

Founder or Joiner?

The Role of Preferences and Context in Shaping Different Entrepreneurial Interests

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Entrepreneurial ventures rely not only on founders but also on “joiners”—start-up employees who are attracted to entrepreneurship, but who do not want to be founders themselves. Drawing on both preference and contextual theories of entrepreneurship, we examine how individuals’ interest in being a founder, a joiner, or neither forms prior to the first career transition. We find that although individuals with founder and joiner interests share similar preferences for entrepreneurial job attributes such as autonomy and risk, their preferences for these attributes also differ in significantly meaningful ways. Contextual factors such as norms, role models, and opportunities exhibit very different relationships with founder and joiner interests. Most interestingly, our results suggest that preferences and context interrelate in unique ways to shape different entrepreneurial interests. In particular, an interest in being a founder is most strongly associated with individuals’ preferences for entrepreneurial job attributes, whereas contextual factors do little to shape a founder interest in individuals who lack these preferences. An interest in being a joiner, on the other hand, is associated with both preferences and context, and this relationship is most pronounced for individuals with preferences that predispose them toward entrepreneurship. This study highlights joiners as a distinct type of entrepreneurial actor and demonstrates the importance of considering the interplay between preferences and context in the study of entrepreneurship.

Keywords: entrepreneurship; joiners; human capital; academic entrepreneurship; scientists and engineers

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1. Introduction

Entrepreneurship is increasingly seen as an attractive employment option for highly skilled individuals. This is evidenced in part by the increasing rate of new venture formation by university graduates (Hsu et al. 2007), the large share of the science and engineering workforce employed in small young firms (National Science Board 2012), and the rising demand for entrepreneurship educational programs across university campuses. Although an expanding body of research examines which individuals become entrepreneurs and why (cf. Hamilton 2000, Gompers et al. 2005, Lazear 2005, Stuart and Ding 2006, Sørensen 2007, Elfenbein et al. 2010), lost in the shadows are individuals who join founders as entrepreneurial employees but who have little interest in becoming founders themselves.¹ Like founders, join-

ers may also be drawn toward participating in entrepreneurship, and thus may be entrepreneurial in ways that have long been assumed unique to founders. At the same time, individuals who want to join a start-up as an employee likely differ from those who want to found one in ways that set them apart as a distinct type of entrepreneurial actor. Understanding joiners takes on even greater importance when one considers that attracting and retaining motivated and highly skilled employees is a critical hurdle founders face in their efforts to build successful ventures (Baron et al. 1996, 2001; Hsu 2008; Wasserman 2012).

In this study, we build on two fundamental explanations of entrepreneurship to consider how interests to participate in entrepreneurship as either a founder or a joiner form. One explanation, grounded largely in economics, emphasizes that individuals with preferences for work attributes associated with the start-up environment, such as a desire for autonomy and a tolerance for risk, are more likely to sort into entrepreneurship (Jovanovic 1979, Kihlstrom and Laffont 1979, Hamilton 2000, Elfenbein et al.

¹ For a notable exception, Neff (2012) examines individuals’ motives to work in Internet start-up companies during the dot.com era of the late 1990s. In addition, a growing body of research on start-up teams distinguishes between founders and nonfounders (Burton and Beckman 2007, Beckman and Burton 2008, Burton et al. 2009, Eesley et al. 2014).

2010).² Sociological explanations, on the other hand, abstract away from preferences to focus on how individuals' social and environmental context influence their attitudes toward the legitimacy and feasibility of engaging in entrepreneurship (Freeman 1986, Halaby 2003, Dobrev and Barnett 2005, Stuart and Ding 2006, Sørensen 2007). Although both streams of research have made considerable contributions to our understanding of which individuals' transition to entrepreneurship, the prevailing focus on founders has limited our understanding of whether the factors widely believed unique to founders might also extend—albeit in different ways—to other individuals who want to join start-ups as employees rather than as founders. Moreover, although entrepreneurship research increasingly accounts for the possibility that individuals sort into entrepreneurial contexts based on their preferences (Dobrev and Barnett 2005, Sørensen 2007, Azoulay et al. 2014), little attention has been directed to the possibility that preferences and context might interrelate in distinct ways to shape different entrepreneurial interests.

We contribute to the entrepreneurship literature by integrating preference and context-based explanations to investigate how interests in being a founder or a joiner—or neither—form prior to the first career transition. Our basic premise is that individuals' entrepreneurial interests arise to the extent that their preferences for entrepreneurial job attributes and/or their exposure to contextual factors that encourage entrepreneurship align with the distinct characteristics of the founder or start-up employee role (Turner 1978, Dobrev and Barnett 2005). There are a number of reasons why we should care about ex ante entrepreneurial interests. First, most economic models of entrepreneurial choice are founded on assumptions regarding preexisting preferences and career interests that are largely unobserved in empirical research (cf. Jovanovic 1979, Kihlstrom and Laffont 1979, Evans and Leighton 1989, Lazear 2005).³ By investigating how individuals' entrepreneurial interests form prior to the decision to enter entrepreneurship, we are able to focus more sharply on the role of preferences and context without confounding them with factors that may facilitate or hinder actual transitions such

as opportunity costs, personal wealth, and access to financial and human capital. Second, studying ex ante entrepreneurial interests provides a sharper distinction between the reasons why people are drawn toward entrepreneurship on the one hand, and actual labor market outcomes on the other.⁴ Indeed, as we elaborate on in §2, the potential (mis)alignment between individuals' entrepreneurial interests and their actual career role has important implications for both workers and employers. Third, understanding which individuals are drawn toward different entrepreneurial roles provides insights into the potential supply of entrepreneurial labor, with relevance for both entrepreneurs looking to hire employees and policy makers seeking to encourage entrepreneurial activity.

Our empirical analysis draws on a novel survey of 4,168 science and engineering Ph.D. candidates at 39 leading U.S. research universities prior to their first professional career transition. We first observe that more than half of academically trained science and engineering Ph.D.'s view entrepreneurship as an attractive career option, and nearly one-third report entrepreneurship to be at least as attractive as more traditional forms of employment in academia and established firms. Moreover, individuals interested in joining a start-up as an employee outnumber those interested in founding a start-up by more than four to one. These numbers illustrate a widespread interest in entrepreneurship and underscore the need for a deeper understanding of different entrepreneurial interests. We next perform a series of regression analyses to compare the profiles of individuals with founder and joiner interests relative to individuals not attracted to entrepreneurship with two key findings. First, both groups share similar preferences for "entrepreneurial" job attributes such as autonomy, risk, and commercialization, but they differ significantly in the configuration and strength of these preferences. At the same time, contextual factors such as norms, role models, and opportunities exhibit different relationships with founder and joiner interests. Second, after accounting for potential sorting into different entrepreneurial contexts, we find evidence that individuals' preferences and context interrelate in distinct ways to shape different entrepreneurial interests. For example, our results suggest that founder interests are associated primarily with preferences, whereas

² Studies in this line of research have also focused on other individual characteristics such as entrepreneurial ability (Elfenbein et al. 2010, Åstebro et al. 2011), overconfidence (Camerer and Lovo 1999, Hayward et al. 2006, Lowe and Ziedonis 2006), and prior entrepreneurial experience (Shane and Khurana 2003, Gompers et al. 2005, Elfenbein et al. 2010).

³ For example, Lazear (2005) contends that individuals who want to become an entrepreneur engage in a range of work activities to develop the skill set necessary to become an entrepreneur. However, he does not observe such ex ante interests, and instead infers them from the diversity of prior work activities.

⁴ Prior studies have found a significant relationship between ex ante interests and behavioral outcomes. For example, Elfenbein et al. (2010) illustrate with longitudinal data that approximately 80% of entrepreneurs and 40% of small firm employees expressed an interest in entrepreneurship several years prior to engaging in entrepreneurship, suggesting a strong link between ex ante interests and future transitions to entrepreneurship.

joiner interests are associated with both preferences and context.

This study has implications for several streams of entrepreneurship research. First, we draw attention to the study of joiners, a distinct type of nonfounding entrepreneurial actor who is attracted to the start-up work setting but has little desire to be a founder himself. Although many of the individual-level factors widely believed to characterize founders also extend to those interested in joining a start-up as an employee, they do so in meaningfully different ways. Thus, although joiners have typically been overlooked or confounded with founders in prior studies (cf. Sørensen 2007), we suggest that they deserve greater attention in their own right. This may be particularly relevant for the growing literature on entrepreneurial human capital that considers how individuals' prior start-up experience and organizational role explain subsequent transitions to entrepreneurship (Burton et al. 2002, Dobrev and Barnett 2005, Gompers et al. 2005, Elfenbein et al. 2010, Campbell et al. 2012), as well as the formation of founding teams (Beckman and Burton 2008), employee turnover (Baron et al. 2001, Burton and Beckman 2007), and start-up human resource practices (Baron et al. 1996). Second, we provide novel empirical evidence that preferences and context interrelate in unique ways to shape different entrepreneurial interests. Thus, rather than abstracting away from or controlling for one set of factors to focus on the other, this study provides a response to the growing chorus of scholars calling for entrepreneurship research to explore the interplay between micro and macro factors in explaining entrepreneurial behavior (Audia and Rider 2006, Sørensen 2007). Third, by examining entrepreneurial interests prior to and separate from realized entrepreneurial transitions, this study provides novel insights into the supply side of entrepreneurial labor and opens up interesting avenues for future research on the reasons that might prevent some from realizing their entrepreneurial ambitions or lead others to engage in entrepreneurial activity that was previously unintended.

2. Distinguishing Between Different Entrepreneurial Interests

To consider different ex ante entrepreneurial interests, we first develop a stylized characterization of the founder and start-up employee roles within entrepreneurial firms that individuals may be attracted to. Whereas founders are typically the creator, owner, and top decision maker of the company, start-up employees include a wide range of nonfounding workers who differ inherently from founders with respect to work activities, ownership, and the risks and rewards associated with entrepreneurship. Founders also occupy

a distinct position of status and authority within the company that is likely viewed as a greater departure from traditional employment roles than that of a start-up employee (Dobrev and Barnett 2005, Ding and Choi 2011). With these differences in mind, the basic premise of this paper is that individuals will be interested in being a founder or a joiner—or neither—to the extent that their preferences for entrepreneurial job attributes and/or their exposure to contextual factors encouraging entrepreneurship align with the characteristics of either the founder or the start-up employee role. Accordingly, we conceptualize joiners as being distinct from founders, even though they may be among the first employees who help founders in their efforts to launch a new company. Joiners may also be serial entrepreneurial employees, working in a number of start-ups over the course of their careers without ever becoming founders themselves. Moreover, their explicit attraction to working in an entrepreneurial setting distinguishes joiners from other start-up employees who are attracted to nonentrepreneurial work settings, such as in established firms.

Understanding how individuals' interests in different entrepreneurial roles form has important implications for the management of entrepreneurial human capital and new venture performance. For example, start-up employees with a strong interest in working in an entrepreneurial setting may receive greater utility from the nonpecuniary benefits inherent in their career role (Akerlof and Kranton 2000), and thus are likely to exert greater effort and be more committed to their organization relative to other start-up employees who do not share this interest. Moreover, individuals with an interest in working in a start-up may be willing to work for lower wages than they would earn in other forms of employment (Stern 2004). This suggests that start-ups may realize considerable benefits from the positive alignment between joiners' entrepreneurial work interests and their actual employment role.

In contrast, when individuals' interests and roles are misaligned, they may behave in ways that are costly to their employer (Turner 1978, Akerlof and Kranton 2000). For example, some individuals may have an interest in being a founder but occupy the role of a start-up employee, perhaps in an attempt to gain entrepreneurial skills and experience in order to start their own company (Dobrev and Barnett 2005, Gompers et al. 2005, Lazear 2005, Elfenbein et al. 2010). Although these individuals may seem like an ideal start-up employee given their entrepreneurial interest, they are also more likely to leave to start their own company when the opportunity arises. Perhaps more critically, these individuals may also recruit away coworkers to join them in their own entrepreneurial efforts (Campbell et al. 2012) and even become

a competitor (Moore 1994).⁵ Thus, hiring employees attracted to the founder role over those attracted to the start-up employee role may have unanticipated negative consequences for start-up performance.

At the other extreme, start-up employees who lack an interest in being either a founder or a start-up employee may have a *distaste* for entrepreneurship, and as a consequence may be less motivated and more likely to leave to pursue employment in established firms. Moreover, although many entrepreneurial firms seek to hire the most talented individuals they can find, if such employees have a distaste for entrepreneurship then they may require an additional wage premium to work in an employment setting that does not align with their career interests. Accordingly, hiring primarily for talent without consideration for individuals' *ex ante* career interests may increase the cost of recruiting and retaining human capital. These examples illustrate that distinguishing between and understanding different entrepreneurial and nonentrepreneurial interests may have important implications for start-up hiring policies, employee productivity, and new venture performance.

Although our general conceptual framework is applicable to a range of entrepreneurial settings, the specific roles played by founders and start-up employees, as well as differences in the factors associated with founder and joiner interests, may vary depending on the particular setting. We situate our discussion within the setting of academic entrepreneurship to examine the entrepreneurial interests of science and engineering Ph.D.'s. Academic entrepreneurship is of special interest for a number of reasons. First, technological discoveries emanating from university research are an essential driver of innovation and economic growth (Thursby et al. 2001, Cohen et al. 2002). Academic entrepreneurship is an important vehicle by which such outcomes can be realized (Shane 2004), and academically trained Ph.D.'s often play a critical role in this process as both founders and employees (Roberts 1991, Shane 2004, Boh et al. 2012). Second, entrepreneurship is increasingly seen as an attractive career option for Ph.D.'s (Roach and Sauermann 2010), and thus understanding founder and joiner interests is relevant to the broader study of the scientific workforce (Stephan 2012, Agarwal and Ohyama 2013). Finally, graduate school is arguably the most formative period

in the professional training of science and engineering Ph.D.'s (Stuart and Ding 2006). Observing Ph.D.'s during this period provides a unique opportunity to examine entrepreneurial interests at a point when they are most likely to form and prior to the first employment transition.

2.1. Preferences for Entrepreneurial Job Attributes

We first consider microlevel explanations of entrepreneurship, which are based in part on the premise that individuals with preferences for specific job attributes, such as autonomy and a tolerance of risk, will sort into entrepreneurship based on their expectations that an entrepreneurial work setting aligns best with their preferences (Jovanovic 1979, Kihlstrom and Laffont 1979, Hamilton 2000, Halaby 2003, Elfenbein et al. 2010). Extending this preference sorting rationale to consider different entrepreneurial interests, we suggest that given their common entrepreneurial work setting, founder and start-up employee roles share similar job attributes, but they also differ in meaningful ways. Accordingly, individuals will be interested in being a founder or a joiner to the extent that their preferences align with the attributes of either the founder or start-up employee role, respectively.

First, individuals may be attracted to entrepreneurship as a founder or a start-up employee based on their preferences for the specific job attributes provided by an entrepreneurial work setting. For example, individuals with a preference for autonomy may be drawn to entrepreneurial firms (McClelland 1961, Evans and Leighton 1989), which, given their smaller size and flatter organizational hierarchy, tend to be less bureaucratic than large established firms (Freeman 1986, Sørensen 2007). Although start-ups may provide both founders and employees with a certain degree of autonomy, the founder role likely entails greater control over one's own work activities than the start-up employee role. Accordingly, individuals with a stronger preference for autonomy are more likely to be attracted to the founder role, whereas those with moderate preferences for autonomy may believe that the founder role requires greater self-direction and decision making than they would like. Thus, they will be more attracted to the start-up employee role, which still affords greater discretion over work activities than employment in established firms (Baron et al. 1996, Neff 2012).

Similarly, prior studies have emphasized that individuals with a tolerance for risk are more likely to participate in entrepreneurship (Kihlstrom and Laffont 1979, Hall and Woodward 2010). Accordingly, individuals with a strong tolerance for risk are more likely to accept the considerable financial and career risks associated with starting one's own company, whereas individuals with a moderate tolerance for risk may

⁵Gordon Moore, in his personal account of the founding of Fairchild Semiconductor Corporation, described the hiring of Ed Baldwin as the company's CEO (Moore 1994). Baldwin departed shortly thereafter to start a competing semiconductor firm and took many key Fairchild Semiconductor personnel with him. In Moore's own words, "[Baldwin] didn't consider Fairchild Semiconductor his company, and since he wanted his own company, he left us" (p. 25).

be inclined to accept the more limited risks of start-up employment. In contrast, individuals with a low tolerance for risk may find start-up employment too risky relative to employment in an established firm, and thus will not be attracted to entrepreneurship.

Although individuals with interests in being a founder or a joiner may share similar preferences for the entrepreneurial work setting, they may differ more markedly with respect to their preferences for the specific work activities that are unique to either the founder or start-up employee role. For example, individuals with a preference for management may be attracted to the founder role since founders are typically responsible for a range of managerial activities such as formulating firm strategies and hiring key personnel (Lazear 2005, Elfenbein et al. 2010). On the other hand, individuals with a preference for specific functional activities may be more attracted to the start-up employee role, which tends to focus on work activities such as research and development, business development, or marketing (Elfenbein et al. 2010).

2.2. Contextual Factors Encouraging Entrepreneurship

An alternative explanation for entrepreneurial activity can be found in sociology, which proposes that factors associated with individuals' social and environmental context such as organizational characteristics (Freeman 1986, Dobrev and Barnett 2005, Audia and Rider 2006, Sørensen 2007), peers (Stuart and Ding 2006, Nanda and Sørensen 2010, Azoulay et al. 2014), and opportunities (Bhide 2000, Shane 2001) influence their attitudes toward the legitimacy and feasibility of entrepreneurship. Drawing on the premise that career interests are socially constructed (Merton 1968, Turner 1978), we contend that contextual factors encouraging entrepreneurship also influence individuals' interest in joining a start-up as an employee, albeit in ways different from interests in being a founder.

Returning to the notion that being a founder is likely viewed as a greater departure from traditional career roles than being a start-up employee (Dobrev and Barnett 2005, Ding and Choi 2011), we suggest that an interest in founding a start-up may require stronger contextual factors to form relative to an interest in joining one. In this study, we focus on social norms, role models, and opportunities as three contextual factors that vary in the strength of their influence, with norms being the weakest and opportunities being the strongest (cf. Stuart and Ding 2006).

Norms have long been considered an important influence on individuals' attitudes toward the acceptability of certain professional activities (Merton 1968). Norms can encourage participation in entrepreneurship by conveying the legitimacy of working in a start-up, as well as by transmitting information about

the characteristics of different entrepreneurial roles. However, given their group-based nature, the influence of norms tends to be more diffuse and weaker relative to other contextual factors (Stuart and Ding 2006). Thus, norms may be sufficient to shape an interest in joining a start-up as an employee, but they may not be strong enough to shape an interest in starting a company as a founder. A stronger influence may come from peers and mentors who have been founders themselves. Such founders act as role models that both legitimize and demonstrate the feasibility of entrepreneurship (Stuart and Ding 2006, Nanda and Sørensen 2010), thereby influencing the entrepreneurial interests of others. However, since these individuals model the role of a founder and not an employee, founder role models may have a stronger influence on interests in founding a company rather than in joining one as an employee.

Unlike the social influence of norms and role models, the discovery of an entrepreneurial opportunity may have a particularly strong influence on shaping individuals' interests in being a founder. This is because such opportunities provide a concrete and actionable basis for starting a company (Roberts 1991, Bhide 2000, Eckhardt and Shane 2003). Although this suggests that individuals with such an opportunity may demonstrate particularly strong interests in being a founder, it is unclear a priori why such an individual would be attracted to being a joiner. Thus, opportunities should have no influence in shaping joiner interests.

2.3. The Interplay Between Preferences and Context

As highlighted in the prior discussion, extant entrepreneurship research has largely examined preferences and context in isolation or as alternative explanations of entrepreneurial activity (Sørensen 2007, Elfenbein et al. 2010, Azoulay et al. 2014). In doing so, each set of theories has implicitly assumed that individual and contextual factors have independent effects. In contrast, we suggest that both sets of factors may interrelate in unique ways to shape distinct entrepreneurial interests.⁶

First, recall our discussion regarding the role of preferences in shaping founder and joiner interests (§2.1). Implicit in this microperspective is the notion that individuals with preferences for entrepreneurial job attributes are intuitively aware of entrepreneurship as a possible career to satisfy their preferences. Although this may indeed be true for some

⁶ Whereas the entrepreneurship literature has treated preferences and context as largely independent, research in social psychology has examined the relationship between context and personality (Mischel 2004), but not within the domain of entrepreneurship.

individuals, others with such preferences may not consider entrepreneurship as a possible career path until exposed to entrepreneurial contextual factors. For example, in our own interviews, many individuals stated that they had a long-standing preference for jobs that enable them to “make my own decisions,” “work on exciting, new technologies,” and “create new technologies that can solve real problems.” And yet few had previously considered entrepreneurship as a possible career path. However, entrepreneurship became more salient as they interacted with entrepreneurs or discovered a commercial opportunity.⁷ Thus, preferences for entrepreneurial job attributes may predispose certain individuals toward an interest in entrepreneurship, but absent exposure to contextual factors that raise the awareness of different entrepreneurial roles, their interests may remain latent.

Sociological theories (§2.2), on the other hand, implicitly assume that individuals exposed to the same contextual factor will be influenced in a similar way (Freeman 1986, Audia and Rider 2006). However, individuals may respond differently to the same contextual factor depending in part upon their preferences. To illustrate, we interviewed two materials science Ph.D. candidates who shared the same Ph.D. advisor who is both a prominent scientist and an entrepreneur. Contrary to the assumption of equal treatment, one student showed little interest in entrepreneurship and instead intended to pursue a career in academia, and the other expressed a desire to found a technology-based company in the future, even though he currently did not have an entrepreneurial opportunity of his own. Upon further probing, the first student expressed a preference for pursuing fundamental research, and stated that although he was aware of his advisor’s entrepreneurial activities, they had little influence on his interest in entrepreneurship given his already strong interest in academia. In contrast, the second student stated that he had always been drawn toward commercializing new technologies and that his advisor’s entrepreneurial activities had influenced his interests in becoming a founder. In a final example, a third interviewee had made a major discovery as part of his graduate research that became the basis for a start-up. However, he chose to forego becoming a founder and instead took a faculty position at another university.

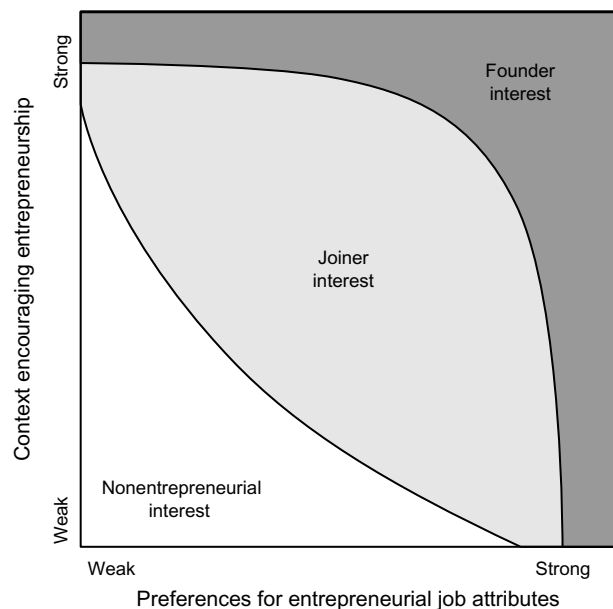
⁷ For example, when asked about his career plans when he started his Ph.D., one interview subject stated the following: “I had no idea [what career I would pursue], I just knew that in the long run I wanted to have a career where I can make my own decisions and be my own boss, and I really like science and engineering, so a Ph.D. would probably make sense for me.” Although he also stated that he did not consider entrepreneurship at the time he started his Ph.D., he went on to start a company based on the commercial potential of his research.

When asked why he did not become a founder, he stated that he wanted to pursue fundamental research that could contribute to solving real-world problems, but he did not want to participate in the commercialization process himself. Thus, as these examples illustrate, individuals’ preferences for different kinds of job attributes and work activities may condition their susceptibility to the influence of contextual factors.

Figure 1 is a stylized representation of this potential interplay. The x axis represents individuals’ preferences for entrepreneurial job attributes, reflecting key factors considered in prior work on microlevel drivers of entrepreneurship. The y axis reflects contextual factors that encourage entrepreneurship, in line with sociological theories. The shaded areas between the two axes represent the conditions under which different entrepreneurial interests are more likely to form.

Consider first individuals who have moderate preferences for entrepreneurship (middle of the x axis). Exposure to strong entrepreneurial contextual factors will increase their awareness of entrepreneurship as a possible career path. However, given that they do not have strong preferences for entrepreneurial job attributes, such individuals are more likely to be in the joiner interest region rather than the founder interest region. Individuals with very strong preferences for entrepreneurial job attributes, on the other hand, may form a founder interest even without exposure to an entrepreneurial context. At the other extreme, individuals without entrepreneurial preferences are unlikely to become interested in entrepreneurship, even when exposed to contextual factors that raise the awareness or legitimacy of entrepreneurial careers.

Figure 1 Interplay Between Preferences and Context



Although Figure 1 is meant to illustrate our conceptualization of the interplay between individual preferences and contextual factors in shaping different entrepreneurial interests, we have no priors regarding specific parameters regarding the relevant “cutoffs” on the two axes or the particular shape of the areas between the axes. Indeed, although Figure 1 suggests that the interplay between preferences and context is symmetric, in reality there may be conditions in which one dimension dominates over the other. Note also that we do not assume that the two axes are independent of each other: for example, individuals with preferences for entrepreneurial job attributes may sort into contexts that are more entrepreneurial (Sørensen 2007, Elfenbein et al. 2010).

In the following empirical analysis, we first consider preferences and context separately as potential drivers of entrepreneurial interests. We then examine their interplay while accounting for potential preference-based sorting into different entrepreneurial contexts.

3. Data, Variables, and Method

3.1. Data

The data for this study are drawn from a survey of science and engineering Ph.D. students at 39 U.S. research universities administered by the authors in spring 2010. We first used the National Science Foundation’s (2009) report on earned doctorates to identify tier 1 U.S. research universities with large doctoral programs in science and engineering. We then selected a subset of institutions based primarily on program size while ensuring variation with respect to private/public status and geographic location. We collected roughly 30,000 email addresses from department websites and invited individuals to participate in the online survey using a four-contact strategy (one invitation, three reminders). For departments that did not list students’ email addresses, we contacted department administrators to request that they forward a survey link to their graduate students. Overall, 88% of our responses were obtained directly from respondents and 12% were obtained through administrators. The initial contact for all respondents occurred over a two-week period in February 2010 and all responses were collected within an eight-week window.⁸ Adjusting for 6.3% undeliverable emails, the direct survey approach achieved a response rate of 30%.

In this study, we restrict our sample to Ph.D. candidates in the advanced stages of their respective programs who have successfully completed their

qualifying exams or equivalent milestones. This is done to obtain a sample of individuals who are closer to making their initial career decision and who have been in their program long enough to be exposed to contextual factors. In addition, we further restrict the sample to individuals who have an interest in research careers in either a start-up, an established firm, or in academia.⁹ Given this, our sample is relatively homogenous with respect to education, work experience, and age, allowing for a sharper focus on our featured variables. By using data from Ph.D. candidates, we complement a nascent body of work on academic entrepreneurship that looks beyond faculty founders to examine the activities of Ph.D.’s and recent graduates (Hsu et al. 2007, Boh et al. 2012). Moreover, although much of our current understanding of academic entrepreneurship is based on data collected nearly two decades ago (Etzkowitz 1998, Owen-Smith and Powell 2001, Stuart and Ding 2006), our data provide unique and recent insights into the entrepreneurial interests of the current generation of science and engineering Ph.D.’s. The sample used in this study consists of 4,168 Ph.D. candidates across the life sciences (49% of sample), physical sciences (27%), and engineering and applied sciences (24%). Table 1 presents the main variables, measures, and summary statistics.

3.2. Dependent Variable

The objective of our empirical analysis is to compare individuals who are interested in being a founder or a joiner to those who are not interested in entrepreneurship. Accordingly, our primary dependent variable measures entrepreneurial interests in an absolute sense rather than relative to other career options. Our approach is to first categorize individuals by whether or not they are interested in entrepreneurship, and then to distinguish between those who are by whether they have an interest in being a founder or a joiner. To achieve this, we utilize two survey questions that were part of a general set of questions regarding future employment after graduation. In the first question, we asked respondents “Putting job availability aside, how attractive do you personally find each of the following careers?” The careers included working in a start-up, an established firm, and academia. Respondents rated each career on a 5-point scale that ranged from “extremely unattractive” to “extremely

⁹ More precisely, we include in our analysis only those individuals who rated the attractiveness of at least one of the three focal careers as a 4 (“attractive”) or 5 (“extremely attractive”). Thus, we exclude from the sample 114 individuals (2.7% of the sample) who either find an alternative career, such as in government or consulting, more attractive, or who do not find any of our focal careers attractive (e.g., they rated the attractiveness of all careers as a “neither attractive nor unattractive”).

⁸ To assess potential nonresponse bias, we compared responses of early and late respondents and found no significant differences.

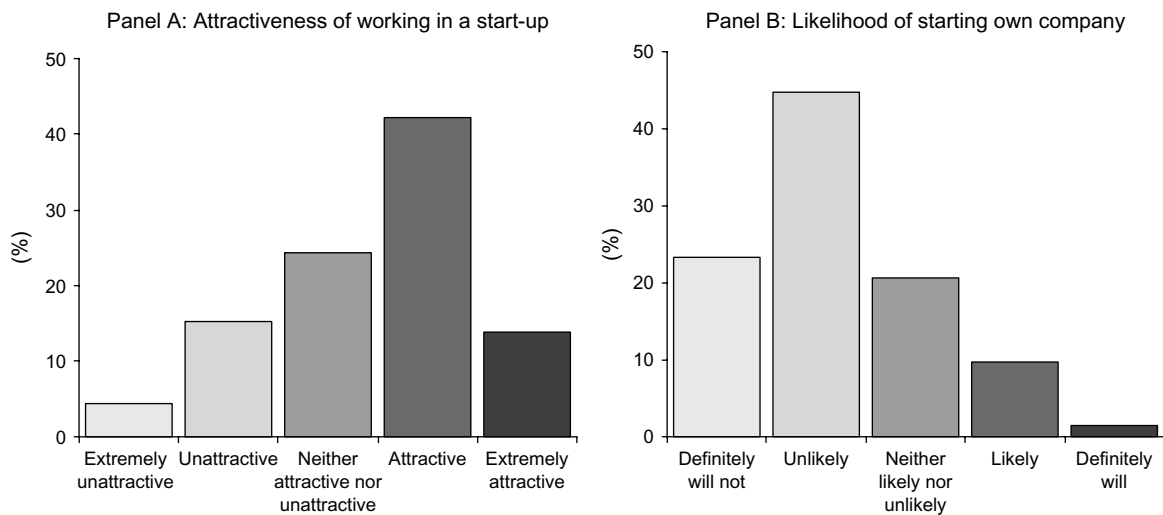
Table 1 Variable Description and Summary Statistics

Variable	Survey question	Type	Mean	S.D.	Min	Max
Dependent variable						
<i>Founder interest</i>	Likely to start own company (4 or 5 on 5-point scale)	Binary	0.11	n.a.	n.a.	n.a.
<i>Joiner interest</i>	Attracted to working in start-up (4 or 5 on 5-point scale), but not likely to start own company (1, 2, or 3 on 5-point scale)	Binary	0.46	n.a.	n.a.	n.a.
<i>Established firm interest</i>	Not attracted to working in start-up (1, 2, or 3 on 5-point scale), but attracted to career in established firm (4 or 5 on 5-point scale)	Binary	0.11	n.a.	n.a.	n.a.
<i>Academia interest</i>	Not attracted to working in start-up (1, 2, or 3 on 5-point scale), but attracted to career in academia (4 or 5 on 5-point scale)	Binary	0.31	n.a.	n.a.	n.a.
Preference variables						
<i>Autonomy</i>	“When thinking about an ideal job, how important is it to you to be able to choose research projects?”	5-pt scale	4.00	0.80	1	5
<i>Income</i>	“When thinking about an ideal job, how important to you is financial income (e.g., salary, bonuses, etc.)?”	5-pt scale	3.96	0.71	1	5
<i>Risk tolerance</i>	“How much do you prefer winning \$1,000 for sure to winning \$2,000 with a 50% chance?”	10-pt scale	2.45	2.50	0	10
<i>Commercialization activities</i>	“When thinking about the future, how interesting would you find work activities that commercialize research results into products or services?”	5-pt scale	3.35	1.12	1	5
<i>Managerial activities</i>	“When thinking about the future, how interesting would you find managerial or administrative work activities?”	5-pt scale	2.90	1.16	1	5
<i>Basic research activities</i>	“When thinking about the future, how interesting would you find work activities in conducting research that contributes fundamental insights or theories (basic research)?”	5-pt scale	4.02	0.92	1	5
<i>Applied research activities</i>	“When thinking about the future, how interesting would you find work activities in conducting research that creates knowledge to solve practical problems (applied research)?”	5-pt scale	4.36	0.65	1	5
Context variables						
<i>Academic norms</i>	“In your lab/department, to what extent are Ph.D.’s encouraged or discouraged to pursue a university faculty position with emphasis on research or development?”	5-pt scale	4.21	0.75	1	5
<i>Entrepreneurial norms</i>	“In your lab/department, to what extent are Ph.D.’s encouraged or discouraged to pursue a job in a start-up firm with emphasis on research or development?”	5-pt scale	3.27	0.72	1	5
<i>Founder role model</i>	“To the best of your knowledge, has your advisor founded an entrepreneurial venture?”	Binary	0.11	0.31	0	1
<i>Entrepreneurial opportunity</i>	“How would you assess the potential commercial value of your current research?”	5-pt scale	2.48	1.17	1	5
Key control variables						
<i>Ability</i>	Derived from survey questions of self-assessed ability, which reflects both objective ability and overconfidence. Regressed self-assessed ability onto objective measures correlated with ability (e.g., publications, awards, department National Research Council ranking, university, etc.) to predict ability (see §3.4).	Predicted value	6.35	0.71	3.9	9.5
<i>Overconfidence</i>	Derived from survey questions of self-assessed ability, which reflects both objective ability and overconfidence. Measure is the difference between self-assessed ability and predicted ability (see §3.4).	Residual value	0.00	1.49	86.9	4.5
<i>Persistence</i>	“To what extent does the following statement describe you? ‘When I fail in something, I am determined to continue trying until I succeed.’”	5-pt scale	4.01	0.75	1	5
<i>Parent self-employed</i>	“Which of the following best reflects your parents’ primary occupation (if retired, indicate former occupation)?” Coded as 1 when either parent is self-employed.	Binary	0.29	0.45	0	1

attractive.” To distinguish between founder and joiner interests, we utilize a second question that asked respondents “How likely are you to start your own company?” rated on a 5-point scale that ranged from “definitely will not” to “definitely will.” Panels A and B in Figure 2 report the distributions for both survey questions, illustrating that a large share of respondents find working in a start-up attractive, but a relatively small share respondents expect that they will start their own company. We code respondents who indicated that they “likely will” or “definitely

will” start their own company (4 or 5 on the scale) as expressing a *Founder interest*.¹⁰ We then code respondents who reported that working in a start-up is

¹⁰ One possible limitation of our measure is that by asking respondents about the likelihood of becoming a founder we may conflate an interest in being a founder and the opportunity to do so. As a consequence, some individuals who have an interest in being a founder but currently lack an opportunity may report that it is less likely that they will be a founder relative to those with an opportunity, thereby understating founder interests. We explore this further in our empirical analysis.

Figure 2 Distribution of Measures of Careers in Entrepreneurship

“attractive” or “extremely attractive” (4 or 5 on the scale) but who think it is unlikely that they will start their own company as expressing a *Joiner interest*.¹¹

Using both survey items jointly to categorize respondents according to their entrepreneurial interests, we observe that 11% have a founder interest and 46% have a joiner interest, irrespective of their interest in other careers. Individuals with founder and joiner interests have similarly high and statistically indistinguishable scores on the attractiveness of a career in a start-up (4.24 and 4.19, respectively), indicating that these two groups differ not in their interest in “working in a start-up” per se, but rather in their interest in being a founder or not.¹² Given that our study focuses on the entrepreneurial interests of science and engineering Ph.D.’s, we further categorize the remaining respondents who are *not* interested in entrepreneurship by whether they are more interested in a career in *Academia* (31%) or in an *Established firm* (11%).¹³ Note again that our featured measure of entrepreneurial interests as defined in this study does not indicate that respondents dislike other career options, nor that entrepreneurship is their most desired career. Instead, our featured measure reflects

the attractiveness of a career in a start-up in an absolute sense, consistent with our research question.

We complement our measure of entrepreneurial interests with a relative measure that reflects the strength of individuals’ interest in entrepreneurship vis-à-vis their interest in other careers.¹⁴ To accomplish this, we reclassify individuals who are attracted to entrepreneurship but report that working in academia is more attractive as having a career interest in academia.¹⁵ Likewise, we recode those who report that working in an established firm is more attractive than working in a start-up as having a career interest in an established firm. Although by construction this approach lowers the share of respondents categorized as having an entrepreneurial interest, the shares remain high: nearly 8% of respondents are most interested in being a founder and 29% are most interested in being a joiner. Of the remaining individuals, 45% are most interested in academia and 18% are most interested in an established firm.¹⁶

3.3. Independent Variables

Preferences. To examine the relationship between preferences for entrepreneurial job attributes and entrepreneurial interests, we include a number of preferences

¹¹ We use 4 as our cutoff value because it reflects a substantively meaningful threshold in individuals’ assessment of the attractiveness or unattractiveness of each career (1 and 2 are unattractive, 3 is indifferent, and 4 and 5 are attractive).

¹² A small share of respondents with founder interests report that working in a start-up is unattractive (1.5% of the sample). Although we include these individuals in the reported analyses, robustness tests that exclude these observations (available from the authors) indicate that our results are not sensitive to their inclusion.

¹³ Individuals who were indifferent between academia and working in an established firm (7%) are included in the established firm category. Robustness checks show that reclassifying these individuals in the academia category does not affect the results.

¹⁴ We thank an anonymous referee for suggesting this approach.

¹⁵ For example, a respondent who rates a career in academia as “extremely attractive” and a career in a start-up as “attractive” is coded as being more interested in academia. A respondent who rates both a career in academia and in a start-up as being “attractive” would be classified as having an entrepreneurial interest.

¹⁶ By comparison, the National Science Foundation Science and Engineering Indicators (2012) report that approximately 12% of science and engineering Ph.D.’s are self-employed, 41% are employed in academia (including postdoc and nontenure track appointments), and 35% are employed in the private sector (including both start-ups and established firms).

that have been featured prominently in prior studies as determinants of entrepreneurship. These include preferences for autonomy (McClelland 1961, Evans and Leighton 1989), income (Jovanovic 1979, Evans and Leighton 1989), and risk (Kihlstrom and Laffont 1979, Hall and Woodward 2010), as well as preferences for different work activities (Lazear 2005). Building on the approach employed by the National Science Foundation's (2003) Survey of Doctorate Recipients, we measure respondents' preferences for *Autonomy* and *Income* by asking them to rate the importance of these job attributes on a 5-point scale from "not at all important" to "extremely important." To measure *Risk tolerance*, we employ a lottery-type question by asking respondents "Imagine you have the choice between winning \$1,000 for sure or winning \$2,000 with a 50% chance. Please indicate which option you prefer." Respondents were provided with a 10-point scale that ranged from "strongly prefer a 100% chance to win \$1,000" to "strongly prefer a 50% chance to win \$2,000." Higher values of this response scale reflect a greater willingness to choose a riskier outcome with a higher potential payoff, which we interpret as a greater tolerance for risk. Next, we measure individuals' preferences for different work activities on a 5-point scale that ranged from "extremely uninteresting" to "extremely interesting." The set of activities included "commercializing research results into products and services" (*Commercialization activities*), "management or administration" (*Managerial activities*), "research that contributes fundamental insights or theories (basic research)" (*Basic research activities*), and "research that creates knowledge to solve practical problems (applied research)" (*Applied research activities*).

Context. To measure departmental *Norms* toward different careers, we asked respondents to indicate the degree to which Ph.D.'s in their research group are encouraged or discouraged to pursue careers in academia and in start-ups, respectively, on a 5-point scale that ranged from "strongly discouraged" to "strongly encouraged." This measure reflects individuals' perceptions of norms, which we expect to more accurately correspond to individual's career interests than consensus-based measures of norms. However, a potential limitation of this measure is that individuals with a stronger interest in entrepreneurship may perceive norms as being more entrepreneurial, thereby inflating the correlation between these two variables. The preference measures included in the regressions should account for some of this effect, and we further address this concern in the empirical analysis. To measure founder role models, we asked respondents if, to the best of their knowledge, their faculty advisor had founded a company in the past three years. The response scale was "yes," "no," or "don't know."

We coded the variable *Founder role model* as 1 if a respondent answered yes and 0 otherwise.¹⁷ Although some respondents may report no or don't know even though their advisor has in fact been a founder, we expect that observed advisor behaviors are a more accurate measure of founder role models.

Regarding entrepreneurial opportunities, prior research has shown that many entrepreneurs start companies based on ideas closely related to their domain of expertise (Roberts 1991, Elfenbein et al. 2010). In addition, recent research demonstrates that inventors' perceptions of the value of their inventions are a key determinant of their decision to start a new venture (Gambardella et al. 2015). Thus, we use Ph.D.'s assessments of the commercial value of their own research as a proxy for entrepreneurial opportunities, which is measured on a 5-point scale ranging from "not valuable" to "extremely valuable." Although this measure is meant to reflect opportunities emanating from a respondent's own research, it does not capture other sources of opportunities such as the research of others or nonresearch ideas and thus may understate the role of opportunities. In addition, an individual's ability to start a company may be limited if his research was sponsored by a firm, which may have rights to any resulting inventions. We control for this by including a variable that indicates whether a respondent's research is industry funded.

Table 2 summarizes the independent and key control variables for each entrepreneurial interest. These summary statistics allow for a simple comparison of the profiles of individuals interested in being a founder to those interested in joining a start-up as an employee, as well as to those who are not interested in entrepreneurship. To illustrate our basic premise that individuals with founder or joiner interests have similar, yet distinct entrepreneurial profiles, Figure 3 graphs the percentage difference from the overall mean for the featured preference variables. These graphs show that individuals with an interest in joining a start-up share similar preferences as those interested in founding a start-up when compared to those not interested in entrepreneurship, but they are also substantively different. For example, individuals with an above average tolerance for risk are attracted to entrepreneurship in general, but those interested in being a founder have a much higher tolerance for risk than those interested in joining a start-up as an employee. We explore these relationships systematically in the regression analyses that follow.

3.4. Control Variables

We include several variables to control for sources of individual heterogeneity that might bias our

¹⁷ Respondents who did not have a Ph.D. advisor at the time of the survey were coded as 0 ($n = 14$, or 0.33% of the sample).

Table 2 Variable Means by Entrepreneurial Interest

Variable	(1) Founder interest	(2) Joiner interest	(3) Established firm interest	(4) Academia interest
Career interest variables				
<i>Likelihood of starting own company</i> (5-pt scale)	4.13	2.18	1.74	1.75
<i>Job attractiveness—Start-up</i> (5-pt scale)	4.25	4.19	2.64	2.38
<i>Job attractiveness—Established firm</i> (5-pt scale)	4.05	4.23	4.30	2.77
<i>Job attractiveness—Academia</i> (5-pt scale)	3.67	3.67	3.12	4.06
Preference variables				
<i>Autonomy</i> (5-pt scale)	4.11	3.95	3.66	4.16
<i>Income</i> (5-pt scale)	4.15	4.07	4.08	3.69
<i>Risk tolerance</i> (10-pt scale)	3.42	2.61	2.08	2.00
<i>Commercialization activities</i> (5-pt scale)	4.17	3.64	3.41	2.61
<i>Managerial activities</i> (5-pt scale)	3.48	3.04	2.94	2.46
<i>Basic research activities</i> (5-pt scale)	3.76	3.97	3.75	4.28
<i>Applied research activities</i> (5-pt scale)	4.47	4.42	4.42	4.19
Context variables				
<i>Academic norms</i> (5-pt scale)	4.10	4.14	4.17	4.36
<i>Entrepreneurial norms</i> (5-pt scale)	3.35	3.36	3.19	3.13
<i>Founder role model</i> (1 if yes)	0.21	0.11	0.09	0.07
<i>Entrepreneurial opportunity</i> (5-pt scale)	3.04	2.60	2.41	2.13
Control variables				
<i>Ability</i> (10-pt scale)	6.60	6.37	6.19	6.30
<i>Overconfidence</i>	0.21	0.04	−0.05	−0.10
<i>Persistence</i> (5-pt scale)	4.21	4.01	3.93	3.98
<i>Parent self-employed</i> (binary)	0.36	0.28	0.25	0.29
<i>Male</i> (binary)	0.79	0.63	0.44	0.51
<i>Age</i>	27.92	27.71	27.33	27.73
<i>Married</i> (binary)	0.47	0.44	0.42	0.47
<i>Children</i> (1 if any children)	0.10	0.10	0.08	0.09

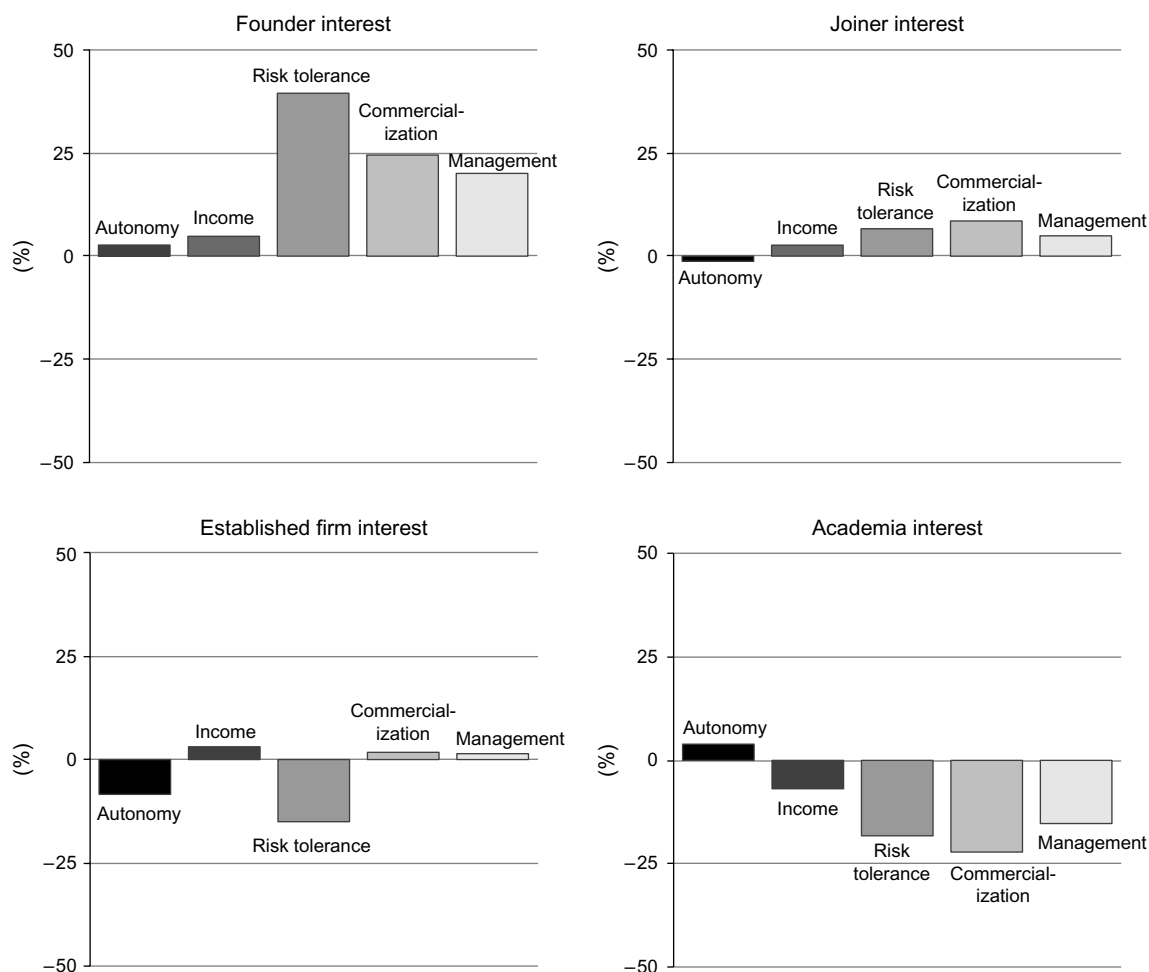
results. First, two individual traits frequently associated with entrepreneurship are ability (Hamilton 2000, Elfenbein et al. 2010, Åstebro et al. 2011) and overconfidence (Camerer and Lovo 1999, Hayward et al. 2006, Lowe and Ziedonis 2006). To proxy for these variables, we begin with a question that asked individuals “How would you rate your research ability relative to your peers in your specific field of study?” using a scale that ranged from “least skilled” (0) to “most skilled” (10).¹⁸ We contend that this measure reflects both respondents’ objective ability as well as their overconfidence in their ability. To disentangle these two components, we first regress self-assessed ability onto correlates of objective (research) ability reported in the survey, including the number of research awards, the number of publications, Ph.D. advisor’s ability, and National Research Council (2010) department rankings. We then calculate the predicted values from this regression, which correlate with the objective component of self-assessed ability and serve as our proxy for *Ability*. Next, we use the residual, which reflects the subjective component of self-assessed ability, as our proxy for *Overconfidence*. We

include both of these measures as controls in our regression analyses. Another individual trait that has been associated with entrepreneurship is *Persistence* (Bird 1988), which we measure by asking respondents how well the following statement describes them: “When I fail in something, I am determined to continue trying until I succeed.” Responses were recorded on a 5-point scale ranging from “Not at all like me” to “Just like me.”

Second, a potential econometric concern is that individuals with a long-standing interest in entrepreneurship may sort into departments that are more entrepreneurial, match with advisors who have founded a company, or choose research topics with greater commercial value, thereby leading to potentially biased estimates of the relationship between contextual factors and entrepreneurial interests. To partly address this concern, we include a number of control variables that are likely related to individuals’ preexisting interest in entrepreneurship. First, parents’ self-employment has been shown to be a strong predictor of entrepreneurial activity (Halaby 2003, Sørensen 2007). We include a binary variable that equals 1 if at least one parent is self-employed (*Parent self-employed*), as well as a second variable that equals 1 if at least one parent is working in academia (*Parent university employed*). We also control for prior start-up

¹⁸ This scale was presented to respondents as a slider that was moved from left to right using a mouse. The slider recorded numbers to the 10th’s decimal place, in effect allowing the response scale to cover 100 increments (from 0.0 to 10.0).

Figure 3 Percentage Difference from Sample Mean by Entrepreneurial Interest



work experience (Shane and Khurana 2003, Gompers et al. 2005, Sørensen 2007, Elfenbein et al. 2010) using a question that asked respondents whether they had ever worked in a start-up (yes or no).

Finally, since career interests may be shaped by perceived labor market conditions, we control for respondents' assessments of job availability in academia, established firms, and start-ups, respectively, in their particular field of study. In addition, consistent with prior studies (Stuart and Ding 2006), we include the number of patent applications as an alternative measure of opportunities. Lastly, we control for respondent demographic characteristics including gender, age, marital status, number of children, nationality, and fixed effects for each individual's university and field of science or engineering.

3.5. The Use of Survey Data

There are a number of general concerns when using survey data that we specifically addressed in the construction of the questionnaire. First, when dependent and independent variables are drawn from the same

source (i.e., a survey), correlations between variables may be inflated because of common methods bias. To reduce spurious correlations among variables, we separated questions in the survey and used different response scales where possible. In addition, the survey inquired about the general Ph.D. experience and a range of career paths to ensure that respondents were not primed to consider any one particular career path (e.g., entrepreneurship). Our empirical analysis that follows demonstrates that the featured independent variables exhibit distinct relationships with different career interests, indicating that the observed relationships are not merely artifacts of a common survey methodology. Moreover, a number of our control variables are measured using similar rating scales as our featured variables, which should account for potential individual-specific bias in responding to common measurement scales (i.e., an individual's tendency to report high or low ratings across questions).

Another concern with self-reported survey measures is that respondents may overstate preferences that seem socially desirable or may interpret questions

in different ways. Although these sources of measurement error are of concern in descriptive analyses, they affect regression analyses only to the extent that they correspond to unobservable respondent characteristics that are correlated with other featured variables. In anticipation of these concerns, we conducted survey pretests by interviewing respondents and found that they differed little in their interpretation of key questions. More importantly, we suggest that our rich set of control variables will account for much of the individual heterogeneity that is typically unobserved in prior studies, thereby controlling for potential sources of heterogeneity that might bias our estimates. Thus, any remaining individual differences in survey response behavior are likely noise and should have little effect on our ability to detect systematic relationships in a large sample of respondents.

Notwithstanding any remaining concerns regarding the use of survey data, our data provide a number of advantages for the purposes of this study. In particular, whereas many studies rely on secondary data such as tax records, business plans, or patents to identify entrepreneurs *ex post*, our data provide more direct measures of *ex ante* entrepreneurial and nonentrepreneurial interests for a large representative sample. Moreover, the detailed individual-level measures provided by the survey allow us to include variables that are typically measured using aggregate proxies or inferred indirectly, such as individuals' preferences for pecuniary and nonpecuniary job attributes, social influences, or perceived opportunities. Accordingly, these data enable us to perform a more nuanced analysis, while also allowing us to consider both individual and contextual factors simultaneously.

4. Analysis

We first examine how preferences and context relate with founder and joiner interests independently. We then examine the interplay between preferences and context while accounting for potential preference-based sorting into different entrepreneurial contexts. We conclude with robustness tests and ancillary analyses to explore the validity of our results and potential alternative explanations. For simplicity, throughout all our analyses we assume that preferences are relatively stable over time (Halaby 2003), and thus do not change appreciably during graduate training.¹⁹ Nevertheless, given limitations inherent in

cross-sectional survey data, we interpret our results as correlational rather than causal.

4.1. Comparing Individuals with Founder and Joiner Interests

We first perform a series of multinomial logistic regressions that contrast individuals with an interest in being a founder, a joiner, or an academic, to the reference group of those with an interest in working in established firms.²⁰ We chose established firms as the reference group to provide greater comparability between our results and prior studies, which often compare founders to individuals employed in (typically) large established firms. Table 3 reports the results for preferences and context variables separately in Models 1 and 2, and the full specification in Model 3. Model 4 complements the featured results by using an alternative dependent variable that reflects entrepreneurial interests relative to other career interests (see §3.2). Standard errors are clustered on universities to account for potential correlation across individuals due to their shared university and geographic region.

Focusing on the full specification in Model 3 of Table 3, we observe that individuals with stronger preferences for autonomy and risk are more likely to express an interest in being a founder (column 3a) or a joiner (column 3b) relative to those with a nonentrepreneurial interest in working in an established firm (the reference category). At the same time, despite these similarities the effect sizes for autonomy and risk tolerance differ markedly between founder and joiner interests. For example, a one standard deviation increase in a preference for autonomy increases the odds of expressing an interest in being a founder by 69%, whereas the same change increases the odds of expressing an interest in joining a start-up by 26%. We tested these differences formally and find that coefficient estimates for autonomy ($\chi^2 = 20.1$) and risk tolerance ($\chi^2 = 8.0$) are significantly different between those with founder and joiner interests.²¹

In contrast to the widely held belief that money is a strong motivating factor for entrepreneurship, we find that preferences for income do not distinguish individuals with a founder or a joiner interest from those interested in working in an established firm, although individuals interested in academia have a

¹⁹ Although we cannot rule out the possibility that preferences may also be shaped by contextual factors during graduate training, we compared mean responses for each preference variable across Ph.D. cohorts in the broader sample (e.g., first-year Ph.D.'s to fifth-year Ph.D.'s) and across different contextual condition. Descriptively, preferences are quite stable over the course of the Ph.D. program and there is no significant difference between those who were exposed to entrepreneurial contexts and those who were not.

²⁰ Although we believe that respondents view each career as a distinct alternative, we also performed alternative-specific conditional logistic regression that relaxes the assumption of the independence of irrelevant alternatives with substantively identical results.

²¹ We further tested for significant differences between founder and joiner interests using logistic regression that restricted the sample to only those individuals with an entrepreneurial interest with the same results.

significantly lower preference for income (column 3c). This result suggests that individuals with founder or joiner interests may be drawn to start-ups not by expectations of financial returns, but rather by nonpecuniary job attributes offered by an entrepreneurial work setting (Hamilton 2000). Indeed, when asked to estimate the average annual compensation—including salary, bonuses, and stock options—for employees in different types of firms, individuals with a founder interest expect start-ups to pay 15% less than established firms (\$78,921 for start-ups compared to \$92,820 for established firms). Similarly, individuals with a joiner interest expect start-ups to pay 16% less than established firms (\$73,782 compared to \$87,595). Thus, individuals seem to form an interest in entrepreneurship despite their expectations that it will pay less than employment in established firms.

With respect to work activities, we find that individuals with a preference for commercializing research results are more likely to express an interest in being founder or a joiner, but the difference between the two is large: a one standard deviation change increases the odds of expressing a founder interest by 133% and the odds of expressing a joiner interest by 32%. The difference between founder and joiner interests is significant ($\chi^2 = 26.3$). Individuals with a preference for managerial activities are also more likely to express an interest in being a founder or a joiner, although the difference is again large and significant ($\chi^2 = 17.2$). We find quite different results for individuals with a preference for conducting basic research, who are more likely to express a joiner interest but not a founder interest. These results illustrate that individuals' entrepreneurial interests differ markedly with respect to their preferences for work activities, with those attracted toward being a founder characterized by strong preferences for commercialization and managerial activities and those interested in being a joiner characterized by more moderate preferences for commercialization and functional work activities.

Turning our attention to contextual factors, we observe that the relationships between different contexts and founder and joiner interests, respectively, differ substantially. Although norms that encourage entrepreneurship have no relationship with a founder interest, they exhibit a significant positive association with a joiner interest. Conversely, having a Ph.D. advisor who has founded a company is significantly associated with a founder interest but not with a joiner interest. Although one might be concerned that entrepreneurial department norms and entrepreneurial advisors go hand in hand, the correlation between these two variables is small (0.11) and the results are robust to entering each variable separately.

We also note that although norms encouraging careers in academia are significantly associated with an interest in academia (column 3c), they are not associated with either a founder or a joiner interest. Thus, contrary to the popular notion that academia deters entrepreneurship, we find no evidence that norms encouraging careers in academia dampen the Ph.D.'s interest in entrepreneurship.

Finally, individuals who perceive their research as having greater commercial value are more likely to express an interest in being a founder, but not in being a joiner. Despite our expectation that opportunities will be a strong predictor of founder interests, the magnitude is not large: a one standard deviation increase in commercial value increases the odds of having a founder interest by only 26%. Although it may seem surprising that opportunities do not exhibit a stronger relationship with founder interests, as we discuss in §4.3, this may be due in part to the fact that a majority of respondents who express a founder interest do not believe that their current research has commercial value.²²

We complement our featured analysis by using an alternative dependent variable that reflects individuals' entrepreneurial interests relative to other career interests, as reported in Model 4 of Table 3. Recall from §3.2 that this dependent variable reclassifies individuals into either the established firm or academia category when these careers were rated as more attractive than entrepreneurship. As such, this approach concentrates those most interested in entrepreneurship in the founder and joiner categories. At the same time, by combining individuals with moderate entrepreneurial interests with those who lack entrepreneurial interests altogether into the academia and established firm categories, this approach makes the reference groups more entrepreneurial than in the featured analyses above. Nevertheless, the results are largely consistent with those in Model 3 of Table 3, providing further evidence of the robustness of our approach.

In summary, our results indicate that individuals with founder and joiner interests exhibit similar profiles when compared to those not interested in

²² Results for certain control variables also warrant mention. First, we note that (research) ability and overconfidence are not significantly associated with either a founder or a joiner interest. However, in ancillary analyses reported in §4.3 we find that overconfidence is significantly associated with respondents' perceptions of the commercial value of their research, as well as the perceived likelihood that they will start a company. Both persistence and having a parent who is self-employed exhibit strong positive associations with a founder interest, but not a joiner interest. Although not reported in Table 3, we also note that men are significantly more likely than women to have an interest in being a joiner or a founder. Marital status and number of children are not significantly associated with either a founder or a joiner interest.

Table 3 Baseline Analysis of Founder and Joiner Interests

Method:	Multinomial logit											
	Preferences			Context			Full specification			Alternate dependent variable		
Description:	<i>Founder interest</i>	<i>Joiner interest</i>	<i>Academia interest</i>	<i>Founder interest</i>	<i>Joiner interest</i>	<i>Academia interest</i>	<i>Founder interest</i>	<i>Joiner interest</i>	<i>Academia interest</i>	<i>Founder interest</i>	<i>Joiner interest</i>	<i>Academia interest</i>
Dependent variable:	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)	(3a)	(3b)	(3c)	(4a)	(4b)	(4c)
Model:												
<i>Autonomy</i>	0.68*** (0.09)	0.31*** (0.06)	0.50*** (0.07)				0.66*** (0.09)	0.29*** (0.06)	0.50*** (0.07)	0.56*** (0.07)	0.17*** (0.06)	0.64*** (0.06)
<i>Income</i>	-0.22 (0.12)	-0.14 (0.08)	-0.58*** (0.09)				-0.22 (0.12)	-0.13 (0.08)	-0.58*** (0.09)	-0.24 (0.13)	-0.16** (0.08)	-0.59*** (0.08)
<i>Risk tolerance</i>	0.11*** (0.03)	0.05** (0.02)	-0.02 (0.03)				0.11*** (0.03)	0.05** (0.02)	-0.03 (0.03)	0.10*** (0.03)	0.06*** (0.02)	-0.00 (0.02)
<i>Commercialization activities</i>	0.80*** (0.12)	0.26*** (0.07)	-0.44*** (0.07)				0.75*** (0.12)	0.24*** (0.07)	-0.44*** (0.07)	0.61*** (0.12)	0.12** (0.06)	-0.42*** (0.05)
<i>Managerial activities</i>	0.33*** (0.06)	0.10** (0.05)	0.00 (0.06)				0.34*** (0.06)	0.10** (0.05)	-0.00 (0.06)	0.32*** (0.06)	0.09** (0.04)	-0.02 (0.05)
<i>Basic research activities</i>	0.10 (0.08)	0.24*** (0.06)	0.30*** (0.08)				0.13 (0.09)	0.24*** (0.06)	0.30*** (0.07)	-0.09 (0.06)	0.00 (0.06)	0.35*** (0.06)
<i>Applied research activities</i>	-0.33** (0.16)	-0.14 (0.10)	-0.45*** (0.09)				-0.38** (0.16)	-0.15 (0.11)	-0.48*** (0.10)	-0.40*** (0.13)	-0.28*** (0.07)	-0.58*** (0.08)
<i>Academic norms</i>				0.04 (0.10)	0.02 (0.09)	0.25*** (0.09)	0.04 (0.11)	0.03 (0.10)	0.28*** (0.10)	-0.06 (0.11)	-0.12 (0.08)	0.28*** (0.07)
<i>Entrepreneurial norms</i>				0.05 (0.09)	0.30*** (0.07)	0.06 (0.07)	0.00 (0.10)	0.24*** (0.07)	-0.04 (0.08)	-0.05 (0.10)	0.15** (0.07)	-0.03 (0.08)
<i>Founder role model</i>				0.64*** (0.20)	0.13 (0.15)	0.04 (0.19)	0.56*** (0.19)	0.13 (0.15)	0.15 (0.20)	0.48*** (0.18)	0.07 (0.14)	0.02 (0.19)
<i>Entrepreneurial opportunity</i>				0.30*** (0.08)	0.12** (0.06)	-0.09 (0.07)	0.23*** (0.09)	0.10 (0.06)	0.05 (0.07)	0.17** (0.08)	0.03 (0.04)	0.00 (0.05)
<i>Ability</i>	0.03 (0.13)	-0.12 (0.10)	0.15 (0.12)	0.03 (0.13)	-0.08 (0.11)	0.17 (0.12)	-0.08 (0.14)	-0.16 (0.11)	0.10 (0.12)	-0.11 (0.13)	-0.18** (0.09)	0.22*** (0.09)
<i>Overconfidence</i>	0.01 (0.05)	-0.01 (0.03)	-0.03 (0.04)	0.04 (0.05)	0.02 (0.04)	-0.03 (0.04)	0.00 (0.05)	-0.01 (0.04)	-0.03 (0.04)	-0.02 (0.05)	-0.01 (0.04)	-0.03 (0.03)
<i>Persistence</i>	0.36*** (0.12)	0.06 (0.08)	-0.02 (0.08)	0.48*** (0.12)	0.13 (0.09)	0.08 (0.08)	0.34*** (0.13)	0.05 (0.09)	-0.03 (0.08)	0.27** (0.13)	-0.00 (0.09)	0.03 (0.08)
<i>Parent self-employed</i>	0.65*** (0.19)	0.16 (0.12)	0.23 (0.12)	0.57*** (0.19)	0.14 (0.11)	0.23** (0.12)	0.64*** (0.19)	0.16 (0.12)	0.24 (0.12)	0.50*** (0.19)	-0.01 (0.12)	0.14 (0.09)
Other control variables	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Observations		4,168			4,168			4,168			4,168	
Log-likelihood		-4,051.64			-4,467.28			-4,016.03			-4,211.15	

Notes. The dependent variable consists of four categories: *Founder interest* (likely to start own company), *Joiner interest* (attracted to start-up employment but not likely to start own company), *Academia interest* (not attracted to entrepreneurship but attracted to academic employment), and the reference group *Established firm interest* (not attracted to entrepreneurship but attracted to established firm employment). Model 4 uses an alternative measure of entrepreneurial interests that reclassifies individuals by their most attractive career. Control variables include gender, age, marital status, number of children, nationality, expectations of job availability (in start-ups, established firms, and academia), field of science or engineering, and university. Robust standard errors clustered on university reported in parentheses.

** $p < 0.05$; *** $p < 0.01$.

entrepreneurship. However, they also differ in significant ways from one another with respect to both preferences and contextual factors. Taken together, these results suggest that individuals with founder and joiner interests are both entrepreneurial in a general sense, but they also highlight the need to better understand the mechanisms that may shape these different entrepreneurial interests. We now seek to provide deeper insights into these mechanisms by exploring the interplay between preferences and context.

4.2. Examining the Interplay Between Preferences and Context

To examine the potential interplay between preferences and context in shaping different entrepreneurial interests, we employ a two-pronged approach by constructing intersection variables for each preference-context condition, as well as employing a regression technique to account for potential sorting into different contexts. We first create three sets of categorical variables that correspond to the intersection of individuals' preferences for entrepreneurial job attributes

on the one hand, and each of the three entrepreneurial contextual factors on the other. For example, to examine the interplay between preferences and norms we construct four binary variables that reflect whether or not individuals have preferences for entrepreneurial job attributes and whether or not they are in a research group that encourages careers in start-ups (i.e., the four categories are *preferences-norms*; *preferences-no norms*; *no preferences-norms*; *no preferences-no norms*). This coding scheme enables us to more carefully examine each preference-context condition, such as when norms are present and preferences are absent, which is not possible when using conventional interaction terms (Goodman 2002). In addition, this approach allows for a more intuitive interpretation of the resulting coefficient estimates compared to the use of interaction terms in nonlinear models (Ai and Norton 2003).

To obtain a measure of whether or not an individual has preferences for entrepreneurial job attributes, we summarize the set of preference measures using principal components factor analysis to construct a one-dimensional variable that serves as a proxy for the strength of respondents' preferences.²³ This approach is appropriate given our earlier findings that individuals with founder and joiner interests share similar preferences for entrepreneurial job attributes that differ primarily in their strength. As expected, the *Preferences* factor score is highly related with entrepreneurial interests: individuals with a founder interest exhibit the highest score (0.66), followed by those with a joiner interest (0.23), and finally those disinterested in entrepreneurship but interested in an established firm (0.13) or in academia (−0.62). We dichotomize the *Preferences* factor score such that positive values are coded as 1 (*Preferences for entrepreneurial job attributes*) and 0 for zero or negative values (*No preferences for entrepreneurial job attributes*). Similarly, we dichotomize the norms and opportunity variables to reflect whether each encourages entrepreneurial behaviors or not.²⁴ Using this approach, we are able to create three sets of categorical variables

²³ We conducted the principal components analysis using preferences for autonomy, income, risk, commercialization activities, and managerial activities. Given that preferences for conducting basic and applied research should not, in theory, be strongly associated with entrepreneurship, we exclude them from the principal components analysis but retain them in the regression analyses as control variables. We used oblimin(0) oblique rotation to allow the factors to have a nonzero correlation and then retained the first factor, which had an eigenvalue of 2.075. The variables with the highest factor loadings are preferences for commercialization (0.73), management (0.72), and income (0.70).

²⁴ Norms are coded as 1 when research groups “encourage” or “strongly encourage” careers in start-ups (4 or 5 on a 5-point scale), and 0 when such careers are “strongly discouraged,” “discouraged,” or “neither encouraged nor discouraged.” Similarly,

that reflect the intersection between preferences and contextual factors for each individual.

In the second step, we recognize that individuals with entrepreneurial preferences may “sort” into contexts that are more entrepreneurial. Although our cross-sectional data do not allow us to precisely identify sorting and treatment effects, we seek to more clearly disentangle preferences and context by adjusting for potential sorting. To do this, we employ inverse probability of treatment weights (IPTW), an econometric technique increasingly used to account for treatment effects in nonrandom samples (Robins et al. 2000, Hirano and Imbens 2002, Imbens 2004). IPTW involves a two-step procedure whereby we first estimate each respondent's probability of being in a given entrepreneurial context (i.e., a treatment condition) based on observable characteristics. These probabilities are then transformed into weights that are used in a second-stage regression of entrepreneurial interests.²⁵ To illustrate, consider Ph.D. candidates whose advisors have founded a company. IPTW gives less weight to those individuals who are more likely to match with an entrepreneurial advisor based on their observable characteristics, thereby adjusting coefficient estimates for potential sorting.

IPTW is based on the assumption that the determinants of sorting into a treatment condition are observed in the data. Our rich survey data enable us to include in the first-stage regressions a wide range of variables that may drive sorting such as individual preferences, prior start-up work experience, parent self-employment, gender, nationality, university, and field of study. To gain further traction in our attempt to account for potential sorting, we utilize a survey measure of respondents' career interests prior to starting their Ph.D. program. This question asked “Thinking back to when you began your Ph.D. program in [year of matriculation], how certain were you at that time that you wanted to pursue a career in a [start-up, established firm, or university, respectively] with an emphasis on research or development?” Responses were scored on a 5-point scale ranging from “Certain not to pursue” to “Certain to pursue.” Approximately 35% of respondents in our sample report a pre-Ph.D. interest in entrepreneurship (4 or 5 on the 5-point scale), and of these the majority express an interest in being a joiner (66%) rather than a founder (23%). We also note that 73% of those expressing a founder

opportunities are coded as 1 when commercial value is “high” or “extremely high” (4 or 5 on a 5-point scale). Having a Ph.D. advisor who has founded a company is already binary.

²⁵ The weight for the average treatment effect is constructed as $\hat{\omega}(t, x) = 1/\hat{e}(x) + (1-t)/(1-\hat{e}(x))$, where t is the treatment condition and $\hat{e}(x)$ is the predicted probability (Robins et al. 2000, Hirano and Imbens 2002, Imbens 2004).

interest and 50% of those expressing a joiner interest report a pre-Ph.D. interest in entrepreneurship, suggesting that for many, entrepreneurial interests may form at earlier stages of life. At the same time, roughly half (46%) of individuals who reported an interest in entrepreneurship at the time of the survey did not have one prior to starting their Ph.D., suggesting that their entrepreneurial interests formed during the Ph.D. program.²⁶ Given that pre-Ph.D. interests are measured contemporaneously with the founder and joiner interest variables, we cannot rule out the possibility that some respondents who became interested in entrepreneurship during the course of their Ph.D. studies might overstate their pre-Ph.D. interest in entrepreneurship.²⁷ For these individuals, however, the first-stage regressions will estimate a higher probability of sorting into a given entrepreneurial context, resulting in lower weights in the second-stage equation and more conservative coefficient estimates.

The results of the IPTW multinomial logistic regressions with preference-context intersection variables and the full set of control variables are presented in Table 4. (The appendix shows the results of the first-stage sorting equations). We first examine the interplay between preferences and entrepreneurial norms in Model 1. After adjusting for potential sorting based on observable characteristics, we find that the likelihood of expressing a founder interest is significantly higher for individuals with entrepreneurial preferences irrespective of whether they are exposed to norms that encourage careers in start-ups (*Preferences & Norms*) or not (*Preferences & No norms*). The difference between these two conditions is insignificant ($\chi^2 = 0.36$). More interesting, however, is that absent preferences for entrepreneurial job attributes, exposure to entrepreneurial norms (*No preferences & Norms*) is not significantly associated with an interest in being a founder. Overall these results suggest that norms themselves have little influence on shaping a founder interest. The pattern for a joiner interest is quite different (column 1b). We find that the likelihood of forming a joiner interest is greatest when individuals both have entrepreneurial preferences and are in a group that encourages careers in start-ups (*Preferences & Norms*). Individuals with preferences but not exposed to entrepreneurial norms (*Preferences & No norms*) are still likely to have a joiner interest,

but the magnitude is significantly smaller. In particular, the odds of expressing a joiner interest is 98% higher for those in the *Preferences & Norms* condition compared to 50% for those in the *Preference & No norms* condition. We also find that individuals who lack preferences but are exposed to norms that encourage entrepreneurship (*No preferences & Norms*) are more likely to have a joiner interest, suggesting that norms may shape interests in joining a start-up as an employee in individuals who lack preferences for entrepreneurial job attributes.

Turning to the interplay between preferences and founder role models in Model 2 of Table 4, we again find that individuals with preferences for entrepreneurial job attributes are significantly more likely to express a founder interest irrespective of whether they have an advisor who has been a founder (*Preferences & Role model*) or not (*Preferences & No role model*). Nevertheless, having an entrepreneurial advisor does increase the likelihood of forming a founder interest: the odds of expressing a founder interest when both preferences and an entrepreneurial advisor are present is 293% greater compared to 113% when only preferences are present. This difference is significant ($\chi^2 = 24.6$). Perhaps most interesting, we find that entrepreneurial advisors have no significant association with a founder interest in individuals who do not have preferences for entrepreneurial job attributes (*No preferences & Role model*), possibly indicating that individuals who lack such preferences are resilient to the influence of founder role models. Indeed, the vast majority of individuals with an advisor who has started a company (78.2%) do not express a founder interest, indicating that exposure to founder role models alone does not appear to be sufficient to shape a founder interest. We find no significant interplay between preferences and founder role models in shaping a joiner interest. This suggests that entrepreneurial advisors may act as a *founder* role model who reinforces individuals' interest in being a founder, but they have little influence on interests in joining a start-up as an employee.

Finally, Model 3 of Table 4 explores the interplay between preferences and entrepreneurial opportunities. Consistent with the above results for both norms and role models, we find that individuals with entrepreneurial preferences are more likely to express a founder interest irrespective of whether they have an opportunity (*Preferences & Opportunity*) or not (*Preferences & No opportunity*). This suggests that an opportunity is not necessary for a founder interest to form. At the same time, the odds of expressing a founder interest is greater when individuals have both preferences and an opportunity (369%) than when individuals have preferences alone (212%). Interestingly, individuals who do not have entrepreneurial preferences but

²⁶ Approximately 12% of respondents reported a pre-Ph.D. interest in entrepreneurship but not an interest in being a founder or a joiner at the time of the survey, suggesting that their entrepreneurial interest declined during their Ph.D. studies.

²⁷ Although retrospective questions are useful if other measures are unavailable, respondents' current views may bias retrospective reports such that they are more similar to current behaviors and interests than is warranted.

Table 4 Interplay Between Preferences and Context

Method:	Inverse probability of treatment weighted multinomial logit								
Description:	Entrepreneurial preferences and entrepreneurial norms			Entrepreneurial preferences and founder role model			Entrepreneurial preferences and entrepreneurial opportunity		
Dependent variable:	<i>Founder interest</i>	<i>Joiner interest</i>	<i>Academia interest</i>	<i>Founder interest</i>	<i>Joiner interest</i>	<i>Academia interest</i>	<i>Founder interest</i>	<i>Joiner interest</i>	<i>Academia interest</i>
Model:	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)	(3a)	(3b)	(3c)
<i>Preferences & Norms</i>	0.55** (0.23)	0.68*** (0.19)	−0.90*** (0.23)						
<i>Preferences & No norms</i>	0.68*** (0.21)	0.40*** (0.11)	−0.67*** (0.13)						
<i>No preferences & Norms</i>	−0.25 (0.32)	0.44** (0.19)	−0.09 (0.19)						
<i>No preferences & No norms</i> (omitted category)	—	—	—						
<i>Preferences & Role model</i>				1.07*** (0.38)	0.12 (0.31)	−0.28 (0.44)			
<i>Preferences & No role model</i>				0.63*** (0.19)	0.09 (0.13)	−0.97*** (0.16)			
<i>No preferences & Role model</i>				0.43 (0.45)	−0.50 (0.31)	−0.49 (0.31)			
<i>No preferences & No role model</i> (omitted category)				—	—	—			
<i>Preferences & Opportunity</i>							1.31*** (0.28)	0.73*** (0.16)	−0.65** (0.31)
<i>Preferences & No opportunity</i>							0.75*** (0.20)	0.39*** (0.14)	−0.66*** (0.14)
<i>No preferences & Opportunity</i>							0.68** (0.34)	0.59** (0.24)	0.28 (0.36)
<i>No preferences & No opportunity</i> (omitted category)							—	—	—
<i>Work interest—Basic research</i>	0.04 (0.09)	0.26*** (0.07)	0.36*** (0.10)	−0.03 (0.14)	0.08 (0.12)	0.09 (0.17)	0.11 (0.11)	0.28*** (0.06)	0.45*** (0.10)
<i>Work interest—Applied research</i>	−0.24 (0.15)	−0.07 (0.11)	−0.46*** (0.09)	−0.07 (0.21)	−0.12 (0.17)	−0.50*** (0.16)	−0.06 (0.16)	−0.22 (0.13)	−0.49*** (0.13)
<i>Academic norms</i>	0.11 (0.11)	0.07 (0.09)	0.40*** (0.11)	−0.07 (0.16)	−0.10 (0.14)	0.21 (0.14)	0.04 (0.12)	0.06 (0.11)	0.17 (0.12)
<i>Entrepreneurial norms</i>				0.07 (0.15)	0.30*** (0.12)	0.11 (0.11)	0.18 (0.13)	0.28*** (0.10)	0.11 (0.13)
<i>Advisor—Founder</i>	0.60*** (0.20)	0.17 (0.16)	0.10 (0.25)				0.49** (0.22)	0.22 (0.15)	0.34 (0.24)
<i>Commercial opportunity</i>	0.33*** (0.10)	0.12** (0.06)	0.08 (0.10)	0.26** (0.12)	0.18 (0.10)	0.14 (0.10)			
Control variables	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Constant	−5.07*** (1.39)	−1.33 (1.09)	1.20 (1.30)	−6.04*** (2.37)	1.39 (1.89)	4.77*** (1.74)	−4.30*** (1.18)	0.22 (1.04)	3.96*** (1.00)
Observations		4,168			4,168			4,168	
Log-likelihood		−7,669.17			−7,622.12			−7,517.38	

Notes. The dependent variable consists of four categories: *Founder interest* (likely to start own company), *Joiner interest* (attracted to start-ups but not likely to start own company), *Academia interest* (not attracted to entrepreneurship but attracted to academia), and the reference group *Established firm interest* (not attracted to entrepreneurship but attracted to established firms). Refer to the text for details on the construction of the preference-context intersection variables. Control variables include ability, overconfidence, persistence, parents' employment, gender, age, marital status, number of children, nationality, pre-Ph.D. career interests (academia and established firm), expectations of job availability (in start-ups, established firms, and academia), field of science or engineering, and university. Robust standard errors clustered on university reported in parentheses.

** $p < 0.05$; *** $p < 0.01$.

do believe that their research has commercial value (*No preferences & Opportunity*) are also more likely to express a founder interest, although the coefficient is smaller. This result is in striking contrast to the previous results that norms and role models have little

association with founder interests among those who lack entrepreneurial preferences, possibly suggesting that the discovery of an opportunity has a stronger or qualitatively different influence on founder interests than do social factors. It is important to note that by

virtue of being in the *No preferences* group, the discovery of an opportunity did not appear to dramatically increase these individuals' preferences for entrepreneurial job attributes. Rather, it appears that perceived opportunities may shape founder interests in individuals whose preferences are not aligned with entrepreneurship. We observe the same pattern for joiner interests, although the magnitude is smaller.

To examine the role of opportunities more closely, we descriptively analyzed the joint distributions of career interests and the perceived commercial value of respondents' research. Focusing first on those who believe that their research has commercial value, we find that only 20% express an interest in being a founder, whereas 51% express an interest in joining a start-up as an employee. The remaining 29% are not interested in entrepreneurship at all. These results suggest that not everyone with a potential commercial opportunity wants to be a founder, raising the interesting question of whether and how opportunities are commercialized, and by whom. Second, we find that of those who express an interest in being a founder, only 39% believe that their research has commercial value. This suggests that the majority of Ph.D.'s with a founder interest do not yet possess an opportunity, or at least not one emanating from their own research. This observation is consistent with prior research on academic entrepreneurship. For example, both Roberts (1991) and Shane (2004) found that many technology entrepreneurs reported a long-standing desire to be an entrepreneur even before they started their company.²⁸

4.3. Robustness Tests and Ancillary Analyses

Table 5 reports a series of robustness checks to address potential concerns regarding the use of cross-sectional survey data, as well as to explore alternative explanations. First, we focus on individuals with the strongest and weakest interests in entrepreneurship by excluding from the sample respondents who rated the attractiveness of working in a start-up as 4 (attractive) or 3 (neither attractive nor unattractive). As seen in Model 1 the results are largely robust to this exclusion. Second, we restrict the sample to

Ph.D. candidates who will graduate within the coming year under the assumption that they are closest to making a career choice, and as such their career interests should be particularly salient and defined. The results in Model 2 are largely consistent with those in Table 3. Third, Model 3 includes as a control variable individuals' pre-Ph.D. interest in entrepreneurship to account for potential sorting at the time of entering the Ph.D. Even though this retrospective measure may overstate preexisting interests in entrepreneurship, the results are very similar to our featured results in Table 3. Finally, it is conceivable that upon discovering an entrepreneurial opportunity, individuals may develop a stronger interest in commercialization or may increase their preferences for entrepreneurial job attributes. To account for this, Model 4 excludes individuals who report that their research has commercial value and we find that the estimates for the preference variables remain largely unchanged.

We further complement our featured analysis by examining the two separate survey questions used to construct the measure of entrepreneurial interests (i.e., the expected likelihood of starting one's own company and the attractiveness of working in a start-up), as well as the attractiveness of careers in established firms and academia. Table 6 reports ordered logistic regression results for each of these four variables regressed onto the same set of preference, context, and control variables as in the featured analyses. First, Model 1 examines respondents' expectations of the likelihood that they will start their own company, and the results are largely consistent with founder interests as reported in the featured results in Table 3. It is interesting to note that whereas overconfidence was not significant in the previous analysis, we now find that it is significantly associated with expectations of starting a company, which is consistent with conventional portrayals of founders as being overconfident (Camerer and Lovallo 1999, Hayward et al. 2006, Lowe and Ziedonis 2006). Model 2 reports results when the dependent variable is the attractiveness of a career in a start-up, and Models 3 and 4 do the same for the attractiveness of established firms and academia, respectively. The results are largely in line with those in the featured analysis. More importantly, these results show that preferences and contextual factors have different relationships with the attractiveness of different career paths. This is notable for two reasons. First, the observed differences in coefficients for the attractiveness of start-ups and established firms suggest that respondents view entrepreneurship as a distinct career path and not simply a form of "industry" employment. Second, these results demonstrate that the same independent variables relate in meaningfully different ways with different dependent

²⁸ One may wonder why individuals with preexisting entrepreneurial interests enter a Ph.D. program in the first place. Our interviews suggest that the preponderance of students chose to do a Ph.D. out of an "interest in doing research" and a belief that earning a Ph.D. will provide better job opportunities in the future. Moreover, a number of our interviewees with strong founder interests stated that they were pursuing a Ph.D. because they believed it would provide them with training and credentials necessary to succeed in starting a company based on scientific research. Some also believed that their Ph.D. research might provide a discovery that would be the basis for a start-up, although they also acknowledged the uncertainty of such an outcome.

Table 5 Robustness Tests

Method:	Multinomial logit											
	Restrict sample to high/low attractiveness of start-up career			Restrict sample to respondents preparing to graduate			Control for pre-Ph.D. entrepreneurial interest			Exclude respondents with entrepreneurial opportunity		
Description:	Founder interest	Joiner interest	Academia interest	Founder interest	Joiner interest	Academia interest	Founder interest	Joiner interest	Academia interest	Founder interest	Joiner interest	Academia interest
Dependent variable:	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)	(3a)	(3b)	(3c)	(4a)	(4b)	(4c)
<i>Autonomy</i>	0.59*** (0.13)	0.20** (0.10)	0.53*** (0.07)	0.55*** (0.10)	0.26*** (0.09)	0.52*** (0.09)	0.67*** (0.09)	0.29*** (0.07)	0.48*** (0.07)	0.64*** (0.11)	0.31*** (0.07)	0.52*** (0.08)
<i>Income</i>	0.05 (0.16)	0.05 (0.11)	-0.58*** (0.09)	-0.24 (0.15)	-0.15 (0.10)	-0.64*** (0.13)	-0.33*** (0.13)	-0.20** (0.09)	-0.54*** (0.10)	-0.32** (0.13)	-0.15 (0.09)	-0.62*** (0.10)
<i>Risk tolerance</i>	0.12*** (0.03)	0.06** (0.03)	-0.04 (0.03)	0.15*** (0.03)	0.06** (0.03)	-0.00 (0.04)	0.09*** (0.03)	0.04** (0.02)	-0.02 (0.03)	0.11*** (0.03)	0.04 (0.03)	-0.04 (0.03)
<i>Commercialization activities</i>	1.11*** (0.19)	0.46*** (0.11)	-0.44*** (0.07)	0.84*** (0.16)	0.27*** (0.09)	-0.41*** (0.10)	0.62*** (0.12)	0.17** (0.07)	-0.40*** (0.07)	0.85*** (0.13)	0.25*** (0.08)	-0.44*** (0.07)
<i>Managerial activities</i>	0.38*** (0.10)	0.19*** (0.08)	-0.00 (0.06)	0.25*** (0.08)	0.09 (0.08)	-0.03 (0.09)	0.30*** (0.07)	0.07 (0.05)	0.02 (0.06)	0.32*** (0.06)	0.07 (0.05)	0.02 (0.06)
<i>Basic research activities</i>	0.27*** (0.11)	0.16 (0.09)	0.31*** (0.08)	0.22** (0.10)	0.32*** (0.08)	0.34*** (0.08)	0.16** (0.08)	0.26*** (0.06)	0.30*** (0.08)	0.12 (0.11)	0.18*** (0.07)	0.23*** (0.09)
<i>Applied research activities</i>	-0.10** (0.20)	0.29 (0.15)	-0.49*** (0.10)	-0.38 (0.20)	-0.15 (0.13)	-0.53*** (0.10)	-0.44*** (0.17)	-0.19 (0.11)	-0.45*** (0.10)	-0.46*** (0.18)	-0.10 (0.11)	-0.47*** (0.10)
<i>Academic norms</i>	0.06 (0.18)	0.10 (0.13)	0.34*** (0.10)	0.10 (0.14)	0.13 (0.12)	0.39*** (0.12)	0.11 (0.12)	0.09 (0.10)	0.27*** (0.10)	0.08 (0.10)	0.04 (0.10)	0.29*** (0.11)
<i>Entrepreneurial norms</i>	0.10 (0.15)	0.25 (0.14)	-0.04 (0.08)	0.03 (0.12)	0.33*** (0.10)	0.06 (0.10)	-0.10 (0.10)	0.16** (0.08)	-0.01 (0.08)	-0.11 (0.11)	0.30*** (0.09)	-0.02 (0.08)
<i>Founder role model</i>	0.68** (0.28)	0.37** (0.19)	0.13 (0.23)	0.45** (0.21)	0.14 (0.21)	0.29 (0.26)	0.56*** (0.20)	0.16 (0.16)	0.12 (0.20)	0.80*** (0.30)	0.18 (0.17)	0.18 (0.24)
<i>Entrepreneurial opportunity</i>	0.29** (0.14)	0.11 (0.08)	0.07 (0.07)	0.22** (0.10)	0.08 (0.07)	0.00 (0.07)	0.20** (0.08)	0.08 (0.06)	0.07 (0.07)			
<i>Pre-Ph.D. start-up career interest</i>							1.21*** (0.13)	0.76*** (0.06)	-0.41*** (0.07)			
Control variables	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Constant	-15.53*** (2.03)	-7.94*** (1.43)	0.04 (1.12)	-7.95*** (1.76)	-3.16*** (1.19)	0.29 (1.28)	-12.13*** (1.37)	-4.50*** (0.98)	1.95 (1.06)	-9.26*** (1.99)	-3.51*** (1.30)	-0.10 (1.29)
Observations		2,369			2,609			4,168			3,262	
Log-likelihood		-1,924.31			-2,459.18			-3,673.27			-3,075.22	

Notes. Control variables include ability, overconfidence, persistence, parents' self-employment or university employment, gender, age, marital status, children, nationality, expectations of job availability (in start-ups, established firms, and academia), field of science or engineering, and university. Robust standard errors clustered on university reported in parentheses.

** $p < 0.05$; *** $p < 0.01$.

variables, further mitigating concerns over common methods bias (see §3.5).

5. Conclusion

In this study, we focused attention on different entrepreneurial actors by investigating which individuals aspire to participate in entrepreneurship as a founder and which are drawn toward joining founders as start-up employees. Using a broad and representative sample of 4,168 science and engineering Ph.D.'s prior to their initial career transition, we first showed that interests in joining entrepreneurial ventures as an employee are much more pervasive than interests in becoming a founder. We then performed a series of regression analyses to compare individuals interested

in being a founder or a joiner to those not interested in entrepreneurship. Our results indicate that individuals with a joiner interest share many similarities with those interested in being a founder, suggesting that joiners are entrepreneurial in ways previously not considered. At the same time, we also find significant differences with respect to preferences for entrepreneurial job attributes and contextual factors that encourage entrepreneurial activity. Moreover, our analyses suggest that individual preferences and contextual factors do not simply have independent relationships with entrepreneurial interests, but instead they interrelate in systematic and meaningful ways to shape different career interests.

Our results should be considered in light of some important limitations. First, the cross-sectional survey data limit our ability to identify underlying causal

Table 6 Career Interest Measures

Method:	Ordered logit			
	<i>Likely to start own company</i>	<i>Attractiveness of start-up</i>	<i>Attractiveness of established firm</i>	<i>Attractiveness of academia</i>
Model:	(1)	(2)	(3)	(4)
<i>Autonomy</i>	0.26*** (0.04)	0.00 (0.04)	−0.38*** (0.04)	0.82*** (0.05)
<i>Income</i>	0.03 (0.05)	0.31*** (0.04)	0.55*** (0.04)	−0.19*** (0.05)
<i>Risk tolerance</i>	0.09*** (0.01)	0.05*** (0.01)	0.01 (0.01)	0.03** (0.02)
<i>Commercialization activities</i>	0.39*** (0.04)	0.64*** (0.04)	0.54*** (0.04)	−0.12*** (0.04)
<i>Managerial activities</i>	0.23*** (0.02)	0.11*** (0.03)	0.07** (0.03)	−0.17*** (0.03)
<i>Basic research activities</i>	−0.06 (0.04)	0.03 (0.04)	0.06 (0.05)	0.92*** (0.04)
<i>Applied research activities</i>	0.10 (0.06)	0.33*** (0.07)	0.56*** (0.06)	−0.02 (0.06)
<i>Academic norms</i>	−0.10** (0.05)	−0.12** (0.06)	−0.01 (0.04)	0.07 (0.05)
<i>Entrepreneurial norms</i>	−0.02 (0.04)	0.25*** (0.05)	0.07 (0.05)	0.09** (0.04)
<i>Founder role model</i>	0.25** (0.11)	0.05 (0.11)	−0.11 (0.12)	0.08 (0.09)
<i>Entrepreneurial opportunity</i>	0.22*** (0.03)	0.05 (0.03)	0.08*** (0.03)	0.07*** (0.02)
<i>Ability</i>	0.06 (0.06)	−0.23*** (0.05)	−0.13** (0.05)	0.52*** (0.05)
<i>Overconfidence</i>	0.06*** (0.02)	0.01 (0.02)	0.03 (0.02)	0.12*** (0.02)
<i>Persistence</i>	0.18*** (0.06)	0.11** (0.05)	0.08 (0.04)	0.06 (0.04)
<i>Parent self-employed</i>	0.34*** (0.07)	0.01 (0.07)	−0.15*** (0.06)	−0.00 (0.07)
<i>Male</i>	0.85*** (0.07)	0.51*** (0.06)	0.07 (0.07)	0.48*** (0.08)
<i>Age</i>	−0.00 (0.01)	−0.00 (0.01)	−0.00 (0.01)	0.00 (0.02)
Other control variables	Incl.	Incl.	Incl.	Incl.
Observations	4,168	4,168	4,168	4,168
Log-likelihood	−4,689.61	−5,103.25	−4,701.92	−4,720.92

Notes. The dependent variables are respondents' reports of how likely they are to start their own company (Model 1) and the attractiveness of careers in a start-up (Model 2), an established firm (Model 3), and in academia (Model 4), respectively (all measured on a 5-point scale). Control variables include marital status, children, nationality, expectations of job availability (in start-ups, established firms, and academia), field of science or engineering, and university. Robust standard errors clustered on university reported in parentheses.

** $p < 0.05$; *** $p < 0.01$.

mechanisms. As discussed below, however, our insights regarding differences and similarities between founder and joiner interests have important implications even when interpreted as correlational in nature. Relatedly, although our analysis employing inverse probability of treatment weights provided only tentative insights into potential sorting and treatment effects, the results point toward particularly promising areas for future longitudinal studies seeking to determine when and how sorting versus treatment

explain entrepreneurial behaviors. Disentangling sorting and treatment effects is particularly important from a policy perspective since each would suggest unique mechanisms for stimulating different types of entrepreneurial activity. Finally, our sample consists of science and engineering Ph.D.'s, a small and highly specialized segment of the knowledge workforce who contribute disproportionately to innovation and entrepreneurship. Although our general discussion of founder and joiner interests is likely to apply

to entrepreneurship more generally, the specific relationships between preferences, context, and entrepreneurial interests may be different in other settings. However, given the increasing importance of academic entrepreneurship in creating economic growth, as well as increasing interest in the science and engineering workforce, we believe that our empirical setting is highly relevant and provides important insights to both scholars and policy makers alike.

These results have a number of implications for the literature regarding entrepreneurial activity, founding teams, and human capital. First, we provide evidence that not all individuals interested in entrepreneurship want to be founders, and those who want to join entrepreneurial ventures as employees exhibit unique entrepreneurial profiles. Thus, rather than considering all early start-up members as entrepreneurs (cf. Gompers et al. 2005, Sørensen 2007), scholars may benefit from clearly distinguishing between different entrepreneurial actors (cf. Dobrev and Barnett 2005, Burton and Beckman 2007, Beckman and Burton 2008, Eesley et al. 2014). Such a distinction should provide a sharper lens for examining founder and employee transitions to entrepreneurship, as well as investigating the specific contributions of joiners to new venture performance.

Our discussion also suggests that career interests may be an important factor to consider with respect to recruiting and retaining talented entrepreneurial human capital. In particular, a growing body of research on entrepreneurial spawning from small firms (Gompers et al. 2005, Sørensen 2007, Elfenbein et al. 2010) suggests that some individuals work in start-ups to learn about becoming a founder. Although such individuals may seem like ideal start-up employees given their interest in entrepreneurship, start-ups may be better off hiring individuals interested in the start-up employee role and who have little interest in starting a company themselves. At the other extreme, hiring primarily for talent without consideration for individuals' career interests may result in higher wages and great turnover for employees with a *distaste* for entrepreneurship.

Our results provide evidence that both individual preferences and contextual factors relate significantly with entrepreneurial interests, although these relationships are more nuanced than portrayed in prior work. In particular, whereas prior research has largely focused on individual characteristics or contextual factors in isolation, our results suggest that they may play different roles for different individuals and may even have important joint effects. As a consequence, empirical studies focusing on one set of factors while ignoring or simply controlling for the other are likely to provide an incomplete picture. For example, our results suggest that for many, a desire to

be a founder is based largely on (possibly innate) preferences. For others, however, an interest in being a founder seems to emerge after discovering an opportunity, even in the absence of preferences for entrepreneurial job attributes. Even more importantly, our results suggest that preferences and context *jointly* may be most conducive to the formation of an interest in joining a start-up. To the extent that individuals have preferences for entrepreneurial job attributes such as autonomy, risk, and commercialization, but are not exposed to organizational or cultural influences that encourage entrepreneurial behaviors, the supply of entrepreneurial human capital may be constrained. Conversely, the culture of entrepreneurial regions such as Silicon Valley and Boston may highlight start-ups as a viable work setting, thereby raising the salience of latent joiner interests in individuals whose preferences for job attributes and work activities align with entrepreneurship.

Our results may also inform efforts by educators and policy makers to increase the supply of entrepreneurial human capital or to stimulate academic entrepreneurship. In particular, the results suggest that simply changing entrepreneurial norms, exposing individuals to founder role models, or mandating entrepreneurship courses may not result in the desired outcomes, especially if directed at individuals who lack preferences for entrepreneurial job attributes. Accordingly, efforts aimed at increasing entrepreneurial activity may benefit from considering which individuals might be most receptive to policy interventions and what role they might play in entrepreneurial firms.

Our findings also suggest several areas for future research. First, longitudinal studies are needed to examine how founder and joiner interests translate into entrepreneurial activity. As alluded to earlier, studying *ex ante* interests separately from realized transitions allows for the consideration of not only the match between interests and actual career outcomes but also the potential mismatch. For example, it will be interesting to examine which individuals with a founder interest do not become a founder and why. Insights into this question may provide information on the obstacles that these individuals face in their efforts to realize their entrepreneurial intentions. At the same time, future research is needed to examine whether and how individuals with a founder interest but who lack immediate entrepreneurial opportunities acquire the opportunities necessary to launch a new venture. It is conceivable that these individuals are willing to launch ventures even with low-quality opportunities, which may have potentially detrimental effects on their entrepreneurial success. On the other hand, some individuals may become entrepreneurs even though they have little genuine interest in

entrepreneurship. This may be due in part to a lack of career alternatives, or perhaps because they discover opportunities that are simply too good to pass up. Whether a founder had a longstanding interest in becoming an entrepreneur or responded to the unexpected discovery of an opportunity may have important implications for the success of a new venture.

Most importantly, our findings highlight the need to complement the pervasive focus in extant entrepreneurship research on founders with research on joiners, individuals drawn to entrepreneurship for different reasons and who likely play distinct roles in entrepreneurial ventures. How do founders identify others interested in joining their efforts? To what extent do the similarities between founders and joiners facilitate the formation of more effective entrepreneurial teams? Do the significant differences we observed with respect to preferences and context create tensions between founders and joiners, or do they facilitate the division of labor among complementary

entrepreneurial roles? We hope that our study stimulates future research on these and other intriguing questions.

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Appendix. First-Stage Logit Regressions for Inverse Probability of Treatment Weights

Method: Description:	Logit Entrepreneurial norms		Logit Founder role model		Logit Entrepreneurial opportunity	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Autonomy</i>	0.06 [0.04]		0.17** [0.08]		0.18** [0.07]	
<i>Income</i>	-0.03 [0.05]		0.06 [0.08]		-0.01 [0.07]	
<i>Risk tolerance</i>	-0.01 [0.02]		0.02 [0.02]		0.03 [0.02]	
<i>Commercialization activities</i>	0.01 [0.04]		0.20*** [0.06]		0.29*** [0.05]	
<i>Managerial activities</i>	0.08** [0.04]		-0.03 [0.05]		-0.06 [0.04]	
<i>Entrepreneurial preference (binary)</i>		0.01 [0.08]		0.17 [0.12]		0.24** [0.10]
<i>Basic research activities</i>	0.13*** [0.03]	0.12*** [0.03]	-0.17** [0.08]	-0.17** [0.08]	-0.26*** [0.04]	-0.26*** [0.04]
<i>Applied research activities</i>	0.04 [0.05]	0.05 [0.05]	0.03 [0.11]	0.12 [0.12]	0.41*** [0.08]	0.51*** [0.07]
<i>Pre-Ph.D. start-up career interest</i>	0.22*** [0.05]	0.23*** [0.05]	0.01 [0.06]	0.05 [0.06]	0.06 [0.06]	0.11 [0.06]
<i>Pre-Ph.D. faculty career interest</i>	0.01 [0.04]	0.01 [0.04]	0.01 [0.05]	0.03 [0.05]	0.05 [0.06]	0.07 [0.05]
<i>Pre-Ph.D. established firm career interest</i>	0.02 [0.05]	0.01 [0.04]	0.12* [0.07]	0.11* [0.07]	0.07 [0.05]	0.06 [0.04]
<i>Prior start-up work experience</i>	0.04 [0.11]	0.04 [0.11]	0.42*** [0.15]	0.42*** [0.15]	0.30*** [0.11]	0.30*** [0.11]
<i>Male</i>	-0.05 [0.08]	-0.06 [0.08]	-0.03 [0.12]	-0.00 [0.13]	-0.17** [0.07]	-0.12 [0.07]
<i>Age</i>	-0.01 [0.01]	-0.01 [0.01]	-0.02 [0.02]	-0.02 [0.02]	-0.01 [0.02]	-0.01 [0.02]
<i>Ability</i>	0.19*** [0.07]	0.21*** [0.07]	0.33*** [0.08]	0.34*** [0.08]	0.49*** [0.08]	0.49*** [0.08]
<i>Overconfidence</i>	-0.01 [0.02]	-0.01 [0.02]	-0.01 [0.04]	0.00 [0.04]	0.11*** [0.03]	0.11*** [0.03]

(Continued)

Method: Description:	Logit Entrepreneurial norms		Logit Founder role model		Logit Entrepreneurial opportunity	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Persistence</i>	0.11*** [0.04]	0.12*** [0.04]	-0.02 [0.08]	0.01 [0.08]	0.26*** [0.07]	0.30*** [0.07]
<i>Parent self-employed</i>	-0.06 [0.07]	-0.07 [0.07]	0.08 [0.13]	0.08 [0.13]	-0.02 [0.10]	-0.02 [0.10]
<i>Parent university-employed</i>	-0.01 [0.08]	-0.01 [0.08]	0.09 [0.12]	0.08 [0.12]	-0.01 [0.12]	-0.02 [0.12]
Control variables	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Constant	-4.32*** [0.70]	-4.10*** [0.64]	-5.89*** [0.69]	-5.10*** [0.57]	-8.80*** [0.76]	-8.10*** [0.71]
Observations	4,168	4,168	4,168	4,168	4,168	4,168
Log-likelihood	-2,382.83	-2,386.18	-1,267.74	-1,275.17	-1,833.32	-1,852.81

Notes. The dependent variable in Models 1 and 2 is whether a department encourages careers in a start-up (coded as 1 if 4 or 5 on the original 5-point scale); the dependent variable in Models 3 and 4 is whether the Ph.D. advisor has been a founder (yes = 1); and the dependent variable in Models 5 and 6 is whether the respondent's research is commercially valuable (coded as 1 if 4 or 5 on a 5-point scale). Control variables include marital status, children, nationality, expectations of job availability (in start-ups, established firms, and academia), field of science or engineering, and university. Robust standard errors clustered on university reported in parentheses.

** $p < 0.05$; *** $p < 0.01$.

References

Agarwal R, Ohyama A (2013) Industry or academia, basic or applied? Career choices and earnings trajectories of scientists. *Management Sci.* 59(4):950–970.

Ai C, Norton EC (2003) Interaction terms in logit and probit models. *Econom. Lett.* 80(1):123–129.

Akerlof GA, Kranton RE (2000) Economics and identity. *Quart. J. Econom.* 115(3):715–753.

Åstebro T, Chen J, Thompson P (2011) Stars and misfits: Self-employment and labor market frictions. *Management Sci.* 57(11):1999–2017.

Audia PG, Rider CI (2006) *Entrepreneurs as Organizational Products Revisited* (Lawrence Erlbaum Associates, Hillsdale, NJ).

Azoulay P, Liu CC, Stuart TE (2014) Social influence given (partially) deliberate matching: Career imprints in the creation of academic entrepreneurs. Working paper, Harvard Business School, Boston.

Baron JN, Burton MD, Hannan MT (1996) The road taken: Origins and evolution of employment systems in emerging companies. *Indust. Corporate Change* 5(2):239–275.

Baron JN, Hannan MT, Burton MD (2001) Labor pains: Change in organizational models and employee turnover in young, high-tech firms. *Amer. J. Sociology* 106(4):960–1012.

Beckman CM, Burton MD (2008) Founding the future: Path dependence in the evolution of top management teams from founding to IPO. *Organ. Sci.* 19(1):3–24.

Bhide A (2000) *The Origin and Evolution of New Businesses* (Oxford University Press, New York).

Bird B (1988) Implementing entrepreneurial ideas: The case for intention. *Acad. Management Rev.* 13(3):442–453.

Boh WF, De-Haan U, Strom RJ (2012) University technology transfer through entrepreneurship: Faculty and students in spin-offs. Working paper, Ewing Marion Kauffman Foundation, Kansas City, Missouri.

Burton MD, Beckman CM (2007) Leaving a legacy: Position imprints and successor turnover in young firms. *Amer. Sociol. Rev.* 72(2):239–266.

Burton MD, Anderson PC, Aldrich HE (2009) Owner founders, nonowner founders and helpers. Reynolds PD, Curtin RT, eds. *New Firm Creation in the United States*, International Studies in Entrepreneurship (Springer, New York), 115–133.

Burton MD, Sørensen JB, Beckman CM (2002) Coming from good stock: Career histories and new venture formation. Lounsbury M, Ventresca MJ, eds. *Research in the Sociology of Organizations* (Emerald Group Publishing, Bingley, UK), 229–262.

Camerer CF, Lovallo D (1999) Overconfidence and excess entry: An experimental approach. *Amer. Econom. Rev.* 89(1):59–82.

Campbell BA, Ganco M, Franco AM, Agarwal R (2012) Who leaves, where to, and why worry? Employee mobility, entrepreneurship and effects on source firm performance. *Strategic Management J.* 33(1):65–87.

Cohen WM, Nelson RR, Walsh JP (2002) Links and impacts: The influence of public research on industrial R&D. *Management Sci.* 48(1):1–23.

Ding W, Choi E (2011) Divergent paths to commercial science: A comparison of scientists' founding and advising activities. *Res. Policy* 40(1):69–80.

Dobrev SD, Barnett WP (2005) Organizational roles and transition to entrepreneurship. *Acad. Management J.* 48(3):433–449.

Eckhardt JT, Shane SA (2003) Opportunities and entrepreneurship. *J. Management* 29(3):333–349.

Eesley CE, Hsu DH, Roberts EB (2014) The contingent effects of top management teams on venture performance: Aligning founding team composition with innovation strategy and commercialization environment. *Strategic Management J.* 35(12):1798–1817.

Elfenbein DW, Hamilton BH, Zenger TR (2010) The small firm effect and the entrepreneurial spawning of scientists and engineers. *Management Sci.* 56(4):659–681.

Etzkowitz H (1998) The norms of entrepreneurial science: Cognitive effects of the new university–industry linkages. *Res. Policy* 27:823–833.

Evans DS, Leighton LS (1989) Some empirical aspects of entrepreneurship. *Amer. Econom. Rev.* 79(3):519–535.

Freeman J (1986) Entrepreneurs as organizational products: Semiconductor firms and venture capital firms. Libecap G, ed. *Advances in the Study of Entrepreneurship, Innovation, and Economic Growth* (JAI Press, Greenwich, CT), 33–58.

Gambardella A, Ganco M, Honoré F (2015) Using what you know: Patented knowledge in incumbent firms and employee entrepreneurship. *Organ. Sci.* 26(2):456–474.

Gompers P, Lerner J, Scharfstein D (2005) Entrepreneurial spawning: Public corporations and the genesis of new ventures, 1986 to 1999. *J. Finance* 60(2):577–614.

- Goodman LA (2002) How to analyze survey data pertaining to the time bind, and how not to analyze such data. *Soc. Sci. Quart.* 83(4):925–940.
- Halaby CN (2003) Where job values come from: Family and schooling background, cognitive ability, and gender. *Amer. Sociol. Rev.* 68(2):251–278.
- Hall RE, Woodward SE (2010) The burden of the nondiversifiable risk of entrepreneurship. *Amer. Econom. Rev.* 100(3):1163–1194.
- Hamilton BH (2000) Does entrepreneurship pay? An empirical analysis of the returns to self-employment. *J. Political Econom.* 108(3):604–631.
- Hayward MLA, Shepherd DA, Griffin D (2006) A hubris theory of entrepreneurship. *Management Sci.* 52(2):160–172.
- Hirano K, Imbens GW (2002) Estimation of causal effects using propensity score weighting: An application to data on right heart catheterization. *Health Services & Outcomes Res. Methodology* 2(3–4):259–278.
- Hsu DH (2008) Technology-based entrepreneurship. Shane S, ed. *Handbook of Technology and Innovation Management* (John Wiley & Sons, West Sussex, UK), 367–388.
- Hsu DH, Roberts EB, Eesley CE (2007) Entrepreneurs from technology-based universities: Evidence from MIT. *Res. Policy* 36(5):768–788.
- Imbens GW (2004) Nonparametric estimation of average treatment effects under exogeneity: A review. *Rev. Econom. Statist.* 86(1):4–29.
- Jovanovic B (1979) Job matching and the theory of turnover. *J. Political Econom.* 87(5):972–991.
- Kihlstrom R, Laffont J (1979) A general equilibrium entrepreneurial theory of firm formation based on risk aversion. *J. Political Econom.* 87(4):719–748.
- Lazear EP (2005) Entrepreneurship. *J. Labor Econom.* 23(4):649–680.
- Lowe RA, Ziedonis AA (2006) Overoptimism and the performance of entrepreneurial firms. *Management Sci.* 52(2):173–186.
- McClelland DC (1961) *The Achieving Society* (D. Van Nostrand Company, Princeton, NJ).
- Merton RK (1968) *Social Theory and Social Structure* (Free Press, New York).
- Mischel W (2004) Toward an integrative science of the person. *Annual Rev. Psych.* 55:1–22.
- Moore GE (1994) The accidental entrepreneur. *Engrg. Sci.* 1994 (Summer):23–30.
- Nanda R, Sørensen JB (2010) Workplace peers and entrepreneurship. *Management Sci.* 56(7):1116–1126.
- National Research Council (2010) *A Data-Based Assessment of Research-Doctorate Programs in the United States* (National Academies Press, Washington, DC).
- National Science Board (2012) *Science and Engineering Indicators 2012* (National Science Foundation, Arlington, VA).
- National Science Foundation (2003) Survey of Doctorate Recipients. Accessed April 3, 2015, http://www.nsf.gov/statistics/srvydoctoratework/survey2003/sdr_2003.pdf.
- National Science Foundation (2009) Doctorate Recipients from U.S. Universities: Summary Report 2007–08. Special Report NSF 10-309. Accessed April 3, 2015, <http://www.nsf.gov/statistics/nsf10309/>.
- Neff G (2012) *Venture Labor: Work and the Burden of Risk in Innovative Industries* (MIT Press, Cambridge, MA).
- Owen-Smith J, Powell WW (2001) Careers and contradictions: Faculty responses to the transformation of knowledge and its uses in the life sciences. *Res. Sociology Work* 10:109–140.
- Roach M, Sauermann H (2010) A taste for science? Ph.D. scientists' academic orientation and self-selection into research careers in industry. *Res. Policy* 39(3):422–434.
- Roberts E (1991) *Entrepreneurs in High Technology* (Oxford University Press, New York).
- Robins JM, Hernán MA, Brumback B (2000) Marginal structural models and causal inference in epidemiology. *Epidemiology* 11(5):550–560.
- Shane S (2001) Technological opportunities and new firm creation. *Management Sci.* 47(2):205–220.
- Shane S (2004) *Academic Entrepreneurship: University Spinoffs and Wealth Creation* (Edward Elgar Publishing, Northampton, MA).
- Shane S, Khurana R (2003) Bringing individuals back in: The effects of career experience on new firm founding. *Indust. Corporate Change* 12(3):519–543.
- Sørensen JB (2007) Bureaucracy and entrepreneurship: Workplace effects on entrepreneurial entry. *Admin. Sci. Quart.* 52:387–412.
- Stephan PE (2012) *How Economics Shapes Science* (Harvard University Press, Cambridge, MA).
- Stern S (2004) Do scientists pay to be scientists? *Management Sci.* 50(6):835–853.
- Stuart T, Ding W (2006) When do scientists become entrepreneurs? The social structural antecedents of commercial activity in the academic life sciences. *Amer. J. Sociology* 112(1):97–144.
- Thursby JG, Jensen R, Thursby MC (2001) Objectives, characteristics and outcomes of university licensing: A survey of major U.S. universities. *J. Tech. Transfer* 26(1–2):59–72.
- Turner RH (1978) The role and the person. *Amer. J. Sociology* 84(1):1–23.
- Wasserman N (2012) *The Founder's Dilemmas: Anticipating and Avoiding the Pitfalls That Can Sink a Startup* (Princeton University Press, Princeton, NJ).