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Are Foreign Stem PhDs More Entrepreneurial? Entrepreneurial Characteristics, Preferences and Employment Outcomes of Native and Foreign Science & Engineering PhD Students

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ABSTRACT

Prior research has shown that immigrants make important contributions to US innovation and are more likely than natives to become entrepreneurs. However, there is little evidence on how foreign and native high-skilled workers differ prior to entering the workforce. Moreover, little attention has been paid to distinguishing between founders and employees who join startups. We draw on a longitudinal survey of over 5,600 foreign and native STEM PhD students at U.S. research universities to examine entrepreneurial characteristics and career preferences prior to graduation, as well as founding and employment outcomes after graduation. First, we find that foreign PhD students differ from native PhD students with respect to individual characteristics typically associated with entrepreneurship such as risk tolerance, a preference for autonomy, and interest in commercialization. Second, foreign PhD students are more likely to express intentions to become a founder or a startup employee prior to graduation. Third, despite their entrepreneurial career interests, foreign PhDs are less likely to become founders or startup employees in their first industry job after graduation. These patterns call for future research on factors that enable or constrain foreign STEM workers from realizing their entrepreneurial career aspirations.

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1 Introduction

A large body of literature shows that immigrant and foreign workers are more likely than U.S. natives to become entrepreneurs (Borjas, 1986; Fairlie, 2008; Hunt, 2011; Fairlie and Lofstrom, 2015; Kahn et al., 2017). Recent studies have also shown that immigrants play key roles as founders and early employees in technology firms (Hart and Acs, 2011) and in entrepreneurial clusters such as Silicon Valley (Saxenian, 1994). Although this pattern is well-documented, the underlying reasons why immigrants are more entrepreneurial remain an important area of investigation. Some researchers argue that labor market factors such as discrimination (Oreopoulos, 2011) or language requirements (Hunt, 2011) constrain opportunities for career advancement in existing firms, making entrepreneurship more attractive than wage employment. Moreover, the availability of immigrant networks (Saxenian, 2002) or co-ethnic financing (Bengtsson and Hsu, 2015) may encourage or facilitate immigrants' moves to entrepreneurship. Others contend that immigrants differ from natives in individual characteristics and preferences such as risk tolerance (Blume-Kohout, 2016) or that they may self-select into STEM fields that provide greater exposure to entrepreneurial opportunities (Hunt, 2011).

Although considerable research effort has been directed toward understanding founding activity among immigrants, little attention has been paid to foreign workers who join startups as employees rather than as founder. Such entrepreneurial employees are particularly important in technology-intensive ventures (Baron et al., 2001; Roach and Sauermann, 2015; Kim, 2018) where foreign PhDs constitute a significant and particularly productive part of the science and engineering workforce (Stephan and Levin, 2007; National Science Board, 2014). As such, it is important to understand differences between native and foreign PhD students with respect to individual attributes such as risk preferences or entrepreneurial aspirations, as well as whether such individual characteristics might explain differences between native and foreign PhDs in their likelihood to take employment in technology-based startups.

We provide initial comparative evidence on entrepreneurial preferences and outcomes of native and foreign science and engineering doctorates using survey data from over 5,600 STEM PhD students at 39 U.S. research universities. These students were observed during graduate education and then again after transition into their first-time industry employment, including becoming a founder. As such, the data allow us to compare foreign and native PhD students with respect to their ex ante entrepreneurial career preferences as well as their ex post employment.

We report three key findings. First, foreign PhD students differ from their native peers with respect to characteristics and preferences that are typically associated with entrepreneurship. Specifically, foreign PhD students are more risk tolerant, have greater preferences for autonomy, and are more interested in commercialization activities than native PhD students. Second, foreign PhD students are more likely than natives to have intentions of becoming a founder or joining a startup as an employee, suggesting that they might become important entrepreneurial actors and human capital for technology startups. Third, however, PhDs are less likely than natives PhDs to either become a founder or to join a startup as an employee after graduation, and instead are more likely to work in an established firm. Given the stronger entrepreneurial interests of foreign PhDs prior to entering the private sector, these differences in employment outcomes are unlikely to reflect differences in career preferences and instead point to possible labor market factors that may constrain entrepreneurial activity and startup employment.

2 Data

Our empirical analysis utilizes the Science and Engineering PhD Panel Survey (SEPPS), a national longitudinal survey of 5,669 science and engineering PhD students from 39 top-tier U.S. research universities. To obtain the initial sample, we identified U.S. research universities with doctoral programs in science and engineering fields by consulting the National Science Foundation's reports on earned doctorates (National Science Foundation, 2009). Our selection of universities was based primarily on program size while also ensuring variation in private/public status and geographic region. The 39 universities in our sample produced roughly 40% of the graduating PhDs in science and engineering fields in 2009.

We collected roughly 30,000 email addresses from department websites and invited individuals to participate in the online survey using a four-contact strategy (one invitation, three reminders). For departments that did not list students' email addresses, we contacted department administrators to request that they forward a survey link to their graduate students. Overall, 88% of our responses were obtained directly from respondents and 12% were obtained through administrators. The initial contact for all respondents occurred over a two-week period in February 2010 and all responses were collected within an eight-week window. Adjusting for 6.3% undeliverable emails, the direct survey approach achieved an adjusted response rate of

30%.[1] Respondents were surveyed again in 2013 and 2016 with an average response rate of 73% of the initial 2010 sample. Given our interest in career preferences prior to entering the workforce, we use the most recent survey prior to graduation.

We distinguish between foreign and native PhD students through a survey question that asked whether the respondent was a U.S. citizen during graduate school. PhD students who were U.S. citizens were classified as *native*, while non-U.S. citizens were classified as *foreign*. Approximately 34.3% of our sample are foreign PhD students. To examine for potential response bias, we benchmarked our sample to the NSF Survey of Earned Doctorates, where the share of foreign-born science and engineering PhDs graduating in 2012 was 40.2% (National Science Foundation, 2017).[2] Whereas the SED includes all doctorate-granting universities, our sample is drawn from top-tier R1 universities where the share of foreign-born PhDs may differ. Given that PhD students at top research universities likely differ in their preferences, ability, and employment opportunities, our results may not be generalizable to all PhD students from U.S. universities. Among the foreign PhD students in our sample, approximately 24.0% are from China and 15.7% are from India.[3] The share of foreign PhD students is highest in computer science (54.1%) and engineering (43.0%), and lowest in the life sciences (23.4%). Our statistical analyses control for 18 detailed fields of study to account for heterogeneity in the nature of research, norms regarding career paths, and other unobserved factors.

3 Results

Building on prior work on predictors of entrepreneurship, we first examine differences between foreign and native PhD students with respect to individual characteristics such as ability and risk tolerance in section 3.1. We then study differences in founder intentions and preferences for joining startup employment in section 3.2. In section 3.3., we examine foreign PhD students' intentions to remain in the U.S. after graduation. We then compare foreign and native PhDs with respect to their post-graduation outcomes as a founder, a startup employee, or an established firm

[1] See Sauermann & Roach (2013) for details on the survey methodology, sample, and response rate.
[2] Authors' calculations based on Data Table 17 for science and engineering fields and graduation years corresponding to the survey used in this study: https://ncses.nsf.gov/pubs/nsf19301/assets/data/tables/sed17-sr-tab017.xlsx
[3] Foreign PhD students were asked for their nationality in the survey. Approximately 4% of respondents did not report their citizenship or nationality. We used LinkedIn data on the country of their undergraduate degree as an indicator of their nationality where possible to fill in missing data.

employee, and explore the extent to which these outcomes may be explained by ex-ante career preferences in section 3.4.

3.1 Comparing entrepreneurial characteristics of native and foreign PhD students

The entrepreneurship literature has examined a range of individual characteristics as predictors of entrepreneurial behaviors and founder transitions (Shane et al., 2003; Astebro et al., 2011; Kerr et al., 2017). Recent work suggests that these characteristics may also explain career preferences to join startups as an employee (Roach and Sauermann, 2015). Our survey allows us to compare foreign and native PhD students with respect to a number of characteristics commonly associated with entrepreneurship, including preferences for specific job attributes such as autonomy and commercialization, and individual characteristics such as risk tolerance and ability. Table 1 reports mean values for these variables for native and foreign PhD students.

Risk tolerance. We obtain a proxy for risk tolerance by using a lottery type question (Charness et al., 2013). More specifically, we asked respondents to choose between one of two gambles on 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 reflect a greater willingness to choose a riskier outcome with a higher potential payoff, which we interpret as a greater tolerance for risk.

Importance of autonomy and income. We measure respondents' preferences for autonomy and financial income by asking them to rate the importance of these job attributes, among other job attributes, on a 5-point scale from "not at all important" to "extremely important." To measure autonomy, we asked about the importance of "freedom to choose research projects", and to measure income we asked about the importance of "financial pay (e.g., salary, bonuses)".

Interest in work activities. We measure individuals' interest in different work activities on a 5-point scale that ranged from "extremely uninteresting" to "extremely interesting." The set of activities included "commercializing research results into products and services" (Commercialization activities), "management or administration" (Managerial activities), "research that contributes fundamental insights or theories (basic research)" (Basic research activities), and "research that creates knowledge to solve practical problems (applied research)".

Ability. We employ two different measures to proxy for ability. First, we use the academic reputation of a PhD student's university department based on the National Research Council's rankings (National Research Council, 2010).[4]. Although these are department-level research rankings rather than individual-level measures of ability, department quality is observable to prospective employers and is likely an important factor in hiring decisions. Moreover, it is likely that highly ranked departments are more selective in admitting and training PhD students such that department quality is likely correlated with individual ability as well. Second, we obtain a subjective individual-level measure of ability by asking respondents to rate their own (research) ability relative to their peers using a slider scale that ranged from 1 to 10. Although this measure likely captures both true ability and overconfidence (Camerer and Lovallo, 1999), we expect that individuals' perceptions of their own ability are likely to influence their job search behaviors, their confidence during job interviews, and their own expectations of success, especially in entrepreneurship (Roach and Sauermann, 2015; Lazear, 2016).

Table 1 reports summary statistics for these variables for native PhD students, all foreign PhD students combined, as well as separately for foreign PhD students from China, India, and Western countries (Western Europe, Canada and Australia). The table also reports potentially important control variables taken from the survey, including gender and marital status. In addition, to control for social factors that may shape entrepreneurial preferences during graduate school, we include founder role models, measured as a binary variable whether or not the PhD advisor had founded a startup, and lab norms that encourage working in startups, measured on a 5-point scale that ranged from "strongly discouraged" to "strongly encouraged" (Roach and Sauermann, 2015; Roach, 2017).

To account for potential systematic differences across degree fields and universities, we estimate differences in the above individual characteristics using OLS to regress individual preferences and characteristics onto a foreign PhD student categorical variable (foreign is 1, native is 0) while controlling for degree field and university fixed effects. Tables 2a and 2b shows the key coefficients. The first set of results in Table 2a shows significant differences between foreign and native PhD students even after controlling for detailed degree field (17 science and engineering fields) and university fixed effects (39 universities), while the next three

[4] NRC rankings are not available for some departments in our sample. In such cases, we used the university average for the broader field of study. For example, if the ranking of the department of electrical engineering for a given university was unavailable, we used the average of all engineering departments at the same university.

sets of regressions distinguish different groups of foreign PhD students (e.g., Chinese, Indian, Western), with native PhD students as the omitted category. Table 2b shows differences between foreign and native PhDs students by major degree field controlling for detailed degree field and university fixed effects. All regressions also include field and university fixed effects and standard errors are clustered by university.

Focusing first on the results comparing all foreign PhD students to natives, we find that the risk tolerance of foreign PhD students is significantly higher than that of natives (0.59 points higher than the native PhD mean of 1.88). Foreign PhD students also report greater importance of autonomy and income, as well as a higher interest in commercialization activities. We also find that foreign PhD students have a higher self-assessed ability. More detailed regressions that break out certain nationalities show that PhD students from Western countries do not differ much from native PhD students, while large differences emerge between native and PhD students from China and India.

Table 2b provides additional detail by showing differences between foreign and native PhD students for the broad fields of the life sciences, chemistry, physics, engineering, and computer sciences. Although coefficients vary in magnitude, the overall patterns are consistent across fields. Taken together, we find significant differences between native and foreigner PhD students with respect to a number of individual characteristics, including factors commonly associated with entrepreneurship, most notably tolerance for risk, and interest in commercialization, and self-assessed ability. Our analyses also suggest the need to go beyond aggregate considerations to distinguish foreign individuals coming from different cultural backgrounds.

3.2 Entrepreneurial career preferences during graduate school

To examine how native and foreign PhD students differ in their entrepreneurial career preferences, we asked respondents while in graduate school the attractiveness of different career paths after graduation, as well as their own expectations of becoming a founder. To measure founder intentions, we asked “How likely are you to start your own company?” on a 5-point Likert scale ranging from “Definitely will not” (1) to “Definitely will” (5). We code *founder intentions* as 1 for respondents who reported that they “definitely will” (5) start their own company, and 0 otherwise. To measure preferences for joining a startup as an employee, we

asked respondents: “Putting job availability aside, how attractive or unattractive do you personally find each of the following careers?”, where careers included “startup job with an emphasis on research or development” and “established firm job with an emphasis on research or development.” Respondents rated each career independently using a 5-point scale ranging from “extremely unattractive” (1) to “neither attractive nor unattractive” (3) to “extremely attractive” (5). We code *joiner preferences* as 1 for respondents who reported that a startup job was “attractive” (4) or “extremely attractive” (5) but did not express a founder intention, and 0 otherwise. We note that this measure captures joiner preferences in an absolute sense rather than relative to other careers. As such, a joiner preference does not necessarily imply that other careers were rated as less attractive, nor that joining a startup was respondents’ most preferred career (see Roach and Sauermann, 2018). Rather, this measure captures individuals with predisposition toward working in a startup.

Table 3a compares shares of PhD students with founder intentions and joiner preferences among foreign and native PhD students. Overall, a higher share of foreign PhD students report entrepreneurial preferences relative to native PhD students. Approximately 21% of foreign PhD students express founder intentions during graduate school, compared to about 10% of native PhD students. Similarly, 49% of foreign PhD students express a preference for joining a startup as an employee compared to approximately 42% of native PhD students. When analyzing nationalities separately, we see that roughly one-quarter of Chinese and Indian PhD students have founder intentions and roughly half have joiner preferences. A slightly higher share of foreign PhD students from Western countries have entrepreneurial interests compared to natives, but Western PhD students are still less entrepreneurial than Chinese and Indian PhD students with respect to their founder intentions. Comparisons by field in Table 3b show that significantly higher founder intentions of foreign students hold across all fields with the exception of physics, while stronger joiner intentions are observed in life sciences, chemistry, and physics, but not engineering or computer science.

We again estimate a series of regression analyses to account for systematic differences across fields and universities. The dependent variable is a categorical measure indicating whether an individual has a founder interest, a joiner preference, or a preference to work in either an

established firm or in academia and not in entrepreneurship.[5] Table 4 reports multinomial logistic regression results with established firm career preference (and no entrepreneurial preference) as the reference category for the dependent variable (relative risk ratios reported; values less than one indicate a negative relationship).

Model 1 reports the baseline results controlling for demographic characteristics, field and university. Foreign PhD students have an almost three times higher odds of expressing a founder intention than native PhD students relative to an established firm preference (Model 1a) and almost twice the odds of native PhD students to have a joiner preference (Model 1b). These differences persist even when ability and preferences for specific job characteristics are included, although including these variables does lead to a significant reduction in the estimated differences, indicating that they may partly explain why foreign students have stronger entrepreneurial interests (Model 2). Model 3 distinguishes between different nationalities and shows that Chinese and Indians are significantly more likely than native PhD students to have founder intentions (Model 3a) and joiner preferences (Model 3b). PhD students from Western countries do not differ from natives in their founder intentions and are only slightly more likely to have joiner preferences (Model 3b).

Taken together, foreign PhD students report stronger founder intentions as well as preferences for working in a startup environment than native PhD students. To some extent, these differences appear to reflect differences in individual characteristics such as risk tolerance, an interest in commercialization, and subjective ability. One potential explanation is that those individuals who come to the U.S. as graduate students are less risk averse and of higher ability than the average person in their home country, resulting in higher levels of such characteristics among foreign PhD students. There may also be selection effects among natives prior to entering the PhD such that U.S. citizens who have strong entrepreneurial interests choose to engage in entrepreneurship early on rather than pursuing a PhD. It is again notable that differences in entrepreneurial interests are more pronounced between natives and foreign PhD students from China and India than between natives and foreign PhD students from Western countries. The latter observation is consistent with recent findings by Hunt (2011) and Kahn et al. (2017), who

[5] For individuals who have no founder interest and have no preference for joining a startup, we compared the ratings of attractiveness of working in an established firm or in a faculty position to assign them to the respective categories.

find that Asian PhD students exhibit a greater interest in entrepreneurship than European PhD students who tend to show preferences similar to U.S. natives.

3.3 Intentions to stay

Before turning our attention to employment outcomes, it is important to consider whether foreign PhD students plan to stay in the U.S. Indeed, the extent to which foreign PhD students with founder intentions or joiner preferences intend to stay and work in the U.S. has important implications for U.S. immigration policies to retain STEM PhD students from U.S. universities (Kahn and MacGarvie, 2018).

To gain insights into foreign PhD students' intentions to stay in the U.S. after graduation we asked during graduate school "After completing your current PhD degree and any postdoc, which of the following best describes your future plans?", where the options were to stay in the U.S. permanently, work in the U.S. for a few years before returning to their home country, return to their home country immediately after graduation, move to some other country, or don't know yet. Table 5a reports the share of foreign PhD students' future plans by founder and joiner interests, as well as by nationality. Roughly 80% of foreign PhD students with either founder or joiner preferences intend to work in the U.S. at least temporarily after graduation, indicating that entrepreneurially-oriented individuals would like to stay and work in the U.S. after graduation. Across nationalities, approximately 70-80% of foreign PhD students have intentions of working in the U.S. at least temporarily, although there are larger differences across nationality in the share who intend to stay in the U.S. permanently and those who intend to eventually return to their home country. Table 5b reports stay intentions by degree field, where again roughly 80% of foreign PhDs intend to stay in the U.S. permanently or temporarily after graduation. These shares are consistent with observed aggregate stay rates for science and engineering doctorates in the U.S., although the observed stay rates by nationality vary (Finn, 2012; Kahn and MacGarvie, 2018).

3.4 Post-graduation entrepreneurial outcomes: founding or joining startups

We now turn out attention to the ex post career outcomes of PhDs after graduation. To obtain comprehensive data on employment outcomes, we supplemented the survey with hand-curated career profile data from LinkedIn and Google searches. Using both survey and online

search data, we identified post-graduate outcomes for 83.6% of first wave respondents. Tables 6a and 6b report on the current status of our respondents approximately one to five years after graduation. Specific employment outcomes are for those respondents working in the U.S. only; foreign PhDs who are working outside the U.S. or whose current status was undetermined are not included (82.6% of foreign PhDs). Note that 34.7% of PhDs in our sample have done a postdoc, with a slightly higher share of native PhDs (36.5%) compared to foreign PhDs (31.0%). However, individuals who transitioned to academia or industry after having done a postdoc are classified based on the current position in subsequent analyses, so that the postdoc classification only refers to PhDs who were last observed as still being in a postdoc position.

To identify whether PhDs were employed in a startup or an established firm, we rely upon survey and LinkedIn data on employer age and number of employees at the time an individual started working at the company. We code startups (i.e., young and small) as any employer that is five years or younger and has 100 or fewer employees at the time the employee joined the company. All other employers are coded as "established" firms, including fast growing entrepreneurial ventures that had over 100 employees at the time the PhD joined the company (e.g., Uber) and corporate spinoffs that are typically young and large (e.g., Google Life Sciences spinoff Verily).

Approximately 65% of Chinese and Indian PhDs are employed in the U.S. private sector, with the vast majority in industrial R&D positions in established firms or startups. Just over 60% of Western PhDs are employed in the private sector, and over one-quarter of these are in other industry careers such as consulting, finance, and patent law. For comparison, roughly 50% of native PhDs are employed in the U.S. private sector. Table 6b shows that the share of PhDs working in industry varies greatly by field – from 65-70% in engineering and computer science to 35% in the life sciences – but the shares of foreign and native PhDs within field are roughly comparable.

We now explore whether foreign and native PhDs differ in their propensity to become a founder or to take positions in startups after graduation, focusing on the 2,318 PhDs who entered employment in U.S. industrial R&D occupations between 2010-2016. To identify R&D occupations, we rely on survey responses regarding work activities (e.g., basic research, development, etc.), as well as LinkedIn data on job titles (e.g., research scientist, software engineer, etc.). We exclude from our sample individuals employed in consulting, finance, and

non-R&D occupations. In addition, we exclude self-employed PhDs and retain only founders of technology companies who are the CEO, CTO, or CSO of their company. In this industry-only sample, 4.6% of foreign PhDs were founders and 7.4% worked in startups, compared to 6.3% of native PhDs who were founders and 14.3% who worked in startups, indicating that foreign graduates were less likely to become founder and to join startups as employees.

To examine these differences more systematically, we estimate multinomial logistic regressions where the dependent variable is whether a PhD was a founder or a startup employee versus an established firm employee (omitted category of the dependent variable). Table 7 shows the results, reporting relative risk ratios (values below 1 indicate a negative relationship). The baseline Model 1 shows that foreign PhDs are significantly less likely than natives to join a startup and are also somewhat less likely to found their own firms (though sample size for founders is small, leading to imprecise estimates). These differences become even more pronounced once we control for foreign students' ex ante entrepreneurial career preferences (Model 2). The seemingly inconsistent finding that foreign PhDs have a greater interest in entrepreneurship during graduate school but lower rates of participating in entrepreneurship after graduation is illustrated in Fig. 1. Further analyses distinguishing foreign nationalities show that these patterns are driven largely by Chinese and Indian PhDs, while Western PhDs show higher entrepreneurial outcomes that are similar to those of native PhDs.

4 Discussion

Foreign PhDs are a large share of the most specialized and advanced STEM workers in the U.S. and may be a particularly important source of human capital for entrepreneurial firms. Although there has been considerable research comparing immigrants and natives with respect to founding activities, less is known about how foreign-born and natives might differ in their characteristics prior to engaging in entrepreneurship (or not). Moreover, and of particular concern for the career paths of STEM PhDs, little attention has been paid to employment in startups. Using panel data from 5,660 U.S. PhD graduates, we find that the foreign PhD students are more interested in founding or joining startups than natives prior to graduation, but are significantly less likely to become founders or to enter startup employment in their first industry job after graduation.

This apparent inconsistency between ex ante entrepreneurial preferences and ex post outcomes suggest that foreign PhDs may face certain constraints in their ability to participate in entrepreneurship that U.S. citizens do not. For example, foreign PhDs with founder intentions may be required to seek employment in large established firms rather than start their own company in order to obtain a temporary or permanent work visa.[6] As such, immigration policies that enable foreign PhDs to become entrepreneurs may facilitate higher rates of foreign PhDs starting potentially high-growth technology companies. Regarding working in a startup, startups may be less likely to sponsor work visas than established firms, or PhDs may believe that established firms provide a better pathway to either a temporary (e.g., H-1B) or permanent work visa (National Academies Press, 2007; Roach and Skrentny, 2019).

Our chapter also speaks to the results in the chapter in this volume by Ganguli and Gaulé. Both chapters, for example, consider career and location preferences of native and foreign PhDs, however Ganguli and Gaulé focus primarily on differences between foreign and natives PhDs with respect to academic career preferences while we focus on differences in entrepreneurial career preferences. I addition, both chapters point to visa policies as a potential key variable to explore in shaping native/foreign differences. In their case, visa policies may shape career preferences, whereas our results suggest that visa policies may shape career outcomes, conditional on preferences. Future research can productively examine how students' beliefs regarding visas policies interact with location and career preferences for different paths in academia (such as research or teaching as emphasized by Ganguli and Gaulé's research) and in industry (such as established firms or startups, as emphasized here).

Although this research takes a novel approach towards understanding STEM PhD career paths by measuring both ex ante entrepreneurial career preferences and ex post employment outcomes, future work could fruitfully investigate more deeply the job search and transition processes. Our results suggest that such work should also be sensitive to potential differences between different groups of foreign workers, e.g., those from China, India, or Western countries. These individuals may not only differ in their career preferences, but also in the labor market

[6] We should note that for new graduates, the F-1 Optional Practical Training work authorization enables foreign doctorates to work on their own company for up to three years with the STEM extension. During this time, foreign founders could self-petition for a permanent resident visa through a National Interest Waiver or they could be sponsored by the startup for a temporary or permanent visa. The latter option is only available if the venture secures funding and establishes an independent board of directors with discretion over the founder's employment within the venture. Thus, while there are pathways for new graduates to become founders, they entail significant risk and commitment of resources, and also may impair the venture's ability to secure funding or attract key employees.

constraints they face, such as country-specific quotas for work permits (Amuedo-Dorantes and Furtado, 2018; Kahn and MacGarvie, 2018).

While this chapter emphasizes the supply-side perspective of individual workers, the observed patterns may also have important implications for firms who often compete for highly skilled human capital. Both individuals' career preferences and institutional constraints are likely to shape the supply of labor to different types of firms and thus may affect firms' ability to grow and innovate. Of course, the patterns we observed will also be shaped by labor market demand. Although the demand-side remained only implicit in our study, future work that integrates both supply and demand-side perspectives may be particularly promising.

Given our limited understanding of the mechanisms underlying our results, we do not yet have a sufficient empirical basis for concrete policy recommendations. However, our results reinforce the notion that foreign science and engineering PhDs are an important potential source of STEM human capital (Stephan and Levin, 2007; National Science Board, 2014). At the same time, our findings that foreign graduates with entrepreneurial preferences appear to be more constrained from pursuing such careers suggests that the allocation of this human capital may not be optimal. As such, our study provides urgency to research and policy discussions related to retaining and supporting high-skilled foreign-born who come to the U.S. for graduate school, and to create conditions that allow them to pursue their career aspirations while also contributing to U.S. economic growth and innovation. Given the strong entrepreneurial interest of foreign PhDs, foreign graduates may also deserve closer attention in efforts to encourage the commercialization of university research through entrepreneurial spinouts.

References

C. Amuedo-Dorantes, Furtado, D. 2018. Settling for Academia? H-1B Visas and the Career Choices of International Students in the United States. *Journal of Human Resources*. in press.

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

J.N. Baron, 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.

O. Bengtsson, Hsu, D.H. 2015. Ethnic Matching in the U.S. Venture Capital Market. *Journal of Business Venturing*. 30 338-354.

M.E. Blume-Kohout. 2016. Why Are Some Foreign-Born Workers More Entrepreneurial than Others? *Journal of Technology Transfer*. 41(6) 1327-1353.

G.J. Borjas. 1986. The self-employment experience of immgrants. *Journal of Human Resources*. 21(4) 485-506.

C. Camerer, Lovallo, D. 1999. Overconfidence and excess entry: An experimental approach. *American Economic Review*. 89(1) 306-318.

G. Charness, Gneezy, U., Imas, A. 2013. Experimental methods: Eliciting risk preferences. *Journal of Economic Behavior & Organization*. 87 43-51.

R.W. Fairlie. 2008. *Estimating the Contribution of Immigrant Business Owners to the U.S. Economy*. U.S. Small Business Administration, Office of Advocacy, Washington, D.C.

R.W. Fairlie, Lofstrom, M. 2015. *Immigration and Entrepreneurship*.

M.G. Finn. 2012. *Stay Rates of Foreign Doctorate Recipients from U.S. Universities*. Oak Ridge Institute for Science and Education.

D.M. Hart, Acs, Z.J. 2011. High-Tech Immigrant Entrepreneurship in the United States. *Economic Development Quarterly*. 25(2) 116-129.

J. Hunt. 2011. Which Immigrants Are Most Innovative and Entrepreneurial? Distinctions by Entry Visa. *Journal of Labor Economics*. 29(3) 417-457.

S. Kahn, La Mattina, G., MacGarvie, M.J. 2017. “Misfits,” “stars,” and immigrant entrepreneurship. *Small Business Economics*. 49(3) 533-557.

S. Kahn, MacGarvie, M. 2018. THE IMPACT OF PERMANENT RESIDENCY DELAYS FOR STEM PHDS: WHO LEAVES AND WHY. *NBER Working Paper 25175*.

S.P. Kerr, Kerr, W.R., Xu, T. 2017. *Personality traits of entrepreneurs: A review of recent literature*.

D. Kim. 2018. Is there a startup wage premium? Evidence from MIT graduates. *Research Policy*. 47(3) 637-649.

E.P. Lazear. 2016. *Overconfidence and occupational choice*.

National Academies Press. 2007. *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. National Academies Press, Washington, DC.

National Research Council. 2010. *A data-based assessment of research-doctorate programs in the United States*. National Academies Press, Washington, DC.

National Science Board. 2014. *Science and Engineering Indicators 2014*. National Science Foundation, Arlington, VA.

National Science Foundation. 2009. Survey of Earned Doctorates.

National Science Foundation. 2017. *Survey of Earned Doctorates*. National Science Foundation, Arlington, VA.

P. Oreopoulos. 2011. Why Do Skilled Immigrants Struggle in the Labor Market? A Field Experiment with Thirteen Thousand Resumes. *American Economic Journal: Economic Policy*. 3(4) 148-171.

M. Roach. 2017. Encouraging entrepreneurship in university labs: Research activities, research outputs, and early doctorate careers. *PLoS ONE*. 12(2) e0170444.

M. Roach, Sauermann, H. 2015. Founder or Joiner? The Role of Preferences and Context in Shaping Different Entrepreneurial Interests. *Management Science*. 61(9) 2160-2184.

M. Roach, Sauermann, H. 2018. *Who joins a startup? Ability, preferences, and entrepreneurial human capital*.

M. Roach, Skrentny, J. 2019. U.S. Visa Policies and STEM PhD Employment in Technology Startups. *Working Paper*.

H. Sauermann, Roach, M. 2013. Increasing Web Survey Response Rates in Innovation Research: An Experimental Study of Static and Dynamic Contact Design Features. *Research Policy*. 42(1) 273-286.

A. Saxenian. 1994. *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*. Havard University Press, Cambridge, MA.

A. Saxenian. 2002. Silicon Valley's New Immigrant High-Growth Entrepreneurs. *Economic Development Quarterly*. 16(1) 20-31.

S. Shane, Locke, E.A., Collins, C.J. 2003. Entrepreneurial motivation. *Human Resource Management Review*. 13 257-279.

P. Stephan, Levin, S. 2007. *Foreign scholars in US science: Contributions and costs*. University of Wisconsin Press, Madison.

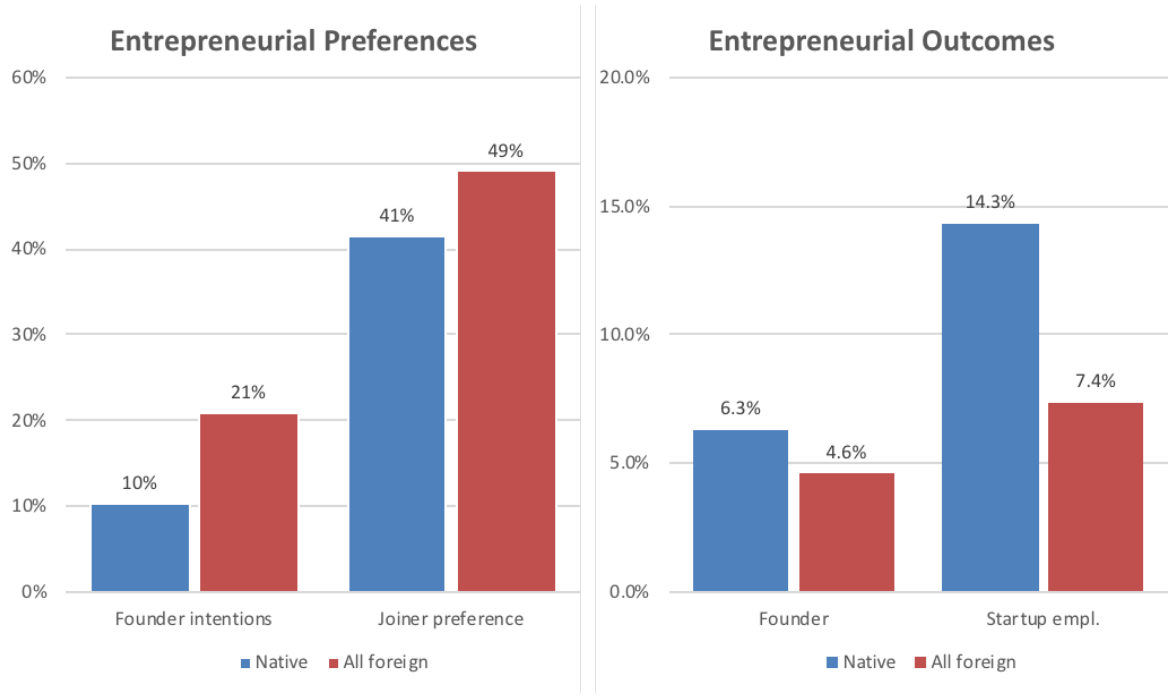

Fig. 1 – Entrepreneurial preferences and outcomes between native and foreign PhDs

Table 1: Summary statistics comparing native and foreign PhD preferences and characteristics

	Native (n=3880)		All foreign (n=1792)		China (n=447)		India (n=295)		Western (n=175)	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Risk tolerance	1.88	2.29	2.54	3.00	2.92	3.29	2.68	3.21	1.85	2.18
Importance of autonomy	3.94	0.85	4.06	0.75	3.88	0.73	4.21	0.63	4.07	0.83
Importance of income	3.94	0.74	4.08	0.65	4.09	0.60	4.09	0.68	3.89	0.70
Interest in basic research	3.93	0.98	3.84	0.99	3.43	1.06	4.06	0.85	4.05	0.93
Interest in applied research	4.34	0.68	4.35	0.65	4.25	0.61	4.45	0.61	4.37	0.75
Interest in commercialization	3.27	1.11	3.69	1.02	3.91	0.84	3.78	1.06	3.30	1.17
Interest in management	2.83	1.18	3.03	1.11	3.41	0.95	2.91	1.16	2.62	1.20
Self-assessed ability	6.17	1.66	6.66	1.64	6.79	1.59	6.80	1.55	6.40	1.66
Lab academic norms	4.23	0.77	4.05	0.77	4.05	0.71	4.10	0.77	4.11	0.82
Lab entrepreneurial norms	3.23	0.72	3.40	0.69	3.51	0.68	3.47	0.70	3.23	0.72
Founder role model	0.36	0.48	0.38	0.48	0.32	0.47	0.45	0.50	0.34	0.48
Male	0.58	0.49	0.70	0.46	0.71	0.45	0.75	0.43	0.71	0.46
Married	0.51	0.50	0.55	0.50	0.51	0.50	0.63	0.48	0.55	0.50

Table 2a: Differences in preferences and characteristics between foreign and native PhD students

	All foreign (n=1,792)		China (n=447)		India (n=295)		Western (n=175)	
Risk tolerance	0.59***	(0.08)	1.02***	(0.14)	0.75***	(0.20)	-0.04	(0.14)
Importance of autonomy	0.13***	(0.02)	-0.04	(0.05)	0.27***	(0.03)	0.12	(0.08)
Importance of income	0.13***	(0.02)	0.14***	(0.03)	0.14**	(0.05)	-0.05	(0.06)
Interest in basic research	-0.03	(0.03)	-0.42***	(0.05)	0.27***	(0.04)	0.11	(0.08)
Interest in applied research	-0.03*	(0.02)	-0.13***	(0.03)	0.02	(0.03)	0.03	(0.06)
Interest in commercialization	0.33***	(0.04)	0.55***	(0.05)	0.31***	(0.08)	0.06	(0.09)
Interest in management	0.21***	(0.04)	0.58***	(0.05)	0.04	(0.09)	-0.14	(0.08)
NRC ranking of univ. dept.	-0.06	(0.03)	-0.13**	(0.04)	-0.09	(0.05)	0.02	(0.04)
Self-assessed ability	0.54***	(0.05)	0.68***	(0.06)	0.68***	(0.07)	0.30*	(0.12)

Notes: OLS coefficients regressing preferences and characteristics onto foreign nationality controlling for degree field and university fixed effects (n=5,669). Robust standard errors clustered on university reported in parentheses; *** p < 0.001, ** p < 0.01, * p < 0.05.

Table 2b: Differences in preferences and characteristics between foreign and native PhD students by degree field

	Life Sciences (n=1,979)		Chemistry (n=644)		Physics (n=846)		Engineering (n=1,612)		Comp. Sci. (n=645)	
Risk tolerance	0.63***	(0.14)	0.79**	(0.23)	0.64**	(0.19)	0.52**	(0.18)	0.32	(0.22)
Importance of autonomy	0.15**	(0.04)	0.16*	(0.07)	0.15*	(0.07)	0.11*	(0.05)	-0.01	(0.06)
Importance of income	0.12**	(0.04)	0.14	(0.08)	0.09	(0.05)	0.12***	(0.03)	0.23**	(0.07)
Interest in basic research	-0.13	(0.07)	-0.06	(0.12)	0.15*	(0.07)	0.08	(0.06)	-0.20**	(0.06)
Interest in applied research	0.01	(0.04)	0.02	(0.05)	-0.02	(0.06)	-0.09**	(0.03)	-0.03	(0.06)
Interest in commercialization	0.49***	(0.07)	0.48***	(0.11)	0.31***	(0.09)	0.14**	(0.05)	0.35***	(0.08)
Interest in management	0.14*	(0.07)	0.41**	(0.15)	0.27***	(0.07)	0.12	(0.06)	0.34**	(0.11)
NRC ranking of univ. dept.	-0.08	(0.05)	0.04	(0.07)	-0.08	(0.06)	-0.14*	(0.06)	-0.04	(0.02)
Self-assessed ability	0.44***	(0.08)	0.72***	(0.14)	0.66***	(0.13)	0.47***	(0.10)	0.49***	(0.11)

Notes: OLS coefficients regressing preferences and characteristics onto foreign PhD students by degree field controlling for degree field and university fixed effects (n=5,669). Robust standard errors clustered on university reported in parentheses; *** p < 0.001, ** p < 0.01, * p < 0.05.

Table 3a: Share of PhD students with entrepreneurial career preferences by nationality

	Native (n=3,880)	All foreign (n=1,792)	China (n=447)	India (n=295)	Western (n=175)
Founder interest	10.3%	20.7%	24.1%	25.4%	13.1%
Joiner interest	41.7%	49.1%	50.6%	50.8%	48.3%
Combined interests	**52.0%**	**69.7%**	**74.7%**	**76.2%**	**61.4%**

Table 3b: Share of PhD students with entrepreneurial career preferences by degree field

	Life Sciences (n=1,979)		Chemistry (n=644)		Physics (n=846)		Engineering (n=1,612)		Comp. Sci. (n=645)	
	Native	Foreign	Native	Foreign	Native	Foreign	Native	Foreign	Native	Foreign
Founder interest	6.6%	13.7%	6.7%	19.2%	7.4%	9.8%	16.4%	26.1%	20.2%	27.9%
Joiner interest	38.2%	50.0%	46.0%	56.9%	39.8%	55.8%	46.6%	46.5%	43.4%	45.1%
Combined interests	**44.8%**	**63.7%**	**52.7%**	**76.1%**	**47.1%**	**65.6%**	**63.0%**	**72.7%**	**63.6%**	**73.0%**

Table 4: Founder intentions and joiner career preferences during graduate school

Method	**Multinomial logit**											
Dependent variable	**Founder**	**Joiner**	**Academia**	**Founder**	**Joiner**	**Academia**	**Founder**	**Joiner**	**Academia**	**Founder**	**Joiner**	**Academia**
Model	**(1a)**	**(1b)**	**(1c)**	**(2a)**	**(2b)**	**(2c)**	**(3a)**	**(3b)**	**(3c)**	**(4a)**	**(4b)**	**(4c)**
Foreign PhD	2.93***	1.98***	1.15	2.00***	1.72***	1.21						
	(0.40)	(0.19)	(0.12)	(0.24)	(0.16)	(0.15)						
Chinese							3.13***	1.91***	0.76	1.91***	1.65***	1.04
							(0.49)	(0.25)	(0.14)	(0.28)	(0.23)	(0.23)
Indian							4.56***	2.99***	1.48	2.73***	2.34***	1.22
							(1.14)	(0.71)	(0.43)	(0.70)	(0.56)	(0.32)
Western							1.65	1.66*	1.21	1.56	1.63*	1.06
							(0.51)	(0.35)	(0.25)	(0.51)	(0.35)	(0.28)
Other foreign							2.73***	1.88***	1.23	1.94***	1.66***	1.32
							(0.52)	(0.23)	(0.16)	(0.35)	(0.20)	(0.19)
Risk tolerance				1.10***	1.02	0.97				1.10***	1.02	0.97
				(0.03)	(0.02)	(0.03)				(0.03)	(0.02)	(0.03)
Imp. of autonomy				1.91***	1.33***	1.75***				1.91***	1.33***	1.74***
				(0.14)	(0.06)	(0.11)				(0.14)	(0.06)	(0.11)
Imp. of income				0.84	0.94	0.63***				0.84*	0.94	0.63***
				(0.07)	(0.06)	(0.05)				(0.07)	(0.06)	(0.05)
Int. in basic research				1.11*	1.25***	1.26***				1.10	1.25***	1.25***
				(0.06)	(0.05)	(0.08)				(0.06)	(0.05)	(0.08)
Int. in applied research				0.90	1.00	0.61***				0.90	1.00	0.60***
				(0.10)	(0.08)	(0.05)				(0.10)	(0.08)	(0.05)
Int. in commercialization				2.60***	1.51***	0.68***				2.60***	1.51***	0.68***
				(0.20)	(0.08)	(0.03)				(0.19)	(0.08)	(0.03)
Int. in management				1.34***	1.04	0.99				1.34***	1.04	0.99
				(0.08)	(0.03)	(0.04)				(0.08)	(0.03)	(0.04)
NRC univ. dept. ranking				1.19*	0.97	0.99				1.19*	0.97	0.98
				(0.10)	(0.07)	(0.09)				(0.10)	(0.07)	(0.09)
Self-assessed ability				1.18***	1.04	1.03				1.18***	1.04	1.04
				(0.05)	(0.03)	(0.03)				(0.05)	(0.03)	(0.03)
Lab entrepreneurial norms				1.21**	1.25***	1.06				1.20**	1.25***	1.06
				(0.08)	(0.08)	(0.06)				(0.08)	(0.08)	(0.06)
Founder role model				1.22	0.93	0.93				1.22	0.92	0.92
				(0.14)	(0.06)	(0.09)				(0.14)	(0.06)	(0.09)

Male	4.29***	2.22***	1.47***	4.07***	2.15***	1.38***	4.31***	2.23***	1.48***	4.08***	2.16***	1.39***
	(0.53)	(0.17)	(0.12)	(0.56)	(0.17)	(0.12)	(0.53)	(0.17)	(0.12)	(0.57)	(0.17)	(0.12)
Married	1.09	1.09	1.09	1.10	1.04	0.92	1.08	1.08	1.08	1.10	1.04	0.92
	(0.12)	(0.08)	(0.11)	(0.14)	(0.08)	(0.10)	(0.12)	(0.07)	(0.11)	(0.14)	(0.08)	(0.10)
Children	1.05	1.15	1.21	0.96	1.07	1.25	1.07	1.17	1.21	0.97	1.09	1.24
	(0.20)	(0.20)	(0.24)	(0.20)	(0.19)	(0.28)	(0.20)	(0.20)	(0.24)	(0.21)	(0.19)	(0.27)
Field of study FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
University FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations		5,660			5,660			5,660			5,660	
Log-likelihood		-6712.49			-5901.54			-6700.55			-5897.85	

Notes: Coefficients reported as relative risk ratios. The dependent variable consists of four categories: Founder interest (likely to start own company), Joiner interest (attracted to start-up employment but not likely to start own company), Academia interest (not attracted to entrepreneurship but attracted to academic employment), and the reference group Established firm interest (not attracted to entrepreneurship but attracted to established firm employment). In all specifications native PhD students are the omitted category; coefficient estimates for foreign PhD students together and by nationality are relative to native PhD students. Robust standard errors clustered on university reported in parentheses; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 5a: Foreign PhD students' intentions to stay in the U.S. by nationality

	Founder interest (n=274)	Joiner interest (n=682)	All foreign (n=1,358)	China (n=447)	India (n=295)	Western (n=175)
Stay in the US permanently	41.6%	42.8%	42.2%	17.4%	48.4%	37.9%
Work in US before returning home	37.6%	40.1%	37.2%	54.1%	35.8%	38.6%
Return home after graduation	17.8%	11.9%	15.3%	24.3%	8.8%	15.7%
Move to another country	0.7%	0.9%	0.8%	0.0%	2.3%	2.1%
Don't know yet	2.2%	4.4%	4.6%	4.2%	4.7%	5.7%

Table 5b: Foreign PhD students' intentions to stay in the U.S. by degree field

	Life Sciences (n=336)	Chemistry (n=114)	Physics (n=195)	Engineering (n=463)	Comp. Sci. (n=260)
Stay in the US permanently	47.9%	36.8%	38.0%	38.9%	48.1%
Work in US before returning home	33.9%	43.9%	35.9%	39.1%	35.8%
Return home after graduation	13.7%	13.2%	16.4%	17.9%	11.9%
Move to another country	0.3%	1.8%	1.0%	0.7%	1.2%
Don't know yet	4.2%	4.4%	8.7%	3.5%	3.1%

Table 6a: Current status of PhDs 1-5 years after graduation by nationality

	Native (n=3,250)	All foreign (n=1,504)	China (n=387)	India (n=264)	Western (n=148)
Founder	2.0%	1.9%	2.8%	1.1%	3.4%
Startup empl	5.3%	3.6%	2.8%	4.9%	5.4%
Est. firm empl	29.1%	38.6%	50.4%	48.5%	29.1%
Other industry	14.6%	11.6%	9.6%	9.9%	23.0%
Academia	27.5%	28.5%	20.9%	22.0%	21.6%
Postdoc	12.8%	9.8%	9.8%	6.8%	8.1%
Other non-profit	8.8%	6.0%	3.6%	6.8%	9.5%

Table 6b: Current status of PhDs 1-5 years after graduation by degree field

	Life Sciences (n=1,565)		Chemistry (n=549)		Physics (n=678)		Engineering (n=1,296)		Comp. Sci. (n=583)	
	Native	Foreign	Native	Foreign	Native	Foreign	Native	Foreign	Native	Foreign
Founder	1.2%	1.5%	0.7%	0.8%	0.8%	0.0%	4.4%	1.9%	2.2%	3.8%
Startup empl	3.7%	2.7%	5.7%	4.7%	5.4%	3.6%	6.3%	3.5%	10.0%	4.5%
Est. firm empl	14.7%	14.9%	34.0%	37.5%	29.7%	22.3%	40.7%	48.7%	51.9%	57.5%
Other industry	19.0%	15.8%	15.4%	11.7%	12.8%	16.1%	12.7%	9.7%	2.6%	7.7%
Academia	34.3%	36.9%	25.9%	31.3%	27.2%	35.8%	18.1%	24.5%	24.4%	19.8%
Postdoc	18.1%	17.3%	9.7%	7.8%	15.5%	17.6%	7.8%	6.4%	4.1%	3.8%
Other non-profit	9.0%	11.0%	8.6%	6.3%	8.7%	4.7%	10.1%	5.2%	4.8%	2.9%

Table 7: Multinomial logistic regressions of entrepreneurial outcomes

Method	Multinomial logit							
Dependent variable	Founder	Startup empl.	Founder	Startup empl.	Founder	Startup empl.	Founder	Startup empl.
Model	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
Foreign PhD	0.76	0.51***	0.59*	0.48***				
	(0.19)	(0.08)	(0.15)	(0.07)				
Chinese					0.67	0.31**	0.48*	0.28**
					(0.25)	(0.12)	(0.18)	(0.11)
Indian					0.34*	0.48	0.25***	0.44*
					(0.15)	(0.18)	(0.10)	(0.17)
Western					1.70	0.74	1.66	0.73
					(0.65)	(0.22)	(0.64)	(0.22)
Other foreign					0.58	0.57**	0.46*	0.54***
					(0.19)	(0.11)	(0.16)	(0.10)
Founder interest			7.81***	1.98**			8.35***	2.02**
			(2.30)	(0.44)			(2.47)	(0.44)
Joiner interest			1.51	1.67**			1.53	1.67***
			(0.47)	(0.27)			(0.48)	(0.26)
Male	1.45	1.04	1.08	0.94	1.44	1.06	1.07	0.96
	(0.37)	(0.14)	(0.30)	(0.14)	(0.37)	(0.15)	(0.30)	(0.14)
Married	1.23	1.11	1.16	1.09	1.27	1.09	1.20	1.08
	(0.24)	(0.16)	(0.24)	(0.16)	(0.25)	(0.16)	(0.24)	(0.16)
Children	1.19	0.87	1.24	0.86	1.20	0.86	1.25	0.84
	(0.26)	(0.20)	(0.28)	(0.20)	(0.26)	(0.21)	(0.28)	(0.21)
Constant	0.03***	0.14***	0.02***	0.09***	0.03***	0.14***	0.02***	0.09***
	(0.02)	(0.05)	(0.01)	(0.04)	(0.02)	(0.05)	(0.01)	(0.04)
Field of study FE	Y	Y	Y	Y	Y	Y	Y	Y
Year started job FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	2,422		2,422		2,422		2,422	
Log-likelihood	-1282.42		-1241.65		-1278.67		-1236.12	

Notes: Coefficients reported as relative risk ratios relative to established firm employment. In all specifications native PhDs are the omitted category; coefficient estimates for foreign PhDs together and by nationality are relative to native PhDs. Robust standard errors clustered on university reported in parentheses; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.