

Founder or Joiner? The Role of Preferences and Context in Shaping Entrepreneurial Orientations

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

January 2013

Under review at *Management Science*

We thank Rajshree Agarwal, Howard Aldrich, Oliver Alexy, Michael Bikard, Diane Burton, Seth Carnahan, Jing Chen, Wes Cohen, Rafael Corredoira, Gary Dushnitsky, Chuck Eesley, Maryann Feldman, April Franco, Ben Hallen, David Hsu, David Kirsch, Shon Hiatt, and Tom Vanacker for their helpful comments and suggestions, as well as seminar participants at Boston University, Copenhagen Business School, Duke University, London Business School, Stanford University, UC-Berkeley, University of Maryland, the DRUID Summer Conference, the Fox-Kauffman Workshop on Empirical Entrepreneurship, the Georgia Tech Roundtable for Engineering Entrepreneurship Research, the IZA Entrepreneurship Workshop, the Maryland Entrepreneurship Conference, the NBER Entrepreneurship Working Group Meeting, and the Strategic Management Society Annual International Conference. We would also like to thank the Georgia Research Alliance for financial support. Michael Roach thanks the Kauffman Foundation Junior Faculty Fellowship for financial support. All errors are our own.

ABSTRACT

Entrepreneurial ventures rely not only on founders, but also on “joiners” – individuals who are attracted to working in startups as employees but who do not want to be founders themselves. We examine the role of individual preferences and social-contextual influences in shaping founder and joiner orientations prior to the first career transition. In doing so, we consider the possibility that micro and macro factors exert not only independent influences, but also interrelate to shape different entrepreneurial orientations. Using a sample of 4,282 science and engineering PhD students preparing to make their initial career transition, we find that individuals with founder and joiner orientations share similar preferences for entrepreneurial job attributes, but they also differ significantly in the strength and nature of these preferences. Social-contextual influences such as entrepreneurial norms, mentors, and opportunities play different roles in shaping the two types of orientations. After accounting for individuals’ pre-existing entrepreneurial orientation, our results suggest that a founder orientation is primarily associated with strong preferences for entrepreneurial job attributes, even in the absence of contextual influences. A joiner orientation, on the other hand, appears to emerge when both preferences and contextual influences are present. Moreover, social forces encouraging entrepreneurship have little association with entrepreneurial orientations when individuals lack preferences for entrepreneurial job attributes. Our findings highlight the importance of distinguishing between founders and joiners as distinct entrepreneurial actors, and contribute to the entrepreneurship literature by exploring the role – and interplay – of micro and macro factors in shaping entrepreneurial orientations.

1 Introduction

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 the rapid rise in demand for entrepreneurship education at universities. While considerable research effort has focused on explaining who becomes a founder (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), little attention has been directed toward understanding individuals who are drawn toward participating in entrepreneurship as employees, choosing to join founders in their entrepreneurial ventures rather than seeking to become founders themselves. Such entrepreneurial “joiners” have long been hidden in the shadows of founders as less visible agents of entrepreneurship, and yet they are worthy of greater attention in their own right. Although joiners may share certain characteristics with founders, such as an interest in commercializing ideas into products and a willingness to make trade-offs between working in an exciting and dynamic work setting in exchange for lower pay and greater employment risks (Neff 2012), the factors that shape individuals’ motives to join a startup may also differ from those that shape motives to found a startup in fundamental ways. Such differences take on even greater importance given that attracting motivated and highly skilled employees is one of the key hurdles founders face in their efforts to build successful entrepreneurial ventures (Baron et al. 1996, Baron et al. 2001, Hsu 2009). Thus, understanding the similarities and differences between founders and joiners, as well as the factors that lead individuals to be oriented toward one role or the other, may have important implications for future entrepreneurship research, policies to encourage entrepreneurial activities, and entrepreneurs themselves.

In this paper, we examine the formation of individuals’ orientations toward participating in entrepreneurship as either a joiner or a founder prior to their initial career transition. In doing so, we contribute to the entrepreneurship literature by integrating and extending the often-disparate literatures that emphasize either micro or macro level theories. One body of research, largely grounded in economics and psychology, suggests that individual-level characteristics such as preferences for autonomy, risk, and ability predict transitions into entrepreneurship (McClelland 1961, Kihlstrom and Laffont 1979, Busenitz and Barney 1997, Hamilton 2000, Elfenbein et al. 2010, Astebro et al. 2011, Carnahan et al. 2012). While emphasizing individual

heterogeneity, this literature often overlooks the influence of the external environment in shaping entrepreneurial motives. Sociological theories, on the other hand, argue that social-contextual factors such as organizational characteristics, peers, and opportunities shape entrepreneurial transitions (Thornton 1999, Dobrev and Barnett 2005, Stuart and Ding 2006, Sorensen 2007, Azoulay et al. 2009, Nanda and Sorensen 2010). Although this line of research increasingly accounts for the fact that individuals may choose to work in different organizational settings based on their pre-existing preferences (Dobrev and Barnett 2005, Sorensen 2007, Azoulay et al. 2009), little research has explicitly examined the possibility that preferences may condition the influence of social-contextual factors in shaping entrepreneurial behaviors. In this paper, we consider not only the independent role of micro and macro factors, but we also explore their potential interplay in shaping entrepreneurial orientations.

Our empirical analysis draws upon on a survey of 4,282 science and engineering PhD students nearing their first professional career transition, as well as over 50 interviews of survey respondents, faculty advisors, and startup founders and joiners. These data complement prior entrepreneurship research by providing detailed measures of the factors that may underlie the emergence of nascent entrepreneurial orientations at the individual level, rather than relying upon more aggregate organization or regional level data. We first document the pervasiveness of entrepreneurial orientations 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 express an interest in being a founder, while an additional 45% state an interest in joining a startup as an employee, but not as a founder. In a series of regression analyses, we find that individuals with joiner and founder orientations share similar preferences for “entrepreneurial” job attributes such as autonomy, risk, and commercialization, but they also exhibit significant differences with respect to the nature and strength of these preferences, as well as the influence of social-contextual factors. Furthermore, we find suggestive evidence that those with a pre-existing entrepreneurial orientation sort into organizational contexts or research projects that are more entrepreneurial, but we find little evidence that they match with entrepreneurial mentors. More importantly, after accounting for individuals’ pre-existing entrepreneurial orientation, our results suggest that a founder orientation is primarily associated with strong preferences for entrepreneurial job attrib-

utes and it is likely to emerge even in the absence of social influences favoring entrepreneurship, although such influences appear to further reinforce it. A joiner orientation, on the other hand, tends to emerge when both entrepreneurial preferences and entrepreneurial social-contextual influences are present. Finally, social factors encouraging entrepreneurship have little association with entrepreneurial orientations when individuals lack preferences for entrepreneurial job attributes.

This study has important implications for entrepreneurship research as well as managerial practices and policy. First, our study suggests that joiners share many similarities with founders, but nevertheless exhibit their own unique entrepreneurial profiles. As such, many of the preference and contextual factors studied in prior entrepreneurship research appear to apply not only to founders, but also extend, albeit in different ways, to non-founding entrepreneurial actors. Second, we provide novel evidence regarding the role of individual preferences and social-contextual factors as potential drivers of entrepreneurial orientations. While both sets of factors seem to matter, the most interesting finding is that preferences and context appear to interrelate in unique ways that are associated with different entrepreneurial orientations. Thus, rather than abstracting away from—or controlling for—one set of factors in the interest of focusing on the other, this study provides a response to the growing chorus of scholars calling for entrepreneurship research to direct greater attention to exploring the interplay between micro and macro factors (Audia and Rider 2006, Sorensen 2007) with implications for entrepreneurial transitions and founding team formation. In addition, a more nuanced understanding of the role of preferences and contextual factors is not only of scholarly interest, but also provides guidance for policy makers interested in encouraging entrepreneurial activity and the supply of entrepreneurial human capital. Finally, examining entrepreneurial orientations prior to and separate from realized entrepreneurial actions opens up interesting avenues for future research on entrepreneurial activity, including studies of the reasons that may prevent some individuals from realizing their entrepreneurial ambitions, or lead others to engage in entrepreneurial activities that they had not initially planned.

2 Entrepreneurial Orientations: Distinguishing between Founders and Joiners

Many developed societies increasingly celebrate entrepreneurship (Aldrich and Yang 2012), as evidenced in part by increasing rates of entrepreneurship (Hsu et al. 2007), changes in

cultural values (Neff 2012), growing attention toward entrepreneurship education, government initiatives to encourage and foster entrepreneurship, and extensive media coverage of prominent startups and entrepreneur icons. We contend that the growing allure of entrepreneurship is not limited to just those with a desire to found their own company, but also extends to “joiners,” individuals who are drawn to entrepreneurial ventures as employees but who have little desire to be founders themselves. Despite the relative lack of attention to entrepreneurial joiners in the literature, many new ventures rely critically on the contributions of employees (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 types of organizations (Campbell et al. 2012).

We conceptualize joiners as individuals who actively seek employment in entrepreneurial ventures over other forms of employment, largely because they find certain aspect of startup employment particularly attractive. For example, joiners may be drawn to startups in part because they offer a stimulating work setting with greater opportunities to develop human capital, to advance rapidly within the firm, and to exert greater control over careers and work activities (Neff 2012). As such, joiners are distinct from both founding team members as well as other non-founding employees, even though joiners may be among the first employees of a new venture or join founders in their efforts to launch a new company. Like founders, joiners participate in the entrepreneurial process of commercializing opportunities through the creation of new companies, however unlike founders joiners often do not hold significant ownership stakes or executive positions within new ventures (Ruef et al. 2003, Carter et al. 2004). Furthermore, not all start employees are joiner. First, since joiners have little desire to be founders themselves, they are distinguished from other entrepreneurial employees who work in startups primarily as a means to learn about entrepreneurship as a stepping-stone toward satisfying their own founder ambitions (Gompers et al. 2005, Sorensen 2007, Elfenbein et al. 2010). Second, joiners’ explicit attraction to working in an entrepreneurial setting also further distinguishes them from other startup employees who may view working in a new venture as simply a form of employment or who may work in a startup because they lack other career opportunities. Thus, founders and joiners are both entrepreneurial actors who are distinguished by their desired role within new ventures.

In our attempt to distinguish between founders and joiners, we focus on the formation of individuals’ entrepreneurial orientations prior to their transition to entrepreneurship. That is, we

examine who *wants* to be a founder or a joiner, rather than who *becomes* a founder or a joiner.¹ As such, we examine the factors that shape entrepreneurial orientations—individuals’ interests and motives that are the precursors to entrepreneurial transitions—without confounding them with factors that may constrain or facilitate actual transitions such as opportunity costs, access to capital, personal debt, or other constraints to entrepreneurship. Our general premise is that founders and joiners play distinct roles within entrepreneurial ventures that differ with respect to attributes such as responsibilities, risks and rewards, and work activities, and people will be attracted to the role of a founder or a joiner based on their expectations of how each role aligns with their preferences for such attributes and general career orientation (Markus and Nurius 1986, Ibarra 1999, Stern 2004, Roach and Sauermann 2010, Agarwal and Ohyama 2012). At the same time, we suggest that preferences may not automatically translate into explicit interest in entrepreneurship, but that the development of a joiner or founder orientation may also depend upon certain social-contextual influences that may differ in their particular strength and nature.

In our consideration of the potential antecedents of founder and joiner orientations, we develop a conceptual framework that is applicable to a range of entrepreneurial settings where recruiting skilled and motivated employees is of great importance to the success of new ventures. At the same time, however, the particular roles played by founders and joiners, as well as potential differences in the antecedents of founder and joiner orientations, may vary depending on the particular setting. In this study, we situate our discussion within the context of academic entrepreneurship to examine the entrepreneurial orientations of science and engineering PhDs. Academic entrepreneurship generally, and the role of newly-minted PhDs in particular, is of special interest for a number of reasons. First, entrepreneurial activities have been increasingly accepted as legitimate in many academic departments and receive significant attention from administrators and policy makers who see university spinouts as a potential source of economic growth (Etzkowitz 1998, Zucker et al. 1998, Owen-Smith and Powell 2001, Thursby et al. 2001, Shane 2004). As such, universities offer an institutional setting with considerable heterogeneity in contextual influences and with potentially important policy relevance. In addition, graduate training is arguably the most formative period in the professional training of science and engineering

¹ We recognize that many individuals who want to be a founder (i.e., they have a founder orientation) may not have the option to be a founder at their first career transition, and instead may work in a startup to gain entrepreneurial experience prior to founding their own company. Joiners, on the other hand, are more likely to have the option to work in a startup if they so choose, and thus understanding their career orientation may be more closely linked to their initial career choice.

PhDs (Stuart and Ding 2006), and thus when nascent entrepreneurial orientations are likely to form. Second, universities are frequently a source of important technological discoveries, and there is growing interest in the contributions of university-based technologies to innovation and economic growth. Academic entrepreneurship is an important vehicle by which such outcomes can be realized (Mowery et al. 2004, Shane 2004). Moreover, university-based discoveries are often nascent, emerging technologies that require substantial human capital to commercialize, and PhD-trained joiners often play a particularly important role in the venture formation process (Roberts 1991, Shane 2004, 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, Thursby and Thursby 2004), often leaving PhDs who were part of the research team to be key actors in the commercialization of university discoveries (Boh et al. 2011). Finally, academic entrepreneurship is seen as an increasingly attractive career option by newly-minted PhDs, making the understanding of joiner and founder orientations relevant to the broader study of scientific careers and labor markets (Roach and Sauermann 2010, Agarwal and Ohyama 2012, Stephan 2012).

In the next two sections, we consider in more detail the role of micro and macro-level factors as potential predictors of joiner and founder orientations.

2.1 Preferences for entrepreneurial job attributes and work activities

We first consider the micro perspective taken by economists and psychologists, which has emphasized that individuals' preferences for certain job attributes typically associated with starting a new venture, such as risk and autonomy, contribute to a predisposition toward being a founder (Kihlstrom and Laffont 1979, Hamilton 2000, Shane and Khurana 2003, Shane 2004, Ozcan and Reichstein 2009, Elfenbein et al. 2010). Although founders and joiners may share a similar attraction to participating in entrepreneurship, the roles that founders and joiners play within new ventures differ with respect to the particular kinds of job attributes and work activities involved. As such, the individuals expressing founder orientations and those expressing joiner orientations may differ with respect to both the nature and strength of their preferences for these attributes.

First, while most new ventures provide both founders and joiners with a certain degree of autonomy, founders can expect to have greater autonomy over the direction of the company and

key decisions than joiners. As such, individuals with a strong preference for autonomy may be drawn toward being a founder in order to exercise greater freedom and control over building a business and commercializing their own ideas (Roberts and Wainer 1971, Boswell 1973, Shane 2004). At the same time, even the joiner role is likely to offer considerable opportunities for greater ownership and discretion over day-to-day activities relative to employment in large established firms (Neff 2012). Thus, while joiners are likely to have weaker preferences for autonomy than founders, they may still consider it more important than individuals interested in careers in established firms. Second, both entrepreneurial roles may offer significant opportunities for learning and career advancement. For example, relative to working in an established firm, joining a startup may provide employees with more work-related responsibilities and activities that allow them to build skills and human capital, thereby providing greater opportunities for career advancement relative to employment in established firms (Elfenbein et al. 2010, Neff 2012). Starting one's own company as a founder may provide opportunities to develop an even greater variety of skills (Lazear 2005) while also offering the most immediate path to a top position. Thus, individuals who value learning and career advancement may be attracted to both entrepreneurial roles, but especially that of a founder.

Founders and joiners may also differ with respect to their attitudes toward the risks and rewards associated with participating in entrepreneurship. Prior research has stressed that founders incur considerable risk with respect to financial investments, career opportunities, and status in starting their own company, suggesting that they are more risk tolerant than employees (Kihlstrom and Laffont 1979, Begley and Boyd 1987, Seth and Sen 1995, Sarasvathy et al. 1998). As employees, joiners may face less risk than founders, however startup employment is likely to offer lower levels of job security than employment in established firms. While joiners may be willing to internalize the risks inherent in working for a startup in exchange for greater career opportunities (Neff 2012), it is likely the individuals with a higher tolerance for risk will be attracted to the role of founder or a joiner. The financial rewards of participating in entrepreneurship through the availability of stock options and the possibility of greater total compensation may also attract those with a preference for wealth. However, since founders can expect to obtain greater financial wealth in return for their investments in money and effort relative to joiners, individuals with a founder orientation may have stronger preferences for wealth than those with a joiner orientation. On the other hand, some have argued that most entrepreneurs pursue new ven-

tures primarily for non-financial reasons (Xu and Ruef 2004). Given the conflicting results in the literature, it is unclear *a priori* what relationship preferences for wealth will have with orientations toward being a founder or a joiner.

Finally, founders and joiners might also be distinguished by their preferences for certain work activities. Foremost, a preference for commercializing ideas into tangible and useful products may be most strongly associated with both a founder and a joiner orientation, particularly among science and engineering PhDs. For example, in interviews of academic entrepreneurs at MIT, Shane (2004) found that many faculty engaged in entrepreneurship primarily out of a passion to see their discoveries put into practice. This same desire may extend to joiners as well. In our own interviews, PhDs commonly referenced a desire to participate in research with tangible, practical applications as a primary motive for joining startups. While the desire to engage in commercialization may be shared by founders and joiners alike, their preferences for either general managerial tasks or more specific work 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 (Lazear 2005, Astebro and Thompson 2011), while joiners are likely to focus on more specific functions such as research and development, business development, or marketing and sales. Thus, preferences for managerial versus specific functional activities will likely further distinguish between founder and joiner orientations.

2.2 Social-contextual influences: Norms, mentors, and opportunities

Turning our attention to macro theories of entrepreneurship, research in sociology suggests that entrepreneurial behaviors are primarily shaped by social-contextual factors such as organizational characteristics, norms, peers, and opportunities (Thornton 1999, Dobrev and Barnett 2005, Stuart and Ding 2006, Sorensen 2007, Azoulay et al. 2009, Nanda and Sorensen 2010). The role of contextual factors in shaping entrepreneurial motives may be particularly important for highly trained scientists and engineers, where imprinting into the norms of science and the formation of career orientations are likely to occur during graduate training (Stuart and Ding 2006). For example, although academia has traditionally been governed by the norms of science that eschew commercial activities such as entrepreneurship, recent research has shown that institutional support for commercialization such as departmental norms that favor commercial activity and the entrepreneurial activities of prominent faculty have contributed to increasing rates of

academic entrepreneurship (Stuart and Ding 2006, Bercovitz and Feldman 2008, Azoulay et al. 2009)

Although these studies have established a relationship between contextual factors and entrepreneurial behaviors, they provide little guidance in thinking about potential differences in the antecedents of founder and joiner orientations. This is due in part to the literature's implicit assumption that the contextual factors that encourage entrepreneurship only influence founders, while their influence on joiners has not been explored. We suggest that it is useful to consider that different types of contextual influences may have qualitatively and quantitatively different effects on individuals, potentially leading to the formation of different types of entrepreneurial motivations. In particular, it is conceivable that academically trained PhDs see founding a new venture as a radical transition away from more traditional forms of employment (Ding and Choi 2011), whereas becoming a joiner might be seen as somewhat more consistent with more common career options in industry. If so, then it is conceivable that strong contextual factors may be needed to foster founder orientations, while somewhat weaker influences may be sufficient to shape joiner orientations. As such, we expect that relatively diffuse and group-based contextual factors such as institutional norms may shape a general orientation toward participating in entrepreneurship as a joiner (Stuart and Ding 2006), but may be insufficient to shape a founder orientation. On the other hand, prominent peers and mentors with founding experience may exert a stronger and more direct influence (Stuart and Ding 2006, Azoulay et al. 2009). Within the context of academic entrepreneurship, a PhD's academic advisor may act a role model who legitimizes and exemplifies certain behaviors such as academic entrepreneurship (Kenny and Goe 2004, Azoulay et al. 2009). Thus, assuming that advisors have a stronger influence than more diffuse departmental norms, entrepreneurial norms may be associated with a joiner orientation, while entrepreneurial advisors may shape both joiner and founder orientations.

A separate line of research has focused attention on the role of opportunities as a contextual factor driving transitions to entrepreneurship (Bhide 2000, Shane 2001, Stuart and Ding 2006, Ding and Choi 2011). The prevailing view suggests that the discovery of an opportunity provides a concrete and actionable basis for founding a company, and that founder intentions form (only) after an opportunity is discovered (Shane 2000). On the other hand, an interest in being a founder may form prior to the discovery of an opportunity. For example, in a survey of MIT graduates, Roberts (1991) found that many technology entrepreneurs were attracted to en-

trepreneurship long before they discovered an opportunity or founded their own companies. In more recent interviews of MIT academic entrepreneurs, Shane (2004) found that many faculty start a university spinoff because they have always desired to be an entrepreneur. According to one MIT professor “I always wanted to start a company. It was always in the back of my mind.” Another founder in software 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.” At the same time, our interviews of science and engineering PhDs and faculty suggests that some individuals who have opportunities have little interest in pursuing them. This is consistent with prior research that has found that faculty disinterest is a significant impediment to the commercialization of university research (Thursby and Thursby 2002, Thursby and Thursby 2004). Thus, while we expect a positive relationship between opportunities and a founder orientation, this relationship may not be deterministic.

Up to this point, our discussion has focused on the potential roles of preferences and social-contextual factors in shaping founder and joiner orientations. However, individuals with a pre-existing entrepreneurial orientation may also sort into particular contexts that may allow them to further their entrepreneurial interests (Sorensen 2007, Azoulay et al. 2009, Ozcan and Reichstein 2009, Elfenbein et al. 2010). For example, such individuals may sort into organizational contexts that support or encourage entrepreneurial activity, or may seek to work with advisors who have entrepreneurial experience. Similarly, individuals with a pre-existing founder orientation may actively 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). While the focus of our paper is the potential role of contextual factors in shaping founder and joiner intentions, we will also examine and control for such selection effects in our empirical analysis below.

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 report on earned doctorates (2008) to iden-

tify U.S. research universities with large doctoral programs in science and engineering. We selected a subset of institutions based primarily on program size while ensuring variation with respect to private/public status and geographic location. We collected roughly 30,000 individual names and email addresses from listings provided on departments' websites. We invited these individuals to participate in the online survey using a four-contact strategy (one invitation, three reminders). Adjusting for 6.3% undeliverable emails, the direct survey approach achieved a response rate of 30%. When individual contact information was not available, we used department administrators as a second channel to approach respondents. In those cases, we emailed administrators with the request to forward a survey link to their graduate students. Overall, 88% of our responses were obtained directly from respondents and 12% were obtained through administrators.

In this study we focus on PhDs in the advanced stages of their respective programs: those who have successfully completed their qualifying exams or equivalent milestones. We focus on late-stage students because they are closer to making their initial career decisions—including entrepreneurship—than PhDs in earlier stages of their programs. Moreover, advanced PhDs have been in the program long enough to be influenced by institutional norms and advisors. The final sample used for this study consists of 4,282 PhD students at 39 different research universities across the life sciences, physical sciences, applied sciences, and engineering.

By employing detailed survey data on a large, representative sample of the population of science and engineering PhDs, we complement prior empirical work on entrepreneurship in important ways. First, while many studies rely upon secondary data such as business plans, research disclosures, patents, and other sources to identify entrepreneurs *ex post*, our data provide more direct measures of *ex ante* entrepreneurial orientations, which are the primary focus of this study. Observing individuals before they actually transition to entrepreneurship also controls for potentially confounding influences of the entrepreneurial experience itself on individuals' preferences and social context (Sexton and Bowman 1985, Stuart and Ding 2006, Elfenbein et al. 2010). A second advantage is that the data contain detailed measures of individual preferences, department norms, advisor activities, and perceptions about commercial opportunities that are often not available to scholars. This enables us to consider individual and contextual factors simultaneously and also allows for a more precise and nuanced analysis than commonly used proxy variables. Moreover, since all our respondents are in a broad cohort of PhD students who are preparing to

enter the professional labor force for the first time, 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 (e.g., Roberts 1991, Shane 2004, Stuart and Ding 2006), a nascent body of work has begun to look beyond faculty founders to examine the role of students and recent graduates in entrepreneurial activity (Boh et al. 2011, Astebro et al. 2012). Our data complement those used in prior studies by providing insights into a large sample of highly-trained science and engineering students. Finally, while there is a widespread belief that attitudes in academia are increasingly commercially-oriented (Etzkowitz 1998, Owen-Smith and Powell 2001, Stuart and Ding 2006, Bercovitz and Feldman 2008), much of our understanding of academic entrepreneurship is based on data collected more than a decade ago and empirical evidence on current attitudes remains sparse. Our data provide unique and recent insights from the latest generation of science and engineering PhDs.

We supplement the survey responses with more than 50 research interviews conducted at seven research universities and one university-affiliated national laboratory. Although the majority of interviewees were respondents to the survey, other interviewees also included startup founders and joiners, university faculty, postdoctorates, and senior university technology transfer personnel. Each interview lasted from 30-60 minutes and the subjects were asked a range of open-ended questions. For survey respondents, questions included their reasons for entering a PhD program, how they chose their advisor and dissertation research project, experience during the PhD, and their career goals. We incorporate insights from these interviews where appropriate to corroborate the regression results and provide greater clarity in interpreting our findings.

3.2 Dependent variable

Our primary dependent variable is a categorical measure of each respondent's entrepreneurial orientation (founder or joiner) or other career orientation (academia or established firm). To construct these four categories we employ two survey items that were part of a general set of questions asking respondents about future employment after graduation. We use both measures jointly to classify respondents according to their entrepreneurial orientation at the time of the survey. In the first question, we asked respondents "How likely are you to start your own com-

pany?" on 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 a *founder orientation*. The second question asked "Putting job availability aside, how attractive do you personally find a career in a startup with an emphasis on research or development?" and captured respondents' general attraction to working in a startup². 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 a *joiner orientation*.

In our data, 11% of individuals have an orientation toward being a founder and 45% have an orientation toward being a joiner. Respondents with a joiner orientation and those with a founder orientation have similarly high scores on the attraction of working in a startup (4.24 for founders and 4.19 for joiners), suggesting that these two groups differ not in their interest in "working" in a startup per se, but rather in their interest in being a founder or not. In addition, although a small share of those with a founder orientation report that working in a startup is unattractive (1.5% of the sample), we interpret this as individuals who would engage in entrepreneurship only as a founder (i.e., "the boss") and who are not attracted to participating in the entrepreneurial process more generally. We exclude these respondents in a robustness test with no significant change in the results.

The remaining 44% of individuals are classified broadly as being disinterested in entrepreneurship. Given the context of our study, we further distinguish this group between those who are more orientated toward a career in academia and those who are more oriented toward a career in an established firm by drawing upon additional survey questions that ask about the attractiveness, again on a 5-point scale, of careers in academia as either research or teaching faculty, and careers in an established firm, government, or other setting 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 oriented toward academia (27.7%), and all others were coded as orientated toward established firms (16.2%). Although this distinction is crude, our objective

² This measure is not mutually exclusive with other career options, and did not ask respondents to make tradeoffs between working in a startup over alternative careers such as in academia or in an established firm.

is to construct a broad distinction between academic and non-academic careers for our non-entrepreneurial reference group.³

3.3 Independent variables

Individual Preferences – To measure individual preferences for *autonomy, opportunities for career advancement, 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 tolerance*, we asked respondents the following question: “Imagine you have the choice between winning \$1,000 for sure or winning \$2,000 with a 50% chance. Please indicate which option you prefer.” Respondents were provided with a 10-point scale that ranged from “strongly prefer a 100% chance to win \$1,000” to “strongly prefer a 50% chance to win \$2,000.” Higher values of this response scale reflect a greater tolerance to risk while lower values reflect a greater aversion to risk. We measure individuals’ *work interests* in different 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-Contextual Influences – To measure *institutional norms* toward different careers, we asked respondents to indicate the degree to which PhDs in their department or lab are encouraged or discouraged to pursue careers in academia and in a startup, respectively.⁴ The scale for these items ranged from 1 (strongly discouraged) to 5 (strongly encouraged). While over 81% of departments encouraged careers in academia, only 32% encouraged careers in startups. However, it is important to point out that a majority of departments (59%) are indifferent to careers in startups (i.e., neither encourage nor discourage) while only 9% of departments discouraged such careers. Moreover, approximately 30% of departments encouraged careers in both academia and startups, possibly reflecting a convergence of scientific and commercial norms.

³ To clarify, this does not reflect all individuals with an orientation toward careers in academia or industry, but rather the subset of individuals who are not also attracted to a career in a startup.

⁴ 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 not 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.

To measure the entrepreneurial activities of mentors, 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 *entrepreneurial mentor*, and all other responses as 0. While some respondents may report "no" or "don't know" even though their advisor may have in fact founded a venture, we expect that only behaviors known to the respondent will have an influence on their entrepreneurial orientation (Greenberg 2009). Eleven percent of PhDs in our sample have an advisor who has founded a company.

Regarding opportunities, prior research has shown that many technology entrepreneurs start companies based on opportunities closely related to their domain expertise (Roberts 1991, Shane 2000). As such, we suggest that science and engineering PhDs' entrepreneurial opportunities arise primarily from their own research activities. We measure *commercial opportunity* by asking respondents to assess the potential commercial value of their current research on a 5-point scale, from "not valuable" to "extremely valuable." Recent research by Gambardella et al. (2012) has shown that entrepreneurs' perceptions of the value of their patents are significantly associated with their decision to start a new venture. Consistent with prior research (Stuart and Ding 2006, Bercovitz and Feldman 2008), we also use the survey reported number of patent applications on which the respondent was listed as an inventor as an alternative opportunity measure. While both measures should be reasonable proxies for commercial opportunities emanating from a respondent's own research, they do not necessarily reflect opportunities resulting from other research projects or entrepreneurial opportunities that are not technology-based. In addition, we recognize that not all commercially valuable research results are suitable opportunities for starting a new company. For example, PhDs whose research is funded by industry sources may not have the option to commercialize their research because the rights to any output may be assigned to the sponsoring firm. As such, we include a binary control variable that equals 1 if the respondent's research is industry funded, and 0 otherwise. Table 1 presents the variables, their measure, and summary statistics.

3.4 Control variables

We include several additional control variables. First, we control for demographic background, including gender, age, and nationality. Second, an individual characteristic that has been

related to entrepreneurship is ability (Hamilton 2000, Elfenbein et al. 2010, Astebro et al. 2011, Astebro and Thompson 2011, Campbell et al. 2012, Carnahan et al. 2012, Eesley and Roberts 2012). To proxy for *ability*, we use a question 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). While this measure does not capture all relevant dimensions of ability, it should be a reasonable proxy, especially in the context of science and technology entrepreneurship. Third, a potential determinant of early career preferences is the parents’ career, which may influence a respondent’s values and career choices (Aldrich and Kim 2007). We include a variable that equals 1 if at least one parent is self-employed and 0 otherwise and a second variable that equals 1 if at least one parent is working in academia and 0 otherwise. To account for the possibility that entrepreneurial orientation reflects 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. Finally, we control for university and field effects by including dummies for 39 universities and 10 aggregate fields of science and engineering.

3.5 The use of survey data

There are a number of general concerns when using survey data that we specifically addressed in the construction of our survey instrument. First, a concern when both the dependent and independent variables are drawn or constructed from the same source (i.e., a survey) is common methods bias, which could magnify the correlations between variables (Podsakoff et al. 2003) To minimize this concern, groups of question were intentionally separated in the survey questionnaire to reduce priming effects and mitigate possible spurious correlations between variables. Moreover, as illustrated in our empirical analysis, the featured independent variables exhibit significant and distinct relationships with each category of our dependent variable measuring different career orientations, providing support that the observed relationships are not artifacts of our survey methodology.

Another concern with self-reported measures of preferences for job characteristics is that respondents may overstate preferences that seem socially desirable (e.g., autonomy) and give artificially low scores to preferences that may seem less socially desirable. To mitigate this concern, we stated clearly in the survey invitation that responses would be kept strictly confidential.

Moreover, any social desirability bias that is common to respondents should not affect our correlational results. Finally, there may be measurement error in respondents' interpretation of specific questions. However, such error is of concern only to the extent that it is driven by unobservable characteristics that are correlated with either the dependent variable or other independent variables (i.e., *nonclassical* measurement error). Other sources of measurement error will introduce noise that may attenuate our coefficient estimates, likely leading to conservative estimates of differences between joiners and founders or of the relationships between entrepreneurial orientations and individual preferences and social context.

Despite these concerns, the survey data also provide some advantages. First, the detailed individual-level measures provided by the survey allow us to include variables that are typically either measured using aggregate proxies or omitted altogether in entrepreneurship research, in particular, individuals' preferences. Furthermore, the data include a range of detailed controls for typically unobserved variables, thereby reducing possible sources of unobservable heterogeneity more common in prior studies.

4 Analysis

Our first set of analyses examines for similarities and differences between the profiles of individuals with founder and joiner orientations on the one hand, and those disinterested in entrepreneurship on the other. We then utilize a measure of individuals' pre-existing entrepreneurial orientation to explore potential selection into different contextual settings. In section 5, we offer a more detailed analysis of the interplay between individual preferences and social-contextual factors in shaping entrepreneurial orientations. While we seek to rule out alternative explanations and endogeneity, all results are interpreted as correlational due to the cross-sectional nature of the data.

4.1 Comparing founder and joiner orientations

We begin with a series of multinomial logistic regressions that compare the coefficients of the likelihood of having an orientation toward being a founder, a joiner, or an academic, to the reference group of those with an orientation toward working in established firms. We chose established firms as the reference group to provide greater comparability between our results and prior studies, which often compare founders to other individuals employed in (typically) large

established firms. Although we believe that respondents view each of these careers as distinct alternatives, we also performed alternative-specific conditional logistic regression that relaxes the assumption of the independence of irrelevant alternatives (IIA) with substantively identical results. The featured results from the multinomial logistic regression are presented in Table 2. While we report results for each set of preferences and context variables separately, we focus our discussion on the full specification in Model 5. To directly compare founder and joiner orientations, Model 6 reports logistic regression results for a sample that is restricted to only those individuals with an orientation toward entrepreneurship (i.e., excluding the academia and established firm groups).

Focusing first on individual characteristics, we observe that individuals with stronger preferences for autonomy, opportunities for career advancement, and who are more risk tolerant, are more likely to have a founder or a joiner orientation relative to individuals seeking careers in an established firm (the reference group). However the effect sizes between the founder and joiner groups differ markedly. For example, a one standard deviation higher preference for autonomy is associated with a 68% greater likelihood of being in the founder group versus the established firm group, while for the joiner group it increases the likelihood by 26%. The logit results in Model 6 show that the differences in preferences are significant, whereby individuals with stronger preferences for autonomy and risk more likely to have a founder orientation rather than a joiner orientation. Interestingly, preferences for wealth do not significantly distinguish those with a founder or joiner orientation from those with an orientation toward a career in industry, suggesting that a desire for money, while likely still important, is not a defining characteristic of entrepreneurial orientations.

The results for preferences for specific work activities in Model 5 show that those with a strong preference for commercialization research results into products and services are more likely to have either a founder or a joiner orientation compared to those oriented toward established firms, although this effect is again strongest for those with a founder orientation. Model 6 suggests that a one standard deviation increase in a preference for commercialization increases the likelihood of wanting to be a founder over a joiner by 84%.⁵ Individuals with a strong prefer-

⁵ We recognize that interests in specific work activities, especially commercialization, may partly be driven 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 analyses available from the authors we find that individual preferences, which are thought to be relatively persistent, are strongly associated with an interest in commercialization. While only suggestive, these results provide some evidence that an

ence for managerial activities are significantly more likely to have a founder, but not a joiner, orientation. We also find that individuals with an interest in conducting basic research are more likely to have either a founder or a joiner orientation relative to those who want to work in an established firm, and this effect is strongest for joiners. We conjecture that the latter finding might suggest that those science and engineering PhDs with a greater “taste for science” might expect startups to provide them with greater opportunities to conduct basic research than employment in established firms. One implication of this finding is that technology-based startups may provide a hybrid employment setting that combines the benefits of both science and commercialization.

Turning our attention to social factors, we observe that the profiles of founders and joiners are quite different. First, while departmental norms that encourage entrepreneurship have no relationship with the likelihood of a founder orientation, they exhibit a strong positive association with a joiner orientation. Entrepreneurial advisors, on the other hand, are significantly associated with a founder orientation but show no relationship with an orientation toward being a joiner. Although it is conceivable that department norms and advisors’ 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 confirm that these differences are significant even when we directly contrast joiner and founder orientations. Although the general pattern of results is expected, the findings that norms seem to have no relationship with a founder orientation and that entrepreneurial advisors have no relationship with a joiner orientation is not. We explore for possible sorting and social influence effects below.

Finally, we examine the relationship between the commercial value of individuals’ research and their orientation toward entrepreneurship. As expected, we find that as the commercial value of a PhDs’ research increases, they are more likely to have an entrepreneurial orientation, and the relationship is stronger for a founder orientation than a joiner orientation. Model 6 shows that the difference between founder and joiner orientations is statistically significant and the magnitude of this effect is quite large: a one standard deviation increase in commercial value increases the likelihood of being having a founder orientation over a joiner orientation by 80%. Thus it appears that individuals whose research has greater commercial potential are more at-

individual’s interest in commercialization may be determined by other factors exogenous to their current context and current interest in participating in entrepreneurship.

tracted toward entrepreneurship in a general sense, and the majority of these individuals (50%) are more oriented toward being a joiner than a founder (20%).

4.2 Sorting based on pre-existing entrepreneurial orientation

Our conceptual discussion eluded to the possibility that individuals with a pre-existing entrepreneurial orientation may sort into contexts that support or encourage entrepreneurial activity or actively seek out research projects that are likely to result in commercially valuable discoveries. To examine the possibility of selection, we include as a predictor a measure of each respondent's *pre-existing orientation* toward entrepreneurship at the time of starting the PhD program. In particular, we asked: "Thinking back to when you began your PhD program in [year of matriculation], how certain were you at that time that you wanted to pursue a career in a startup with an emphasis on research or development?" Responses were scored on a 5-point scale ranging from "certain not to pursue" to "certain to pursue." Approximately 34% of the PhDs in our sample reported a pre-existing entrepreneurial orientation (4 or 5 on the 5-point scale). Given that this measure is based on individuals' recall of their earlier entrepreneurial orientation, it may be overstated for people with a current orientation toward being a founder or a joiner.⁶ As consequence, our analysis may overstate possible selection effects and the results should be interpreted with caution. Nevertheless, we observe that of those who want to be a founder at the time of the survey, 73% report a pre-existing entrepreneurial orientation while only 50% of those with a joiner orientation report the same. Thus it appears that, at least descriptively, a founder orientation may be more likely to form at earlier stages of life relative to a joiner orientation.⁷ At the same time, of those with a pre-existing entrepreneurial orientation, 65% report their current orientation as a joiner and 24% report their orientation as a founder, suggesting that a longstanding interest in joining a startup may be more pervasive than a longstanding interest in founding one's own company.

To examine for possible sorting effects, we include the measure of a respondent's pre-existing interest in entrepreneurship as a predictor of whether an individual is in a department

⁶ 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.

⁷ This is further supported by one of our control variables in that individuals who have at least one parent who is self-employed are more likely to have a founder orientation, but not a joiner orientation.

with norms that encourage entrepreneurship, has a PhD advisors who is a founder, or works on projects with perceived commercial value. In these regressions, presented in Table 3, we interpret a significant coefficient of the *pre-existing orientation* as suggestive evidence that individuals with a pre-PhD interest in entrepreneurship may sort into a particular social context or seek out certain types of research that help them to achieve their entrepreneurial ambitions. Models 1 and 2 report ordered logistic regression results which show that individuals with a pre-existing entrepreneurial orientation are more likely to be in a department that encourages careers in entrepreneurship, even after controlling for individual characteristics (Model 2). These results are further supported by our interviews, which suggest that individuals with a longstanding orientation toward entrepreneurship are drawn toward departments located in universities that they believe to be more entrepreneurial, such as MIT, Stanford, and Caltech. Interviewees reported that they believed these departments would not only expose them to the broader entrepreneurial community outside their university, but they may also provide them with future opportunities to engage in entrepreneurship. However, the interviewees also informed us that the entrepreneurial culture of the department was of secondary consideration in influencing their choice next to the prestige, nature of research projects and collegiality of faculty and students. Thus, while we do find systematic evidence that PhDs may sort into departments based on their pre-existing entrepreneurial orientation, there is still considerable heterogeneity in their precise motives for joining a particular department.

Models 3 and 4 report logistic regression results to assess whether PhDs with a pre-existing entrepreneurial orientation are more likely to have an advisor who is a founder. They are not. These results are robust to the inclusion of additional controls for advisor characteristics including advisor's ability, rank, and patenting activity (results available from the authors). These results are consistent with recent research by Azoulay, Liu and Stuart (2009) which suggests that PhDs match with advisors based largely on geographic location, shared research interests and the prestige of the advisor. In our interviews, PhD students consistently reported that they matched with their advisors based on shared research interests and compatible personalities. Even individuals with a particularly strong entrepreneurial orientation reported their advisor's entrepreneurial activities as being of lesser importance in choosing their advisors than research and compatibility. One explanation cited by a number of interviewees is that they enter a PhD out of an interest in conducting research, not learning about entrepreneurship, and thus they choose an ad-

visor who will allow them to do research that aligns with their own interests and who provides them with the greatest career opportunities upon graduation. Although it is still conceivable that entrepreneurial PhDs might be drawn toward entrepreneurial advisors, our results suggest that this is not a primary driver of the match between student and advisor.

Finally, we examine whether respondents with a pre-existing entrepreneurial orientation are more likely to have current research projects with commercial value. When entered separately (Model 5) the pre-existing entrepreneurial orientation measure has a positive relationship with commercial value, yet as seen in Model 6 this result is sensitive to the inclusion of the measures of individual preferences, especially an interest in commercialization. Given that an interest in commercialization may increase with the discovery of a commercial opportunity, these results should be interpreted with caution. Although our interviews revealed that a number of people with a longstanding interest in entrepreneurship did choose research projects that are more commercially-oriented, for many there was little expectation at the time they started their projects that it might provide the basis for a new venture. Moreover, many indicated that they chose projects primarily because of their intrinsic interest in the research, followed by research that might provide them with the widest range of future career options, including in academia. Even the small handful of interviewees who chose a particular project because it might provide them with an opportunity to start their own company indicated that they were well aware of the considerable uncertainty regarding the eventual success of the project.

In summary, our results suggest that individuals with founder and joiner orientations share similar “entrepreneurial” profiles when compared to those not interested in entrepreneurship. However, they also exhibit significant differences from each other with respect to preferences for autonomy, risk, commercialization, and managerial work. Moreover, we find that institutional norms, mentors, and opportunities have different relationships with orientations toward being a founder or a joiner. Taken together, these results suggest that both founders and joiners are “entrepreneurial” in a general sense, but also highlight the need to consider differences in the factors shaping founder and joiner intentions. In addition, our examination of possible sorting effects suggests that individuals with pre-existing interest in entrepreneurship may sort into departments that are more entrepreneurial and may seek out research projects that are more likely to result in commercially valuable outputs. However, we find no evidence for sorting with re-

spect to entrepreneurial mentors. In the following section, we seek to provide deeper insights into the potential interplay between individual preferences and social-contextual factors.

5 The Interplay between Preferences and Context

As highlighted in the previous section, prior entrepreneurship research has largely examined preferences and contextual factors in isolation or, increasingly, as alternative explanations of entrepreneurship (Stuart and Ding 2006, Sorensen 2007, Azoulay et al. 2009, Ozcan and Reichstein 2009, Elfenbein et al. 2010). As such, each set of theories has implicitly assumed that micro and macro level factors have independent effects. In contrast, we suggest that both sets of factors may interrelated and, indeed, both may be necessary for entrepreneurial orientations to form.

5.1 Integrating preference and context-based theories

Implicit in the preference-based view of entrepreneurship is the notion that individuals with the “right” set of preferences for entrepreneurial job attributes will be aware of entrepreneurship as a possible career to satisfy these preferences. We suggest, however, that individuals with such preferences may not automatically be aware of entrepreneurship as possible career, and as such they may have a “latent” entrepreneurial orientation that becomes manifest under certain conditions. For example, some individuals may simply not be aware of entrepreneurship as a viable career path to satisfy their preferences, while others may not consider entrepreneurship because it violates social norms regarding which careers one *should* pursue. Others still may not actively consider an entrepreneurial career because they have yet to discover an opportunity to “live out” their entrepreneurial ambitions. We propose, and elaborate upon below, that social-contextual factors play a critical role in the awareness of a latent entrepreneurial orientation. Contextual views, on the other hand, suggest that the formation of entrepreneurial motives (or not) are primarily the result of exposure to different social and environmental factors that influence people within a given setting in a similar way. However, such views have not explicitly considered that individuals may respond in different ways to the same contextual influence, thereby leading some who are exposed, to say an entrepreneurial mentor, to form a founder orientation while others are not influenced at all. We propose an alternative view whereby individuals’ preferences condition their susceptibility to contextual influences; that is, people with pref-

ences for entrepreneurial job attributes are more likely to be influenced by contextual factors that encourage entrepreneurship, while those lacking these preferences may not be influenced at all, even by strong entrepreneurial contextual influences.

We follow prior work in assuming that preferences for job attributes are relatively innate and slow to change over time (Halaby 2003). First, consider individuals with strong preferences for entrepreneurial attributes such as autonomy, risk, commercialization, and management. Given the strength of their preferences for these entrepreneurial job attributes, these individuals may more readily think of founding a startup as a desirable career. As such, relatively weak social influences such as, general norms encouraging entrepreneurship may have little additional influence on shaping their already strong entrepreneurial orientation. Entrepreneurial mentors, however, may act as explicit role models who demonstrate the feasibility of becoming a founder, thereby reinforcing already strong preferences to shape a founder orientation (Greenberg 2009). Similarly, the perception of possessing a potentially valuable and actionable commercial opportunity may encourage such individuals to strongly consider enacting entrepreneurial plans, potentially further strengthening their founder orientation. At the same time, individuals with strong entrepreneurial preferences may express a founder orientation even if they do not currently possess an opportunity, perhaps because they believe that an opportunity will emerge in the near future (Roberts 1991, Shane 2004).

Second, consider individuals with moderately strong preferences for entrepreneurial job attributes. Given their modest preferences, these individuals are less likely to see joining a startup as clear career option and may require an external influence to raise their awareness. As such, diffuse and more universal contextual factors such as institutional norms encouraging entrepreneurship may increase these individuals' awareness of joining a startup as a way to satisfy their more moderate entrepreneurial career preferences. These individuals may also be influenced by entrepreneurial mentors, who are likely to raise the awareness of startups as an acceptable place of employment and may even provide employment opportunities in their own ventures. However, while mentors may stimulate a joiner orientation, we suspect that they will not typically be able to stimulate a founder orientation in individuals who have only relatively modest preferences for entrepreneurial job attributes since these preferences are a better match for a joiner role rather than a founder role.

Finally, individuals with weak preferences for entrepreneurial job attributes (i.e., those who would not be a good fit for either the founder or joiner role) may be unlikely to respond to social-contextual factors encouraging entrepreneurship. For example, individuals who value job security, who do not have an interest in commercializing technology, or who have no desire to be their own boss may show little interest in either founding or joining a new venture, even when exposed to entrepreneurial norms, mentors with founder experience, or commercial opportunities. Indeed, this point is supported in prior research that has demonstrated that many faculty with significant commercial opportunities have little interest in pursuing them, perhaps because they desire to stay focused on research or because they are deterred by the riskiness of new ventures (Thursby and Thursby 2002, Thursby and Thursby 2004).

5.2 Constructing preference-context intersection variables

To examine the interplay between preferences and context, we employ a simple approach by creating three sets of categorical variables that reflect the intersection of each preference-context pair. For example, for the “preference-mentor” pair, we construct four binary variables that reflect combinations of whether or not the individual has entrepreneurial preferences and whether or not their advisor is a founder⁸. This coding scheme allows us to carefully examine different preference-context combinations, providing more intuitive interpretations than interactions involving continuous variables. Moreover, this approach is more appropriate than using interaction terms between each preference and contextual variable, which would not allow for a complete examination of all relationships and would result in complex and difficult to interpret coefficient estimates.

We further simplify our analysis by using principal components factor analysis to summarize respondents’ preferences for various entrepreneurial job characteristics into a single factor score.⁹ This factor score should be a rough proxy for each individual’s disposition toward entrepreneurship or not. As expected, the factor score is positively associated with entrepreneurial orientations such that those with a founder orientation exhibit the highest score (0.67), followed by those with a joiner orientation (0.25), those oriented toward a career in an established firms

⁸ In our preference-mentor example, the four variables are “preferences and mentor”, “no preferences and mentor”, “preferences and no mentor”, and “no preferences and no mentor”.

⁹ Given that preferences for conducting basic and applied research should not, in theory, be strongly associated with entrepreneurial preferences, we exclude them from the factor analysis. The variables with the highest factor loadings are, in order from highest to lowest, preferences for commercialization, management, wealth, and career advancement.

(0.01), or in academia (-0.67). We dichotomize the factor score at zero and code positive values as 1 (*entrepreneurial preferences*) and zero or less as 0 (no preferences). We also dichotomized the social-contextual variables such that norms are coded as 1 when departments “encourage” or “strongly encourage” careers in startups, and opportunities are coded as 1 when commercial value is “high” or “extremely high” (the mentor variable is already binary).

5.3 Analyzing the interplay between preferences and context

To more clearly focus on individuals who are likely subject to social influence and to mitigate potential sorting effects, we exclude those respondents with a pre-existing interest in entrepreneurship at the time of starting their PhD studies. As such, any entrepreneurial interests observed at the time of the survey can be attributed to changes over the course of the PhD training. This approach is predicated on the assumption that individuals *without* a pre-existing entrepreneurial orientation sort into a given context based on factors unrelated to entrepreneurship, such as the prestige or location of the university, or the specific field of research (Azoulay et al. 2009). While self-reports of a pre-existing entrepreneurial orientation are likely higher for those with a current entrepreneurial orientation, we believe that excluding these individuals from this analysis provides a more conservative test of the interplay between preferences and context in shaping entrepreneurial orientations.

Mirroring our baseline regressions in Table 2, we use this restricted sample of respondents without a pre-existing entrepreneurial orientation to estimate multinomial logistic regressions with respondents’ current career orientations as the dependent variable (founder, joiner, academia, established firm; with established firm as the omitted category). The results are presented in Table 4. Models 1 through 3 use the binary measure of entrepreneurial preferences to construct the categorical variables as described above. The results in Model 1 for the interplay between preferences and department norms show that individuals with preferences for entrepreneurial job attributes are more likely to form a founder orientation whether they are in departments that encourage careers in startups (*Preferences & Norms*) or not (*Preferences & No norms*). In other words, their founder orientation forms irrespective of department norms, and the difference is not significant. More interestingly, if individuals do not have entrepreneurial preferences, they do not form a founder orientation even when in departments that encourage entrepreneurship (*No preferences & Norms*). The pattern for a joiner orientation is quite different. We

find that a joiner orientation forms when both preferences and norms are present (*Preferences & Norms*), but not otherwise. When considered in light of our results in §4.1 that those with a founder orientation have stronger entrepreneurial preferences and those with a joiner orientation have more moderate preferences, these results suggest that norms may have a greater influence on individuals with moderate entrepreneurial preferences, but little to no influence on individuals with either strong or weak entrepreneurial preferences. However, we are careful to interpret our results as merely suggesting a possible influence and not as convincing evidence that such casual effects exist.

The results in Model 2 examine the interplay between preferences and entrepreneurial mentors. Again we find that individuals with preferences for entrepreneurial job attributes are more likely to form a founder orientation irrespective of the social influence (i.e., both *Preferences & Mentor* and *Preferences & No mentor*), but having an entrepreneurial advisor seems to intensify the likelihood of forming a founder orientation. We find no significant relationship between entrepreneurial preferences and entrepreneurial mentors in shaping a joiner orientation, despite the fact that a larger share of PhD students with entrepreneurial advisors have a joiner orientation (47%) relative to a founder orientation (21%). These results are consistent with the idea that entrepreneurial advisors may act as positive *founder* role models that reinforce individuals' interest in being a founder, but have little additional influence on individuals' interest in joining a startup. Perhaps more interesting, we find that the presumably strong influence of entrepreneurial mentors has no relationship with either a founder or a joiner orientation in individuals who do not have preferences for entrepreneurial job attributes (*No preferences & Mentor*), even though these students reflect more than a third of all entrepreneurial advisors in our sample.

Finally, Model 3 explores the interplay between preferences and commercial opportunity. Consistent with the results for norms and mentors, we find that a founder orientation seems to form when individuals have entrepreneurial preferences irrespective of whether they have an opportunity or not, although the effect is magnified when they do perceive that they have an opportunity (*Preferences & Opportunity* versus *Preferences & No opportunity*). More interesting, however, we observe that individuals who do not have entrepreneurial preferences but do perceive that their research has commercial value (*No preferences & Opportunity*) seem to form a founder orientation. This result is in striking contrast to the prior results that norms and mentors may have no influence on those who lack entrepreneurial preferences, possibly suggesting that

the discovery of an opportunity has a strong influence on entrepreneurial orientation. In other words, highly valuable opportunities may simply be too good to pass up, even for individuals whose preferences would be more aligned with employment in an established firm or in academia. With respect to a joiner orientation, we observe that individuals who believe that their research has commercial value are somewhat more likely to form an orientation toward working in a startup irrespective of their preferences, possibly suggesting that the discovery of an opportunity can provide the impetus to participate in entrepreneurship not just as a founder but also as a joiner. Indeed, the joiner role may allow scientists and engineers with promising technologies to continue to focus on their R&D work, while still participating in the commercialization process. At the same time, we should not lose sight of the finding that a founder orientation still seems to form even in the absence of an opportunity (*Preferences & No opportunity*), suggesting an opportunity may not be necessary for a founder orientation to form.

To examine more closely the role of opportunities, we analyzed the distribution of commercially valuable opportunities across respondents with founder and joiner orientations in the full sample. Focusing first on those individuals who believe that their research has commercial value, we find that a full 50% want to be a joiner and only 30% want to be a founder. Thus, 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, or at least an opportunity emanating from their own research. We also observe that 24% of 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 orientation forms 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.

As a final analysis, we recognize that a possible limitation of our measure of the attractiveness of working in a startup is that it does not ask respondents to make tradeoffs between entrepreneurship and other career options. As a consequence, our results—particularly the descriptives—may overstate the attractiveness of entrepreneurship, especially in being a joiner. Similar-

ly, 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, we performed separate regressions for the measures of the attractiveness of a career in a startup, an established firm, and academia, respectively.¹⁰ Although these measures do not distinguish between the attractiveness of being a founder or a joiner, each of these three possible career paths is independent of others and thus allows us to examine whether the predictors of an interest in a career in entrepreneurship differ from other possible career paths. We find significant differences in the regression results predicting the attractiveness of a career in a startup relative to careers in an established firm or academia, suggesting that entrepreneurship is indeed seen as a distinct career path.

6 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 organizations. Moreover, while prior work has examined characteristics of entrepreneurs after they transition in entrepreneurship, little is known regarding how orientations toward entrepreneurship form in the first place. Using a sample of 4,282 science and engineering PhD students nearing their initial career transition, we first provided descriptive insights into founder and joiner orientations, finding that interests in joining entrepreneurial ventures are much more pervasive than interests in becoming a founder. We then performed a series of regression analysis to compare individuals with a founder orientation, a joiner orientation, and those not interested in entrepreneurship at all. Our results suggest that individuals with a joiner orientation share many similarities with oriented toward being a founder. However, we also observe significant differences between founder and joiner orientations in the role of preferences for autonomy, risk, and certain work activities, as well as in the role of institutional norms, mentors, and commercial opportunities. Moreover, our analyses suggest that individual characteristics and contextual factors do not simply have independent influences on entrepre-

¹⁰ Results are available from the authors.

neurial motives, but more critically that they interrelate in systematic and important ways. Additional analyses provide suggestive evidence that individuals with a pre-existing interest in entrepreneurship may sort into contexts that are more entrepreneurial, while the entrepreneurial interests of others may emerge after they enter an entrepreneurial context.

Our results should be considered in light of some important limitations. First, the cross-sectional survey data limit our ability to make causal inferences regarding the underlying mechanisms. Even when interpreted as correlational in nature, however, our insights regarding differences and similarities between founders and joiners have important implications. Relatedly, our analysis of selection versus treatment effects relies on a retrospective survey measure and provides only suggestive insights. At the same time, this analysis tantalizingly hints that selection and treatment effects may operate differently along the micro and macro 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 preferences on the one hand, and contextual influences 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 science and engineering PhD students 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 roles of preferences and context in shaping a founder or a joiner orientation 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 PhD careers, we believe that our empirical setting is highly relevant and provides important insights.

Our results have a number of implications for the entrepreneurship literature regarding entrepreneurial transitions, founding teams, and human capital. First, we provide evidence that an interest in entrepreneurship extends beyond founders to include joiners, but at the same time joiners are unique entrepreneurial actors who differ from founders. Given the common practice of measuring all early members of startups as “entrepreneurs” (see for example Sorensen 2007), scholars should take greater care to clearly distinguish between founders, joiners, and other entrepreneurial employees to mitigate possible confounding effects and to ensure more precise re-

sults. In addition, our results suggest, for example, that autonomy is an important factor not only for entrepreneurs but also for entrepreneurial employees. While high levels of autonomy may allow startups to attract human capital – perhaps even at a lower wage than established firms offering less autonomy (see Stern 2004) – firms tend to become more bureaucratic as they grow and age (Sorensen 2007). As a result, “joiners” who were attracted to working in a startup precisely because of factors such as higher levels of autonomy may become less satisfied with their jobs in more mature firms and seek out opportunities in newly emerging firms. Furthermore, our findings have implications for a growing body of research on entrepreneurial spawning from small firms (Gompers et al. 2005, Sorensen 2007, Elfenbein et al. 2010). For example, it is likely that many individuals with a founder orientation may first work in startups to learn how to be an entrepreneur and to search for opportunities. Although such employees may seem ideal given their similarities with founders, there is also considerable risk that they may leave to found their own, and quite possibly competing, firm. Joiners, on the other hand, also share similar preferences as founders, but given their disinterest in being a founder, they may be more ideal entrepreneurial employees. Given the importance to entrepreneurial companies of hiring talented and skilled employees (Baron et al. 2001, Hsu 2009), these results may also help founders and startup managers in attracting entrepreneurially-minded human capital.

Second, we provide evidence that both individual preferences and social-contextual influences relate strongly with entrepreneurial orientations, although the relationships are more nuanced than portrayed in prior work. In particular, whereas prior research on entrepreneurial transitions has largely focused on individual or contextual factors in isolation, our results suggest that they have important joint effects. As such, empirical studies focusing on one set of influences while ignoring or controlling for the other are likely to underestimate effect sizes for some groups of individuals while overestimating them for others. This also has important implications for the entrepreneurship literature by providing suggestive evidence regarding how entrepreneurial motives form and, more importantly, the possible determinants of entrepreneurial transitions. For example, while our results suggest that for many a desire to be a founder may be based largely on innate preferences, for others such a desire seems to emerge after discovering an opportunity. One implication of this finding is that there may be at least two distinct pathways to becoming a founder, one based on preferences (i.e., selection) and the other based on contextual influences (i.e., treatment), which have not been fully accounted for in prior studies. As a consequence, our

understanding of the determinants of entrepreneurial transitions may be incomplete or inaccurate. For joiners, our results suggest that preferences and context together are important for the formation of an interest in working in a startup. To the extent that individuals may possess a predisposition toward being a joiner but are not exposed to organizational or culture influences that encourage such behaviors, then the supply of entrepreneurial human capital may be diminished. This has implications for research on regional clusters where more entrepreneurial regions, such as Silicon Valley and Route 128, may exert pervasive social influences that encourage joiner motives, thereby increasing the supply of motivated entrepreneurial human capital.

These results may also inform efforts by educators and policy makers to increase the supply of entrepreneurial human capital or to increase academic entrepreneurship. In particular, our results suggest that simply changing entrepreneurial norms, exposing individuals to entrepreneurial role models, mandating entrepreneurship courses, or providing commercial opportunities may not necessarily result in the desired outcomes, especially if directed at individuals whose preferences for job attributes are inconsistent with entrepreneurship (such as tenure-track faculty). Rather, such interventions should first provide more general and widespread information to raise awareness, followed by more targeted initiatives aimed at individuals who exhibit a stronger interest in entrepreneurship. Such approaches may also allow for a more effective allocation of scarce resources such as mentors' time, opportunities, or teaching capacity.

Our findings suggest several areas for future research. First, future work is needed to examine how founder and joiner orientations translate into actual entrepreneurial activity. As eluded to in the introduction, studying orientations separately from realized transition allows us to consider not only the match between orientations and actions but especially the mismatch. For example, it will be interesting to study which individuals with a strong founder orientation 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 intentions. On the other hand, some individuals may become entrepreneurs even though they have little genuine interest in entrepreneurship. This may be due in part to a lack of career alternatives, but perhaps also due to opportunities that are simply too good to pass up. We suspect that the degree to which founders have a long-standing interest in entrepreneurship vs. react to the discovery of an opportunities may have long-lasting effects on the success of the new venture. Relatedly, future research is

needed to examine whether and how those individuals with a founder orientation but who lack 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 opportunities that originate with individuals who have no interest in exploiting them through entrepreneurship.

Most importantly, our findings highlight the need to complement the pervasive focus on founders with research on joiners, who are not simply “founders lite,” but who are drawn to entrepreneurship for different reasons and who likely play quite different roles in entrepreneurial ventures. How do those who intend to found a new venture identify others interested in joining their efforts? To what extent do the similarities between founders and joiners facilitate the formation of entrepreneurial teams? Do the significant differences we observe with respect to 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

- Agarwal, R., Ohyama, A. 2012. Industry or Academia, Basic or Applied? Career Choices and Earnings Trajectories of Scientists. *Management Science*. **Forthcoming**.
- Aldrich, H.E., Kim, P.H. 2007. *A Life Course Perspective on Occupational Inheritance: Self-Employed Parents and Their Children*. JAI Press Elsevier, City.
- Aldrich, H.E., Yang, T. 2012. Lost in Translation: Cultural Codes are Not Blueprints. *Strategic Entrepreneurship Journal*. **6**(1) 1-17.
- Astebro, T., Bazzazian, N., Braguinsky, S. 2012. Startups by recent university graduates and their faculty: Implications for university entrepreneurship policy. *Research Policy*. **41** 663-677.
- Astebro, T., Chen, J., Thompson, P. 2011. Start and Misfits: Self-Employment and Labor Market Frictions. *Management Science*. **57**(11) 1999-2017.
- Astebro, T., Thompson, P. 2011. Entrepreneurs, Jacks of all trades or Hobos? *Research Policy*. **40**(2011) 637-649.
- Audia, P.G., Rider, C.I. 2006. *Entrepreneurs as Organizational Products Revisited*. Lawrence Erlbaum Associates, City.
- Azoulay, P., Liu, C.C., Stuart, T.E. 2009. Social Influence Given (Partially) Deliberate Matching: Career Imprints in the Creation of Academic Entrepreneurs. *Harvard Business School Working Paper*.
- Baron, J.N., Burton, M.D., Hannan, M.T. 1996. The Road Taken: Origins and Evolution of Employment Systems in Emerging Companies. *Industrial and Corporate Change*. **5**(2) 239-275.
- Baron, J.N., Hannan, M.T., Burton, M.D. 2001. Labor Pains: Change in Organizational Models and Employee Turnover in Young, High-Tech Firms. *American Journal of Sociology*. **106**(4) 960-1012.
- Begley, T., Boyd, D. 1987. A Comparison of Entrepreneurs and Managers of Small Business Firms. *The Journal of Management*. **13** 99-108.
- Bercovitz, J., Feldman, M. 2008. Academic entrepreneurs: Organizational change at the individual level. *Organization Science*. **19** 69-89.
- Bhide, A. 2000. *The Origin and Evolution of New Businesses*. Oxford University Press, New York.
- Boh, W.F., De-Haan, U., Strom, R.J. 2011. Faculty and Students in Spin-offs: University Technology Transfer through Entrepreneurship.
- Boswell, J. 1973. *The Rise and Decline of Small Firms*. Allen and Unwin, London.
- Busenitz, L., Barney, J. 1997. Differences between entrepreneurs and managers in large organizations: Biases and heuristics in strategic decision making. *Journal of Business Venturing*. **12**(1) 9-30.
- Campbell, B.A., Ganco, M., Franco, A.M., Agarwal, R. 2012. Who Leaves, Where to, and Why Worry? Employee Mobility, Entrepreneurship and Effects on Source Firm Performance. *Strategic Management Journal*. **33** 65-87.

- Carnahan, S., Agarwal, R., Campbell, B.A. 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., Aldrich, H.E., Ruef, M. 2004. *Entrepreneurial teams*. Sage, City.
- Ding, W., Choi, E. 2011. Divergent Paths to Commercial Science: A Comparison of Scientists' Founding and Advising Activities. *Research Policy*. **40**(1) 69-80.
- Dobrev, S.D., Barnett, W.P. 2005. Organizational Roles and Transition to Entrepreneurship. *Academy of Management Journal*. **48**(3) 433-449.
- Eesley, C.E., Roberts, E.B. 2012. Are you experience or are you talented?: When does innate talent vs. experience explain entrepreneurial performance? *Strategic Entrepreneurship Journal*. **6**(3) 207-219.
- Elfenbein, D.W., Hamilton, B.H., Zenger, T.R. 2010. The Small Firm Effect and the Entrepreneurial Spawning of Scientists and Engineers. *Management Science*. **56**(4) 659-681.
- Etzkowitz, H. 1998. The Norms of Entrepreneurial Science: Cognitive Effects of the New University-Industry Linkages. *Research Policy*. **27** 823-833.
- Gambardella, A., Ganco, M., Honore, F. 2012. Leaving Money on the Table: Knowledge Underexploitation within Incumbent Firms and Employee Entrepreneurship. *Working Paper*.
- Gompers, P., Lerner, J., Scharfstein, D. 2005. Entrepreneurial Spawning: Public Corporations and the Genesis of New Ventures, 1986 to 1999. *The Journal of Finance*. **60**(2) 577-614.
- Greenberg, J. 2009. What You Care about or What You Know: Which Mechanism Explains the Intergenerational Transmission of Business Ownership Expectations? *Working Paper*.
- Halaby, C.N. 2003. Where Job Values Come From: Family and Schooling Background, Cognitive Ability, and Gender. *American Sociological Review*. **68** 251-278.
- Hamilton, B.H. 2000. Does Entrepreneurship Pay? An Empirical Analysis of the Returns to Self-Employment. *Journal of Political Economy*. **108**(3) 604-631.
- Hsu, D.H. 2009. *Technology-Based Entrepreneurship*. Wiley-Blackwell, City.
- Hsu, D.H., Roberts, E.B., Eesley, C.E. 2007. Entrepreneurs from technology-based universities: Evidence from MIT. *Research Policy*. **36** 768-788.
- Huber, G.P., Power, D.J. 1985. Retrospective reports of strategic-level managers: Guidelines for increasing their accuracy. *Strategic Management Journal*. **6**(2) 171-180.
- Ibarra, H. 1999. Provisional selves: experimenting with image and identity in professional adaptation. *Administrative Science Quarterly*. **44**(4) 764-791.
- Kenny, M., Goe, W.R. 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** 691-707.

- Kihlstrom, R., Laffont, J. 1979. A general equilibrium entrepreneurial theory of firm formation based on risk aversion. *Journal of Political Economy*. **87**(4) 719–748.
- Lazear, E.P. 2005. Entrepreneurship. *Journal of Labor Economics*. **23**(4) 649-680.
- Markus, H., Nurius, P. 1986. Possible Selves. *American Psychologist*. **41**(9) 954-969.
- McClelland, D.C. 1961. *The Achieving Society*. D. Van Nostrand, New York.
- Mowery, D.C., Nelson, R.R., Sampat, B.N., Ziedonis, A.A. 2004. *Ivory Tower and Industrial Innovation. University-Industry Technology Transfer Before and After the Bayh-Dole Act*. Stanford University Press, Palo Alto, CA.
- Nanda, R., Sorensen, J.B. 2010. Workplace Peers and Entrepreneurship. *Management Science*. **56**(7) 1116-1126.
- National Science Foundation. 2008. Survey of Earned Doctorates.
- Neff, G. 2012. *Venture Labor: Work and the Burden of Risk in Innovative Industries*. MIT Press, Cambridge, MA.
- Owen-Smith, J., Powell, W.W. 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** 109-140.
- Ozcan, S., Reichstein, T. 2009. Transition to Entrepreneurship from the Public Sector: Predispositional and Context Effects. *Management Science*. **55**(4) 604-618.
- Podsakoff, P.M., MacKenzie, J.Y., Lee, J.Y. 2003. Common methods bias in behavioral research: A critical review and recommended remedies. *Journal of Applied Psychology*. **88**(5) 879-903.
- Powell, W.W., Koput, K.W., SmithDoerr, L. 1996. Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly*. **41**(1) 116-145.
- Roach, M., Sauermann, H. 2010. A taste for science? PhD scientists' academic orientation and self-selection into research careers in industry. *Research Policy*. **39**(3) 422-434.
- Roberts, E. 1991. *Entrepreneurs in High Technology*. Oxford University Press, New York.
- Roberts, E., Wainer, H. 1971. Some characteristics of technical entrepreneurship. *IEEE Transactions on Engineering Management*. **18**(3) 100-109.
- Ruef, M., Aldrich, H.E., Carter, N. 2003. The structure of organizational founding teams: Homophily, strong ties, and isolation among U.S. entrepreneurs. *American Sociological Review*. **68**(2) 195–222.
- Sarasvathy, D.K., Simon, H.A., Lave, L. 1998. Perceiving and Managing Business Risks: Differences Between Entrepreneurs and Bankers. *Journal of Economic Behavior and Organization*. **33**(2) 207-225.
- Schwarz, N. 2007. *Retrospective and concurrent self-reports: The rationale for real-time data capture*. Oxford University Press, City.

- Seth, S., Sen, A. 1995. Behavioral characteristics of women entrepreneurs and executives vis-a-vis their male counterparts: An empirical study. *Social Science International*. **11** 18-23.
- Sexton, D.L., Bowman, N. 1985. The entrepreneur: a capable executive and more. *Journal of Business Venturing*. **1**(1) 129–140.
- Shane, S. 2000. Prior knowledge and the discovery of entrepreneurial opportunities. *Organization Science*. **11**(4) 448-469.
- Shane, S. 2001. Technological opportunities and new firm creation. *Management Science*. **47**(2) 205-220.
- Shane, S. 2004. *Academic Entrepreneurship: University Spinoffs and Wealth Creation*. Edward Elgar Publishing Inc., Northampton, MA.
- Shane, S., Khurana, R. 2003. Bringing individuals back in: the effects of career experience on new firm founding. *Industrial and Corporate Change*. **12**(3) 519-543.
- Sorensen, J.B. 2007. Bureaucracy and Entrepreneurship: Workplace Effects on Entrepreneurial Entry. *Administrative Science Quarterly*. **52** 387-412.
- Stephan, P.E. 2012. *How Economics Shapes Science*. Harvard University Press, Cambridge.
- Stern, S. 2004. Do scientists pay to be scientists? *Management Science*. **50**(6) 835-853.
- Stuart, T., Ding, W. 2006. When Do Scientists Become Entrepreneurs? The Social Structural Antecedents of Commercial Activity in the Academic Life Sciences. *American Journal of Sociology*. **112**(1) 97-144.
- Thornton, P.H. 1999. The Sociology of Entrepreneurship. *Annual Review of Sociology*. **25** 19-46.
- Thursby, J.G., Jensen, R., Thursby, M.C. 2001. Objectives, Characteristics and Outcomes of University Licensing: A Survey of Major U.S. Universities. *Journal of Technology Transfer*. **26**(1-2) 59-72.
- Thursby, J.G., Thursby, M.C. 2002. Who is selling the Ivory Tower? Sources of growth in university licensing. *Management Science*. **48**(1) 90-104.
- Thursby, J.G., Thursby, M.C. 2004. Are faculty critical? Their role in university-industry licensing. *Contemporary Economic Policy*. **22**(2) 162-178.
- Xu, H., Ruef, M. 2004. The myth of the risk-tolerant entrepreneur. *Strategic Organization*. **2**(4) 331-355.
- Zucker, L.G., Darby, M.R., Brewer, M.B. 1998. Intellectual human capital and the birth of U.S. biotechnology enterprises. *American Economic Review*. **88**(1) 290-306.

Table 1 – Variable descriptions and summary statistics

Variable	Survey Question	Response	Mean	S.D.	Min	Max
Dependent Variable: Career orientation						
Founder	Likely to start own company (4 or 5 on 5-point scale)	Category 1	10.9%	n.a.	n.a.	n.a.
Joiner	Attracted to working in startup (4 or 5 on 5-point scale), but unlikely to start own company	Category 2	45.2%	n.a.	n.a.	n.a.
Academia	Not attracted to working in startup; attracted to career in academia	Category 3	27.7%	n.a.	n.a.	n.a.
Established firm	Not attracted to working in startup; attracted to career in established firm	Category 4 (base)	16.2%	n.a.	n.a.	n.a.
Independent Variables						
Preference - Autonomy	When thinking about an ideal job, how important is it to you to be able to choose research projects?	5pt scale	3.99	0.81	1	5
Preference - Career Advancement	When thinking about an ideal job, how important to you are opportunities for career advancement	5pt scale	4.21	0.57	1	5
Preference - Wealth	When thinking about an ideal job, how important to you is financial income (e.g., salary, bonuses, etc.)?	5pt scale	3.95	0.72	1	5
Preference - Risk Tolerance	How much do you prefer winning \$1,000 for sure to winning \$2,000 with a 50% chance?	10pt scale	2.45	2.49	0	10
Work Interest - Commercialization	When thinking about the future, how interesting would you find work activities that commercialize 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 activities?	5pt scale	2.90	1.16	1	5
Work Interest - Basic research	When thinking about the future, how interesting would you find work activities 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 activities in conducting research that creates knowledge to solve practical problems?	5pt scale	4.34	0.67	1	5
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
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
Entrepreneurial Mentor	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
Pre-Existing Entrepreneurial Orientation	Thinking back to when you began your PhD program in [year of matriculation], how certain were you at that time that you wanted to pursue a career in a startup with an emphasis on research or development?	5pt scale	2.93	1.09	1	5

Table 2 – Predictors of Founder and Joiner Orientations

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

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

Table 3 – Sorting into Department, Advisor, and Commercial Research

Method Dependent variable	Ordered logit		Logit		Ordered logit	
	Entrepreneurial Norms		Entrepreneurial Mentor		Commerical Opportunity	
Model	(1)	(2)	(3)	(4)	(5)	(6)
PrePhD orientation - Entrepreneurship	0.18*** [0.04]	0.17*** [0.04]	0.07 [0.06]	0.01 [0.06]	0.14*** [0.05]	0.07 [0.05]
Preference - Autonomy		0.09** [0.04]		0.18** [0.08]		0.15*** [0.04]
Preference - Career advancement		0.05 [0.06]		-0.09 [0.12]		-0.08 [0.06]
Preference - Wealth		-0.09** [0.04]		0.09 [0.08]		-0.01 [0.05]
Preference - Risk tolerance		-0.00 [0.02]		0.02 [0.02]		0.02 [0.02]
Work Interest - Commercialization		0.04 [0.04]		0.21*** [0.07]		0.23*** [0.04]
Work Interest - Management		0.06 [0.04]		-0.01 [0.05]		0.02 [0.03]
Work Interest - Basic research		0.18*** [0.04]		-0.13* [0.08]		-0.16*** [0.04]
Work Interest - Applied research		-0.01 [0.05]		0.03 [0.12]		0.41*** [0.05]
PrePhD orientation - Academia	0.05 [0.04]	0.00 [0.04]	-0.04 [0.05]	-0.02 [0.05]	0.01 [0.03]	0.02 [0.03]
PrePhD orientation - Established firm	0.01 [0.04]	0.02 [0.04]	0.13** [0.07]	0.11 [0.07]	0.18*** [0.04]	0.13*** [0.04]
Ability	0.00 [0.02]	-0.02 [0.02]	0.05 [0.03]	0.04 [0.03]	0.16*** [0.02]	0.13*** [0.02]
Parent self-employed	-0.10 [0.06]	-0.09 [0.06]	0.09 [0.13]	0.08 [0.13]	0.07 [0.07]	0.06 [0.07]
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			-4.06*** [0.61]	-4.63*** [0.85]		
Obs.	4266	4266	4266	4266	4266	4266
Log-likelihood	-4210.20	-4191.90	-1320.60	-1306.22	-5834.92	-5735.42

NOTES: *PrePhD orientation-Entrepreneurship* is the respondent's retrospective report of the likelihood that prior to the PhD they wanted to pursue a career in a startup upon graduation and is intended to reflect possible sorting 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 ability, parents' self-employment, expected labor market conditions, pre-PhD career interests, number of publications, gender, age, and nationality; all results report robust standard errors clustered on university reported in parentheses; *** p < 1%, ** p < 5%, * p < 10%.

Table 4 – Interplay between Preferences and Social-Contextual Influence

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

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

Table A1 – Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Founder orientation															
(2) Joiner orientation	-0.32*														
(3) Academic orientation	-0.22*	-0.56*													
(4) Established firm orientation	-0.15*	-0.40*	-0.27*												
(5) Preference - Autonomy	0.05*	-0.04*	0.17*	-0.20*											
(6) Preference - Career Advancement	0.13*	0.11*	-0.19*	-0.03	0.06*										
(7) Preference - Wealth	0.10*	0.14*	-0.24*	0.02	-0.11*	0.47*									
(8) Preference - Risk tolerance	0.14*	0.06*	-0.10*	-0.07*	0.08*	0.02	0.01								
(9) Work Interest - Commercialization	0.26*	0.24*	-0.41*	-0.04	-0.13*	0.28*	0.30*	0.11*							
(10) Work Interest - Management	0.18*	0.11*	-0.26*	0.02	-0.18*	0.29*	0.27*	0.09*	0.45*						
(11) Work Interest - Basic	-0.09*	-0.03	0.22*	-0.14*	0.35*	-0.05*	-0.14*	-0.00	-0.29*	-0.28*					
(12) Work Interest - Applied	0.07*	0.11*	-0.14*	-0.03	0.11*	0.23*	0.12*	0.01	0.27*	0.07*	0.12*				
(13) Dept. norms - Academia	-0.05*	-0.08*	0.12*	0.00	0.05*	0.05*	-0.01	-0.04*	-0.11*	-0.01	0.10*	0.06*			
(14) Dept. norms - Entr.	0.04*	0.12*	-0.12*	-0.05*	0.04*	0.04*	0.02	0.06*	0.12*	0.07*	-0.00	0.05*	0.02		
(15) Advisor - Founder	0.11*	0.01	-0.07*	-0.03	0.02	0.04*	0.04*	0.03	0.12*	0.06*	-0.08*	0.04*	-0.04*	0.11*	
(16) Commercial opportunity	0.17*	0.10*	-0.17*	-0.07*	0.04*	0.13*	0.10*	0.10*	0.31*	0.15*	-0.14*	0.21*	-0.10*	0.19*	0.18*