determinants of R&D spending. For example, CEO characteristics (Barker III & Mueller, 2002), board composition (Baysinger, Kosnik, & Turk, 1991), and top management team features (Kor, 2006) influence firm-level R&D expenditure and strategy. R&D spending even affects the quality of entrepreneurial spinouts. Andersson, Baltzopoulos, and Lööf (2012) show that industry incumbents that made continuous investments in R&D spawned ventures that survived longer than spawns from incumbents that committed fewer resources to R&D.

As pointed out, academic spinouts form to incubate new technologies that require years of development before they are ready for commercialization. Additionally, academic founders have a strong "taste for science" and prefer the research-friendly culture of universities over industry laboratories. It follows that firms founded entirely in the academic knowledge context are imprinted with a preference for researching and developing new products. Accordingly, the research-friendly organizational blueprint of an academic spinout will likely persist, and the venture will reflect the initial priorities of the academic founders well into the future. Over time, as academic spinouts face critical choices, such as which departments to prioritize when hiring or which investments to make, the R&D function within the firm will take top priority. In other words, academics start firms with a research-intensive culture which is likely to endure due to the path-dependent nature of the early decisions made by founders in resource-constrained settings.

Relative to academic spinouts, industry spinouts do not have as strong of an emphasis on R&D. Industry spinouts do not always require the development of radical new technologies because process (not product) innovations are regularly the impetus for firm formation. Additionally, because of the operational know-how of employee entrepreneurs, they can "do more with less" than academic spinouts and may be able to

use resources allocated to R&D more efficiently. For example, industry spinouts have better technological and market-pioneering know-how for exploiting R&D than founders from other contexts.

Hypothesis 2: *Academic spinouts allocate more resources to R&D than industry spinouts.*

CEOs' choices often reflect their personal preferences and characteristics when making decisions and setting organizational goals (Wallace, Little, Hill, & Ridge, 2010). Consequently, the strategic choices made by firm leaders shape the venture in a manner that reflects the direction-setting framework of the chief executive. Take, for example, strategic decisions regarding employee compensation. Female CEOs influence the salary of other women on their top management team (Dezső, Li, & Ross, 2022), while male CEOs pay their employees differently after having a child (Dahl, Dezső, & Ross, 2012). It follows that innovation-related decisions (e.g., which new products to introduce or how much capital to allocate to R&D) will also reflect the tastes and preferences of firm leadership. For example, Ridge, Johnson, Hill, and Bolton (2017) show that top managers that are "technical" people differ from "planning," "manufacturing," and "field" people in terms of new product introduction strategy.

Given that the firm's behavior reflects its leadership, the founder status of the CEO is likely to impact how human and financial capital is allocated to R&D because they have the greatest authority over decision-making. However, the extant literature paints an unclear picture of what effect the founder-CEO will have. For example, following the sudden death of a founder-CEO, Lee, Kim, and Bae (2020) show that firm-level innovation output (patents) drops precipitously. They claim that founder-CEOs attract more scientists and engineers to conduct more exploratory and risky innovation activities than professional CEO. Interestingly, they "do not find evidence that founder-CEO-managed firms allocate more capital to R&D investments than professional-CEO-managed firms."

However, highly relevant research on biotechnology firms suggests that knowledge inherited by founders will significantly impact their technology-related decisions. For example, Basu, Sahaym, Howard, and Boeker (2015) show that the technological expertise of the founders directly affects their firm's innovation output. Similarly, Sahaym et al. (2016) indicate that the presence of a founder-CEO increases the technology overlaps with the parent firm. This finding suggests industry spinouts with founder-CEOs may allocate fewer resources to R&D because their technologies are closer to commercialization.

Imprinting theory suggests that founder-CEOs in academic spinouts would amplify their strong preference for research. Consequently, academic spinouts led by a founder-CEO would dedicate a more significant share of their workforce to R&D and spend more money developing new technologies than academic spinouts led by a professional CEO. However, because academic entrepreneurs are more likely to be replaced (because they lack operational knowledge), those retained may exhibit a unique managerial ability, making them more likely to allocate resources to R&D like an industry veteran. While it is clear that the presence of founder-CEOs will impact how their firms allocate resources to R&D, the extant literature does not paint a clear picture as to how this will differ between industry and academic spinouts. Therefore, we propose that founder-CEOs moderate the influence of knowledge contexts on strategic resource allocation, but we are agnostic as to how it will condition the relationship:

Hypothesis 3: *Founder-CEOs moderate the relationship between spinout type and resource allocation to R&D.*

METHODS

Sample and Data Collection

We tested our hypotheses using a sample of public companies actively engaged in R&D within two knowledge-driven industries, computer programming and life sciences. Knowledge-driven industries are suitable for this study for two reasons. First, they typically require domain-specific technical expertise. Second, firms in these industries devote substantial resources to R&D. Most entrants are entrepreneurial

spin-outs founded by individuals with academic or highly relevant industry experience. The variation in prior employment is central to this empirical study.

The firms in our sample are *de novo* rather than *de alio* entrants based on the pre-entry experience of the founders (Agarwal et al., 2004; Helfat & Lieberman, 2002). Therefore, all of the firms in our sample were new legal entities at their founding with no known financial relationship (i.e., joint venture, franchise, or parent-company spinoffs) to an existing firm. Moreover, we restrict the sample to companies founded within the United States that went public on the NASDAQ or NYSE.

To collect the employment histories of the founders of public companies, we first used the initial public offering (IPO) preliminary prospectus (form S-1) that all firms intending to become publicly traded in the United States must file with the Securities and Exchange Commission (SEC). Electronic versions of the IPO prospectus became reliably available online for firms that became publicly traded beginning in mid-1996 (using the SEC's EDGAR database). We excluded firms that held an IPO before January 1997 due to a lack of complete data availability.

In most instances, the prospectus named the firm's founders and included biographical details, including extensive employment histories. However, if a newly public company was no longer founder-led or did not list the firm's founding team, we used other sources such as industry periodicals, company websites, LinkedIn.com, and Crunchbase.com to collect prior affiliation data.

This study focuses on firms committed to coherent, mutually reinforcing policies or behaviors aimed at R&D. Therefore, we only include firms that reported the total number of employees engaged directly in R&D in the initial prospectus section on employee details. Without this self-reported information, we cannot assess meaningful differences in how innovative firms allocate human and financial capital. If firms with no intention of conducting R&D remained in the sample, it would skew our results toward firms without an innovation strategy. Thankfully, 69.4% of *de novo* life sciences firms and 66.14% of *de novo* computer programming firms that went public between 1997 and 2019 reported their total workforce size and how many employees engaged directly in R&D in the IPO prospectus.

Our final sample includes 685 firms actively engaged in innovation activities started by 1,369 founders. 397 firms in the sample were from the life sciences industry. We considered firms to be a part of the life sciences if their Standard Industrial Classification (SIC) code was overseen by the SEC's Office of Life Sciences at the time of this research. 288 firms in the sample were from the computer programming industry. Firms were part of the computer programming industry if their SIC code indicated that their sector was related to computer software, processing, or programming. A list of the SIC codes included in this study is in Table A-1 of the appendix.

MEASURES

Dependent Variables

Founder-CEO

This variable is a dummy equal to 1 if, at the time of IPO, the firm has a Chief Executive Officer who is a company founder (=0 otherwise).

R&D Spending

This research aims to assess how the knowledge context of founders influences how they allocate resources to R&D activities. Previous research has used a count of patents as an imperfect proxy for innovation output (Audretsch & Feldman, 1996; Kaiser et al., 2018). However, we are primarily concerned with how firms allocate resources to R&D, not the innovation output. Therefore, we use their first reported annual R&D expenditure as a public company to measure how much financial capital they dedicate to innovation activities. R&D expenditure strongly indicates accumulated technical knowledge (Feinberg & Gupta, 2004) and positively correlates with reporting innovation (Baumann & Kritikos, 2016). We obtained yearly R&D spending data from COMPUSTAT for all firms in the sample.

R&D Employment Intensity

This variable measures the share of each firm's workforce whose primary responsibility is R&D. For example, at the time of their IPO in 2018, Principia Biopharma reported the following in their S-1 *"As of August 31, 2018, we had 53 employees, all of whom were full-time and 37 of whom were engaged in research and development activities. All of our employees are located in South San Francisco, California."* For each firm in the sample, we calculated the percentage of the overall workforce primarily engaged with R&D. For Principia Biopharma, 69.81% of their employees worked in innovation-related activities.

Independent Variables

Academic Spinout

This variable is a dummy equal to 1 if every founder team member entered entrepreneurship from a university setting. This variable equals 0 if the founder team includes an entrepreneur from the industry knowledge context.

Industry Spinout

This variable is a dummy equal to 1 if every founder team member entered entrepreneurship from an industry incumbent. This variable equals 0 if the founder team includes an entrepreneur from the academic knowledge context.

Control Variables

Entrepreneurial Experience

We used the employment histories included in the IPO prospectus and company websites to determine the presence of a serial entrepreneur on the founder team. This variable is a dummy equal to 1 if a founder team member has previously started a business.

Firm Age

This variable is included as a control variable to capture differences between firms at various stages of development because imprinting effects decrease with age. Therefore, our model must account for the relationship between firm age and R&D employment outcomes. We derive firm age by taking the natural log of the time elapsed from the firm's founding until the year of the initial public offering.

Founder Team Size

This variable is the count of individuals explicitly labeled as a "founder" or "co-founder" in the IPO prospectus or on the official company website. This study focuses on the knowledge contexts of the individual founders (i.e., where they developed the informational advantages that served as the basis for creating their new firm). Other studies use the broader measure of founding team size, which often includes early joiners of the startup as founding team members (Honoré & Ganco, 2020). Our founder team measure does not have early employees. Therefore, we adopt the more restrictive approach and track only the employment histories of co-founders self-reported by the firm. Additionally, for each firm, we searched employment websites and industry periodicals to determine the existence of any additional co-founders not named in the prospectus.

Unique Prior Affiliation

This variable is a count of the number of unique organizations that the founders of each firm were previously affiliated with immediately before starting their venture. We control the number of unique prior affiliations contexts to account for differences in founder teams originating from a single organization versus teams from multiple organizations. For example, Illumina, a life sciences firm based in San Diego, CA, that developed human genome sequencing tools, was started by five co-founders—two of the five co-founders from CW Group, a venture capital firm. Two of the remaining co-founders were each separately affiliated with established industry incumbents Affymetrix and IRORI Quantum Microchemistry. The

remaining co-founder was from Tufts University. Therefore, in our data, Illumina has five co-founders who spun out of four unique prior affiliations.

Number of Employees

We include the natural log of the self-reported number of employees for each firm to account for the size of the firm.

Year of IPO

To account for broader economic conditions at the time of the IPO for each firm, we control for the year that each firm became publicly traded.

Industry

We include a control variable based on each firm's 4-digit SIC code (listed in their preliminary prospectus) to account for industry-specific characteristics not accounted for in the other variables. A list of SIC codes included in this study is in Table A-1 in the appendix.

Analytical Approach

To test whether the knowledge context of founder teams influences the strategic choices to 1) retain a founder-CEO and 2) allocate resources to R&D, we conduct multivariate analyses. Multivariate analysis is appropriate because it enables me to examine how each of our variables of interest independently contributes to the explained variance in the dependent variable. We begin our analysis using a linear probability model to estimate how the academic and industry knowledge contexts influence retaining a founder as CEO. Linear probability models are appropriate for calculating the probabilities that event will occur. When testing Hypothesis 1, if the firm has an original firm founder in the CEO position, the dependent variable (founder-CEO) is equal to 1 and 0 otherwise. We use the following equation (1) to test Hypothesis 1,

$$\begin{aligned} Probability\ of\ Founder\ CEO \\ = \alpha + \beta_1 Academic\ Spinout\ Dummy + \beta_2 Industry\ Spinout\ Dummy \\ + \beta_3 Entrepreneurial\ Experience\ Dummy + \beta_4 \ln(Firm\ Age + 1) \\ + \beta_5 Founder\ Team\ Size + \beta_6 Knowledge\ Contexts \\ + \beta_7 \ln(Number\ of\ Employees + 1) + \beta_8 IPO\ Year\ Vector \\ + \beta_9 SIC\ Code\ Vector \end{aligned}$$

We use linear regression to explore how the knowledge context of the founder team influences R&D activity. To test Hypothesis 2 and Hypothesis 3, we use the following linear ordinary least square regression equations (2):

$$\begin{aligned} R\&D\ Activity = \alpha + \beta_1 Academic\ Spinout\ Dummy + \beta_2 Industry\ Spinout\ Dummy \\ + \beta_3 Serial\ Founder\ Dummy + \beta_4 \ln(Firm\ Age + 1) \\ + \beta_5 Founder\ Team\ Size + \beta_6 Unique\ Prior\ Affiliation \\ + \beta_7 \ln(Number\ of\ Employees + 1) + \beta_8 IPO\ Year\ Vector \\ + \beta_9 SIC\ Code\ Vector \end{aligned}$$

In the equation above, we assess R&D activity separately using three dependent variables, *R&D Employment Intensity*, *Total R&D Spending*, and *R&D Spending per Employee*. Additionally, to test how having a founder-CEO moderates the relationship between knowledge contexts and R&D outcomes, we include the following interaction term, *Founder-CEO Dummy.* In the equation above, we interact this term with the *Academic Spinout Dummy* and *Industry Spinout Dummy*.

We use R software to conduct each of our analyses. we first correct for heteroskedasticity to perform hypothesis tests and calculate confidence intervals for the marginal effect our independent variables have

on the dependent variables. We use the White (1980) estimator to correct heteroskedasticity and calculate robust standard errors. Furthermore, we use the "car" package in R to calculate the Variance Inflation Factor (VIF), which assesses multicollinearity among the model variables. The mean VIF for all variables is 1.87 for Equation 1 and 1.79 for Equation 2. For each of these equations, the average VIF is far less than 10, the threshold Chatterjee and Price (1991) suggested, indicating multicollinearity is not biasing the regression model findings.

RESULTS

Main Analysis

Table 1 contains descriptive statistics and correlations among all the variables included in our analysis. In our data, the mean firm started with a two-person founder team originating from 1.59 unique prior affiliations. 31% of the firms in our sample were industry spinouts, meaning every founder team member entered entrepreneurship from an industry incumbent. 15% of the firms in our sample were academic spinouts, meaning every founder team member entered entrepreneurship from a university. Regardless of their knowledge context, 45% of the firms in our sample had at least one founder team member with entrepreneurial experience.

At the time of IPO, the firms in our sample had a mean age of 8.64 years and had approximately 225.92 employees. 51% of the firms in our data have a founder serving as CEO. Additionally, the mean R&D expenditure in the first year as a publicly traded company is $25.36 million and $310,000 per employee. The average R&D employment intensity is 45%, meaning nearly half of the employees of the firms in our sample performed R&D functions in their firm.

Several correlations among the main variables of interest are significant. For example, the *Academic* and *Industry Spinout* dummy variables are each significantly correlated with the dependent variable *Founder-CEO*, albeit in opposite directions. The significant negative correlation between the academic knowledge context and founder-CEOs and the positive correlation between the industry knowledge context and founder-CEOs provide initial support for Hypothesis 1. *Founder-CEO* is also negatively correlated with *Firm Age*, which we expected since founders are more likely to be replaced as CEO as firms enter later stages of maturity.

Regarding R&D activity, the *Academic Spinout* dummy variable positively relates to *R&D Employment Intensity* and *R&D Spending per Employee*. Surprisingly, the academic knowledge context was not significantly associated with *Total R&D Spending*, suggesting that other factors may mediate the relationship between academic founders and future R&D spending. The *Industry Spinout* dummy variable has a significant negative correlation with *R&D Employment Intensity* and total *R&D Spending*. As predicted, founder teams entirely from industry make different strategic choices related to R&D than academic founders. These relationships provide additional support for Hypothesis 2. Interestingly, the *Founder-CEO* variable does not correlate with any of the dependent variables related to R&D.

TABLE 1
CORRELATION TABLE

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1. Firm age	8.64	5.53											
2. Number of employees	225.92	374.26	0.29***										
3. Founder team size	2	1.13	-0.16***	0									
4.Ent experience dummy	0.45	0.5	-0.16***	0.02	0.13***								
5. Founder-CEO dummy	0.51	0.5	-0.10*	0.02	0.03	0.05							
6. Advanced degree rate	0.38	0.16	-0.19**	-0.31***	0.11	0.01	-0.13						
7. Unique Prior Affiliation	1.59	0.8	-0.14***	0.01	0.74***	0.22***	0.01	0.09					
8. Industry spinout dummy	0.31	0.46	0	-0.04	-0.22***	-0.41***	0.12**	0.04	-0.27***				
9. Academic spinout dummy	0.15	0.36	0.07	-0.10**	-0.04	-0.29***	-0.22***	0.09	-0.13***	-0.29***			
10. R&D employment intensity	0.45	0.24	-0.25***	-0.35***	0.15***	0.05	-0.01	0.42***	0.17***	-0.09*	0.20***		
11. Total R&D spending	25.36	41.35	0.01	0.44***	0.09*	0.07	-0.01	0.05	0.10**	-0.08*	0.04	0.14***	
12. R&D spending per employee	0.31	0.48	-0.19***	-0.25***	0.05	0.08*	-0.04	0.22**	0.09*	0	0.08*	0.52***	0.21***

TABLE 2
COMPARING FIRMS BY KNOWLEDGE CONTEXT

	Academic	Blended	Industry	Kruskal Wallis Test
Number of Firms	104	367	214	p-value
1. Firm age	9.49 (5.02)	8.4 (5.22)	8.62 (6.23)	.034
2. Number of employees	136.23 (255.61)	264.96 (459.84)	202.56 (218.54)	.000
3. Founder team size	1.89 (1.25)	2.25 (1.16)	1.63 (0.9)	.000
4. Ent experience dummy	0.12 (0.32)	0.72 (0.45)	0.15 (0.36)	.000
5. Founder-CEO dummy	0.25 (0.44)	0.53 (0.5)	0.6 (0.49)	.000
6. Advanced degree rate	0.4 (0.19)	0.36 (0.13)	0.39 (0.16)	.390
7. Unique Prior Affiliation	1.35 (0.79)	1.85 (0.85)	1.27 (0.53)	.000
8. R&D employment intensity	0.57 (0.24)	0.44 (0.24)	0.42 (0.24)	.000
9. Total R&D spending	29.06 (42.82)	27.32 (49.15)	20.19 (20.31)	.044
10. R&D spending per employee	0.41 (0.43)	0.28 (0.42)	0.32 (0.58)	.000

Note: Values are the means (S.D.) for each variable

R&D spending figures are in the millions of dollars

Table 2 compares entrepreneurial teams relevant to this research and provides additional descriptive statistics of 1) firms formed entirely in the academic knowledge context, 2) firms founded entirely in the industry knowledge context, and 3) firms that form across each of these two contexts which we refer to as "Blended" teams. We use the non-parametric Kruskal Wallis Test to test differences in the means across these three groups for each variable used in this study. The only variable that doesn't differ between the three types of teams is the percentage of their workforce with an advanced degree. This table provides strong, preliminary evidence that the knowledge context of the founders influences their firm's entrepreneurial strategy.

The focal interest of this research are differences between the academic and industry knowledge context. Therefore, we directly compare the means of academic and industry spinouts to provide additional evidence supporting our hypotheses. Regarding *Founder-CEO*, 25% of academic spinouts had a founder-CEO at the time of IPO compared to 60% for industry spinouts. A pairwise Wilcoxon Rank Sum test confirms these groups differ significantly ($p < .001$) in their likelihood of retaining a founder as chief executive. This relationship provides additional support for Hypothesis 1.

Hypothesis 2 states that academic and industry spinouts' strategic choices related to R&D activity will differ. The mean first-year *Total R&D Spending* is approximately \$29.06 million for academic teams and \$20.19 million for industry spinouts. The mean *R&D Employment Intensity* is 57% for academic and 42% for industry spinouts. Pairwise Wilcoxon Rank Sum tests indicate a statistically significant difference between industry and academic spinouts regarding total *R&D Spending* ($p < .10$), *R&D Spending per employee* ($p < .000$), and *R&D Employment Intensity* ($p < .000$). These relationships support Hypothesis 2.

Table 3 contains the results of the linear probability model we used to assess Hypothesis 1, which states that academic spinouts are less likely to have a founder-CEO than industry spinouts. As predicted by Hypothesis 1, there is a negative relationship between firms founded entirely in the academic knowledge context and retaining a founder as chief executive. The coefficient for the *Academic Spinout* variable is negative and significant ($\beta = -.260, p < .001$). This finding suggests that, on average, academic spinouts decrease the probability of having a founder-CEO by 26%. While the coefficient for *Industry Spinout* was positive, it was not significant ($\beta = .071, p = .201$). Additionally, a test of the difference between the *Academic Spinout* and *Industry Spinout* coefficients reveals their difference to be significant ($F = 28.87, p < .001$). This finding further supports Hypothesis 1.

TABLE 3
REGRESSION ANALYSIS FOR FOUNDER-CEO

	Founder-CEO
Academic spinout dummy	-0.260***
	(0.066)
Industry spinout dummy	0.071
	(0.056)
Ent experience dummy	0.023
	(0.051)
ln(Firm age + 1)	-0.105**
	(0.042)
Founder team size	0.021
	(0.025)
Unique Prior Affiliation	-0.033
	(0.036)
ln(Number of employees + 1)	0.013
	(0.024)
Constant	0.260
	(0.179)
Observations	685
R^2	0.158
Adjusted R^2	0.083
Residual std. error	0.479 (df = 628)
F statistic	2.110*** (df = 56; 628)
Note:	*p<0.1; **p<0.05; ***p<0.01
	Control variables for industry and year not shown
	Parentheses contain robust standard errors

Table 4 contains the results of linear regression models with three dependent variables, *R&D Employment Intensity, R&D Spending, and R&D Spending per Employee*. Hypothesis 2 states that academic spinouts will allocate more resources to R&D activities than industry spinouts. Regarding allocating human capital to the R&D function, the coefficient for *Academic Spinout* in model 1 indicates

the academic knowledge context has a positive and significant relationship ($\beta = .062, p < .01$) with *R&D Employment Intensity*. While the coefficient for *Industry Spinout* was positive, but it was not significant ($\beta = .010, p = .543$). Additionally, a test of the difference between the *Academic Spinout* and *Industry Spinout* coefficients indicates they differ significantly ($F = 5.16, p < .05$). Our results suggest that academic spinouts dedicate 6.2 percentage points more of their firm's workforce to R&D than firms with at least one founder from the industry knowledge context.

TABLE 4
REGRESSION ANALYSIS OF R&D OUTCOMES

	R&D employment intensity		Total R&D spending		R&D spending per employee	
	(1)	(2)	(3)	(4)	(5)	(6)
Academic spinout dummy	0.062***	0.086***	8.738**	11.571*	0.002	-0.008
	(0.021)	(0.026)	(4.423)	(6.105)	(0.041)	(0.052)
Academic x founder-CEO		-0.076**		-8.114		0.017
		(0.045)		(6.803)		(0.065)
Industry spinout dummy	0.010	0.021	0.246	2.741	0.060**	0.032
	(0.017)	(0.024)	(2.066)	(3.478)	(0.035)	(0.046)
Industry x founder-CEO		-0.018		-4.182		0.047
		(0.030)		(5.564)		(0.068)
Founder-CEO dummy	0.018	0.033*	1.437	3.712	0.013	-0.004
	(0.014)	(0.018)	(2.915)	(3.029)	(0.027)	(0.035)
Ent experience dummy	-0.004	-0.002	2.928	3.227	0.001	0.0002
	(0.014)	(0.015)	(2.915)	(3.029)	(0.030)	(0.030)
Firm age	-0.049***	-0.047***	-7.918***	-7.726***	-0.073**	-0.073***
	(0.014)	(0.015)	(2.687)	(2.608)	(0.029)	(0.029)
Founder team size	0.008	0.009	-0.851	-0.681	-0.024*	-0.026*
	(0.008)	(0.008)	(1.247)	(1.167)	(0.014)	(0.014)
Unique Prior Affiliation	0.027**	0.026**	2.894	2.730	0.040*	0.041*
	(0.012)	(0.012)	(2.090)	(2.017)	(0.023)	(0.023)
Number of employees	-0.054***	-0.054***	18.433***	18.501***	-0.155***	-0.156***
	(0.010)	(0.009)	(3.353)	(3.388)	(0.027)	(0.027)
Constant	0.919***	0.915***	-58.370***	-58.814***	0.688***	0.688***
	(0.064)	(0.064)	(15.712)	(15.870)	(0.150)	(0.150)

	R&D employment intensity		Total R&D spending		R&D spending per employee	
	(1)	(2)	(3)	(4)	(5)	(6)
Observations	685	685	685	685	685	685
R^2	0.590	0.592	0.310	0.311	0.566	0.566
Adjusted R^2	0.553	0.554	0.247	0.246	0.526	0.525
Residual std. error	0.162 (df = 627)	0.162 (df = 625)	35.877 (df = 627)	33.908 (df = 625)	0.329 (df = 627)	0.330 (df = 625)
F statistic	15.858^{***} (df = 57; 627)	15.401^{***} (df = 59; 625)	4.937^{***} (df = 57; 627)	4.777^{***} (df = 59; 625)	14.327^{***} (df = 57; 627)	13.820^{***} (df = 59; 625)

Note: *p<0.1; **p<0.05; ***p<0.01

Control variables for industry and year not shown

Parentheses contain robust standard errors

R&D Spending figures are in millions of dollars

Regarding allocating financial capital to the R&D function, the coefficient for *Academic Spinout* in model 3 indicates the academic knowledge context has a positive and significant relationship ($\beta = 8.74, p < .05$) with *Total R&D Spending*. While the coefficient for *Industry Spinout* was positive, it was not significant ($\beta = .246, p = .905$). Additionally, a test of the difference between the *Academic Spinout* and *Industry Spinout* coefficients indicates they differ significantly ($F = 4.01, p < .05$). Our results suggest that academic spinouts dedicate $8.74 million more to R&D than firms with at least one founder from the industry knowledge context.

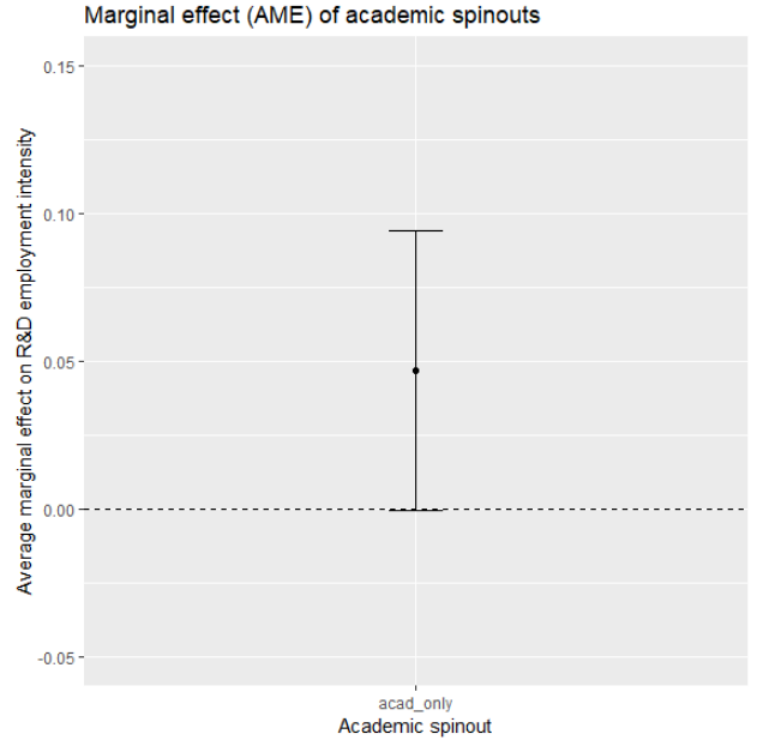
Additionally, *Academic* and *Industry Spinouts* differ in their *R&D Spending per employee*. The coefficient for *Industry Spinout* in model 5 indicates the industry knowledge context has a positive and partially significant relationship ($\beta = .060, p < .05$) with *R&D Spending per employee*. While the coefficient for *Academic Spinout* was positive, it was not significant ($\beta = .002, p = .961$). However, a test of the difference between the *Academic Spinout* and *Industry Spinout* coefficients indicates they do not differ significantly ($F = 1.52, p = .22$).

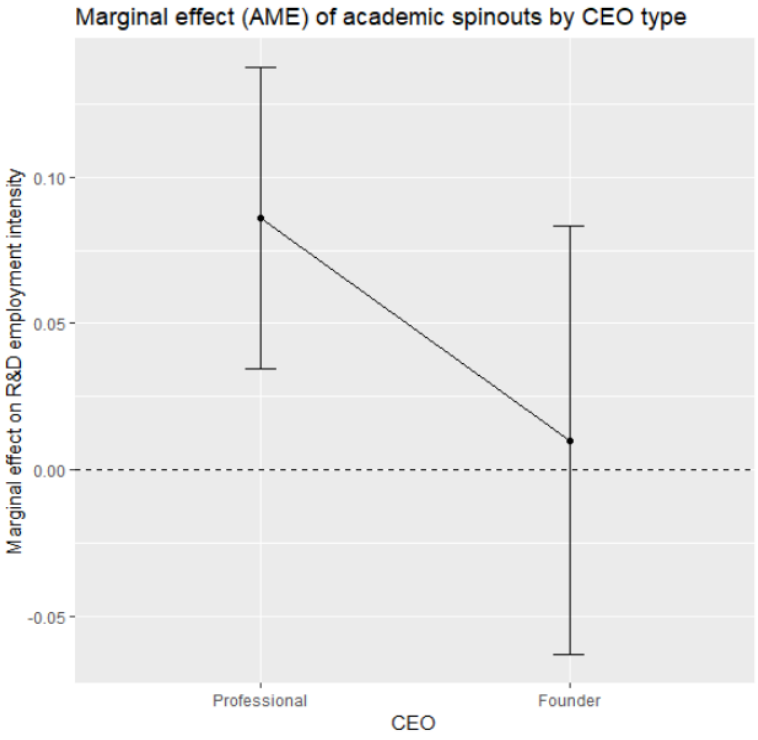
All told the findings in Table 4 support Hypothesis 2, which states that firms formed in the academic knowledge context will allocate more resources to R&D than firms formed within industry settings.

Moderation

Hypothesis 3 states founder-CEOs moderate the strength of the relationship between knowledge contexts and R&D activity. To test this hypothesis, we first examine the coefficients and interactions relevant to academic and industry spinouts in the fully saturated linear regression models in Table 4. In model 2, the coefficient on the interaction between *Academic Spinout* and *Founder-CEO* is negative and significant ($\beta = -.076, p < .05$). The moderation plot for this significant interaction is depicted in Figure 2. The coefficient on the interaction between *Academic Spinout* and *Founder-CEO* is insignificant in model 4 ($\beta = -8.114, p = .233$) and model 6 ($\beta = .017, p = .795$), respectively. The coefficient on the interaction between *Industry Spinout* and *Founder-CEO* is negative and insignificant in model 2 ($\beta = -.018, p = .556$) and model 4 ($\beta = -4.18, p = .452$) while it is positive and insignificant in model 6 ($\beta = .047, p = .486$). Based on the findings in Table 4, Hypothesis 3 is only partially supported; Founder-CEOs moderate the relationship between the academic knowledge context and R&D employment intensity.

FIGURE 1
MARGIAL EFFECT OF ACADEMIC SPINOUT BY CEO TYPE

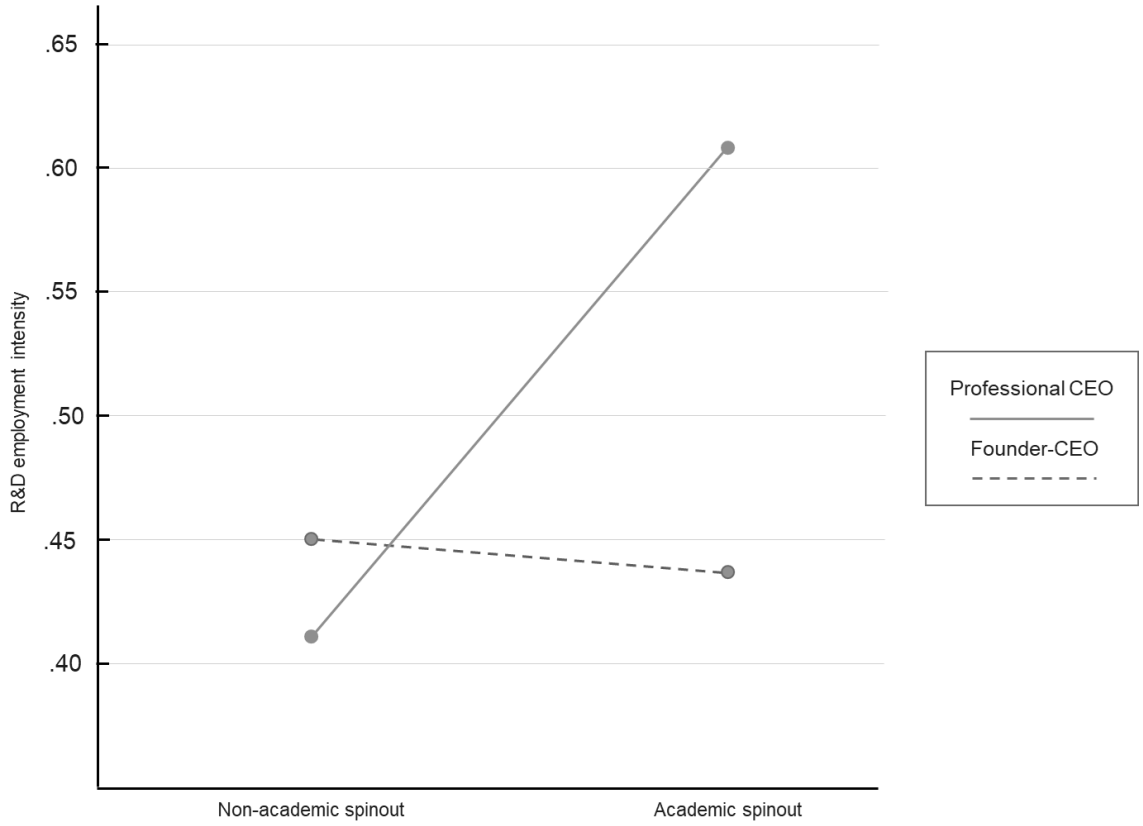




Note, Error bars represent 95%. Other variables take their mean values. The top figure depicts the marginal effect on R&D employment intensity in the linear probability model. In contrast, figure B below illustrates the marginal effects at different levels of the moderator's values.

Next, we evaluate the sign and significance of the significant interaction in model 2 and how it affects the marginal effect of *Academic Spinout* at both levels of the moderator's values (Bonini, Deng, Ferrari, John, & Ross, 2021; Busenbark, Graffin, Campbell, & Lee, 2022; Wulff, 2015). Figure 1b depicts the results of model 2. The Y-axis represents the average marginal effect of *Academic Spinout* on the firm's *R&D Employment Intensity*, and the X-axis shows the two levels of the *Founder-CEO* dummy variable. Thus, Figure 1b plots the average marginal effect of *Founder-CEO*, holding all other variables at their means (Wulff, 2015). The negative slope of the line provides support for Hypothesis 3. This evidence indicates that the positive relationship between *Academic Spinout* and *R&D Employment Intensity* weakens when the CEO is a founder.

FIGURE 2
MODERATION PLOT OF FOUNDER-CEO EFFECT ON ACADEMIC SPINOUTS



When interpreting our moderation hypotheses, we also compare the effect size and significance of the fully saturated model's main independent variable of interest. When we include the interaction, Model 2 shows a substantial increase in the relative effect of *Academic Spinout*. In the full model, A*cademic Spinout* increases *R&D Employment Intensity* by 8.6 percentage points which provides additional support for Hypothesis 2 ($\beta = .086, p = .001$). Interestingly, in the fully saturated model, the *Founder-CEO* coefficient is also positive and significant, indicating a 3.3 percentage point increase ($\beta = .033, p = .071$) in *R&D Employment Intensity*.

For the robustness check, we assessed the effect of the academic knowledge context by using the percentage of academic founders among the founding team members. The adjustment did not change the direction or statistical significance of the coefficients. The regression results are detailed in Tables A-2 and A-3 in the appendix.

Selection Bias

To ensure robustness, we use the Heckman (1979) approach and correct for sample selection bias that may stem from firms that chose to report their *R&D Employment Intensity* in their preliminary prospectus and those that did not. Therefore, we obtained two sets of results, one without the Heckman correction for selection bias and the other with the Heckman correction applied. Interestingly, the findings between these two sets of results are broadly consistent, with no material differences in the sign or significance of the regression coefficients. Statistical indicators of selection bias were also insignificant, indicating that the potential selection bias may not have substantially impacted the estimated relationships. Additionally, as noted by Certo, Busenbark, Woo, and Semadeni (2016), the unnecessary inclusion of a Heckman correction can bias model findings. Therefore, we base our analysis on the findings in Tables 3 and 3. While the consistency between the two sets of results is reassuring, the Heckman correction model serves as a robustness check by explicitly addressing selection bias concerns. The regression output with the Heckman correction is in Table A-4 in the appendix.

Post Hoc Moderated Mediation Analyses

The correlation between *Academic Spinout* and *R&D Employment Intensity* was positive and significant in Table 1, as were the respective coefficients in regression models 1 and 2 in Table 4. Based on these findings, we have established a relationship between the academic knowledge context and how firms allocate human capital to R&D in entrepreneurial ventures. Our results show that when teams form entirely in academia, their firms dedicate more of their workforce to R&D than if their founder team included an industry veteran. Interestingly, the main effect of the *Founder-CEO* variable in model 2 is positive and significant, indicating that founder-CEOs directly affect R&D in addition to the interaction effect. However, an interesting difference emerged when we included the *Founder-CEO* interaction term in model 4, which explores the effect of knowledge contexts on total R&D spending. The main effect of *Academic Spinout* is positive and significant, but the *Founder-CEO* variable and interaction terms are insignificant. Given that paying employees to perform R&D activities is a substantial driver of R&D spending, the insignificant coefficients in model 4 are surprising. This non-finding suggests further analysis is needed to uncover why and under what conditions the academic knowledge context and founder-CEO variables are related to total R&D spending.

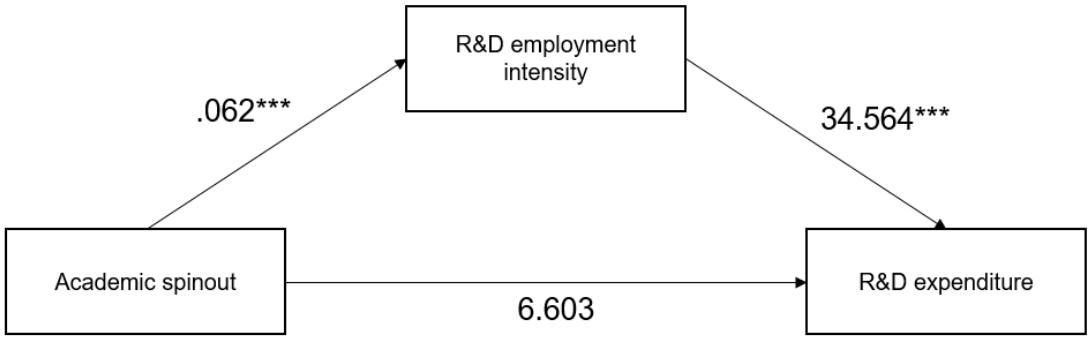
TABLE 5
MEDIATION ANALYSIS

		95 % confidence interval		
	Estimate	Lower	Upper	p-value
Average causal mediation effect	2.14	.31	4.44	.00
Average direct effect	6.60	-1.19	14.31	.10
Total effect	8.74	.89	16.66	.03
Proportion mediated	.244	.02	1.07	.04

Based on the relationships in our main analysis, it appears that R&D employment may be the mechanism through which the academic knowledge context affects R&D spending. Additionally, based on the significant interaction in model 2, it appears that the indirect effect of the academic knowledge context

on R&D spending may be conditional on the founder status of the CEO. In other words, our data suggest a moderated mediation may explain these relationships (Preacher, Rucker, & Hayes, 2007).

FIGURE 3
MEDIATION



To first establish that *R&D Employment Intensity* mediates the relationship between *Academic Spinout* and *R&D Spending*, we use the bootstrap confidence intervals method (Edwards & Konold, 2020; Preacher & Hayes, 2008) using the R package 'Mediation' (Tingley, Yamamoto, Hirose, Keele, & Imai, 2014). Table 5 contains the mediation analysis results, which are also in Figure 3. The average causal mediation effect, total effect, and proportion mediated are all positive and significant.

TABLE 6
MODERATED MEDIATION ANALYSIS

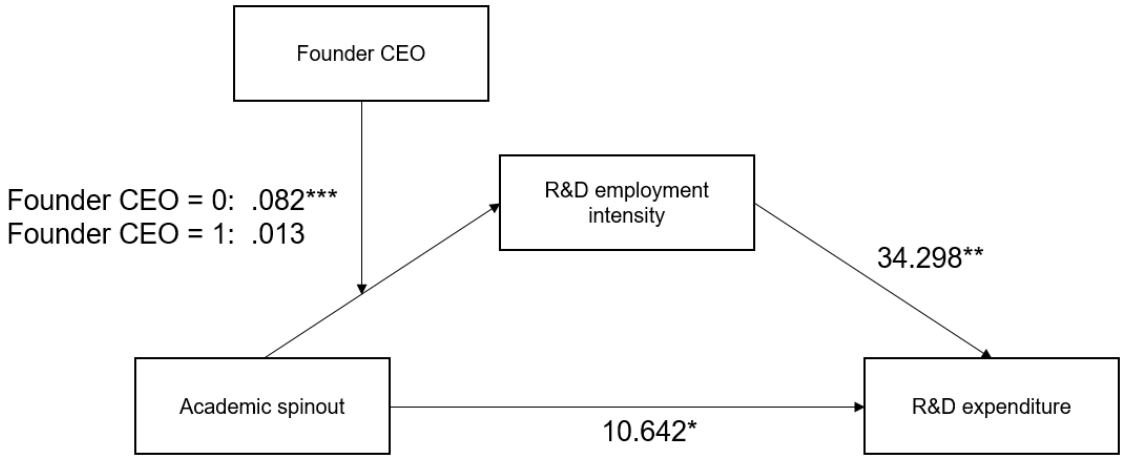
	Founder-CEO = 0			
		95 % confidence interval		
	Estimate	Lower	Upper	p-value
Average causal mediation effect	2.81	.67	6.39	.00
Average direct effect	7.83	-1.64	18.14	.14
Total effect	10.64	1.00	21.24	.02
Proportion mediated	.26	.069	1.58	.02

	Founder-CEO = 1			
		95 % confidence interval		
	Estimate	Lower	Upper	p-value
Average causal mediation effect	.44	-2.02	3.48	.76
Average direct effect	3.66	-4.13	10.14	.33
Total effect	4.10	-3.38	11.32	.28
Proportion mediated	.11	-2.35	3.15	.76

Note, Nonparametric bootstrap confidence intervals with the percentile method. 500 simulations were conducted at each level of founder-CEO.

Next, we test whether the mediated relationship is conditional on the presence of a *Founder-CEO*. we conducted a bootstrap mediation analysis at each moderator level to test for a first-stage moderated mediation. The results of these mediation analyses are in Table 6. When Founder-CEO = 0, the average causal mediation effect is positive and highly significant. However, when we calculate the effects at Founder-CEO =1, the average causal mediation effect is insignificant. The results of these bootstrapped analyses are depicted in Figure 4 and suggest a first-stage moderated mediation.

FIGURE 4
FIRST STAGE MODERTATED MEDIATION



DISCUSSION

We started this study with the idea that founders from differing knowledge contexts will make different strategic choices. In particular, our primary claims are that 1) academic spinouts will be less likely to have a founder-CEO than industry spinouts, 2) academic spinouts will allocate more resources to R&D than industry spinouts, 3) academic spinouts led by a founder will enact different strategy than those led by hired CEO. The theoretical explanation for our claims relies on the established finding that at the heart of academic entrepreneurship are innovations that are less ready for commercialization than those in industry settings. Because of this reality, academic spinouts rarely elect an academic research scientist to become CEO because they need the operational knowledge that comes with bringing in an experienced executive. Additionally, academic spinouts will allocate a greater share of their workforce to the R&D function in their firm to develop their nascent technologies. They have less need for sales, marketing, administrative, and finance functions than industry spinouts with market-ready technology. Additional theoretical support for our hypotheses comes from the robust finding that university scientists prefer settings with a strong focus on R&D and are thus likely to form heavily R&D-focused firms.

We also observed that R&D employment intensity mediates the relationship between academic entrepreneurship and firm-level R&D spending. Interestingly, we also show that this relationship is conditional on the presence of a founder-CEO. This finding is surprising and somewhat counterintuitive. Because academic spinouts form to incubate new technologies developed in university settings by professors, the founders of these firms imprint their preference for R&D onto their firms. This results in highly R&D-intensive workforces, which drives overall R&D spending. However, when one of the academic founders is retained as the company's chief executive, this *weakens* the effect of the academic knowledge context on R&D resource allocation. Academic firms in our sample led by a founder-CEO dedicate 44.1% of their workforce and spend $19 million per year on R&D. In comparison, academic spinouts with an outside executive in charge dedicate 61% of their workforce and spend $32.4 million per

year on R&D. Intuitively, we would expect these figures to be in reverse, whereby an academic founder-CEO *strengthens* the academic taste for science by creating even more R&D intensive firms.

A closer look at the differences in academic spinouts reveals a possible theoretical explanation. Academic spinouts with a founder-CEO have smaller founder teams with more entrepreneurial experience and originate from fewer universities than academic spinouts without a founder-CEO. Given these statistically significant differences, academic spinouts with a founder-CEO may form tighter-knit founder teams within a single university laboratory and do so with more operational knowledge than is typically thought of for companies formed in academia. In other words, academic spinouts led by a founder-CEO resemble industry spinouts in their entrepreneurial strategy. Consequently, the driving force behind the moderated mediation revealed in our primary and post hoc analyses is academic spinouts without a founder capable or interested in taking over the CEO position.

This study makes several contributions to the literature as one of the few studies directly comparing academic and industry spinouts. First, we show how academic and industry spinouts differ with respect to strategic leadership. we show that the academic knowledge context is unlikely to generate a spinout that retains a founder as CEO. Second, we show that academic spinouts allocate resources to R&D differently than industry spinouts. Academic spinouts staff their firms with more people dedicated to R&D than industry spinouts and spend more on R&D. Finally, we show how strategic leadership choices and resource allocation decisions are connected; we make the surprising finding that founder-CEOs reduce the resource allocation to R&D in academic spinouts. Together, these findings contribute theoretically to the following literature, entrepreneurial strategy, academic and employee entrepreneurship, spinout generation, knowledge inheritance, strategic leadership, and the corporate governance of entrepreneurial firms.

Implications for Practice

Our findings have implications for practice. For example, the differences between academic and employee entrepreneurship yield heterogeneous approaches to R&D. Prospective stakeholders making an occupational or financial investment in firms founded only by academics can expect that firm to focus heavily on R&D activities in laboratory settings. For prospective employees and co-founders, especially industrial scientists, the organizational culture of the academic spinout may present a non-trivial obstacle to seamlessly integrating into their knowledge production. Investors should expect academic spinouts to allocate more of their investment to research and development salaries than other functions such as sales and marketing. The strategic choice to allocate resources away from sales and marketing can lead to more extended periods until profitability. Additionally, firm stakeholders can expect academic founder-CEOs to operate their firms like industry spinouts.

Limitations and Future Research

This study has some limitations. Principal among them is the selection of our data and sample. While the context of publicly traded firms provided a rich source of founder biographic detail, one could argue that findings related to these firms will not scale to other populations. For example, our R&D variables capture data during and after the time of the IPO. For instance, Hendricks, Howell, and Bingham (2019) show that the IPO process often leads to dramatic increases in organizational complexity. Therefore, our primary findings may not generalize to otherwise successful firms that did not pursue a public offering.

Additionally, our empirical method is not strictly causal. Even though our hypotheses have a foundation of theoretical support for causality, we cannot explicitly claim that academic founders cause greater allocation of resources to R&D based on this study. Future research could extend this work by testing our model in other industries or with a more representative set of firms.

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