Founder or Joiner?
The Interplay between Individual Preferences and Social-Contextual Influences in Shaping Entrepreneurial Interests

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ABSTRACT

Entrepreneurship has emerged as an important driver of economic growth and as an alluring career option for highly trained individuals. However, the entrepreneurship literature has largely ignored that entrepreneurial ventures often require not only founders, but also "joiners" – individuals drawn to entrepreneurial ventures as employees rather than founders. Moreover, we extend micro and macro theories of entrepreneurship by developing a conceptual framework whereby individual preferences interrelate with social-contextual factors to shape founder and joiner interests. Using a sample of 4,282 science and engineering PhD students prior to their initial career transition, we find that individuals with founder and joiner interests share similar "entrepreneurial" profiles compared to individuals not interested in entrepreneurship, but they also differ significantly with respect to both preferences and the influence of social-contextual factors. In addition, we find that social-contextual factors play a critical role in the realization of preference-based entrepreneurial interests, while at the same time individuals' preferences condition their susceptibility to the influence (or not) of social-contextual factors. More precisely, we find that founder interests are largely shaped by strong preferences for entrepreneurial job attributes that are reinforced by social-contextual influences, but still persist even in the absence of such influences. Joiner interests, on the other hand, are malleable and shaped by both preferences and social influences. In addition, absent preferences for entrepreneurial job attributes, social factors have little influence on shaping entrepreneurial interests. Our findings not only highlight the importance of distinguishing between founders and joiners as distinct entrepreneurial actors, but also provide unique insights into the complex relationships between micro and macro factors that are central to entrepreneurship theory.

1 Introduction

Entrepreneurship has long been recognized as an important driver of economic growth. More recently, entrepreneurship is increasingly seen as an alluring career option for highly trained individuals (Elfenbein et al. 2010, Campbell et al. 2012, Neff 2012), as evidenced by the growing number of technology-based ventures (Hsu et al. 2007) and demand for entrepreneurship education at universities. While considerable research effort has focused on explaining who becomes an entrepreneur (Ruef et al. 2003, Carter et al. 2004, Gompers et al. 2005, Stuart and Ding 2006, Hsu, et al. 2007, Sorensen 2007, Ozcan and Reichstein 2009, Elfenbein, et al. 2010, Campbell, et al. 2012), we have a very limited understanding of who *wants* to be an entrepreneur in the first place and how entrepreneurial interests form prior to the initial transition to entrepreneurship. Most importantly, little attention has been directed toward the possibility that others may be drawn to entrepreneurship as employees, choosing to join founders in their entrepreneurial ventures rather than seeking to become founders themselves.

Entrepreneurial "joiners" have long been hidden in the shadows of founders as less visible agents of entrepreneurship. And yet joiners are worthy of greater attention since attracting motivated and highly skilled employees is one of the key hurdles founders face in their efforts to build successful entrepreneurial ventures (Hannan et al. 1996, Baron et al. 2001, Hsu 2009). Like founders, joiners may be willing to trade-off between certain job attributes such as pay and security for greater autonomy and the opportunity to work in an exciting and dynamic work setting (Neff 2012). At the same time, while both founders and joiners participate in entrepreneurship in the sense that they contribute to the exploitation of opportunities in new ventures (Shane and Venkataraman 2000, Shane 2003), they play quite distinct roles in the entrepreneurial process. Consequently, the factors that shape joiner interests may differ from those that shape founder interests in fundamental ways. Thus, distinguishing between founders and joiners may have important implications for future entrepreneurship research, policies to encourage entrepreneurial activities, and entrepreneurs themselves.

In our consideration of the factors that shape founder and joiner interests, we seek to contribute to the entrepreneurship literature by integrating and extending the often-disparate literatures that emphasize either micro or macro level theories. One body of research, largely grounded in economics and psychology, suggests that individual-level characteristics such as preferences for autonomy and risk predict transitions into entrepreneurship (McClelland 1961,

Kihlstrom and Laffont 1979, Busenitz and Barney 1997, Hamilton 2000, Elfenbein, et al. 2010, Astebro et al. 2011, Carnahan et al. 2012). While emphasizing individual heterogeneity, this literature often overlooks the influence of the external environment in shaping entrepreneurial motivations. Sociological theories, on the other hand, argue that social-contextual factors such as institutional norms, peers, and opportunities shape entrepreneurial transitions (Thornton 1999, Shane 2000, Dobrev and Barnett 2005, Stuart and Ding 2006, Sorensen 2007, Azoulay et al. 2009, Nanda and Sorensen 2010). Although this line of research has recently begun to control for the fact that individuals may choose to work in different contexts based on their pre-existing preferences (Dobrev and Barnett 2005, Sorensen 2007, Azoulay, et al. 2009), less attention has been given to how preferences may also condition the influence of social-contextual factors.

Rather than seeing preferences and social-context as alternative or competing explanations for entrepreneurship, we seek to extend the literature by exploring the possibility that preferences and context together are necessary for the formation of entrepreneurial interests. More specifically, we argue that individuals possess preferences for job attribute and work activities that make them more (or less) susceptible to the influence of social-contextual factors that encourage entrepreneurial activities, while at the same time contextual influences are often necessary for people to realize and express their possibly latent entrepreneurial interests. Moreover, absent individual preferences for factors that are central to the entrepreneurial role, interests in being a founder or a joiner may be unlikely to form even in the presence of strong contextual influences. By developing an approach that explicitly accounts for the interdependence of preferences and context in shaping entrepreneurial interests, we attempt to reconcile contradicting findings in recent studies that tend to examine preferences and contextual factors as alternative, rather than interrelated, explanations of entrepreneurship (Stuart and Ding 2006, Sorensen 2007, Azoulay, et al. 2009, Ozcan and Reichstein 2009, Elfenbein, et al. 2010).

Our empirical analysis draws on a survey of 4,282 science and engineering PhD students nearing their initial professional career transition. Our data provide detailed measures of preferences and social-contextual factors, enabling us to examine their relative role and interplay. Using a sample of individuals prior to their first career transition allows us to complement prior entrepreneurship research by observing more directly the mechanisms that may underlie the emergence of entrepreneurial motivations. Moreover, the richness of the survey data enable us to measure detailed preference and contextual variables at the individual level, rather than relying

upon more aggregate firm or regional level data. These data also allow us to mitigate sample selection or recall biases common in other studies by observing individuals' attitudes and behaviors prior to exposure to their initial work context in a diverse and representative sample. In addition to the survey data, we draw on insights from over 50 interviews of survey respondents, faculty advisors, as well as startup founder and joiners to both motivate our conceptual discussion and to inform our interpretation of the empirical results.

We first document the pervasiveness of entrepreneurial interests in science and engineering PhDs, a population that is both a source of numerous novel and valuable discoveries as well as widely believed to increasingly embrace entrepreneurial and commercial activities (Powell et al. 1996, Etzkowitz 1998, Stuart and Ding 2006, Bercovitz and Feldman 2008). In particular, we observe that 11% of respondents have interests in being a founder, while an additional 45% state a strong interest in joining a startup as an employee, but not as a founder. Using regression analysis we find that although those with founder and joiner interests share similar preferences for entrepreneurial job attributes such as autonomy, risk, and commercialization, they differ significantly in the nature and strength of their preferences. Similarly, social-contextual factors play different roles in shaping founder versus joiner interests. More importantly, individual and social-contextual factors interrelate in important ways that are lost when one set of factors is considered in isolation. Our findings are robust to controlling for ability, expectations of labor market conditions and parents' occupations in academia or self-employment. Furthermore, additional analyses demonstrate that entrepreneurship is seen as a career option that is quite distinct from employment in established firms or in academia.

This study has important implications for entrepreneurship research as well as managerial practices and policy. Most importantly, our study highlights joiners as distinct entrepreneurial actors who share many similarities with founders, but nevertheless exhibit their own unique entrepreneurial profiles. As such, this study demonstrates that many of the preference and contextual factors long assumed to influence only founder behaviors also extend, albeit in different ways, to other non-founding entrepreneurial actors. Future work is needed to complement the considerable body of scholarly work on founders to better understand the role and contributions of joiners in the entrepreneurial process. Our insights regarding joiner interests should also be useful for founders who depend critically on joiners and who seek to understand the motivations and interests of potential startup employees. Secondly, we provide novel evidence regarding the

role of individual preferences and social-contextual factors in shaping entrepreneurial interests. While both sets of factors seem to matter, the most interesting finding is that preferences and context jointly shape entrepreneurial interests. As such, rather than abstracting from—or controlling for—one set of factors in the interest of focusing on the other, this study joins the growing chorus of scholars calling for entrepreneurship research to direct greater attention to exploring the interplay between micro and macro factors (Audia and Rider 2006, Sorensen 2007). A more nuanced understanding of the role of individual and social-contextual factors is not only of scholarly interest but also provides guidance for managers and policy makers interested in encouraging entrepreneurial activity and the supply of entrepreneurial human capital. Finally, examining entrepreneurial interests prior to and separate from realized entrepreneurial actions opens up interesting avenues for future research on entrepreneurial activity, including studies of the reasons that may prevent some individuals from realizing their entrepreneurial ambitions, or lead others to engage in entrepreneurial activities that they had not initially planned.

2 Entrepreneurial interests: Distinguishing between founders and joiners

Many developed societies increasingly celebrate entrepreneurship (Aldrich and Yang 2012), which is reflected in part by increasing rates of entrepreneurship (Hsu, et al. 2007), changes in cultural values (Neff 2012), growing attention toward entrepreneurship education, government initiatives to encourage and foster entrepreneurship, and extensive media coverage. We contend that the growing allure of entrepreneurship includes not just a desire to found a new company, but also a more general attraction to participating in the entrepreneurial process. This attraction extends to other entrepreneurial actors beyond founders to include what we term "joiners," individuals drawn to entrepreneurial ventures as employees but who have little desire to be founders themselves. Despite the relative lack of attention to joiners in the prior literature, many new ventures rely critically on the contributions of employees who often complement the skills of founders (Baron et al. 1996, Baron, et al. 2001, Hsu 2009). This is particularly true for innovation-intensive ventures that rely upon highly-skilled employees with advanced degrees, many of whom also have attractive career options in established firms and other high-paying sectors (Campbell, et al. 2012).

We conceptualize joiners as skilled employees who actively seek employment in entrepreneurial ventures over other forms of employment, in part because startups offer a stimulating

work setting with greater opportunities to develop human capital, to advance rapidly within the firm, and to exert greater control over careers and work activities (Neff 2012). Like founders, joiners participate in the entrepreneurial process of commercializing opportunities (Venkataraman 1997), however joiners often do not hold significant ownership stakes or executive positions within new ventures (Ruef, et al. 2003, Carter, et al. 2004). In addition, since joiners have little desire to be founders themselves, we distinguish them from individuals who seek employment in startups primarily as a means to learn about entrepreneurship as a stepping stone toward satisfying their own founder ambitions (Gompers, et al. 2005, Sorensen 2007, Elfenbein, et al. 2010).[1] At the same time, we contend that joiners' attraction to working in an entrepreneurial setting distinguishes them from other startup employees who may view working in an entrepreneurial firm as simply a form of employment or who may prefer a different career path but may work in a startup because they lack other career opportunities.

In this study we examine how different entrepreneurial interests form prior to the initial career transition. As such, we are able to focus our attention on the factors that shape entrepreneurial motivations—the precursors to entrepreneurial transitions—without confounding them with other factors that may determine actual transitions such as opportunity costs, access to capital, personal debt, or other constraints to entrepreneurship. In our consideration of the potential antecedents of founder and joiner interests, we develop a conceptual framework that can be applied to a range of entrepreneurial settings where recruiting highly skilled and motivated employees is of great importance to the success of new ventures. However, the particular roles played by founders and joiners, as well as potential differences in the drivers of founder and joiner interests, may vary depending on the particular setting. In this study we focus our discussion on technology-based ventures that commercialize discoveries emanating from university research, i.e., academic entrepreneurship (Shane 2004). In contrast to prior work that has examined academic entrepreneurship by faculty members (Etzkowitz 1998, Zucker et al. 1998, Shane 2004, Stuart and Ding 2006, Bercovitz and Feldman 2008, Ding 2010), we focus on the entrepreneurial interests of PhD-trained scientists and engineers during arguably the most formative prior of their career training and before they have made their initial career transitions.

[1]We recognize that some individuals who have founder interests may first work in startups to build entrepreneurial experience

Academic entrepreneurship generally, and the role of newly-minted PhDs in particular, is of special interest for a number of reasons. First, universities are frequently a source of important technological discoveries, and there is growing interest in the contributions of university-based technologies to innovation and economic growth. Academic entrepreneurship is an important vehicle by which such outcomes can be realized (Mowery et al. 2004, Shane 2004). Moreover, university-based discoveries are often nascent, emerging technologies that require substantial human capital to commercialize, and PhD-trained joiners can play a particularly important role in the venture formation process (Roberts 1991, Shane 2004, Boh et al. 2011). Second, PhDs play an important role in academic entrepreneurship by either building upon their own research projects or by contributing their highly specialized knowledge to the development of others' opportunities, both of which can be critical to successful technology commercialization (Boh, et al. 2011). This role is amplified by the fact that many faculty members have little interest in engaging in the commercialization process (Thursby and Thursby 2002, 2004), often leaving PhDs who were part of the research team to be key actors in the commercialization of university discoveries (Boh, et al. 2011). Finally, academic entrepreneurship is seen as an increasingly attractive career option for newly-minted PhDs, especially compared to traditional careers in academia or established firms (Roach and Sauermann 2010).

2.1 Preferences for entrepreneurial job attributes and work activities

A prominent line of research has emphasized that individuals' preferences for certain job attributes typically associated with entrepreneurship—such as risk and autonomy—contribute to a "founder" identity or orientation (Kihlstrom and Laffont 1979, Hamilton 2000, Shane and Khurana 2003, Shane 2004, Ozcan and Reichstein 2009, Elfenbein, et al. 2010). Although this line of research has not explored the existence of corresponding "joiner" orientation, we contend that joiners also possess preferences for similar job attributes as founders. However, since founders and joiners play distinct roles within entrepreneurial ventures that differ with respect to factors such as responsibilities, risks and rewards, people will be attracted to role of a founder or a joiner based on their expectations of how each role aligns with their own preferences and career orientation (Markus and Nurius 1986, Ibarra 1999). As a consequence, we expect individuals with founder and joiner interests will share similar preferences for entrepreneurial job attributes,

but they may also differ in important ways with respect to the nature and strength of these preferences.

First, while most new ventures provide both founders and joiners with a certain degree of autonomy, as owners and top decision makers of new ventures founders can expect to have greater autonomy over the direction of the company and key decisions relative to joiners. As such, some individuals with a strong preference for autonomy may be drawn toward being a founder in order to exercise greater freedom and control over building a business and commercializing their own ideas (Roberts and Wainer 1971, Boswell 1973, Shane 2004), while others with possibly weaker preferences for autonomy may be attracted to toward joining startups because they offer opportunities for greater ownership and discretion over day-to-day activities relative to employment in large established firms (Neff 2012). Second, both entrepreneurial roles may offer significant opportunities for learning and career advancement. Some individuals might perceive joining startups as offering responsibilities and variety of work activities to build their skills and human capital, thereby providing greater opportunities for career advancement and mobility relative to employment in established firms (Elfenbein, et al. 2010, Neff 2012). Similarly, starting one's own company as a founder may provide opportunities to develop a variety of skills (Lazear 2005) while also offering the most immediate path to a top position.

Founders and joiners may also differ with respect to their attitudes toward the risks associated with participating in entrepreneurship. Prior research has stressed that founders are more risk tolerant than established firm employees and are willing to incur considerable risk with respect to financial investments, career opportunities, and status in starting their own company (Kihlstrom and Laffont 1979, Begley and Boyd 1987, Seth and Sen 1995, Sarasvathy et al. 1998), suggesting thus individuals who are more tolerant of risk are more likely to form founder interests. At the same time, working in a startup also entails a considerable degree of risk for entrepreneurial employees relative to other career options, particularly with respect to job security. Joiners may be willing to internalize the risks inherent in working for a startup in exchange for greater career opportunities and job mobility (Neff 2012). In addition, while individuals with a greater preference for wealth may be attracted to startups by the availability of stock options and the possibility of greater total compensation (Shane 2004), founders can expect to obtain greater financial wealth in return for their investments in money and effort relative to joiners, assuming that a venture is successful.

Founders and joiners might also be distinguished by their preferences for specific work activities such as research, commercialization, and managerial tasks. Among these three, we believe that preferences for commercializing ideas into tangible, useful products is most strongly associated with entrepreneurial interests in being either a founder or a joiner. For example, in interviews of academic entrepreneurs at MIT, Shane (2004) found that many individuals engaged in entrepreneurship primarily out of a passion to see their discoveries put into practice. This same desire may extend to joiners as well. In our own interviews, PhDs commonly referenced a desire to participate in research with tangible, practical applications as a primary motive for joining startups. While the desire to engage in commercialization may be shared by founders and joiners alike, their preferences for research or management activities may be quite different. Considering again the roles that founders and joiners will occupy in new ventures, founders are expected to engage in a wider range of managerial activities such as business development, financing, and assembling human capital (Lazear 2005, Astebro and Thompson 2011). PhD-trained employees, on the other hand, are more likely to participate primarily in specific functional activities, such research and development activities. Thus, preferences for managerial or more specific functional activities will likely further distinguish between founder and joiner interests.

Implicit in the preference-based view of entrepreneurship is that individuals with the "right" set of preferences will be aware of the association between their preferences and entrepreneurial roles, leading them quite directly to engage entrepreneurial actions. However, individual preferences such as those discussed above simply imply a "latent" entrepreneurial interest that may or may not be realized, depending upon the strength of the preferences and the degree to which people are aware of entrepreneurship as a potentially satisfying and viable career option. As detailed below, we propose that social-contextual factors play a critical role in the awareness or realization of latent entrepreneurial interests.

2.2 Social-contextual influences: Institutional norms, peers, and opportunities

Contrasting the micro perspective taken by psychologists and economists, another line of research suggests that entrepreneurial behaviors are primarily shaped by macro contextual factors such as institutional norms, organizational characteristics, peers, and opportunities (Thornton 1999, Shane 2000, Dobrev and Barnett 2005, Stuart and Ding 2006, Sorensen 2007, Azoulay, et al. 2009, Nanda and Sorensen 2010). The role of contextual factors in shaping entre-

preneurial activities may be of particular importance in academic entrepreneurship, where imprinting into the norms of science and the formation of career orientations typically occur during graduate training. For example, although academia has traditionally been governed by the norms of science that eschew commercial activities such as entrepreneurship, recent research has shown that institutional support for commercialization such as departmental norms that favor commercial activity and the entrepreneurial activities of prominent peers have contributed to increasing rates of academic entrepreneurship (Stuart and Ding 2006, Bercovitz and Feldman 2008).

Although these studies have established a relationship between social-contextual factors and entrepreneurial behaviors, implicit in much of this literature is the notion that social-contextual forces influence all individuals in a similar way (Thornton 1999, Azoulay, et al. 2009). As such, this literature provides little guidance for distinguishing between founder and joiner interests. For many individuals becoming a founder might be perceived as a greater transition away from more traditional forms of employment, particularly for academically trained PhDs (Ding and Choi 2011), while becoming a joiner might be seen as one of many possible career paths. If so, then it is conceivable that variation in the strength of specific social-contextual factors may exert different levels of influence on one's interest in being either a founder or a joiner. For example, more diffuse and group-based contextual factors such as institutional norms and organizational characteristics may shape a general interest in participating in entrepreneurship as a joiner while founder interests, on the other hand, may require more intense and direct influences. High-status faculty entrepreneurs, for example, may exert a strong influence on individuals' perceptions of acceptable career activities and serve as founder role models (Sexton and Bowman 1985, Podolny and Stuart 1995, Stuart and Ding 2006), thus shaping founder interests. A separate line of research has demonstrated a link between commercial opportunities and transitions to entrepreneurship (Bhide 2000, Shane 2001, Stuart and Ding 2006, Ding and Choi 2011), suggesting that the discovery of an opportunity may provide a concrete and actionable basis for founding a company, thereby exerting a strong influence on founder interests.

This view suggests that entrepreneurial interests are primarily the result of exposure to different contextual factors that influence people within a given context in a similar way. More importantly, it also suggests that absent contextual influences that foster entrepreneurship, individuals should not form founder or joiners interests. We propose an alternative view whereby individuals' preferences condition their susceptibility to contextual influences; people with pref-

erences for entrepreneurial job attributes are more likely to be influenced by contextual factors that encourage entrepreneurship, while those lacking these preferences may not be influenced at all. We now examine the interplay between preferences and context in greater detail.

2.3 The interplay between preferences and social-contextual influences

In this section we integrate preference-based and contextual-based theories of entrepreneurship to emphasize that both individual preferences and social-contextual factors are required to form entrepreneurial interests. Continuing our discussion regarding the role of preferences in shaping founder and joiner interests, we follow prior work in assuming that preferences are relatively innate and slow to change over time (Halaby 2003). As such, individuals may possess stable preferences that make them predisposed toward entrepreneurship. However, we suggest that preferences alone are not always sufficient for entrepreneurial interests to form. Instead, people may realize their (latent) entrepreneurial interest at different points in their life and under different conditions. For example, some individuals may simply not be aware of entrepreneurship as a viable career path to satisfy their preferences, while others may not consider entrepreneurship because it violates social norms regarding which careers one *should* pursue or because they have yet to discover an opportunity to "live out" their entrepreneurial ambitions. We contend that social-contextual factors enable latent entrepreneurial interests to become salient, and in this way preferences and context jointly shape founder and joiner interests.

First, consider individuals with strong preferences for factors such as autonomy, risk, commercialization, and management, who we argued above are more likely to have (possibly latent) founder interests. Given the strength of their preferences, these individuals may more readily think of founding a startup as a desirable career and may rely less on contextual factors to shape their founder interests. For example, general norms encouraging entrepreneurship may have little influence on shaping their already strong entrepreneurial interests. High-status peers who are founders, however, may act as explicit role models who demonstrate the feasibility of becoming a founder, thereby reinforcing already strong preferences to shape founder interests (Greenberg 2009). Similarly, commercial opportunities may allow individuals with strong preferences to enact their founder interests. On the other hand, individuals with strong preferences may express founder interest even if they do not currently possess a commercial opportunity,

perhaps because they believe that opportunities will emerge in the near future (Roberts 1991, Shane 2004).

Second, consider individuals with more moderate preferences for entrepreneurial job attributes, which we contend are more likely to form joiner interests. Given their modest preferences for entrepreneurial attributes such as risk or autonomy, or for attributes that may also be available in other types of careers (e.g., advancement and R&D work), these individuals are less likely to see joining a startup as clear career option. As a result, these individuals are less likely to form joiner interests in the absence of the influence of contextual factors. Thus, more diffuse and universal contextual factors such as institutional norms encouraging entrepreneurship may increase individuals' awareness of joining a startup as a way to satisfy their entrepreneurial career preferences. On the other hand, although high-status entrepreneurial peers may raise the awareness of careers in startups, given that they model founder rather than joiner roles, it is less likely that they will shape joiner interests. On the other hand, such entrepreneurial peers may provide individuals with the opportunity to join a startup, thereby shaping joiner interests. The relationship between opportunities and joiner interests is less clear. Formally, being a joiner does not require an opportunity – joiners are typically hired to work on the founder's opportunities. However, one interesting possibility is that people who have a commercial opportunity but who do not wish to pursue it as a founder may see becoming a joiner as an alternative way to commercialize their research. This might be particularly prevalent when research is conducted in teams, with some team members acting a founders and others as joiners.

Finally, we suggest that individuals with weak preferences for entrepreneurial job attributes have a strong *disinterest* in participating in entrepreneurship, and thus are unlikely to respond to social-contextual factors favoring entrepreneurship. For example, individuals who value job security, who do not have an interest in commercializing technology and who have no desire to be their own boss will show little interest in either founding or joining a new venture, even when exposed to supportive entrepreneurial norms, to peers with founder experience, or to commercial opportunities. Indeed, this point is supported in prior research that has demonstrated that many faculty with significant commercial opportunities have little interest in pursuing them, perhaps because they desire to stay focused on research or because they are deterred by the riskiness of new ventures (Thursby and Thursby 2002, 2004). Table 1 summarizes the respective roles of

individual preferences and social-contextual influences separately, and their interplay together, in shaping founder and joiner interests.

Table 1 - Interplay between preferences and social-contextual influences

Social-Contextual Influences	**Preferences** ***Entrepreneurial*** "Founder"– strong preferences for entrepreneurial job attributes; interest is more easily realized "Joiner"– moderate preferences for entrepreneurial job attributes; interest more likely to require contextual influence to be realized	***Non-Entrepreneurial*** **–** weak preferences for entrepreneurial job attributes; *disinterest* is more easily realized
Norms – general and diffuse group attitudes; moderate influence in shaping interest	*Founder interest* – realized irrespective of norms; presence of norms has little additional influence on interest *Joiner interest* – requires both preferences and norms to be realized; absent norms preferences are not sufficient for interest to be realized	*Non-entrepreneurial interest* – norms are not sufficiently strong to override non-entrepreneurial preferences
High-Status Peers – act as founder role model and possibly opportunity for employment; direct and strong influence in shaping interest	*Founder interest* – realized in absence of peers; presence of high-status peers reinforces preferences in shaping interest *Joiner interest* – requires both preferences and high-status peers to be realized; absent peers preferences are not sufficient for interest to be realized	*Non-entrepreneurial interest* – peers are not sufficiently strong to override non-entrepreneurial preferences
Opportunities **–** discovery of opportunity provides actionable basis for founding a company; direct and strong influence in shaping interest	*Founder interest* – realized irrespective of discovery of opportunities; strong influence of opportunities reinforces preferences *Joiner interest* – opportunities are associated with founders, not joiners, and should have no influence	*Non-entrepreneurial interest* – opportunities may be strong enough to override non-entrepreneurial preferences

Up to this point, our discussion has focused on the potential role of social-contextual factors interrelating with preferences to shape founder and joiner interests. However, individuals with preferences associated with entrepreneurship may also sort into particular contexts that may allow them to further their entrepreneurial interests (Sorensen 2007, Azoulay, et al. 2009, Ozcan and Reichstein 2009, Elfenbein, et al. 2010). This is likely to be especially true for individuals with a pre-existing interest in entrepreneurship who may sort into contexts that support or encourage entrepreneurial activity or actively seek out research projects that are likely to result in

commercially valuable knowledge. While the strength of such selection effects is an empirical question – which will be addressed in our analysis –selection effects do not change our qualitative predictions regarding the interplay between individual and social-contextual factors.

3 Data, Variables & Method

3.1 Data

The data for this study are drawn from the Science & Engineering PhD Survey (SEPS), which was administered by the authors in spring 2010 and includes responses from science and engineering PhD students at U.S. research universities. To develop our sample of respondents, we first consulted the National Science Foundation's reports on earned doctorates (2008) to identify U.S. research universities with large doctoral programs in science and engineering. We 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 individual names and email addresses from listings provided on our target departments' websites. We invited these individuals to participate in the online survey using a four-contact strategy (one invitation, three reminders). Adjusting for 6.3% undeliverable emails, the direct survey approach achieved a response rate of 30%. When individual contact information was not available, we used department administrators as a second channel to approach respondents. In those cases, we emailed administrators with the request to forward a survey link to their graduate students. Overall, 88% of our responses were obtained directly from respondents and 12% were obtained through administrators.

A concern with any surveys is that the particular way in which respondents are approached may lead to sample selection or biased responses (Groves and Peytcheva 2008). To address this concern, we randomly assigned respondents into different conditions and varied key aspects of the survey invitation, including incentives to participate in the survey. While this strategy should mitigate selection biases by its very design, it also allowed us to explicitly examine the presence and magnitude of such biases. We did not find significant differences across conditions with respect to any of our key variables.

In this study we focus on PhDs in the advanced stages of their respective programs: those who report that they have successfully completed their qualifying exams or equivalent milestones. Focusing on advanced students has several advantages. First, these PhDs are closer to

making their initial career decisions—including entrepreneurship—than PhDs in earlier stages of their programs. In addition, advanced PhDs have been in the program long enough to be influenced by their department norms and advisors. The final sample used for this study consists of 4,282 PhD students at 39 different research universities across the fields of life sciences, physical sciences, and engineering.

By employing detailed survey data on a large, representative sample of the population of science and engineering PhDs, we complement prior empirical work on entrepreneurship in important ways. First, while many studies rely upon secondary data such as business plans, research disclosures, patents, and other sources to identify entrepreneurs ex post, the SEPS provides direct measures of entrepreneurial interests, which are the primary focus of this study. Moreover, observing individuals *before* they actually engage in entrepreneurial activities controls for potentially confounding influences of the entrepreneurial experience itself on individuals' characteristics and social context (Sexton and Bowman 1985, Stuart and Ding 2006, Elfenbein, et al. 2010).

A second advantage of these data is that they contain detailed measures of individual preferences, department norms, advisor activities, and perceptions about commercial opportunities. This not only allows us to consider individual and contextual factors simultaneously (Sorensen 2007), but it also enables a more precise and nuanced view than commonly used proxy variables. Moreover, since all our respondents are in a broad cohort of PhD students who are preparing to enter the professional labor force for the first time (internships and short-term employment aside), our sample is relatively homogenous with respect to factors such as education, prior work experience, and age, allowing for a sharper focus on our featured variables.

Third, while much of the prior research in academic entrepreneurship has focused on faculty entrepreneurs (Roberts 1991, Zucker, et al. 1998, Shane and Khurana 2003, Stuart and Ding 2006), a nascent body of work has begun to look beyond faculty founders to examine the role of students and recent graduates in entrepreneurial activity (Boh, et al. 2011, Astebro et al. 2012). Our data complement data used in prior work by providing insights into a large sample of highly-trained science and engineering students. Finally, while there is a widespread belief that attitudes in academia are increasingly commercially-oriented (Etzkowitz 1998, Owen-Smith and Powell 2001, Stuart and Ding 2006, Bercovitz and Feldman 2008), much of our understanding of academic entrepreneurship is based on data collected more than a decade ago and empirical evi-

dence on current attitudes remains sparse. Our data provide unique and current insights from the latest generation of science and engineering PhDs.

The survey responses were supplemented by more than 50 research interviews conducted by one of the authors at seven research universities in our sample and one university-affiliated national laboratory. The interviewees included respondents to the survey, as well as university faculty and startup founders and joiners. Each interview lasted from 30-60 minutes and the subjects were asked a range of open-ended questions regarding their reasons for entering a PhD program, how they chose their advisor and dissertation research project, experiences during the PhD, and their future career goals, which included not only entrepreneurship but also careers in academia and industry more generally. We incorporate insights from these interviews where appropriate to either corroborate the regression results or provide greater clarity in interpreting our findings.

3.2 Dependent variable

We employ two survey items to capture individuals' interests in entrepreneurship. Both measures were part of a general set of questions asking respondents about future employment after graduation and any potential postdocs**.** We use both measures jointly to classify respondents according to their entrepreneurial interests at the time of the survey.[2] In the first question, we asked respondents "How likely are you to start your own company?" and provided them with a 5-point scale that ranged from "definitely will not" to "definitely will" (see Figure 1). We code respondents who indicated that they "likely will" or "definitely will" start their own company (4 or 5 on the scale) as expressing *founder interests*. The second measure asks respondents to report the attractiveness of working for a startup after graduation.[3] More specifically, we asked "Putting job availability aside, how attractive do you personally find a career in a startup with an emphasis on research or development?" Respondents were provided a 5-point scale that ranged from "extremely unattractive" to "extremely attractive" (see Figure 2). We code individuals who rate a career in a startup as "attractive" or "extremely attractive" (4 or 5), but do not intend to be

[2] We also preformed regressions for each variable separately to explore the full range of heterogeneity along the response scales. The results are consistent with our featured results presented in the paper using the dichotomized values.

[3] It is important to note that this measure is not mutually exclusive with other career options, and thus respondents are unlikely to be making tradeoffs between working in a startup over alterative careers such as in academia or in an established firm. Nevertheless, as discussed below we control for labor market conditions and perform robustness test to rule out alternative explanations.

a founder (i.e., 1, 2, or 3 on the founder question above) as expressing *joiner interests*. In our data, 10.9% of individuals have an interest in being a founder and 45.2% have an interest in being a joiner (but not a founder). It is important to note that those respondents with joiner interests and those with founder interests have similarly high scores on the attraction of working in a startup (4.24 for founders and 4.19 for joiners, versus 2.45 for all others), which we interpret as a general attraction to entrepreneurship. At the same time, while the vast majority of those with founder interests express a strong attraction to a career in a startup as we would expect, a small share (1.5% of the sample) report working in a startup to be unattractive.[4] We include all founders in the primary regressions and exclude those who are not attracted to working in a startup as a robustness test.

Fig. 1 – Attractiveness of career in a startup

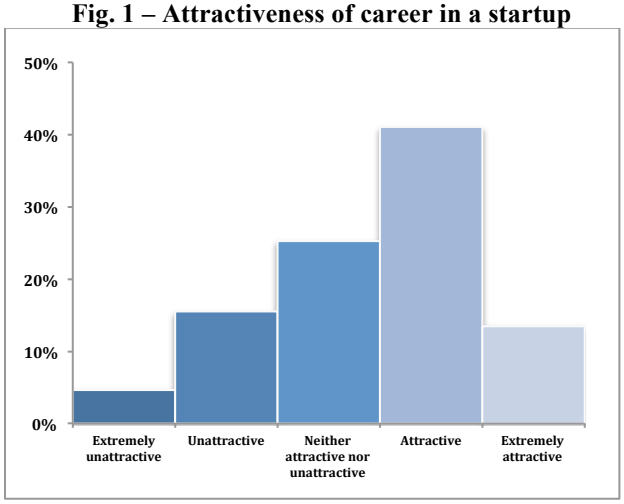
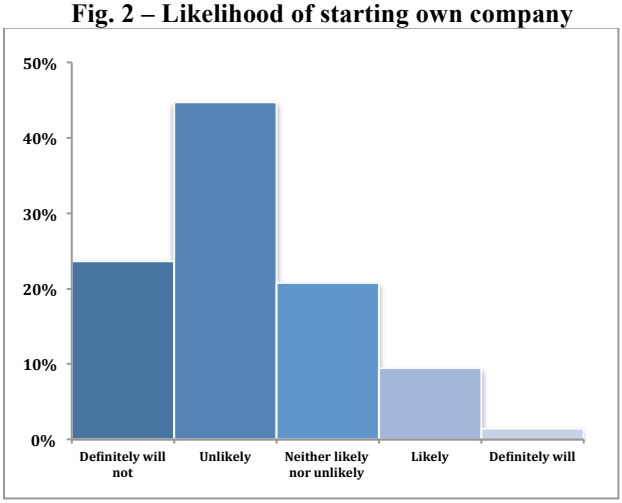


Fig. 2 – Likelihood of starting own company



The remaining 43.9% of individuals who report that working in a startup is unattractive are classified broadly as being *disinterested* in entrepreneurship. We further distinguish this disinterested group between those who are more interested in a career in academia and those who are more interested in a career in an established firm by drawing upon additional survey questions that ask about the attractiveness, on a 5-point scale, of careers in academia as a research faculty or in teaching, respectively, and careers in an established firm, government, or other careers such as law or consulting. Individuals who reported a career in faculty research or teaching as more attractive than a career in one of the other categories were coded as *academia*, and all

[4] We interpret this as individuals who would engage in entrepreneurship only as a founder and are not attracted to participating in the entrepreneurial process more generally.

others were coded as *established firm*. Although this distinction is crude, our objective is to construct a broad distinction between academic and non-academic careers for our disinterested reference group.[5] Table 1 presents the proportion of respondents by entrepreneurial interests, while Table 3 a list of the variables, their description, and summary statistics. Table 4 presents descriptives for founder, joiner, and both disinterested groups Table 5 and reports the correlation matrix.

Table 2 – Entrepreneurial Interest Variables

		Likely to be a founder	
		Yes	**No**
Attracted to career in startup	**Yes**	Founder (9.4%)	Joiner (45.2%)
	No	Founder (1.5%)	Academia (27.7%) / Est. firm (16.2%)

3.3 Independent variables

Preferences – To measure individual preferences for *autonomy, wealth,* and *opportunities for career advancement*, we asked individuals 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 asked respondents the following question: "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 tolerance to risk while lower values reflect a greater aversion to risk. We measure individuals' *work interests* in specific 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", "management or administration", "re-

[5] To clarify, this does not reflect all individuals with an interest in a career in academia or industry, but rather the subset of these two career paths that are not also attracted to a career in a startup.

search that contributes fundamental insights or theories (basic research)" and "research that creates knowledge to solve practical problems (applied research)."

Contextual Influences – To measure *institutional norms* toward different careers, we asked respondents to indicate the degree to which PhDs in their lab or department are encouraged or discouraged to pursue careers in academia and in a startup with an emphasis on research or development, respectively.[6] The scale for these items ranged from 1 (strongly discouraged) to 5 (strongly encouraged). While over 81% of departments encouraged careers in academia, only 32% encouraged careers in startups. However, it is important to point out that a majority of departments (59%) are indifferent (i.e., neither encouraged not discouraged) to careers in startups while only 9% of departments discouraged such careers. Moreover, approximately 30% of departments encouraged careers in both academia and startups, possible reflecting a convergence of scientific and commercial norms.

To measure the entrepreneurial activities of high-status peers, we asked respondents to tell us if, to the best of their knowledge, their faculty advisor had founded an entrepreneurial venture in the past three years. The response scale was yes, no, or don't know. We coded all responses as 1 if the response was yes indicating an *advisor-founder*, and all other responses as 0. While some respondents may report "no" or "don't know" even though their advisor may have in fact founded a venture, we expect that only behaviors observed by the respondent will have an influence on their entrepreneurial interests (Greenberg 2009). On overage only 11% of PhDs in our sample have an advisor who has founded a company.

Regarding opportunities, prior research has shown that many entrepreneurs start companies based on opportunities closely related to their domain expertise, especially technology-based ventures (Cooper 1970, Cooper and Dunkelberg 1981). As such, we suggest that science and engineering PhDs' entrepreneurial opportunities arise primarily from their own research activities. We measure *commercial opportunity* by asking respondents to assess the potential commercial value of their current research on a 5-point scale, from "not valuable" to "extremely valuable." Recent research by Gambardella et al. (2012) has shown that entrepreneurs' perceptions of

[6] One concern with this measure is that it shares similar wording to our joiner measure ("career in a startup with an emphasis on research or development"), which may lead to common methods bias with respect to joiners but nor founders. However, as noted above 89.2% of all founders also reported a "career in a startup with an emphasis on research or development" as attractive, and there is no significant difference in this measure between founders and joiners. Thus, we do not believe our entrepreneurial norms measure to be biased in favor of joiners over founders.

the value of their patents are significantly associated with new venture formation. Consistent with prior research (Stuart and Ding 2006, Bercovitz and Feldman 2008), we also use the survey reported number of patent applications on which the respondent was listed as an inventor as an alternative opportunity measure. While both measures should be reasonable proxies for commercial opportunities emanating from a respondent's own research, they do not necessarily reflect opportunities resulting from other research projects or entrepreneurial opportunities that are not technology-based. In addition, we recognize that not all commercially valuable research results are suitable opportunities for starting a new company. For example, PhDs whose research is funded by industry sources may not have the option to commercialize their research because the rights to any output may be assigned to the sponsoring firm. As such, we include a binary control variable that equals 1 if the respondent's research is industry funded, and 0 otherwise.

3.4 Preference-context intersection variables

As discussed above, we argue that preferences and social-contextual factors interrelate to shape founder and joiner interests. Rather that use interaction terms between each preference and contextual variable, which would not allow for a complete examination of all relationships and would result in complex and difficult to interpret coefficient estimates, we employ a simple approach by creating three sets of categorical variables that reflect the intersection of each preference-context pair. For example, for the "preference-peer" pair, we construct four binary variables that reflect whether the individual has strong or preferences that favor entrepreneurship or not (1/0) and whether their advisor is a founder or not (1/0). In this way we can more carefully examine each preference-context combination, including when one is present (e.g., entrepreneurial preferences) and the other is not (e.g., advisor is not a founder).

Rather than constructing pairs for each of our eight preference variables, we simplify our analysis by using principal components factor analysis to create a single factor score based on each individual's unique set of preferences.[7] As illustrated in the analysis above, these preferences differ significantly between founder and joiner interests, and as such should reflect each individual's disposition toward entrepreneurship. Indeed, the factor score is positively associated with entrepreneurial interests such that those with founder interests exhibit the highest score

[7] The variables with the highest factor loadings are, in order from highest to lowest, preferences for commercialization, management, wealth, and career advancement.

(0.67), followed by those with joiner interests (0.25), and career interests in established firms (0.01) or in academia (-0.67). We dichotomize the factor score at zero and code positive values as 1 (entrepreneurial preferences) and zero or less as 0 (non-entrepreneurial preferences). Norms are coded as 1 when departments "encourage" or "strongly encourage" careers in startups, and opportunities are coded as 1 when commercial value is "high" or "extremely high" (advisors who are founders is already binary). This approach allows us to explore the interplay between preferences and context in a straightforward and interpretable way.

3.5 Control variables

We include several additional control variables. First, we include controls for individual's demographic background, including gender, age, and nationality. Second, an individual characteristic that has been related to entrepreneurship is ability (Hamilton 2000, Elfenbein, et al. 2010, Astebro, et al. 2011, Astebro and Thompson 2011, Campbell, et al. 2012, Carnahan, et al. 2012, Eesley and Roberts 2012). Given that our empirical context is academic entrepreneurship, we measure *ability* as it relates to research by asking respondents "How would you rate your research ability relative to your peers in your specific field of study?" The scale ranged from 0 (least skilled, lowest percentile) to 10 (most skilled, highest percentile). Third, a potential determinant of early career preferences is the parents' career, which may influence a respondent's values and career choices (Aldrich and Kim 2007). In particular, PhDs who have a parent who is an entrepreneur may also find entrepreneurship more attractive. We thus include a variable that equals 1 if at least one parent is self-employed and 0 otherwise. Similarly, respondents raised by a parent who is employed in academia are more likely to be socialized into norms that value academic research over commercial activities, and thus may find entrepreneurship less attractive. Fourth, we include a variable that equals 1 if at least one parent is working in academia and 0 otherwise. To account for the possibility that entrepreneurial interests reflect perceptions of the availability of different kinds of jobs, we asked respondents to provide subjective estimates of the probability that a PhD in their field could find a job in academia, a startup, or an established firm, respectively. We include these probabilities as additional controls. Finally, we control for university and field effects by including dummies for 39 unique universities and 10 aggregate fields of science and engineering.

While the survey provides us with a rich set of measures, a limitation of survey data is the potential for common methods bias. That is, there is the possibility that measures drawn from the same survey instrument may be spurious due to similar response scales or placement of questions in close proximity within the survey (Podsakoff et al. 2003). To mitigate common methods bias, we used different question formats including rating scales and slider scales. We also placed questions pertaining to dependent and independent variables on different pages of the survey questionnaire and separated them by unrelated questions (Podsakoff, et al. 2003).

There are a number of general concerns when using survey data that we specifically addressed in the construction of our survey instrument. First, a concern when both the dependent and independent variables are drawn or constructed from the same source (i.e., a survey) is common methods bias, which could magnify the correlations across variables. To minimize this concern, the survey variables used in this study were worded to measure broad and distinct phenomena so as to reduce correlations between variables. Second, groups of question were intentionally separated in the survey questionnaire to reduce priming effects and mitigate possible spurious correlations between variables. As illustrated in our correlation matrix and empirical analysis, there are numerous survey variables that are not correlated with one another. Moreover, the featured independent variables exhibit significant and distinct relationships with each category of our dependent variable measuring entrepreneurial interests, providing further support that the observed relationships are not artifacts of our survey methodology.

Another concern with self-reported measures of preferences for job characteristics is that respondents may overstate preferences that seem socially desirable (e.g., autonomy) and give artificially low scores to preferences that may seem less socially desirable (Moorman and Podsakoff 1992). To mitigate this concern, we stated clearly in the survey invitation that responses would be kept strictly confidential. Moreover, any social desirability bias that is common to respondents should not affect our correlational results. Finally, measurement error in respondents' interpretation of specific questions is only of concern to the extent that it is driven by unobservable characteristics that are correlated with either the dependent variable or other independent variables. If misinterpretation is idiosyncratic across respondents then it will introduce noise, but not measurement error, and thus attenuate our coefficient estimates.

4 Analysis

Our first set of analyses uses multinomial logistic regression to examine for similarities and differences between the profiles of individuals with founder and joiner interests on the one hand, and those disinterested in entrepreneurship on the other. Complementing this analysis, we directly contrast individuals with founder interests and those with joiner interests using logit regression to test for the significance of any differences. We then restrict the sample to only those individuals whose interest in entrepreneurship developed after entering their current organizational setting to examine whether contextual factors have differing influence on founder and joiner interests. We then use a measure of individuals' pre-PhD interest in entrepreneurship in an effort to disentangle preference sorting and from contextual influence effects. In a final set of analyses, we explore alternative mechanisms and conclude with robustness tests. While we seek to rule out alternative explanations and endogeneity, given that our survey data are cross-sectional all results are interpreted as correlational in nature.

4.1 Comparing founder and joiner interests

We begin with a series of multinomial logistic regressions that compare the profiles of those with an interest in being a founder, a joiner, or to working in academia to the reference group of those with an interest in working in established firms. We chose this particular reference group to provide greater comparability between our results and prior studies, which often compare founders to other individuals employed in large established firms. The featured results are presented in Table 6. While we report results for each set of factors separately, we focus our discussion on the full specification in Model 5. To directly compare founder and joiner interests, Model 6 reports logistic regression results for a sample that is restricted to only those individuals with an interest in entrepreneurship (i.e., excluding the established firm and academia groups).

Focusing first on individual characteristics, we observe that individuals with stronger preferences for autonomy, opportunities for career advancement, and who are more risk tolerant, are more likely to have founder or joiner interest relative to individuals seeking careers in an established firm (the reference group). However the effect sizes between the founder and joiner groups differ markedly. For example, a one standard deviation higher preference for autonomy is associated with a 75% greater likelihood of being in the founder group versus the established firm group, while a one-SD higher score increases the likelihood of being in the joiner group

over the industry group by 28%. The logit results in Model 6 show that the differences in preferences between founders and joiners are significant: a one-SD higher preferences for autonomy increases the likelihood of having an interest in being a founder over a joiner by 54%, while a one-SD increase in risk tolerance increases the likelihood of having founder interests by 14%. Preferences for wealth do not significantly distinguish interests in being a founder or a joiner from those with an interest in a career in industry, and we observe no significant difference between founder and joiner interests with respect to wealth in Model 6.

The results regarding preferences for specific work activities in Model 5 show that those with a strong preference for conducting commercialization are more likely to have founder or joiner interests when compared to those interested in careers in industry, although this effect is strong for those with founder interests. Model 6 suggests that a one standard deviation higher preference for commercialization increases the likelihood of wanting to be a founder over a joiner by 84%. Also as expected, we find that those with a stronger preference for managerial activities are significantly more likely to have founder interests but not joiner interests. It is interesting to note that individuals with founder and joiner interests have stronger preferences for conducting basic research than those who want to work in industry, perhaps suggesting that science and engineering PhDs with a greater "taste for science" expect startups to provide them with more opportunities to conduct basic research relative to employment in established firms. A possible implication of this relationship is that science and technology-based startups may provide a hybrid employment setting that combines the benefits of both science and commercialization.[8]

Turning our attention to the social context, we observe that the profiles of founders and joiners are quite different. First, departmental norms that encourage entrepreneurship are not significantly associated with the likelihood of wanting to be a founder, however they do exhibit a strong positive association with wanting to be a joiner. Entrepreneurial advisors, on the other hand, are significantly associated with wanting to be a founder but show no relationship with an interest in being a joiner. Although it is conceivable that department norms and advisor's activities are highly correlated, the pairwise correlation for these two variables is 0.11 and the results

[8] We recognize that interests in specific work activities, especially commercialization, may be endogenously determined by an individual's interest in participating in entrepreneurship. Although our cross-sectional data limit our ability to rule out such reverse causality, in corollary available from the authors we find that individual preferences, which are thought to be relatively persistent, and a pre-existing interest in entrepreneurship are strongly associated with an interest in commercialization. While simply suggestive, these results provide some evidence that an individual's interest in commercialization is determined largely by other factors exogenous to their current interest in participating in entrepreneurship.

hold even when we enter the norms and advisor variables separately. The logit results in Model 6 confirms that these differences are significant even when we directly contrast joiner versus founder interests: a one-SD increase in department norms decreases the likelihood of having founder over joiner interests by 11.5%, while individuals with entrepreneurial advisors are 40% more likely to want to be a founder over a joiner.

Finally, we examine the relationship between the commercial value of an individual's research and interests in entrepreneurship. As expected, we find that as the commercial value of a PhD's research increases, they are more likely to have entrepreneurial interests, although the relationship is stronger for founder interests than joiner interests. A one standard deviation increase in commercial value increases the likelihood of being in the founder group over the industry group by 35%, while the same change increases the likelihood of being in the joiner group by only 14%. Model 6 shows that this difference between founder and joiner interests is statistically significant, although the magnitude of this effect is not very large.

Although not featured in the analysis, some control variables warrant special mention. First, individuals who have at least one parent who is self-employed are more likely to have founder interests, consistent with prior research (Aldrich and Kim 2007). Interestingly, we observe no such relationship for joiner interest. Second, an interest in entrepreneurship prior to starting the PhD is significantly associated with the likelihood of having founder and joiner interests, although the effect is significantly stronger for founder interests. Both observations suggest that founder interests are shaped earlier in life (i.e., prior to starting the PhD), while joiner intentions are more likely to be shaped later (i.e., during the PhD program). Finally, males are more likely to have an interest in entrepreneurship, and this effect is significantly greater for founders relative to joiners.

In summary, our regression results suggest that individuals with founder and joiner interests share similar "entrepreneurial" profiles when compared to those who are disinterested in entrepreneurship. However, they also exhibit significant differences from each other with respect to preferences for autonomy, risk, commercialization, and managerial work. Moreover, we find that institutional norms, peers, and opportunities have different relationships with interests to be a founder or a joiner. Taken together, these results suggest that both founders and joiners are "entrepreneurial" in a general sense, but also highlight the need to consider differences in the factors

shaping founder and joiner intentions. In the following section, we seek to provide deeper insights into the mechanisms underlying the observed results.

4.2 The interplay between preferences and context

To more clearly identify the possible influence of context on entrepreneurial interests, we restrict our sample to those individuals who *did not* express an interest in entrepreneurship prior to starting their PhD studies. In this way, we assume that an interest in being a founder or a joiner emerged during the PhD as a result of exposure to departmental norms, advisors, or the discovery of a commercial opportunity. This approach is predicated on the assumption that individuals *without* a pre-existing entrepreneurial interest sort into a given context based on factors unrelated to entrepreneurship, such as the prestige or location of the university, or the specific field of research (Azoulay, et al. 2009), but may still have preferences that predispose them to forming an interest in entrepreneurship.

To distinguish between pre-existing and emergent interests, we draw upon a survey measure designed to capture whether respondents' interests in entrepreneurship formed prior to their PhD studies by asking "Thinking back to when you began your PhD program in [year of matriculation], how certain were you at that time that you wanted to pursue a career in a startup 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."[9] We dichotomized this variable at the two highest responses to create a binary variable that reflects respondents' pre-existing interest in entrepreneurship (*pre-existing interest*).[10] Approximately 34% of the PhDs in our sample reported a pre-existing interest in entrepreneurship. While self-reports of a pre-existing interest in entrepreneurship are likely higher for those with a current interest in entrepreneurship, we believe that excluding these individuals from this analysis provides a more conservative test of the interplay between preferences and context in shaping entrepreneurial interests.

Mirroring our baseline regressions in Table 5, we use this restricted sample of respondents *without* a pre-existing interest in entrepreneurship to estimate multinomial logit models with

[9] While retrospective questions can be useful if no real-time measure is available, respondents may not always accurately report past behaviors and interests. It has been suggested, for example, that respondents sometimes assume unrealistic high degrees of stability, resulting in retrospective reports that are more similar to current behaviors and interests than is warranted (Huber and Power 1985, Schwarz 2007). While we are not able to explicitly assess the potential for such biases in our data, they suggest that our analysis below may overstate selection effects and understate treatment effects.

[10] We also performed regressions using the 5-point measure instead of the binary measures with substantively identical results.

respondents' current career interests as the dependent variable (founder, joiner, academia, established firm; with established firm as the omitted category).[11] The results are presented in Table 7. Models 1 through 3 use the binary measure of entrepreneurial preferences to construct the categorical variables as described above. The results in Model 1 for the interplay between preferences and department norms show that individuals with preferences for entrepreneurial job attributes are interested in being a founder irrespective of department norms, and the difference between those in departments that encourage entrepreneurship and those that do not is not significant. Although we observe a similar pattern for joiner interests, we also find that the relationship is strongest when individuals both have preferences and are in departments that encourage entrepreneurship. While individuals with preferences who are not in entrepreneurial departments are also likely to have joiner interests, the effect size is considerably smaller. Interestingly, we also find that those who don't have preferences but who are in entrepreneurial departments are also likely to have joiner interests respect to joiner interests, we see that those with preferences and in entrepreneurial departments have the highest likelihood of having joiner interests, whether they are in entrepreneurial departments or not.

In a final exploratory analysis, we examine more closely the role of opportunities, which show up quite strongly in our main regressions. Recall our earlier conjecture that the relationship between opportunities and entrepreneurial interest may be far from deterministic, i.e., that some individuals with commercial opportunities remain dis-interested in entrepreneurship, while other individuals with a strong entrepreneurial orientation may still have an interest in being a founders even if no opportunity is immediately available (for examples see Roberts 1991, Shane 2004). To explore these possibilities, we analyzed the distribution of commercially valuable opportunities across respondents with founder and joiner interests. Focusing first on those individuals who believe that their research has commercial value, we find that a full 50% of them want to be a joiner and only 30% want to be a founder. Thus, contrary to what one might expect, not everyone who is attracted to entrepreneurship and possesses a commercial opportunity wants to be a founder. Next, of those who want to be a founder only 39% believe that their research has commercial value, suggesting that the majority of PhDs interested in being a founder do not yet possess an opportunity, at least emanating from their own research. We also observe that 24% of

[11] Of these respondents with initially low orientation toward entrepreneurship, 26% reported founder or joiner intentions at the time of the survey, i.e., they have "emergent" entrepreneurial intentions.

joiners believe that their research has commercial value and yet they have no interest in founding a venture to exploit their opportunity. These results provide two key insights. First, it appears that for the majority of people who want to be a founder, their interest formed prior to the discovery of an opportunity (assuming that they do not currently have an opportunity from a source other than their research). Second, the majority of people with a possible commercial opportunity are not interested in being a founder. The latter result raises the question of whether and how opportunities are commercialized, and by whom.

4.3 Sorting based on pre-existing entrepreneurial interests

Our analysis thus far focused on the role of social-contextual factors in shaping entrepreneurial interests, in what could be called "treatment effects". At the same time, our conceptual discussion also eluded to the possibility that individuals with pre-existing interests in entrepreneurship may sort into contexts that support or encourage entrepreneurial activity or actively seek out research projects that are likely to result in commercially valuable discoveries. To examine the possibility of selection, we include as a predictor the binary measure of each respondent's *pre-existing interest* in entrepreneurship. Recall that approximately 34% of the PhDs in our sample reported a pre-existing interest in entrepreneurship. Of these, 65% report their current interest in being a joiner and 24% report an interest in being a founder, suggesting that many individuals with a longstanding interest in entrepreneurship want to be a joiner rather than a founder. Furthermore, of those who want to be a founder at the time of the survey, 73% report a pre-existing entrepreneurial interest while only 50% of joiners report the same. Thus it appears that, at least descriptively, founder interests form at earlier stages of life relative to joiner interests.

In a first set of regressions, Model 1 in Table 8 reports ordered logistic regression results for the pre-existing interest in entrepreneurship with individual preferences and controls as predictor variables (we exclude contextual variables because in principle they should not have an influence on pre-existing interests). We see that preferences for autonomy, commercialization, and a tolerance for risk are significantly associated with a pre-existing interest in entrepreneurship, while a preference for managerial activities exhibits a modest relationship. A preference for wealth is not significantly associated with a pre-existing interest in entrepreneurship, perhaps suggesting that interests in entrepreneurship are driven more by preferences for non-pecuniary job attributes than for pay (Xu and Ruef 2004).

We now examine for sorting effects by examining whether *pre-existing interest* predicts whether an individual is in a department with norms that encourage entrepreneurship, has a PhD advisors who is a founders, or works on projects with perceived commercial opportunities. In these regressions, we interpret significant coefficients of the *pre-existing interest* measure as suggestive evidence that individuals with a pre-PhD interest in entrepreneurship sort into a particular social context or seek out certain types of research, respectively. Models 2 and 3 report ordered logistic regression results to assess whether individuals sort into departments with norms that encourage entrepreneurship. The results show that individuals with a pre-existing interest in entrepreneurship are 42% more likely to be in a department that encourages careers in entrepreneurship, even after controlling for individual characteristics. These results are further supported by our interviews, which suggest that individuals with a longstanding interest in entrepreneurship are drawn toward departments within specific universities that they believe to be more entrepreneurial, such as MIT, Stanford, and Caltech. The interviewees reported that they believed that these departments would not only expose them to the broader entrepreneurial community outside their university, but they may also provide them with future opportunities to engage in entrepreneurship. However, the interviewees also informed us that the entrepreneurial culture of the department was of secondary consideration next to the prestige, nature of research projects and collegiality of faculty and students. Thus, while we do find systematic evidence that PhDs sort into departments based on their pre-existing interests, there is still considerable heterogeneity in the precise motives for joining a particular department.

Models 4 and 5 report logistic regressions results to examine whether PhDs with pre-existing entrepreneurial interests are more likely to have an advisor who is a founder. They are not. These results are robust to the inclusion of additional controls for advisor characteristics including advisor's ability, rank, and patenting activity (results available from the authors). These results are consistent with recent research by Azoulay, Liu and Stuart (2009) which suggests that PhDs match with advisors based largely on shared research interests and the prestige of the advisor. Furthermore, through our interviews we found that PhD students consistently reported that – while they may generally prefer an entrepreneurial environment - they matched with their advisors based on shared research interests and compatible personalities. Even among those individuals with a particularly strong interest in entrepreneurship, they reported their advisor's entrepreneurial activities as being of lesser importance than research area and compatibility in choosing

their advisors. Thus, we find little evidence to support the notion that on average PhD students with entrepreneurial interests systematically match with entrepreneurial advisors.

Finally, we examine whether those with a pre-existing interest in entrepreneurship are more likely to have research projects with commercial value. When entered separately in Model 6 we observe a significant relationship between a pre-existing interest in entrepreneurship and commercial value, yet as seen in Model 7 these results are sensitive to the inclusion of the measures of individual preferences, especially an interest in commercialization. Given that an interest in commercialization may increase with the discovery of a commercial opportunity, these results should be interpreted with caution. Although our interviews revealed that a number of people with longstanding interests in entrepreneurship did choose research projects that are more commercially-oriented, for many there was little expectation at the time they started their projects that it might provide the basis for a new venture. Moreover, many indicated that they chose projects primarily because of their intrinsic interest in the research, followed by research that might provide them with the widest range of future career options, including in academia. Even for the small handful of interviewees who did state that they chose a particular project because it might provide them with an opportunity to start their own company, they all stressed the considerable uncertainty in the eventual success of the project.

Overall, these results suggest a general pattern of individuals differentially sorting into departments and, to a lesser degree, choosing projects based on their pre-existing interest in entrepreneurship. However, we find little systematic evidence that people choose advisors based on whether the advisor has entrepreneurial experience. Taken together, the analyses reported in this section suggest that our baseline results reflect both sorting and treatment effects, although sorting and treatment appear to play somewhat different roles for the different aspects of social context and commercial opportunities. In particular, the positive relationship between the social context and entrepreneurial interest appears to reflect both sorting and treatment effects, while the strong relationship between opportunities and entrepreneurial interests seems to reflect primarily treatment effects. While limited by the cross-sectional nature of our data, these results suggest interesting avenues for future research using longitudinal data. We will return to these research opportunities in the final section of the paper.

4.4 Robustness Tests

We conducted a number of robustness checks.[12] First, recall that our featured results define individuals who scored 4 or 5 on our interest measures as having founder and joiner interests. In an alternative analysis not reported here, we use a more stringent cutoff, classifying only those who scored the highest rating of 5. Using this cutoff, our sample includes 4.7% founders, 8.8% joiners, 45.2% industry and 41.3% academia. We then used this new classification to re-estimate both the multinomial regression models as well as the logit models directly comparing founders and joiners. The results of the multinomial logit models for founder interests are qualitatively similar to our main specification (Table 5) with respect to individual characteristics, however the influence of advisors and commercial opportunity are no longer significant. In addition, the results for joiner interests largely dissipate relative to our featured results above. However, a caveat is in order, as the industry reference group for the multinomial regressions now contains a large share (55%) of individuals who reported working in a startup as attractive (4 out of 5). Thus, the estimates compare those who are *extremely attracted* to working in a startup to both those who *attracted* and those who are *not* a*ttracted*, and we have little basis for expecting highly significant differences. Logistic regression results suggest that even when we restrict the analysis to individuals with very strong entrepreneurial interests, many individual level differences between those with founder and joiner interests remain. Interestingly, however, differences between the two groups with respect to social and opportunity factors become insignificant. While the results using this more restrictive classification of respondents should be interpreted with caution due to the relatively small sample size, the weaker effects of social and opportunity factors may reflect that these factors operate primarily for individuals who are on the margin with respect to entrepreneurial interests rather than for people with very strong entrepreneurial interests.

Second, it is conceivable that our field and university fixed effects absorb some interesting variation on social-contextual factors or commercial opportunities. We excluded these fixed effects but find no significant change in our featured coefficients. As a final test, we recognize that a possible limitation of our measure of attractiveness is that it does not ask respondents to make tradeoffs between entrepreneurship and other career options. This may result in respondents overstating the attractiveness of entrepreneurship, especially in being a joiner. Similarly, since

[12] These results are not reported in the paper, however they are available from the authors.

we categorize respondents as "joiners" or "founders" based on their scores on the entrepreneurship measures, regardless of their scores on other types of careers, our measure of the attractiveness of a career in a startup may simply reflect a general "industry" career option and may not fully distinguish entrepreneurship as a unique career path. To test this, we preformed separate regressions for the measures of the attractiveness of a career in a startup, an established firm, and academia, respectively. Although these measures do not distinguish between founder or joiner interests, they are independent of one other and allow us to examine whether the predictors of interest in entrepreneurship differ from those of an interest in careers in established firms. We find significant differences in the regression results, suggesting that entrepreneurship is indeed seen as a distinct career path.

5 Conclusion

Entrepreneurship is increasingly seen as an engine of growth and has attracted significant attention from policy makers, educators, and scholars. While much of the research on entrepreneurship has focused on founders, new ventures rely critically on individuals who join founders in their efforts to build successful ventures. Moreover, while much prior work has examined characteristics of entrepreneurs after they transition in entrepreneurship, little is known regarding how interests to engage in entrepreneurship form in the first place. Using a sample of 4,282 science and engineering PhD students near their initial career transition, we first provide descriptive insights into founder and joiner interests, finding that interest in joining entrepreneurial ventures are much more pervasive than interests in becoming a founder. We then employ regression analysis to compare individuals with founder interests, joiner interests, and those who are not interested in entrepreneurship at all. Drawing on largely separate streams of prior literature, we simultaneously consider individual characteristics, social context, and perceived commercial opportunities as potential antecedents of entrepreneurial interests. Our results suggest that individuals with interests in being a founder versus a joiner share many similarities when compared to those who are not interested in entrepreneurship. However, we also observe significant differences in the role of individual characteristics such as preferences for autonomy and risk, the role of institutional norms and prominent peers, and in the importance of commercial opportunities in shaping the two types of entrepreneurial interests. Moreover, our analyses suggest that individual characteristics and social-contextual factors do not simply have independent influences on entre-

preneurial intentions but that they interrelate in systematic and important ways. In auxiliary analyses, we explored the extent to which these differences reflect selection versus treatment effects. Our results suggest that the observed relationships between entrepreneurial interests and social context reflect both selection and treatment effects, while the relationships with opportunities seem to reflect primarily "treatment" after individuals have joined their PhD programs.

Our results should be seen in light of some important limitations. First, the cross-sectional survey data limit our ability to make causal inferences regarding underlying mechanisms. Even when interpreted as correlational in nature, however, our insights regarding differences and similarities between founders and joiners have important implications. Relatedly, our analysis of selection versus treatment effects relies on a retrospective survey measure and provides only suggestive insights. At the same time, this analysis suggests that selection and treatment effects may operate differently along the three sets of factors considered in this study. As such, it points towards particularly promising areas for future longitudinal studies seeking to determine when and how such selection versus treatment effects explain observed relationships between entrepreneurial interests on the one hand, and social context or opportunities on the other. Disentangling selection and treatment is particularly important from a policy perspective since they would suggest quite different levers for efforts to increase entrepreneurial activity. Finally, our sample consists of highly trained scientists and engineers and focuses on technology entrepreneurship. While our general discussion of the roles of joiner versus founders is likely to apply to entrepreneurship more generally, our particular findings regarding the role of individual characteristics, social context, and commercial opportunities in shaping founder and joiner interests may not generalize. However, given the increasing interest in academic entrepreneurship among scholars and policy makers, the particularly large potential of technology-based startups in creating economic growth, and the growing interest of science and engineering PhDs in entrepreneurial careers, we believe that our empirical setting is highly relevant and provides important insights.

Our results have a number of managerial and policy implications. First, we provide evidence that an interest in entrepreneurship extends beyond founders to include joiners and provide some first evidence regarding the particular factors that attract joiners to work in startup firms. Given the important role joiners play in new venture success, these results may help founders and startup managers in attracting entrepreneurially-minded human capital. Our results suggest,

for example, that autonomy is an important factor not only for entrepreneurs but also for entrepreneurial employees. While high levels of autonomy may allow startups to attract human capital – perhaps even at a lower wage than established firms offering less autonomy (see Stern 2004) – firms tend to become more bureaucratic as they grow and age (Sorensen 2007). As a result, "joiners" who were attracted to working in a startup exactly because of factors such as higher levels of autonomy may become less satisfied with their jobs and may seek to opportunities in newly emerging firms. As such, if startups seek to keep their early employees over a long term, they should seek to preserve organizational structures and a culture that meets the entrepreneurial orientations of their employees. Second, we provide evidence that both individual preferences and social context relate strongly with entrepreneurial interests. Whereas prior research on entrepreneurial transitions has largely focused on individual or contextual factors in isolation, we provide evidence from data that combine preference and social-contextual variables simultaneously and show that they have important joint effects. As such, our results may inform efforts by educators and policy makers to increase the supply of entrepreneurial human capital or to increase academic entrepreneurship. In particular, our results suggest that simply changing entrepreneurial norms, exposing individuals to entrepreneurial role models, mandating entrepreneurship courses, or providing commercial opportunities will not necessarily be the most effective approach. Rather, such interventions should be targeted at individuals who already exhibit strong entrepreneurial interests (e.g., by allowing people to self-select into entrepreneurship courses) or by targeting individuals with latent entrepreneurial orientations. Such a targeted approach will be particular important given that resources such as mentors' time, technological opportunities, or teaching capacity are costly and in limited supply.

Our findings suggest several additional areas for future research. First, future work is needed to examine how founder and joiner interests translate into actual entrepreneurial activity. As eluded to in the introduction, studying interests separately from realized transition allows us to consider not only the match between interests and actions but especially the mismatch. For example, it will be interesting to study which individuals with strong founder interests do not end up being founders, and why. Insights into this question may provide information on the "latent supply" of entrepreneurs and may also allow policy makers to remove obstacles that some of these individuals faced in efforts to implement their entrepreneurial interests. On the other hand, some individuals may become entrepreneurs even though they have little genuine interest in en-

trepreneurship. This may be due to the lack of career alternatives, but perhaps also due to opportunities that are simply too good to pass up. We suspect that the degree to which actual founders have long-standing founder interests vs. reacted more opportunistically to opportunities may have long-lasting effects on the success of the new venture.

Second, our results suggest that there is a strong relationship between commercial opportunities and entrepreneurial interests. At the same time, we found that this relationship is far from deterministic. More precisely, nearly two-thirds of those who are interested in being a founder do not believe that their current research has commercial potential, perhaps indicating that their desire to be a founder originates prior to the discovery of an entrepreneurial opportunity. Furthermore, of all PhDs who believe that their current research possess commercial value, only one-fifth want to be a founder. Future research is needed to examine whether and how those individuals with strong founder interests but without immediate commercial opportunities acquire the opportunities necessary to successfully 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. Just as important, we need to understand what happens to the opportunities that reside with individuals who have no interest in exploiting them through entrepreneurship.

Most importantly, our findings highlight the need to complement the common focus on founders with additional work on joiners, who are not simply "founders lite," but who are drawn to entrepreneurship for different reasons and who likely play quite different roles in entrepreneurial ventures. How do those who intend to found a new venture identify others interested in joining their efforts? To what extent do the similarities between founders and joiners facilitate the formation of entrepreneurial teams? Do the significant differences we observe with respect to individual preferences and interest in work activities create tensions between founders and joiners, or do they facilitate the division of labor among complementary entrepreneurial roles? We hope that our paper stimulates future research on these and other interesting questions.

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Table 3 – Variable descriptions and summary statistics

Variable	Survey Question	Response	Mean	S.D.	Min	Max
Dependent Variable: Career interest						
Founder	Likely to start own company (4 or 5 on 5-point scale)	Category 1	10.9%	n.a.	n.a.	n.a.
Joiner	Attracted to working in startup (4 or 5 on 5-point scale), but unlikely to start own company	Category 2	45.2%	n.a.	n.a.	n.a.
Academia	Not attracted to working in startup; attracted to career in academia	Category 3	27.7%	n.a.	n.a.	n.a.
Established firm	Not attracted to working in startup; attracted to career in established firm	Category 4 (base)	16.2%	n.a.	n.a.	n.a.
Independent Variables						
Preference - Autonomy	When thinking about an ideal job, how important is it to you to be able to choose research projects?	5pt scale	3.99	0.81	1	5
Preference - Career Advancement	When thinking about an ideal job, how important to you are opportunities for career advancement	5pt scale	4.21	0.57	1	5
Preference - Wealth	When thinking about an ideal job, how important to you is financial income (e.g., salary, bonuses, etc.)?	5pt scale	3.95	0.72	1	5
Preference - Risk Tolerance	How much do you prefer winning $1,000 for sure to winning $2,000 with a 50% chance?	10pt scale	2.45	2.49	0	10
Work Interest - Commercialization	When thinking about the future, how interesting would you find work activites thatc ommercialize research results into products or services?	5pt scale	3.34	1.12	1	5
Work Interest - Management	When thinking about the future, how interesting would you find managerial or administrative work activites?	5pt scale	2.90	1.16	1	5
Work Interest - Basic research	When thinking about the future, how interesting would you find work activites in conducting research that contributes fundamental insights or theories?	5pt scale	4.00	0.93	1	5
Work Interest - Applied research	When thinking about the future, how interesting would you find work activites in conducting research that creates knowledge to solve practical problems?	5pt scale	4.34	0.67	1	5
Dept. norms - Academia	In your lab/department, to what extent are PhDs encouraged or discouraged to pursue a university faculty position with emphasis on research or development?	5pt scale	4.20	0.75	1	5
Dept. norms - Entrepreneurship	In your lab/department, to what extent are PhDs encouraged or discouraged to pursue a job in startup firm with emphasis on research or development?	5pt scale	3.27	0.72	1	5
Advisor - Founder	To the best of your knowledge, has your advisor founded an entrepreneurial venture?	Binary	0.10	0.30	0	1
Commercial Opportunity	How would you assess the potential commercial value of your current research?	5pt scale	2.47	1.17	1	5

Table 4 – Descriptive Statistics by Career Interests

Dependent variable:	(1) Founder	(2) Joiner	(3) Academia	(4) Est. Firm
Attractiveness of Entrepreneurship	4.25	4.19	2.36	2.61
Preference - Autonomy	4.11	3.95	4.22	3.60
Preference - Career advancement	4.42	4.27	4.04	4.17
Preference - Wealth	4.15	4.07	3.67	4.00
Preference - Risk tolerance	3.42	2.61	2.04	2.04
Work Interest - Commercialization	4.17	3.64	2.58	3.32
Work Interest - Management	3.48	3.04	2.41	2.98
Work Interest - Basic research	3.76	3.97	4.34	3.63
Work Interest - Applied research	4.47	4.42	4.20	4.28
Dept. norms - Academia	4.10	4.14	4.36	4.19
Dept. norms - Entrepreneurship	3.35	3.36	3.13	3.18
Advisor - Founder	0.20	0.10	0.06	0.09
Commercial opportunity	3.04	2.60	2.12	2.35

Table 5 – Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Preference - Autonomy											
(2) Preference - Career Adv.	0.06*										
(3) Preference - Wealth	-0.11*	0.47*									
(4) Preference - Risk tolerance	0.08*	0.02	0.01								
(5) Work Interest - Comm.	-0.13*	0.28*	0.30*	0.11*							
(6) Work Interest - Mgt	-0.18*	0.29*	0.27*	0.09*	0.45*						
(7) Work Interest - Basic	0.35*	-0.05*	-0.14*	-0.00	-0.29*	-0.28*					
(8) Work Interest - Applied	0.11*	0.23*	0.12*	0.01	0.27*	0.07*	0.12*				
(9) Dept. norms - Academia	0.05*	0.05*	-0.01	-0.04*	-0.11*	-0.01	0.10*	0.06*			
(10) Dept. norms - Entr.	0.04*	0.04*	0.02	0.06*	0.12*	0.07*	-0.00	0.05*	0.02		
(11) Advisor - Founder	0.02	0.04*	0.04*	0.03	0.12*	0.06*	-0.08*	0.04*	-0.04*	0.11*	
(12) Commercial opportunity	0.04*	0.13*	0.10*	0.10*	0.31*	0.15*	-0.14*	0.21*	-0.10*	0.19*	0.18*

Table 6 – Predictors of Founder and Joiner Interests

Method	Multinomial Logit									Logit
Description	Preferences			Context			Full Specification			Joiner vs.
Dependent variable:	Founder	Joiner	Academia	Founder	Joiner	Academia	Founder	Joiner	Academia	Founder
	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)	(3a)	(3b)	(3c)	(4)
Preference - Autonomy	0.67**	0.31**	0.62**				0.64**	0.29**	0.62**	0.39**
	(0.09)	(0.06)	(0.07)				(0.09)	(0.06)	(0.07)	[0.10]
Preference - Career advancement	0.38**	0.16*	-0.14				0.39**	0.17*	-0.15	0.13
	(0.13)	(0.08)	(0.10)				(0.14)	(0.08)	(0.09)	[0.13]
Preference - Wealth	-0.15	0.01	-0.33**				-0.15	0.02	-0.34**	0.04
	(0.11)	(0.08)	(0.09)				(0.11)	(0.08)	(0.09)	[0.11]
Preference - Risk tolerance	0.13**	0.06**	-0.01				0.12**	0.06**	-0.02	0.06**
	(0.02)	(0.02)	(0.03)				(0.02)	(0.02)	(0.03)	[0.02]
Work activities - Commercialization	0.91**	0.36**	-0.31**				0.86**	0.35**	-0.31**	0.61**
	(0.10)	(0.06)	(0.07)				(0.11)	(0.06)	(0.07)	[0.12]
Work activities - Management	0.26**	0.04	-0.05				0.27**	0.04	-0.05	0.24**
	(0.06)	(0.05)	(0.05)				(0.06)	(0.05)	(0.05)	[0.06]
Work activities - Basic research	0.19**	0.32**	0.45**				0.22**	0.32**	0.45**	-0.12+
	(0.07)	(0.05)	(0.06)				(0.07)	(0.05)	(0.06)	[0.07]
Work activities - Applied research	-0.09	0.07	-0.25**				-0.15	0.06	-0.29**	-0.03
	(0.14)	(0.08)	(0.08)				(0.15)	(0.09)	(0.08)	[0.12]
Dept. norms - Academia				0.07	0.01	0.25**	0.02	-0.00	0.26**	0.06
				(0.10)	(0.07)	(0.08)	(0.11)	(0.08)	(0.08)	[0.08]
Dept. norms - Entrepreneurship				0.03	0.28**	0.02	-0.01	0.22**	-0.09	-0.18**
				(0.09)	(0.07)	(0.07)	(0.09)	(0.07)	(0.08)	[0.07]
Advisor - Founder				0.62**	0.08	0.02	0.52**	0.05	0.10	0.40**
				(0.20)	(0.13)	(0.17)	(0.19)	(0.13)	(0.18)	[0.15]
Commercial opportunity				0.38**	0.17**	-0.03	0.27**	0.11*	0.08+	0.16**
				(0.06)	(0.04)	(0.04)	(0.07)	(0.05)	(0.05)	[0.06]
Num. patents				0.05	-0.02	-0.07	0.03	-0.02	-0.04	0.06
				(0.08)	(0.07)	(0.10)	(0.09)	(0.08)	(0.09)	[0.07]
Ability	0.04	-0.01	-0.00	0.13**	0.06*	0.05	0.02	-0.02	-0.01	0.02
	(0.05)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.05)	(0.03)	(0.03)	[0.05]
Parent self-employed	0.58**	0.09	0.17	0.53**	0.10	0.20+	0.58**	0.09	0.18	0.51**
	(0.17)	(0.11)	(0.12)	(0.17)	(0.11)	(0.11)	(0.17)	(0.11)	(0.12)	[0.15]
Control variables	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Field fixed effects	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
University fixed effects	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Constant	-12.47**	-5.56**	-1.02	-6.14**	-2.48**	-2.07**	-12.47**	-6.21**	-1.91*	-9.15**
	(0.93)	(0.70)	(0.73)	(0.79)	(0.63)	(0.66)	(1.05)	(0.85)	(0.92)	[0.81]
Obs.		4282			4282			4282		2336
Loglikelihood		-4361.40			-4829.60			-4320.64		-870.29

NOTES: The dependent variable in Models 1-3 consists of four categories: *founder* (likely to start own company), *joiner* (attracted to entrepreneurship but not likely to start own company), *academia* (not attracted to entrepreneurship and attracted to academia), and the reference group *established firm* (not attracted to entrepreneurship and attracted to established firm); the dependent variable in Model 4 equals 1 if founder, 0 if joiner, and the sample is restricted to only those with entrepreneurial interests (i.e., either founder or joiner); control variables include number of publications, expected job availability, age, and nationality; all columns report robust standard errors clustered on university reported in parentheses; ** p < 1%, * p < 5%, + p < 10%.

Table 7 – Interplay between Preferences and Social-Contextual Influence

Method	Multinomial Logit								
Description	Preferences & Entrepreneurial Department Norms			Preferences & Advisor - Founder			Preferences & Commercial Opportunity		
Dependent variable:	Founder	Joiner	Academia	Founder	Joiner	Academia	Founder	Joiner	Academia
	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)	(3a)	(3b)	(3c)
Entr. Prefs. & High Entr. Dept. Norms	0.61*	0.69**	-0.90**						
	(0.30)	(0.19)	(0.23)						
Entr. Prefs. & Low Entr. Entr. Norms	0.60*	0.24	-0.70**						
	(0.28)	(0.16)	(0.16)						
Non-Entr. Prefs. & High Dept. Entr. Norms	-0.23	0.34	-0.16						
	(0.35)	(0.22)	(0.18)						
Entr. Prefs. & Advisor-Founder				1.40**	0.11	-0.46			
				(0.46)	(0.28)	(0.30)			
Entr. Prefs. & No Advisor-Founder				0.71**	0.20	-0.73**			
				(0.29)	(0.15)	(0.15)			
Non-Entr. Prefs. & Advisor-Founder				0.99	-0.05	0.08			
				(0.64)	(0.29)	(0.24)			
Entr. Prefs. & High Comm. Opportunity							1.58**	0.45*	-0.67**
							(0.32)	(0.20)	(0.23)
Entr. Prefs. & Low Comm. Opportunity							0.88**	0.23	-0.72**
							(0.25)	(0.16)	(0.14)
Non-Entr. Prefs. & High Comm. Opportunity							1.24**	0.38+	0.36
							(0.45)	(0.21)	(0.23)
Work Interest - Basic research	0.21+	0.34**	0.59**	0.20+	0.34**	0.59**	0.22*	0.34**	0.56**
	(0.11)	(0.05)	(0.06)	(0.11)	(0.05)	(0.06)	(0.11)	(0.05)	(0.06)
Work Interest - Applied research	-0.21	0.07	-0.33**	-0.21	0.08	-0.33**	-0.19	0.09	-0.33**
	(0.20)	(0.08)	(0.07)	(0.19)	(0.08)	(0.07)	(0.19)	(0.08)	(0.07)
Dept. norms - Academia	0.02	-0.00	0.21*	0.01	0.02	0.20*	-0.01	0.01	0.20*
	(0.17)	(0.09)	(0.10)	(0.17)	(0.09)	(0.09)	(0.17)	(0.09)	(0.09)
Dept. norms - Entrepreneurship				-0.05	0.19*	-0.06	-0.04	0.20*	-0.05
				(0.15)	(0.09)	(0.10)	(0.16)	(0.09)	(0.10)
Advisor - Founder	0.81**	-0.10	0.13				0.81**	-0.06	0.14
	(0.32)	(0.17)	(0.21)				(0.32)	(0.17)	(0.21)
Commercial opportunity	0.34**	0.12*	0.09	0.34**	0.13*	0.09			
	(0.11)	(0.05)	(0.06)	(0.11)	(0.05)	(0.06)			
Num. patents	0.07	0.01	-0.01	0.07	0.00	-0.01	0.06	0.01	-0.01
	(0.15)	(0.09)	(0.12)	(0.14)	(0.09)	(0.12)	(0.15)	(0.09)	(0.12)
Pre-PhD interest - Entrepreneurship	0.86**	0.71**	-0.42**	0.85**	0.70**	-0.42**	0.88**	0.71**	-0.41**
	(0.18)	(0.07)	(0.08)	(0.18)	(0.07)	(0.08)	(0.18)	(0.08)	(0.08)
Pre-Phd interest - Academia	0.30*	0.24**	0.46**	0.31*	0.24**	0.46**	0.30*	0.24**	0.47**
	(0.15)	(0.05)	(0.06)	(0.15)	(0.05)	(0.06)	(0.15)	(0.05)	(0.06)
Ability	0.09	-0.02	-0.03	0.09	-0.02	-0.03	0.10	-0.02	-0.03
	(0.06)	(0.03)	(0.04)	(0.06)	(0.03)	(0.04)	(0.06)	(0.03)	(0.04)
Parent self-employed	0.80**	0.07	0.14	0.80**	0.07	0.14	0.81**	0.08	0.14
	(0.27)	(0.11)	(0.12)	(0.27)	(0.11)	(0.12)	(0.27)	(0.11)	(0.12)
Control variables	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Field fixed effects	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
University fixed effects	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Constant	-10.18**	-5.28**	-2.44**	-10.03**	-6.03**	-2.28**	-9.69**	-5.94**	-2.22**
	(1.62)	(0.82)	(0.68)	(1.65)	(0.86)	(0.77)	(1.62)	(0.88)	(0.78)
Obs.		2807			2807			2807	
Loglikelihood		-2767.91			-2776.23			-2775.93	

NOTES: Sample is restricted to respondents who did not express an interest in entrepreneurship prior to entering their current context (i.e., prior to starting the PhD program); the dependent variable in Models 1-3 consists of four categories: *founder* (likely to start own company), *joiner* (attracted to entrepreneurship but not likely to start own company), *academia* (not attracted to entrepreneurship and attracted to academia), and the reference group *established firm* (not attracted to entrepreneurship and attracted to established firm); control variables include ability, parents' occupations, expected labor market conditions, number of publications, gender, age, and nationality; all columns report robust standard errors clustered on university reported in parentheses; ** $p < 1\%$, * $p < 5\%$, + $p < 10\%$.

Table 8 – Sorting into Department, Advisor, and Commercial Research

Method	Ordered logit	Ordered logit		Logit		Ordered logit	
Dependent variable	Pre-existing interest - Entr	Department norms - Entrepreneurship		Advisor - Founder		Commerical Opportunity	
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)
PrePhD interest - Entrepreneurship		0.18**	0.17**	0.07	0.01	0.14**	0.07
		[0.04]	[0.04]	[0.06]	[0.06]	[0.05]	[0.05]
Preference - Autonomy	0.20**		0.09*		0.18*		0.15**
	[0.05]		[0.04]		[0.08]		[0.04]
Preference - Career advancement	0.12		0.05		-0.09		-0.08
	[0.08]		[0.06]		[0.12]		[0.06]
Preference - Wealth	-0.03		-0.09*		0.09		-0.01
	[0.05]		[0.04]		[0.08]		[0.05]
Preference - Risk tolerance	0.03*		-0.00		0.02		0.02
	[0.01]		[0.02]		[0.02]		[0.02]
Work Interest - Commercialization	0.34**		0.04		0.21**		0.23**
	[0.04]		[0.04]		[0.07]		[0.04]
Work Interest - Management	0.07+		0.06		-0.01		0.02
	[0.04]		[0.04]		[0.05]		[0.03]
Work Interest - Basic research	0.02		0.18**		-0.13+		-0.16**
	[0.05]		[0.04]		[0.08]		[0.04]
Work Interest - Applied research	-0.06		-0.01		0.03		0.41**
	[0.05]		[0.05]		[0.12]		[0.05]
PrePhD interest - Academia	-0.19**	0.05	0.00	-0.04	-0.02	0.01	0.02
	[0.04]	[0.04]	[0.04]	[0.05]	[0.05]	[0.03]	[0.03]
PrePhD interest - Established firm	1.67**	0.01	0.02	0.13*	0.11	0.18**	0.13**
	[0.05]	[0.04]	[0.04]	[0.07]	[0.07]	[0.04]	[0.04]
Ability	0.02	0.00	-0.02	0.05	0.04	0.16**	0.13**
	[0.02]	[0.02]	[0.02]	[0.03]	[0.03]	[0.02]	[0.02]
Parent self-employed	0.12	-0.10	-0.09	0.09	0.08	0.07	0.06
	[0.07]	[0.06]	[0.06]	[0.13]	[0.13]	[0.07]	[0.07]
Control variables	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Field fixed effects	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
University fixed effects	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Constant				-4.06**	-4.63**		
				[0.61]	[0.85]		
Obs.	4266	4266	4266	4266	4266	4266	4266
Log-likelihood	-4569.17	-4210.20	-4191.90	-1320.60	-1306.22	-5834.92	-5735.42

NOTES: The dependent variable in Model 1 is *Pre-existing Interest–Entrepreneurship*, which is the respondent's retrospective report of the likelihood that prior to the PhD they were likely to pursue a career in a startup upon graduation (5-point Likert scale from "Not at all likely" to "Extremely likely") and is intended to reflect possible selection effects; the other dependent variables are as follows: Models 2 & 3 is the extent to which the department encourages careers in a startup on a 5-point scale; Models 4 & 5 is whether the advisor has been a founder (yes=1); Models 6 & 7 is the commercial value of the respondent's research on a 5-point scale; control variables include number of publications, expected job availability, gender, age, and nationality; all results report robust standard errors clustered on university reported in parentheses; ** p < 1%, * p < 5%, + p < 10%.