Founder or Joiner?
The Role of Individual, Social, and Opportunity Factors in Shaping Entrepreneurial Interests

Michael Roach
Fuqua School of Business
Duke University
michael.roach@duke.edu

Henry Sauermann
Scheller College of Business
Georgia Institute of Technology
henry.sauermann@scheller.gatech.edu

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Comments are welcome.

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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. While prior research has examined which individuals eventually transition into entrepreneurship, we know little about how individuals' interests in entrepreneurship form prior to their initial transition. Moreover, 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. Using a sample of 4,282 science and engineering PhD students prior to their initial career transition, we compare individuals' interests in being a founder or a joiner with respect to three sets of potential antecedents: individual characteristics, social context, and perceived opportunities. We find that while individuals with founder and joiner interests share similar "entrepreneurial" characteristics compared to individuals not interested in entrepreneurship, they also differ significantly with respect to important characteristics such as preferences for autonomy, risk aversion, and work interests. Moreover, social contextual factors and commercial opportunities have divergent relationships with joiner versus founder interests. Supplementary analyses suggest that our results reflect both sorting and treatment effects. Overall, our findings highlight the importance of distinguishing between founder and joiner interests and provide unique insights into their complex relationships with 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. Moreover, little attention has been directed toward the fact that many individuals may be drawn to joining founders as entrepreneurial employees rather than to being founders themselves.

Such 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 for a number of reasons. First, 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). Joiners may share similar preferences as founders in their willingness 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). Second, 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 each play quite different 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, policy, and entrepreneurs themselves.

In this study, we examine two interrelated research questions. First, we ask why people are drawn toward participating in entrepreneurship as a potential career? Second, for those who are attracted to entrepreneurship, do the factors that predict interests in being a founder differ from those that predict interests in being a joiner? We suggest that a deeper understanding of the nature and sources of individuals' interest in entrepreneurship, and distinguishing between differ-

ent types of interests, can provide unique and informative insights into the origins of entrepreneurial actions and outcomes that are largely absent in the extant literature. Moreover, examining entrepreneurial interests prior to and separate from realized entrepreneurial actions opens up interesting avenues for future research on entrepreneurial activity, including factors that may prevent some individuals from realizing their entrepreneurial intentions, or lead others to engage in entrepreneurship they had not initially planned.

In our consideration of founder and joiner interests, we seek to integrate the often-disparate literatures on the roles of individual, social contextual, and opportunity factors in shaping entrepreneurship. One body of research, largely based in economics and psychology, suggests that individual characteristics such as preferences for particular job attributes or ability predict transitions into entrepreneurship (McClelland 1961, Kihlstrom and Laffont 1979, Busenitz and Barney 1997, Hamilton 2000, Elfenbein, et al. 2010). While emphasizing individual-level heterogeneity, this approach often overlooks the influence of the external environment in shaping individuals' participation in entrepreneurship. Sociological theories, on the other hand, argue that social contextual factors such as institutional norms, prominent peers, and the work environment shape entrepreneurial transitions (Thornton 1999, Dobrev and Barnett 2005, Stuart and Ding 2006, Sorensen 2007, Nanda and Sorensen 2010). Yet this line of research tends to neglect that individuals may sort into different social contexts based on their pre-existing disposition (Sorensen 2007), thus making it difficult to tease apart individual and social drivers of transitions to entrepreneurship.

While entrepreneurship research increasingly attempts to incorporate both individual and social factors together, (Stuart and Ding 2006, Sorensen 2007, Ozcan and Reichstein 2009, Elfenbein, et al. 2010), to date few studies have examined specific individual preferences and social factors simultaneously, and studies on how individuals might be influenced differently within the same social context are limited (see Dobrev and Barnett 2005 for an exception). We overcome these limitations by examining the interplay between individual preferences and social contextual factors using detailed survey data at the level of the individual. Furthermore, by using a feature of our survey data that allows us to distinguish between pre-existing and emergent entrepreneurial interests, we are able to empirically explore for sorting and treatment effects as two distinct mechanisms that shape entrepreneurial interests.

Although less studied, we also incorporate a third stream of research that highlights the role of opportunities on transitions into entrepreneurship. While this line of research suggests that entrepreneurial transitions are contingent upon the discovery of an opportunity (Shane 2000, Eckhardt and Shane 2003, Shah and Tripsas 2007), it remains an open question whether individuals' interests in entrepreneurship emerge as a result of the discovery of an opportunity or whether opportunities are the result of individuals' direct efforts to satisfy their pre-existing entrepreneurial desires. Moreover, it is far from obvious that all individuals who discover an opportunity want to be a founder, and indeed some may prefer to participate in the entrepreneurial process as a joiner rather than a founder or to forego entrepreneurship altogether. We examine the relationship between opportunities and entrepreneurial interests while simultaneously considering for individual characteristics and social contextual factors.

Our empirical analysis draws on a survey dataset of 4,282 science and engineering PhD students nearing their initial professional career transition. Our data provide detailed measures of individual characteristics, social context, and commercial opportunities across a representative sample prior to respondents' first career transition, and thus these data are not only less prone to sample selection or recall biases common in other studies, but they also allow us to more directly observe underlying mechanisms. As such, this study complements and extends prior research by providing novel insights into the antecedents of entrepreneurial interests using a diverse and representative cohort of individuals just prior to entering the labor market.

Using these data, 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). We observe that 11% of respondents expect to be a founder in the future, while an additional 45% show a strong interest in joining a startup as an employee, but not as a founder. Using regression analysis we compare the profiles of individuals with joiner interests, founder interests, and those with no interest in entrepreneurship. We find that individuals with founder interests exhibit similar characteristics as the founders studied in prior research, even though the respondents in our sample have not yet transitioned to entrepreneurship. While individuals with joiner interests share many characteristics with those with founder interests, we also observe some significant differences in preferences for autonomy, risk, and commercialization and managerial

activities. More notably, our results suggest that different aspects of the social context have divergent effects on founder and joiner interests, respectively.

In additional analyses we seek to distinguish the role of sorting versus treatment effects in explaining our results. We find evidence that individuals with a pre-existing interest in entrepreneurship sort into social contexts that are more entrepreneurial and into research with greater commercial potential, but sorting effects differ between founders and joiners. We also find evidence that both social context and commercial opportunity influence entrepreneurial interests, although the nature and strength of these effects differ between founder and joiner interests. Our findings are robust to controlling for prior work experience in a startup, 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 industrial employment in established firms, as well as employment in academia.

Our results have important implications for future entrepreneurship research as well as managerial practices. Most importantly, they highlight joiners as unique entrepreneurial actors who share many similarities with founders, but the results also emphasize the need to distinguish founders from joiners. As such, more scholarly work is needed to examine a range of issues related to joiners, complementing the considerable body of work on founders. Specific insights on joiners will 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 relative role of individual factors, social factors, and opportunities in shaping entrepreneurial interests. In doing so, we complement prior work that has largely focused on these dimensions separately, suggesting that all three have important impacts – controlling for each other - while also highlighting that their relative roles differ for different types of entrepreneurial interests. A more nuanced understanding of the role of the three sets of factors is not only of scholarly interest but also provides guidance for managers and policy makers interested in shaping the supply of entrepreneurially oriented individuals.

2 Entrepreneurial interests: Distinguishing between founders and joiners

Many developed societies increasingly celebrate entrepreneurship (Aldrich and Yang 2012), which is reflected in part by changes in cultural values (Neff 2012), increasing rates of entrepreneurship (Hsu, et al. 2007), growing attention toward entrepreneurship education, exten-

sive media coverage, and government initiatives to encourage and foster entrepreneurship. 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 entrepreneurial actors beyond founders to include what we term "joiners," individuals drawn to entrepreneurial ventures as employees rather than as founders. 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, many of whom also have attractive career options in established firms and other high-paying sectors (Campbell, et al. 2012). As such, understanding who is attracted to joining founders in entrepreneurial ventures can help nascent founders in their efforts to recruit talent, and may also provide insights for policy makers and educators interested in shaping the supply of human capital for entrepreneurial activity.

Joiners are skilled employees who actively seek employment in entrepreneurial ventures over other forms of employment, in part because startups offer a dynamic and stimulating work setting with more opportunities to develop their human capital, to advance rapidly within the firm, and greater control over their careers and work activities (Neff 2012). Like founders, joiners participate in the entrepreneurial process, but joiners do not hold significant ownership stakes, executive positions, or make key managerial decisions for the new venture (Ruef, et al. 2003, Carter, et al. 2004). In addition, given that joiners do not want to be founders themselves, they are distinct from individuals who seek employment in startups primarily as a means to learn about entrepreneurship as a stepping stone toward satisfying their founder ambitions (Elfenbein, et al. 2010). At the same time, joiners' attraction to working in an entrepreneurial setting further distinguishes them from other startup employees who may view working in an entrepreneurial firm as simply a form of employment.

While both founders and joiners participate in entrepreneurship, we suggest that the antecedents of founder and joiner interests may differ for two broad reasons. First, a prominent line of line of entrepreneurship research argues that many founders possess a specific "founder identity" (Shane and Khurana 2003, Shane 2004) that may be determined by genetics traits (Nicolaou et al. 2008) or a "taste" for starting a company (Kihlstrom and Laffont 1979, Hamilton 2000,

Shane 2004, Ozcan and Reichstein 2009, Elfenbein, et al. 2010, Astebro and Thompson 2011).[1] Although founders and joiners may share a similar taste for entrepreneurship, we argue that they will differ with respect to the nature and strength of the preferences underlying this taste. Second, founders and joiners play different roles within entrepreneurial ventures that likely differ with respect to factors such as responsibilities, risks and rewards, and job attributes. As such, different kinds of people may be attracted to one role or the other based on their expectations of how each aligns with their own career identity and goals (Markus and Nurius 1986, Ibarra 1999).

While prior research has not explored the existence of corresponding "joiner identities," we suspect that any such identity is much less pronounced relative to a founder identity. As such, we argue that an interest in being a joiner reflects primarily an attraction to working in a particular type of work setting that is judged to be more attractive than other alternative settings. For example, Neff (2012) argues that social changes in the U.S. labor market over the past thirty years have given rise to a dramatic increase in the appeal of working in entrepreneurial ventures. Driven in part by the decline of lifetime employment opportunities, individuals are more willing to accept career risks and view jobs in entrepreneurial firms as providing greater opportunities to learn, advance their careers, and receive greater satisfaction from the ownership of their work. To the extent that joiner identities are less prominent than founder identities, we suspect that individuals with founder and joiner interests will exhibit subtle differences in their individual characteristics and may be shaped differently by social influences or entrepreneurial opportunities. We discuss these differences in greater detail below. However, since our focus is primarily in the interest to engage in entrepreneurship and not actual transitions, we abstract from factors such as opportunity costs, access to capital, and other financial constraints that may play a bigger role in realized entrepreneurial outcomes.

In our consideration 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 context. In this study we focus our dis-

[1] For example, Shane (2004) founded that many faculty start a university spinoff because they have always desired to be an entrepreneur. As one MIT professor reported, "I always wanted to start a company. It was always in the back of my mind," and another stated "I've been interested for a very long time in starting companies. For better or for worse, I think I have an entrepreneurial inclination."

cussion 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 at the beginning of their career, before they have made their initial career transitions.

Academic entrepreneurship generally, and the role of new PhDs in particular, are especially interesting for a number of reasons. First, there is growing interest in the contributions of university-based technologies to innovation and economic growth, and academic entrepreneurship is an important mechanism by which such hopes 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, highlighting the important role of joiners in the venture formation process (Roberts 1991, Shane 2004, Boh et al. 2011). Third, PhDs play an important role in academic entrepreneurship by either building upon their own research projects or by contributing their highly specialized knowledge, 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 themselves (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 by junior science and engineering PhDs is of interest not only because PhDs play an important role in technology startups, but also because such startups are seen as an increasingly attractive career option for newly-minted PhDs, especially compared to the traditional careers in academia or established firms (Roach and Sauermann 2010).

In the remainder of this section we discuss in greater detail how founder and joiner interests may be shaped by three sets of factors: individual characteristics, social context, and commercial opportunities.

2.1 Individual Characteristics: Preferences, Ability and Work Activities

While there are a wide range of individual factors that may relate to entrepreneurship, we limit our attention to those factors that we believe are most strongly associated with entrepreneurial interests generally, while also potentially having different relationships with an interest in

being a founder versus a joiner. First, it is widely believed that individuals with a preference for autonomy are attracted to entrepreneurship because new ventures allow them to exercise greater freedom and more control over their own activities and business decisions (Roberts and Wainer 1971, Boswell 1973, Shane 2004). 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 than other new venture employees such as joiners. Similarly, while individuals with a greater preference for wealth may be attracted to startups by the availability of stock options and opportunities for rapid promotion (Shane 2004), founders can expect to receive greater wealth in return for their investments in money and effort relative to joiners, assuming that a venture is successful. At the same time, inherent in all startups is a considerable degree of risk relative to other career options. While individual who have a greater preference for risk—or who are less risk averse—may be more attracted to startups as either a founder or a joiner (Begley and Boyd 1987, Seth and Sen 1995, Sarasvathy et al. 1998), founders can expect to bear a greater share of these risks relative to employees such as joiners. Thus, although we expect that preferences for autonomy, wealth, and risk predict an interest in entrepreneurship generally, we also expect that these preferences are more strongly related to founder interests than to joiner interests.

Another 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). Research using a broad range of samples suggest that both low and high ability individuals are more likely to be self-employed, though for different reasons (Hamilton 2000, Astebro, et al. 2011, Astebro and Thompson 2011, Carnahan, et al. 2012). In particular, low ability individuals may enter self-employment and entrepreneurship because they lack alternative career opportunities and may thus engage primarily in subsistence entrepreneurship. High ability individuals, on the other hand, may prefer to work in small firms (either as founders or as joiners) because this setting more strongly links compensation and rewards to higher performance (Zenger 1994, Elfenbein, et al. 2010). In considering the role of ability in our particular context, it is important to keep in mind that PhD-trained scientists are likely to come from the upper end of the ability distribution relative to the overall population, and general unemployment among PhD trained scientists is very low (National Science Board 2012). Thus, we expect that "subsistence entrepreneurship" will play a minor role for PhD-

trained scientists, even among low-ability scientists. In contrast, high-ability scientists may believe that they will be more successful at commercialization and can reap significant financial rewards, leading them to exhibit a greater interest in engaging in entrepreneurship as a founder. Given that being a founder may require greater ability to build a business relative to working in one, we expect that ability is more strongly related to founder interests than to joiner interests.[2]

A less explored class of attributes is an individual's 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 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, a PhD research scientist in an energy startup from MIT stated that he joined the venture because he wanted to make a difference in solving the world's energy problems. Moreover, he felt that his prior academic research did not have a direct connection to solving these problems, and being a joiner allowed him to commercialize research discoveries into practical technologies. 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 in research and development activities. Thus we expect that individuals with a stronger preference for management are more likely to express an interest in being a founder, while those with a strong preference for conducting research are more likely to be interested in being a joiner.

2.2 Social Context: Institutional Norms and Prominent Peers

Sociological research suggests that institutional norms and prominent peers also play important roles in shaping entrepreneurial interests. While academia has traditionally been governed by the norms of science that eschew commercial activities such as entrepreneurship, com-

[2] Considering our specific context, it is also conceivable that the most attractive career option for PhDs with high research ability is academia (Roach and Sauermann 2010). However, we would still expect that ability predicts a preference for entrepreneurship

mercialization and entrepreneurship are increasingly accepted as legitimate activities in academic departments (Etzkowitz 1998, Owen-Smith and Powell 2001). Recent research has shown that institutional support for commercialization such as general department norms that favor commercial activity, as well as the entrepreneurial activities of prominent peers have contributed to increasing rates of academic entrepreneurship (Stuart and Ding 2006, Bercovitz and Feldman 2008). While much of this research has implicitly assumed that social forces will influence individuals in similar ways, we suggest that the role of social context in shaping entrepreneurial interests may differ between founders and joiners. If, as argued above, founder interests stem from a stronger entrepreneurial orientation, then we might expect that such interests are more resilient to departmental norms regarding entrepreneurship (Dobrev and Barnett 2005). On the other hand, to the extent that joiner interests are based on a less pronounced entrepreneurial orientation, they may be more malleable and influenced by department norms that encourage entrepreneurial activities (Markus and Kunda 1986). At the same time, becoming a founder might be perceived by PhDs with a less pronounced entrepreneurial orientation as too great a transition away form the traditional norms of science (Ibarra 1999, Ding and Choi 2011), suggesting that general entrepreneurial norms may increase PhDs interest in joining entrepreneurial firms, but may not be strong enough to induce interest in founding one.

Scholars have also considered the influence of prominent peers and mentors, which may shape individuals' perceptions of acceptable career activities and serve as concrete role models (Sexton and Bowman 1985, Podolny and Stuart 1995, Stuart and Ding 2006). Within the context of academic entrepreneurship, a PhD's academic advisor acts a role model who can legitimatize certain behaviors such as academic entrepreneurship (Sexton and Bowman 1985, Ibarra 1999, Kenny and Goe 2004). For example, a recent study by Azoulay, Liu & Stuart (2009) found that faculty advisors influence postdocs' engagement in commercial activities, even after accounting for postdocs' prior commercial activities and selection of advisor. Assuming that advisors as role models have a stronger influence than more diffuse departmental norms, we expect entrepreneurial advisors will positively influence joiner interests while also strengthening and reinforcing founder interests. The influence of prominent peers, however, on entrepreneurial interests may be greatest for individuals with stronger preferences for entrepreneurship (Greenberg 2009), which as argued above are more likely to have founder interests.

Up to this point, our discussion has focused on the potential role of the social context in shaping founder and joiner interests – what could be called "socialization" or "treatment" effects. Of course, it is also possible that individuals with strong pre-existing founder or joiner interests may sort into departments that support entrepreneurship or seek out advisors who have successfully engaged in entrepreneurial activities in the past as role models. Although Azoulay et al. (2009), as well as our own interviews find little evidence for selection based on pre-existing entrepreneurial interests, we consider such sorting effects in the empirical analysis.

2.3 Commercial Opportunities

Finally, we turn our attention to the relationship between entrepreneurial interests and perceived commercial opportunities. Prior research has demonstrated a link between commercial opportunities and founding activity (Bhide 2000, Shane 2001, Stuart and Ding 2006, Ding and Choi 2011), although the precise nature of this relationship remains unclear. One the one hand, it is possible that founder interests emerge only after individuals "discover" an opportunity, i.e., the possession of an opportunity leads to founder interests (Shane 2000). On the other hand, individuals with pre-existing founder interests may also seek to "create" opportunities by choosing research projects that are more likely to lead to commercializable results or otherwise search for opportunities (Roberts 1991, Shane 2004, Azoulay, et al. 2009). The latter would be akin to the sorting effects discussed above with respect to social context. While both mechanisms suggest a strong positive relationship between opportunities and founder interests, individuals with a stronger entrepreneurial orientation may also express an interest in being a founder 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). Equally interesting, our interviews of science and engineering PhDs suggests that some individuals who have 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). Thus, while we expect a positive relationship between opportunities and founder interests, this relationship may not be deterministic.

The relationship between opportunities and joiner interests is less clear. Formally, the joiner role does not require the possession of an opportunity – joiners are typically hired to work on the founder's idea. 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. In that case, the possession of a commercial opportunity may also predict joiner interests. Despite the latter possibility, we expect that commercial opportunities more strongly predict founder interests than joiner interests.

2.4 Summary

In summary, we suggest that founders and joiners, while sharing many entrepreneurial similarities, play different roles in entrepreneurial firms. As such, we expect some significant differences in the factors associated with founder interests versus joiner interests. More specifically, we expect that individuals with founder interests will show similar characteristics as the founders studied in prior work. Individuals with joiner interests may share some of these same characteristics, but they are likely to have weaker preferences for factors such as risk and autonomy, and different preferences for work activities. We expect that institutional norms will have a positive influence on joiner interests but may have little impact on founder interests. Prominent peers with entrepreneurial experience, in contrast, may serve as important role models that shape both founder and joiner interests. Finally, we expect to observe a strong, although not deterministic, relationship between commercial opportunity and founder interests, while the relationship between opportunities and joiner interests is likely to be weak.

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 fields. We selected a subset of institutions based primarily on program size while ensuring variation with respect to private/public status and geographic region. 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 survey using a four-contact strategy (one invitation, three reminders). All surveys were conducted online. 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.

Using survey data on a sample of science and engineering PhDs complements prior empirical work on academic 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 interest 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 social 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 one 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), there 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 scientists 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 evidence on current attitudes remains sparse. Our data provide unique and current insights.

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.

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.[3] 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." 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.[4] 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

[3] 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.

[4] 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.

development?" Respondents were provided a 5-point scale that ranged from "extremely unattractive" to "extremely attractive". We code individuals who rate a career in a startup as attractive or extremely attractive (4 or 5), but do not intend to be 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. It is important to note that those respondents with joiner interests and those with founder interests have similarly high scores on the second measure, which we interpret as a general attraction to entrepreneurship (4.24 for founders and 4.19 for joiners, versus 2.45 for all others). 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. We interpret this as individuals who would engage in entrepreneurship only as a founder and have no desire to "work" in a startup per se. We include all founders in the primary regressions and exclude those who are not attracted to entrepreneurship as a robustness test.

Table 1: Categorization of career interests

		Likely to be a Founder	
		Yes	**No**
Attracted to Entrepreneurship	**Yes**	Founder (9.4%)	Joiner (45.2%)
	No	Founder (1.5%)	Academia (27.7%) Industry (16.2%)

The remaining 43.9% of individuals who report that working in a startup is unattractive are classified broadly as having "non-entrepreneurial" interests. We further distinguish between those who are more interested in a career in academia and those who are more interested in a career in industry 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 others were coded as *industry*. Although

this distinction is crude, our objective is simply to construct a coarse distinction between academic and non-academic careers for our non-entrepreneur reference group.[5] Table 1 presents a list of the variables, their description, and summary statistics, while Table 2 reports the correlation matrix. Table 3 presents descriptives for founder, joiner, and both non-entrepreneur groups.

3.3 Independent Variables

Individual Characteristics – To measure individual preferences for *autonomy* and *wealth*, 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 aversion*, 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 aversion to risk while lower values reflect a greater tolerance to risk. 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). Unlike prior measures of ability such as an individual's highest degree or salary, our measure reflects the individual's self-perceived research ability, which should be more directly linked to their future career decisions. We also include as a more objective measure of research ability as the self-reported number of publications.[6] 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", "research that contributes fundamental insights or theories (basic research)" and "research that creates knowledge to solve practical problems (applied research)."

Social Context – 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 dis-

[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.
[6] Both measures reflect scientific ability and may not capture other dimensions of ability such as managerial or social skills.

couraged to pursue careers as university and in a startup with an emphasis on research or development, respectively.[7] The scale for this item ranged from 1 (strongly discouraged) to 5 (strongly encouraged). To measure the entrepreneurial activities of prominent 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 founded a venture, we expect that only behaviors observed by the respondent should have an influence on their interests.

Commercial Opportunity – 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. Consistent with prior research (Stuart and Ding 2006, Bercovitz and Feldman 2008), we also use the 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 nor 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 variable that equals 1 if the respondent's research is industry funded, and 0 otherwise.

3.4 Control variables

We include several control variables. First, we include controls for individual's demographic background, including gender, age, and nationality. One potential determinant of early career preferences is the parents' career, which may influence a respondent's values and career

[7] 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.

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. We include a variable that equals 1 if at least one parent is working in academia and 0 otherwise. Finally, individuals with prior work experience in a startup may differ from other PhDs in unobservable ways, thus we include a measure that equals 1 if a respondent has worked for a startup 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).

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 not interested in entrepreneurship on the other. Complementing this analysis, we directly contrast individuals with founder interests and those with joiner interests using logit regression. We then use a measure of individuals' pre-PhD interest in entrepreneurship in an effort to disentangle sorting and treatment effects. In a final set of analyses, we explore alternative mechanisms and conclude with robustness tests. While we seek to rule out alternative explana-

tions 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 industry. We chose as the reference group those individuals with an interest in working in industry to provide greater comparability between our results and prior studies, which often compare founders to other individual employed in industry. The featured results are presented in Table 4. While we report results for each set of factors separately, we focus our discussion on the full specification in Model 5. To direct 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.

Focusing first on individual characteristics, we observe that both founders and joiners have significantly stronger preferences for autonomy, as well as lower levels of risk aversion than individuals seeking industry careers (the reference group). However the effect sizes between the two 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 industry 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 aversion decreases the likelihood of having founder interests by 14%. Somewhat surprisingly, preferences for wealth have no relationship with founder interests in the full specification. However, preferences for wealth are significant when entered separately in Model 1 and also clearly distinguish between those interested in entrepreneurship from those respondents preferring a career in industry.

The results for ability paint a somewhat more nuanced picture than expected based on the extant literature. The full specification (Model 5) shows no significant relationship between ability and entrepreneurial interests. Interestingly, however, ability has a significant positive coefficient for founder interests in Model 1, which includes only individual characteristics. Explorato-

ry analyses suggest that the effect of ability disappears once we include the measure of commercial opportunities, which ability strongly predicts. This observation suggests that higher ability scientists may be more likely to express an interest in being a founder not because they believe that they will be more effective in running an entrepreneurial venture (Lazear 2005, Elfenbein, et al. 2010, Astebro and Thompson 2011), but because they are more likely to possess valuable commercial opportunities. The results regarding ability have to be interpreted in light of the limitation that our ability measure captures primarily research ability and not necessarily other types of ability and skills that might be more important to entrepreneurial transitions. At the same time, prior studies also do not directly observe entrepreneurial ability as such, and instead proxy for ability using education (Astebro, et al. 2011) or wages (Elfenbein, et al. 2010).

The results regarding preferences for specific work activities show that those with a strong preference for conducting commercialization are more likely to have founder or joiner interests when compared to those seeking careers in industry. As expected, however, a preference for commercialization is significantly stronger among founders than among joiners: 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, we find that departmental norms encouraging entrepreneurship are not significantly associated with the likelihood of wanting to be a founder, however they do

[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 results not presented here 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 their interest in participating in entrepreneurship.

exhibit a strong positive association with wanting to be a joiner. Entrepreneurial advisors are significantly associated with wanting to be a founder but show no relationships 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 hold even when we enter the norms and advisor variables separately. The logit results in Model 6 confirms that these differences hold even when we directly contrast individuals with joiner versus founder interests: a one-SD increase in department norms increases the likelihood of having joiner over founder interests by 11.5%, while individuals with entrepreneurial advisors are 40% more likely to want to be a founder over a joiner. These results suggest that different social factors are associated in different ways with individuals' interests in entrepreneurship. We explore whether individuals sort into social contexts that are more entrepreneurial or whether they are influenced by their social context below.

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 increases, individuals are more likely to have entrepreneurial interests, although the relationship is stronger for founder interests than joiner interests. For example, 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 the two entrepreneurial groups 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, we find that PhDs who have worked in a startup and males are more likely to have founder or joiner interests relative to the industry reference group. Second, while individuals whose parents are employed in a university are less likely to want to be a founder or a joiner, consistent with prior research (Aldrich and Kim 2007) having at least one parent who is self-employed significantly increases the likelihood of wanting to be a founder.[9]

In summary, our baseline regressions suggest that individuals with founder and joiner interests share similar entrepreneurial profiles when compared to those with non-entrepreneurial

[9] While not included in the table, we also find that PhD students from China and India are more likely to be interested in being a founder or joiner than U.S. PhD students, a result that is somewhat counter to the prevailing notion of Americans as exhibiting especially strong orientations toward entrepreneurship. However, these results may be specific to our sample of science and engineering PhD students.

interests. However, they also exhibit significant differences from each other with respect to preferences for autonomy, risk, commercialization, and managerial work. More importantly, we find that institutional norms and peers have different relationships with interests to be a founder or a joiner. Taken together, these results suggest that both joiners and founders are "entrepreneurial" in a general sense, but also highlight the need to consider joiners as a distinct type of entrepreneurial actor. In the following section, we seek to provide deeper insights into the mechanisms underlying the observed results.

4.2 Sorting and treatment effects

Our conceptual discussion focused on the potential effects of social context and opportunities in shaping entrepreneurial interests, in what could be called "treatment effects". At the same time, we also eluded to the possibility that individuals with pre-existing interest 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 knowledge. In this section, we seek to disentangle sorting and treatment effects by drawing on a survey measure designed to capture respondents' interest in entrepreneurship *prior* to starting the PhD. More precisely, we first asked respondents "Thinking back to when you began your PhD program in [year], how certain were you at that time that you wanted to pursue a career in a startup/entrepreneurial firm 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." [10] 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*).[11] Approximately 34% of the PhDs in our sample reported a pre-existing interest in entrepreneurship. Of these, 65% are classified as joiners and 24% report an interest in being a founder, suggesting that many individuals with a longstanding interest in entrepreneurship many want to be a joiner rather than a founder. Furthermore, of those who want to be a founder roughly 73% report a pre-existing entrepreneurial interest while only 50% of joiners report the same. Thus, it appears that, at least

[10] 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.

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

descriptively, founder interests are formed largely at earlier stages in life while joiner interests are equally likely to be pre-existing as they are to emerge during PhD studies.

Model 1 in in Table 5 reports logistic regression results for the pre-existing interest in entrepreneurship with individual preferences and controls as predictor variables. We see that preferences for autonomy, commercialization, and management activities are significantly associated with a pre-existing interest in entrepreneurship, and a tolerance for risk and ability exhibit a modest relationship.

Sorting effects – In a first set of regressions, we examine for sorting effects by using the *pre-existing interest* variable as a predictor of entrepreneurial department norms, founder advisors, and 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 favor 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. To examine whether individuals with founder or joiner interests might differentially sort into entrepreneurial departments, we constructed two new variables that further bifurcate the pre-existing interest variable into founder and joiner interests. The validity of these two variables rests on the assumption that an individual's interest in being a founder or a joiner did not change during the PhD program. While this assumption is admittedly untestable with our data, the results nevertheless should provide useful insights into distinguish between different sorting effects for founders and joiners. Although we interpret these results with caution, we find in Model 4 that those with a pre-existing interest in being a joiner are more likely to sort into departments that encourage working in a startup, while those with a pre-existing interest in being a founder are not.

Models 5 and 6 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. However, when we include variables that distinguish between founder and joiner pre-existing interests in Model 7 we find that those individuals with a pre-existing interest to be a founder are more likely to have an advisor who is a founder, while those who want to be a joiner

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).

Finally, we examine whether those with a pre-existing interests in entrepreneurship are more likely to work on research projects with commercial value. When entered separately in Model 8 we observe a significant relationship between a pre-existing interest in entrepreneurship, yet as seen in Model 9 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. When we enter variables for founder and joiner pre-existing interest we find a modest relationship founders interests and commercial value, providing some evidence suggesting that individuals interested in entrepreneurship may choose projects with greater commercial value. We find that ability is a strong predictor of commercial value, providing additional evidence that the effect of ability on entrepreneurial interests may be mediated through opportunities, as discussed above. Overall, these results suggest a general pattern of individuals differentially sorting into departments, choosing advisors and, to a lesser degree, choosing projects based on their pre-existing interest in entrepreneurship.

Treatment effects – Next, we seek to more clearly identify possible treatment effects, or the extent to which the social context or commercial opportunities shape entrepreneurial interests over the course of the PhD program. For that purpose, we limit our analysis to respondents who did *not* have a strong pre-existing interest in entrepreneurship when starting the PhD, i.e., we use only the 66% of respondents with neutral or low scores on the pre-PhD measure (1-3 on the 5-point scale). We interpret significant coefficients of social context or opportunities as evidence of treatment effects. This is predicated on the assumption that individuals *without* a pre-existing interest in entrepreneurship sort into a departments, advisors, or research topics 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). Mirroring our baseline regressions in Table 5, we use this smaller sample to estimate multinomial logit models with respondents' current career interests as the dependent variable (founder, joiner, academia, industry; with industry as the omitted

category).[12] The results are presented in Table 6. Consistent with the findings by Azoulay et al. (2009), Model 1a suggests that founder interests are shaped by entrepreneurial advisors, as well as by research with high perceived commercial value. These results are robust to the inclusion of individual characteristics (Model 2a). Standardized coefficients indicate that entrepreneurial advisors have a stronger effect on emergent entrepreneurial interests than the other featured variables – having an advisor who is a founder is associated with an 88% greater likelihood of having emergent founder interests relative to the base group. Model 1b shows that joiner interests are influenced by both departmental norms that encourage careers in startups and possessing commercially valuable research. These results are also robust to the inclusion of individual characteristics in Model 2b. It is interesting to note that despite the regression results, the a far greater share of respondents whose advisor is a founder are interested in being a joiner (47%) rather than a founder (21%), and 32% are not influenced into participating in entrepreneurship at all. Similarly, of those in departments that encourage entrepreneurship, only 13% are interested in being a founder, 55% are interested in being a joiner, and the remaining 32% are not interested in entrepreneurship.

In a final exploratory analysis, we examine more closely the role of opportunities, which show up quite strongly in our treatment 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

[12] 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.

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.

4.3 Robustness Tests

We conducted a number of robustness checks. First, recall that our set of controls includes a variable measuring whether respondents had prior startup experience. This variable strongly predicted entrepreneurial interests. In an alternative specification, we exclude those respondents with prior startup experience from the sample (10.3% of observations) with no effect on the substantive findings. 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.

Finally, 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 reported in Table 7, 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 in Model 1a 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 in Model 1b 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 in Model 1b 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 in Model 2 show 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.

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 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, Models 3-5 in Table 7 report 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 "non-entrepreneurs". 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. 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. These differences 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.

Our results should be seen in light of some important limitations. First, our 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 pro-

vides 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 implications for our understanding of entrepreneurship. First, we provide evidence that an interest in entrepreneurship extends beyond founders to include joiners. Although little is known about joiners, there are implications for hiring and retaining employees; also they may people critical entrepreneurial actors who contribute to new venture success. For the commercialization of university research, joiners could be important boundary-spanners. More attention to better understand joiners. 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 social factors in isolation, we provide evidence from data that combine individual preferences, social context, and opportunity factors simultaneously.

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 entrepreneurship. 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, several important research questions emerge from the distinction between founder and joiner interests. 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.

REFERENCES

Aldrich, H. E. and P. H. Kim**.** 2007. "A life course perspecitve on occupational inheritance: Self-employeed parents and their children.," In *Research in the sociology of organziation,* ed. M. R. a. M. Lounsbury, 33-82. Oxford, UK: JAI Press Elsevier.

Aldrich, H. E. and T. Yang**.** 2012. "Lost in translation: Cultural codes are not blueprints." *Strategic Entrepreneurship Journal*, 6(1), pp. 1-17.

Astebro, T.; N. Bazzazian and S. Braguinsky**.** 2012. "Startups by recent university graduates and their faculty: Implications for
university entrepreneurship policy." *Research Policy*, 41, pp. 663-77.

Astebro, T.; J. Chen and P. Thompson**.** 2011. "Start and misfits: Self-employment and labor market frictions." *Management Science*, 57(11), pp. 1999-2017.

Astebro, T. and P. Thompson**.** 2011. "Entrepreneurs, jacks of all trades or hobos?" *Research Policy*, 40(2011), pp. 637-49.

Azoulay, P.; C. C. Liu and T. E. Stuart**.** 2009. "Social influence given (partially) deliberate matching: Career imprints in the creation of academic entrepreneurs." *Harvard Business School Working Paper*.

Baron, J. N.; M. D. Burton and M. T. Hannan**.** 1996. "The road taken: Origins and evolution of employment systems in emerging companies." *Industrial and Corporate Change*, 5(2), pp. 239-75.

Baron, J. N.; M. T. Hannan and M. D. Burton**.** 2001. "Labor pains: Change in organizational models and employee turnover in young, high-tech firms." *American Journal of Sociology*, 106(4), pp. 960-1012.

Begley, T. and D. Boyd**.** 1987. "A comparison of entrepreneurs and managers of small business firms." *The Journal of Management*, 13, pp. 99-108.

Bercovitz, J. and M. Feldman**.** 2008. "Academic entrepreneurs: Organizational change at the individual level." *Organization Science*, 19, pp. 69-89.

Bhide, A. 2000. *The origin and evolution of new businesses*. New York: Oxford University Press.

Board, N. S. 2012. "Science and engineering indicators 2012," In. Arlington, VA: National Science Foundation (NSB 12-01).

Boh, W. F.; U. De-Haan and R. J. Strom**.** 2011. "Faculty and students in spin-offs: University technology transfer through entrepreneurship."

Boswell, J. 1973. *The rise and decline of small firms*. London: Allen and Unwin.

Busenitz, L. and J. Barney**.** 1997. "Differences between entrepreneurs and managers in large organizations: Biases and heuristics in strategic decision making." *Journal of Business Venturing*, 12(1), pp. 9-30.

Campbell, B. A.; M. Ganco; A. M. Franco and R. Agarwal**.** 2012. "Who leaves, where to, and why worry? Employee mobility, entrepreneurship and effects on source firm performance." *Strategic Management Journal*, 33, pp. 65-87.

Carnahan, S.; R. Agarwal and B. A. Campbell**.** 2012. "Heterogeneity in turnover: The effect of relative compensation dispersion of firms on the mobility and entrepreneurship of extreme performers." *Strategic Management Journal*, Forthcoming.

Carter, N.; H. E. Aldrich and M. Ruef**.** 2004. "Entrepreneurial teams," In *The handbook of entrepreneurial dynamics: The process of organizational creation,* ed. W. B. Gartner, K. G. Shaver, N. M. Carter and P. D. Reynolds, 299–310. Thousand Oaks, CA: Sage.

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

Ding, W. W. 2010. "The impact of founder professional education background on the adoption of open science by for-profit biotechology firms," In *Working Paper*.

Dobrev, S. D. and W. P. Barnett**.** 2005. "Organizational roles and transition to entrepreneurship." *Academy of Management Journal*, 48(3), pp. 433-49.

Eckhardt, J. T. and S. A. Shane**.** 2003. "Opportunities and entrepreneurship." *Journal of Management*, 29(3), pp. 333-49.

Elfenbein, D. W.; B. H. Hamilton and T. R. Zenger**.** 2010. "The small firm effect and the entrepreneurial spawning of scientists and engineers." *Management Science*, 56(4), pp. 659-81.

Etzkowitz, H. 1998. "The norms of entrepreneurial science: Cognitive effects of the new university-industry linkages." *Research Policy*, 27, pp. 823-33.

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

Greenberg, J. 2009. "What you care about or what you know: Which mechanism explains the intergenerational transmission of business ownership expectations?," In *NYU Working Paper*.

Groves, R. and E. Peytcheva**.** 2008. "The impact of nonresponse rates on nonresponse bias." *Public Opinion Quarterly*, 72(2), pp. 167-89.

Hamilton, B. H. 2000. "Does entrepreneurship pay? An empirical analysis of the returns to self-employment." *Journal of Political Economy*, 108(3), pp. 604-31.

Hannan, M. T.; M. D. Burton and J. N. Baron**.** 1996. "Inertia and change in the early years: Employment relations in young, high technology firms." *Industrial and Corporate Change*, 5(2), pp. 503-36.

Hsu, D. H. ed**.** *Technology-based entrepreneurship*. Wiley-Blackwell, 2009.

Hsu, D. H.; E. B. Roberts and C. E. Eesley**.** 2007. "Entrepreneurs from technology-based universities: Evidence from mit." *Research Policy*, 36, pp. 768-88.

Huber, G. P. and D. J. Power**.** 1985. "Retrospective reports of strategic‐level managers: Guidelines for increasing their accuracy." *Strategic Management Journal*, 6(2), pp. 171-80.

Ibarra, H. 1999. "Provisional selves: Experimenting with image and identity in professional adaptation." *Administrative Science Quarterly*, 44(4), pp. 764–91.

Kenny, M. and W. R. Goe**.** 2004. "The role of social embeddedness in professorial entrepreneurship: A comparison of electrical engineering and computer science at uc berkeley and stanford." *Research Policy*, 33, pp. 691-707.

Kihlstrom, R. and J. Laffont**.** 1979. "A general equilibrium entrepreneurial theory of firm formation based on risk aversion." *Journal of Political Economy*, 87(4), pp. 719–48.

Lazear, E. P. 2005. "Entreprenreurship." *Journal of Labor Economics*, 23(4), pp. 649-80.

Markus, H. and Z. Kunda**.** 1986. "Stability and malleability of the self-concept." *Journal of Personality and Social Psychology*, 51(4), pp. 858-66.

Markus, H. and P. Nurius**.** 1986. "Possible selves." *American Psychologist*, 41(9), pp. 954-69.

McClelland, D. C. 1961. *The achieving society*. New York: D. Van Nostrand.

Mowery, D. C.; R. R. Nelson; B. N. Sampat and A. A. Ziedonis**.** 2004. *Ivory tower and industrial innovation. Univeristy-industry technology transfer before and after the bayh-dole act.* Palo Alto, CA: Stanford University Press.

Nanda, R. and J. B. Sorensen**.** 2010. "Workplcae peers and entrepreneurship." *Management Science*, 56(7), pp. 1116-26.

National Science Foundation**.** 2008. "Survey of earned doctorates."

Neff, G. 2012. *Venture labor: Work and the burden of risk in innovative industries*. Cambridge, MA: MIT Press.

Nicolaou, N.; S. Shane; L. Cherkas; J. Hunkin and T. D. Spector**.** 2008. "Is the tendency to engage in entrepreneurship genetic?" *Management Science*, 54(1), pp. 167-79.

Owen-Smith, J. and W. W. Powell**.** 2001. "Careers and contradictions: Faculty responses to the transformation of knowledge and its uses in the life sciences." *Research in the Sociology of Work*, 10, pp. 109-40.

Ozcan, S. and T. Reichstein**.** 2009. "Transition to entrepreneurship from the public sector: Predispositional and context effects." *Management Science*, 55(4), pp. 604-18.

Podolny, J. M. and T. E. Stuart**.** 1995. "A role-based ecology of technological-change." *American Journal of Sociology*, 100(5), pp. 1224-60.

Podsakoff, P. M.; J. Y. MacKenzie and J. Y. Lee**.** 2003. "Common methods bias in behavioral research: A critical review and recommended remedies." *Journal of Applied Psychology*, 88(5), pp. 879-903.

Powell, W. W.; K. W. Koput and L. SmithDoerr**.** 1996. "Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology." *Administrative Science Quarterly*, 41(1), pp. 116-45.

Roach, M. and H. Sauermann**.** 2010. "A taste for science? Phd scientists' academic orientation and self-selection into research careers in industry." *Research Policy*, 39(3), pp. 422-34.

Roberts, E. 1991. *Entrepreneurs in high technology*. New York: Oxford University Press.

Roberts, E. and H. Wainer**.** 1971. "Some characteristics of technical entrepreneurship." *IEEE Transactions on Engineering Management*, 18(3), pp. 100-09.

Ruef, M.; H. E. Aldrich and N. Carter**.** 2003. "The structure of organizational founding teams: Homophily, strong ties, and isolation among u.S. Entrepreneurs." *American Sociological Review*, 68(2), pp. 195–222.

Sarasvathy, D. K.; H. A. Simon and L. Lave**.** 1998. "Perceiving and managing business risks: Differences between entrepreneurs and bankers." *Journal of Economic Behavior and Organization*, 33(2), pp. 207-25.

Schwarz, N. 2007. "Retrospective and concurrent self-reports: The rationale for real-time data capture," In *The science of real-time data capture: Self-reports in health research,* ed. A. Stone, S. Shiffman, A. Atienza and L. Nebeling, 11-26. Oxford University Press.

Seth, S. and A. Sen**.** 1995. "Behavioral characteristics of women entrepreneurs and executives vis-a-vis their male counterparts: An empirical study." *Social Science International*, 11, pp. 18-23.

Sexton, D. L. and N. Bowman**.** 1985. "The entrepreneur: A capable executive and more." *Journal of Business Venturing*, 1(1), pp. 129–40.

Shah, S. and M. Tripsas. 2007. "The accidental entrepreneur: The emergent and collective process of user entrepreneurship." *Strategic Entrepreneurship Journal*, 1, pp. 123-40.

Shane, S. 2004. *Academic entrepreneurship: University spinoffs and wealth creation*. Northampton, MA: Edward Elgar Publishing Inc.

Shane, S. 2003. *A general theory of entrepreneurship: The individual opportunity nexus*. Cheltenham, UK: Edward Elgar.

Shane, S. 2000. "Prior knowledge and the discovery of entrepreneurial opportunities." *Organization Science*, 11(4), pp. 448-69.

Shane, S. 2001. "Technological opportunities and new firm creation." *Management Science*, 47(2), pp. 205-20.

Shane, S. and R. Khurana. 2003. "Bringing individuals back in: The effects of career experience on new firm founding." *Industrial and Corporate Change*, 12(3), pp. 519-43.

Shane, S. and S. Venkataraman. 2000. "The promise of entrepreneurship as a field of research." *Academy of Management Review*, 25(1), pp. 217-26.

Sorensen, J. B. 2007. "Bureaucracy and entrepreneurship: Workplace effects on entrepreneurial entry." *Administrative Science Quarterly*, 52, pp. 387-412.

Stuart, T. and W. Ding. 2006. "When do scientists become entrepreneurs? The social structural antecedents of commercial activity in the academic life sciences." *American Journal of Sociology*, 112(1), pp. 97-144.

Thornton, P. H. 1999. "The sociology of entrepreneurship." *Annual Review of Sociology*, 25, pp. 19-46.

Thursby, J. G. and M. C. Thursby. 2004. "Are faculty critical? Their role in university-industry licensing." *Contemporary Economic Policy*, 22(2), pp. 162-78.

Thursby, J. G. and M. C. Thursby. 2002. "Who is selling the ivory tower? Sources of growth in university licensing." *Management Science*, 48(1), pp. 90-104.

Zenger, T. R. 1994. "Explaining organizational diseconomies of scale in r&d: Agency problems and the allocation of engineering talent, ideas, and effort by firm size." *Management Science*, 40(6), pp. 708-29.

Zucker, L. G.; M. R. Darby and M. B. Brewer. 1998. "Intellectual human capital and the birth of u.S. Biotechnology enterprises." *American Economic Review*, 88(1), pp. 290-306.

Table 1: Variable descriptions and summary statistics

Variable	Survey Question	Response	Mean	S.D.	Min	Max
Dependent Variable: Career Interests						
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.
Industry	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 - 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
Risk Aversion	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
Ability	How would you rate your research ability relative to other PhDs in your specific field	10pt scale	6.35	1.65	0	10
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
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
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
Num. patents	How many patent applications or issued patents list you as an inventor?	Count	0.21	0.77	0	8
Prior employment in startup	Have you ever been employed in a startup firm?	Binary	0.10	0.30	0	1

Table 2: Descriptive Statistics by Career Interests

Dependent variable:	(1) Founder	(2) Joiner	(3) Academia	(4) Industry
Attractiveness of Entrepreneurship	4.25	4.19	2.36	2.61
Preference - Autonomy	4.11	3.95	4.22	3.60
Preference - Wealth	4.15	4.07	3.67	4.00
Risk aversion	6.58	7.39	7.99	7.91
Ability	6.81	6.41	6.27	6.00
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 3: Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Preference - Autonomy												
(2) Preference - Wealth	-0.11*											
(3) Risk Aversion	-0.08*	-0.01										
(4) Ability	0.20*	0.08*	-0.07*									
(5) Num. publications	0.06*	-0.02	0.01	0.21*								
(6) Work Interest - Commercialization	-0.13*	0.30*	-0.12*	0.12*	-0.02							
(7) Work Interest - Management	-0.19*	0.27*	-0.09*	0.07*	-0.03	0.46*						
(8) Work Interest - Basic	0.35*	-0.14*	0.00	0.12*	0.07*	-0.30*	-0.29*					
(9) Work Interest - Applied	0.11*	0.13*	-0.02	0.12*	0.03	0.27*	0.07*	0.12*				
(10) Dept. norms - Academia	0.05*	-0.01	0.04*	0.01	0.06*	-0.11*	-0.01	0.11*	0.06*			
(11) Dept. norms - Entrepreneurship	0.04*	0.02	-0.06*	0.04	-0.04*	0.12*	0.07*	-0.00	0.06*	0.02		
(12) Advisor - Founder	0.02	0.05*	-0.04	0.04*	0.04	0.12*	0.08*	-0.08*	0.05*	-0.04*	0.12*	
(13) Commercial opportunity	0.04*	0.11*	-0.11*	0.17*	-0.03	0.31*	0.15*	-0.14*	0.21*	-0.10*	0.19*	0.17*

Table 4: Predictors of Founder and Joiner Interests

Method	Multinomial Logit															Logit
Description	Individual Characterisitics			Work Activities			Social Context			Commercial Opportunity			Full Specification			Entr. Intent
Dependent variable:	Founder	Joiner	Academia	Founder	Joiner	Academia	Founder	Joiner	Academia	Founder	Joiner	Academia	Founder	Joiner	Academia	Founder
	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)	(3a)	(3b)	(3c)	(4a)	(4b)	(4c)	(5a)	(5b)	(5c)	(6)
Preference - Autonomy	0.59**	0.37**	0.80**										0.69**	0.30**	0.61**	0.43**
	(0.09)	(0.06)	(0.06)										(0.09)	(0.06)	(0.07)	[0.10]
Preference - Wealth	0.33**	0.16*	-0.53**										-0.01	0.08	-0.38**	0.08
	(0.10)	(0.08)	(0.08)										(0.10)	(0.07)	(0.09)	[0.11]
Risk aversion	-0.15**	-0.07**	0.02										-0.12**	-0.06**	0.01	-0.06**
	(0.02)	(0.02)	(0.03)										(0.02)	(0.02)	(0.03)	[0.02]
Ability	0.10*	0.03	-0.01										0.04	-0.01	-0.02	0.02
	(0.04)	(0.03)	(0.03)										(0.05)	(0.03)	(0.03)	[0.04]
Work Interest - Commercialization				0.89**	0.36**	-0.37**							0.87**	0.35**	-0.31**	0.61**
				(0.09)	(0.06)	(0.06)							(0.11)	(0.06)	(0.07)	[0.12]
Work Interest - Management				0.27**	0.04	-0.14**							0.30**	0.05	-0.06	0.26**
				(0.05)	(0.04)	(0.05)							(0.05)	(0.04)	(0.05)	[0.06]
Work Interest - Basic research				0.38**	0.40**	0.61**							0.22**	0.32**	0.45**	-0.10
				(0.08)	(0.04)	(0.05)							(0.08)	(0.05)	(0.06)	[0.07]
Work Interest - Applied research				0.06	0.14+	-0.20**							-0.11	0.07	-0.30**	-0.02
				(0.13)	(0.08)	(0.07)							(0.14)	(0.08)	(0.08)	[0.12]
Dept. norms - Academia							0.05	0.00	0.25**				0.02	0.01	0.26**	0.03
							(0.09)	(0.07)	(0.08)				(0.11)	(0.08)	(0.08)	[0.08]
Dept. norms - Entrepreneurship							0.08	0.29**	0.01				-0.01	0.22**	-0.09	-0.17*
							(0.09)	(0.07)	(0.07)				(0.10)	(0.07)	(0.08)	[0.07]
Advisor - Founder							0.76**	0.14	-0.01				0.47*	0.05	0.10	0.40**
							(0.20)	(0.14)	(0.18)				(0.19)	(0.13)	(0.18)	[0.14]
Commercial opportunity										0.41**	0.19**	-0.03	0.26**	0.11*	0.08+	0.15*
										(0.06)	(0.04)	(0.04)	(0.07)	(0.05)	(0.05)	[0.06]
Num. patents										0.06	-0.02	-0.07	0.01	-0.02	-0.04	0.05
										(0.07)	(0.07)	(0.10)	(0.09)	(0.08)	(0.10)	[0.06]
Prior work startup	1.06**	0.19	-0.23	1.00**	0.18	-0.22	1.01**	0.16	-0.27	1.00**	0.15	-0.26	0.98**	0.16	-0.21	1.01**
	(0.20)	(0.15)	(0.21)	(0.19)	(0.15)	(0.20)	(0.20)	(0.15)	(0.18)	(0.20)	(0.15)	(0.18)	(0.20)	(0.15)	(0.22)	[0.17]
Parent self-employed	0.52**	0.08	0.19+	0.57**	0.10	0.17	0.53**	0.11	0.21+	0.52**	0.09	0.20+	0.57**	0.09	0.18	0.53**
	(0.17)	(0.11)	(0.11)	(0.17)	(0.11)	(0.12)	(0.17)	(0.11)	(0.11)	(0.17)	(0.10)	(0.11)	(0.18)	(0.11)	(0.12)	[0.16]
Male	1.46**	0.82**	0.49**	1.60**	0.83**	0.56**	1.62**	0.86**	0.66**	1.62**	0.87**	0.62**	1.53**	0.84**	0.51**	0.81**
	(0.17)	(0.10)	(0.15)	(0.17)	(0.10)	(0.14)	(0.17)	(0.10)	(0.13)	(0.17)	(0.10)	(0.13)	(0.19)	(0.11)	(0.16)	[0.18]
Age	0.01	0.02	0.01	0.01	0.02	0.02+	0.02	0.03+	0.02+	0.02	0.03+	0.02+	0.01	0.02	0.02+	-0.01
	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	[0.02]
Control variables	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Field fixed effects	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
University fixed effects	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Constant	-6.72**	-2.40**	-1.52*	-9.84**	-4.49**	-1.27*	-4.84**	-2.00**	-1.89**	-4.76**	-1.32**	-0.62	-10.38**	-5.33**	-2.40*	-8.14**
	(0.82)	(0.58)	(0.67)	(0.72)	(0.51)	(0.57)	(0.67)	(0.57)	(0.61)	(0.61)	(0.45)	(0.45)	(1.06)	(0.80)	(0.93)	[0.85]
Obs.		4282			4282			4282			4282			4282		2336
Loglikelihood		-4662.32			-4448.35			-4848.20			-4841.12			-4309.27		-852.88

NOTES: The dependent variable in Models 1-5 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 *industry* (not attracted to entrepreneurship and attracted to industry); the dependent variable in Model 6 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, and nationality; all columns report robust standard errors clustered on university reported in parentheses; ** p < 1%, * p < 5%, + p < 10%.

Table 5: Sorting into Department, Advisor, and Commercial Research

Method	Logit	Ordered logit			Logit			Ordered logit		
Dependent variable	Pre-existing interest	Department norms - Entrepreneurship			Advisor - Founder			Commerical Opportunity		
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Pre-existing entrepreneurial interest		0.38**	0.35**		0.15	0.04		0.26**	0.08	
		[0.08]	[0.08]		[0.11]	[0.11]		[0.08]	[0.08]	
Pre-existing interest - Founder				0.08			0.40*			0.24+
				[0.13]			[0.16]			[0.14]
Pre-existing interest - Joiner				0.35**			0.09			0.02
				[0.09]			[0.12]			[0.08]
Preference - Autonomy	0.24**		0.11*	0.12**		0.20**	0.19*		0.18**	0.18**
	[0.06]		[0.04]	[0.04]		[0.07]	[0.07]		[0.04]	[0.04]
Preference - Wealth	-0.03		-0.05	-0.06		0.06	0.06		-0.02	-0.02
	[0.06]		[0.04]	[0.04]		[0.08]	[0.08]		[0.04]	[0.04]
Risk aversion	-0.03+		0.00	0.00		-0.02	-0.02		-0.02	-0.02
	[0.02]		[0.02]	[0.02]		[0.02]	[0.02]		[0.02]	[0.02]
Ability	0.05+		-0.00	-0.00		0.03	0.03		0.15**	0.15**
	[0.03]		[0.02]	[0.02]		[0.03]	[0.03]		[0.02]	[0.02]
Work Interest - Commercialization	0.33**		0.05	0.05		0.21**	0.20**		0.25**	0.24**
	[0.05]		[0.04]	[0.04]		[0.06]	[0.06]		[0.04]	[0.04]
Work Interest - Management	0.11*		0.06	0.06+		-0.02	-0.03		0.01	0.00
	[0.05]		[0.04]	[0.04]		[0.05]	[0.05]		[0.03]	[0.03]
Work Interest - Basic research	-0.01		0.18**	0.17**		-0.15*	-0.14+		-0.17**	-0.17**
	[0.07]		[0.04]	[0.04]		[0.07]	[0.08]		[0.04]	[0.04]
Work Interest - Applied research	0.05		0.00	0.00		0.02	0.01		0.38**	0.38**
	[0.07]		[0.05]	[0.05]		[0.12]	[0.12]		[0.05]	[0.05]
PrePhD interest - Academia	-0.28**	0.06+	0.01	0.00	-0.01	-0.01	-0.00	0.05+	0.02	0.02
	[0.05]	[0.04]	[0.04]	[0.04]	[0.05]	[0.05]	[0.05]	[0.03]	[0.03]	[0.03]
PrePhD interest - Established firm	1.50**	0.05	0.06	0.07*	0.15**	0.10	0.09	0.24**	0.16**	0.17**
	[0.07]	[0.04]	[0.04]	[0.04]	[0.06]	[0.06]	[0.06]	[0.03]	[0.03]	[0.03]
Prior work in startup	0.88**	0.03	0.03	0.06	0.40*	0.39*	0.36*	0.24**	0.20*	0.19*
	[0.15]	[0.10]	[0.11]	[0.11]	[0.16]	[0.16]	[0.16]	[0.08]	[0.08]	[0.08]
Parent self-employed	0.10	-0.09	-0.09	-0.08	0.10	0.08	0.07	0.09	0.06	0.05
	[0.10]	[0.06]	[0.06]	[0.06]	[0.13]	[0.13]	[0.13]	[0.07]	[0.07]	[0.07]
Male	0.73**	0.07	0.06	0.08	0.09	0.05	0.02	-0.02	-0.08	-0.09
	[0.10]	[0.06]	[0.07]	[0.06]	[0.12]	[0.12]	[0.12]	[0.06]	[0.06]	[0.06]
Age	-0.01	-0.02	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02
	[0.01]	[0.01]	[0.01]	[0.01]	[0.02]	[0.02]	[0.02]	[0.01]	[0.01]	[0.01]
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					-2.86**	-3.86**	-3.70**			
					[0.56]	[0.82]	[0.80]			
Obs.	4266	4266	4266	4266	4266	4266	4266	4266	4266	4266
Log-likelihood	-4218.76	-4237.58	-4218.76	-4219.29	-1330.07	-1313.57	-1305.91	-5934.01	-5780.00	-5778.39

NOTES: The variable Pre-existing Entrepreneurial Orientation equals 1 if the respondent reported retrospectively that prior to the PhD they were likely to pursue a career in a startup upon graduation and is intended to reflect possible selection effects; the dependent variables are as follows: Models 1 & 2 is the extent to which the department encourages careers in a startup on a 5-point scale; Models 3 & 4 is whether the advisor has been a founder (yes=1); Models 5 & 6 is the commercial value of the respondent's research on a 5-point scale; control variables include number of publications, expected job availability, and nationality; all results report robust standard errors clustered on university reported in parentheses; ** p < 1%, * p < 5%, + p < 10%.

Table 6: Treatment Effects of Norms, Peers and Commercial Opportunity

Method	Multinomial Logit					
Description	Treatment Variables			Full Specification		
Dependent variable:	Founder	Joiner	Acad.	Founder	Joiner	Acad.
Model	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)
Dept norms - Academia	-0.00	0.03	0.23**	-0.01	0.04	0.24**
	(0.16)	(0.08)	(0.08)	(0.18)	(0.09)	(0.08)
Dept norms - Entrepreneurship	0.03	0.25**	0.00	-0.06	0.17*	-0.12
	(0.15)	(0.08)	(0.08)	(0.16)	(0.08)	(0.10)
Advisor - Founder	0.70*	-0.19	-0.05	0.63*	-0.18	0.03
	(0.33)	(0.16)	(0.20)	(0.31)	(0.18)	(0.20)
Commercial opportunity	0.35**	0.15**	-0.03	0.26*	0.11*	0.09+
	(0.11)	(0.05)	(0.05)	(0.12)	(0.06)	(0.05)
Preference - Autonomy				0.79**	0.35**	0.59**
				(0.13)	(0.07)	(0.07)
Preference - Wealth				-0.27	0.06	-0.36**
				(0.17)	(0.10)	(0.10)
Risk aversion				-0.07+	-0.04+	0.03
				(0.04)	(0.02)	(0.03)
Ability				0.08	-0.03	-0.01
				(0.07)	(0.03)	(0.04)
Work Interest - Commercialization				0.36**	0.10	-0.01
				(0.12)	(0.06)	(0.06)
Work Interest - Management				0.70**	0.26**	-0.33**
				(0.14)	(0.07)	(0.08)
Work Interest - Basic research				0.27*	0.35**	0.43**
				(0.13)	(0.05)	(0.07)
Work Interest - Applied research				-0.46*	-0.02	-0.31**
				(0.21)	(0.09)	(0.08)
Num. patents	0.10	0.01	-0.05	0.08	0.02	-0.01
	(0.14)	(0.09)	(0.12)	(0.16)	(0.09)	(0.12)
Prior work startup	0.72**	-0.18	-0.18	0.59+	-0.15	-0.15
	(0.32)	(0.21)	(0.20)	(0.32)	(0.21)	(0.26)
Parent self-employed	0.79***	0.09	0.21**	0.82***	0.05	0.12
	(0.28)	(0.10)	(0.10)	(0.28)	(0.11)	(0.12)
Male	1.51***	0.84***	0.70***	1.42***	0.76***	0.58***
	(0.23)	(0.12)	(0.14)	(0.24)	(0.14)	(0.16)
Age	0.05	0.02	0.01	0.04	0.01	0.01
	(0.04)	(0.01)	(0.01)	(0.04)	(0.01)	(0.01)
Control variables	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Field fixed effects	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
University fixed effects	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Constant	-6.50**	-1.92**	-1.05+	-9.99**	-4.84**	-1.53+
	(1.36)	(0.63)	(0.61)	(1.80)	(0.88)	(0.92)
Obs.		2808			2808	
Log-likelihood		-3103.67			-2813.15	

NOTES: All models restrict the sample to only those respondents who reported that at the time they started their PhD they were not likely to pursue a career in a startup (it is assumed that their entrepreneurial interests were formed during the PhD); The dependent variable in Models 1 and 2 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 *industry* (not attracted to entrepreneurship and attracted to industry); control variables include number of publications, expected job availability, and nationality; all columns report robust standard errors clustered on university reported in parentheses; ** p < 1%, * p < 5%, + p < 10.

Table 7: Robustness Tests

Method	Multinomial Logit			Logit	Ordered Logit		
Description	Extremely Attracted to Entr.			Comparision	Career Attractiveness		
Dependent variable:	Founder	Joiner	Academia	Founder	Startup	Est. Firm	Academia
Model	(1a)	(1b)	(1c)	(2)	(3)	(4)	(5)
Preference - Autonomy	0.46**	0.10	0.70**	0.47**	0.01	-0.35**	0.81**
	(0.12)	(0.09)	(0.06)	[0.16]	[0.04]	[0.04]	[0.05]
Preference - Wealth	0.20+	0.22*	-0.41**	0.23	0.33**	0.56**	-0.16**
	(0.11)	(0.09)	(0.08)	[0.18]	[0.04]	[0.04]	[0.04]
Risk aversion	-0.09**	-0.02	0.03+	-0.08*	-0.05**	-0.01	-0.03*
	(0.02)	(0.03)	(0.02)	[0.04]	[0.01]	[0.01]	[0.01]
Ability	0.00	0.09*	0.04	-0.04	0.00	0.03	0.15**
	(0.06)	(0.04)	(0.03)	[0.08]	[0.02]	[0.02]	[0.02]
Work Interest - Basic research	0.01	0.04	0.46**	0.19	0.05	0.10*	0.92**
	(0.09)	(0.07)	(0.06)	[0.13]	[0.03]	[0.04]	[0.04]
Work Interest - Applied research	0.56**	0.61**	-0.29**	-0.16	0.39**	0.61**	0.02
	(0.20)	(0.13)	(0.06)	[0.22]	[0.06]	[0.05]	[0.06]
Work Interest - Commercialization	0.90**	0.30**	-0.38**	0.63**	0.62**	0.52**	-0.09**
	(0.15)	(0.07)	(0.04)	[0.20]	[0.04]	[0.04]	[0.03]
Work Interest - Management	0.16*	0.02	-0.11**	0.22*	0.10**	0.06+	-0.16**
	(0.08)	(0.06)	(0.04)	[0.09]	[0.03]	[0.03]	[0.03]
Dept. norms - Academia	0.04	0.12	0.34**	-0.05	-0.12*	0.01	0.11*
	(0.14)	(0.11)	(0.06)	[0.18]	[0.06]	[0.04]	[0.05]
Dept. norms - Entrepreneurship	0.02	0.14	-0.10	-0.14	0.23**	0.07	0.12**
	(0.11)	(0.11)	(0.07)	[0.12]	[0.05]	[0.05]	[0.04]
Advisor - Founder	0.37	0.12	-0.03	0.10	-0.01	-0.18	0.09
	(0.23)	(0.17)	(0.16)	[0.27]	[0.11]	[0.11]	[0.11]
Commercial opportunity	0.14	-0.00	0.01	0.20	0.05+	0.08**	0.10**
	(0.10)	(0.05)	(0.04)	[0.12]	[0.03]	[0.03]	[0.02]
Num. patents	0.10	0.03	-0.04	0.09	0.07*	-0.01	-0.06
	(0.07)	(0.08)	(0.06)	[0.12]	[0.03]	[0.04]	[0.05]
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	-9.84**	-4.49**	-1.27*	-8.33**			
	(0.72)	(0.51)	(0.57)	[1.71]			
Obs.		4282		569	4282	4282	4282
Loglikelihood		-4448.35		-276.18	-5169.66	-4825.32	-4882.33

NOTES: The dependent variable in Model 1 recodes entrepreneurial interests to correspond to those respondents who reported entrepreneurship as extremely attractive (5 out of 5) to reflect the strongest entrepreneurial interests; the categories are: *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 *industry* (not attracted to entrepreneurship and attracted to industry); Model 2 restricts the sample to only those respondents who reported entrepreneurship as extremely attractive (5 out of 5); the dependent variable equals 1 if founder and 0 if joiner; the dependent variables in Models 3-5 are, respectively, the attractiveness of working in a startup, and established firm, and a faculty research position; control variables include number of patents, number of publications, expected job availability, prior startup work experience, gender, nationality, and patents' occupation; all columns report robust standard errors clustered on university reported in parentheses; ** $p < 1\%$, * $p < 5\%$, + $p < 10$.

Figure 1: Attractiveness of working in a startup

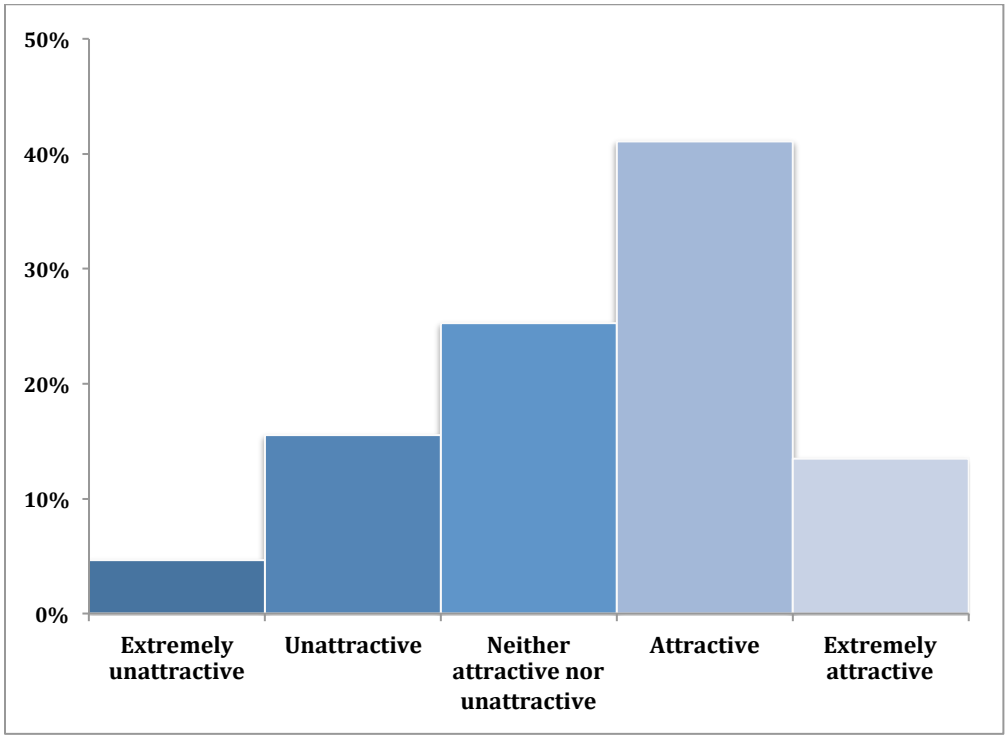

Figure 2: Expected likelihood of founding own company