Do University Entrepreneurship Programs Promote Entrepreneurship?

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Abstract

Recently, many universities have developed programs to promote student entrepreneurship. However, relatively little is known about the impacts of such university initiatives. This paper examines how Stanford University's entrepreneurship initiatives affected entrepreneurial activity using the Stanford Innovation Survey, a unique survey that asks the entrepreneurship activities of Stanford degree-holders. We examine Stanford University's two major initiatives that were established in the mid 1990s - the Stanford Center for Entrepreneurial Studies at the Business School and the Stanford Technology Venture Program at the Engineering School. OLS regressions find that program participation is positively related to entrepreneurship activities. However, selection of more entrepreneurial students into program participation hinders causal interpretation. We utilize the fact that the initiatives were implemented at the school level, i.e., only students in the respective schools were primarily affected by each program, to examine the programs' impacts. Using the introduction of each school's program as an instrument for program participation, we find that the business school program has a negative to zero impact on entrepreneurship. Participation in the engineering school program has no impact on entrepreneurship. However, the business school initiative decreases the probability that the startup fails and increases firm revenue. Overall, the findings imply that university entrepreneurship programs may not increase entrepreneurship, but help students to better identify their potential as entrepreneurs and improve the quality of entrepreneurship.

Keywords: University entrepreneurship education, entrepreneurship, program evaluation

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1. Introduction

Though many universities have been incorporating entrepreneurship related courses and programs into their curriculums, relatively little is known about the impacts of such university initiatives. This paper examines two questions fundamental to entrepreneurship education - whether university entrepreneurship programs affect (1) the decision to become an entrepreneur and (2) the performance of start-ups. Ex-ante it is not clear how university entrepreneurship programs would affect the rate of entrepreneurship and the performance of newly created businesses. If university education programs improve entrepreneurial ability, such programs could result in higher rates of entrepreneurship as well as better start-up performance. However, if students tend to overestimate their entrepreneurial ability ex-ante, and university entrepreneurship programs enable students to better assess their own entrepreneurial ability, entrepreneurship education may deter some students from entering into entrepreneurship. The main objective of this paper is to empirically examine how university entrepreneurship programs affect entrepreneurial choice and startup performance. By doing so, we hope to provide a better understanding of the role university education plays in promoting entrepreneurship.

Specifically, we use the Stanford University Innovation Survey, a survey that asks about the entrepreneurship related activities of Stanford degree-holders, to examine the entrepreneurship consequences of Stanford University's two major entrepreneurship programs that were founded in the mid 1990s – the Stanford Technology Venture Program (STVP) at the Engineering School and the Center for Entrepreneurial Studies (CES) at the Business School. The OLS regressions indicate that program participation is positively and significantly related to various measures of entrepreneurial activity. However, the main challenge of estimating the causal impact of entrepreneurship programs is that program participation is not random - more entrepreneurial students are more likely to participate in the entrepreneurship courses offered by the university. We utilize the fact that the initiatives were implemented at the school level, i.e., the business school and the engineering school, and that primarily students in each school were affected by the respective entrepreneurship programs. This enables us to use the introduction of each school's program as an instrument for program participation.

We find strong evidence of a first stage – the introduction of university entrepreneurship programs increase student participation primarily for students in the respective schools. The participation rate is substantially higher in the business school's entrepreneurship program than in the engineering school's program. Cross-enrollment into the business school's entrepreneurship program by students from the other schools is minimal, though less so for the engineering school's program. We use a difference in difference framework to estimate the first stage and reduced form using students from the other schools as the control group. Inference hinges on the assumption that student characteristics do not change differentially within each school after the introduction of the entrepreneurship programs. We find no evidence that demographic characteristics, such as race, gender, and nationality, as well as, parental entrepreneurship, an important determinant of entrepreneurship, change in each school after program introduction. Given that we find no evidence of selection based on these variables, student characteristics in each school do not seem to have changed significantly after each program was introduced.

The 2SLS estimates indicate that the business school program decreases, or at most has no effect on entrepreneurship. The engineering school initiative has no effect on entrepreneurship. The negative effects we find from the business school program implies that entrepreneurship courses could be helping students to better identify whether they are of the entrepreneurial type or not, and ultimately deter certain students from pursuing entrepreneurship. We also examine whether program participation affects the characteristics and performance of startups after graduation. In particular, we examine whether program participation affects the timing to founding after graduation, the probability of survival, revenue, number of employees, and whether the startup successfully exited through an IPO or acquisition. The main finding here is that the business school initiative seems to increase the probability of survival and startup revenue of surviving firms. Again, we find no significant impact on firm performance from the engineering school program. Overall, the results imply that business school entrepreneurship programs may decrease the entrepreneurship rate, but improve the quality of entrepreneurship in terms of survival and firm revenue. The program enables students to better identify their potential as an entrepreneur, and ultimately results in better startup quality of eventual entrepreneurs. The null effect of entrepreneurship programs on entrepreneurship is quite robust. Though we are not able to identify the exact channels, the increase in performance is likely due to the program (1) deterring students with low entrepreneurial ability from pursuing entrepreneurship, and (2) increasing entrepreneurial ability. Lastly, general entrepreneurship education that targets a broader spectrum of startups, rather than one that solely focuses on technology startups, may be more effective in reducing the uncertainty in entrepreneurial ability or improving startup performance. However, we note that the effects we find here are the average effects at the school level over several years. There still may have been specific teachers, courses, or programs that had significant influences on entrepreneurship. We pursue these aspects further in future research.

The findings of this paper are closely related to Lerner and Malmendier (2013). They utilize the random assignment of peers in business school sections to examine how peers affect entrepreneurial decisions and find that higher share of entrepreneurial peers decrease entrepreneurship. Similar to education programs, peers with entrepreneurship experience help students learn about their own entrepreneurial abilities. Howell (2016) examines entrepreneurial learning in the context of venture competitions. She finds that negative feedback deters entrepreneurs from pursuing their ventures. Whether it is from university entrepreneurship programs, peers with entrepreneurship experience, or negative feedback from venture competitions, the process of learning about one's own entrepreneurial ability seems to mitigate overconfidence in starting a new venture.

Fairlie et al. (2015) use a randomized control trial to examine a large-scale entrepreneurship training program and find no lasting effect on entrepreneurship and business performance. Graevenitz et al. (2010) find that a compulsory entrepreneurship course at the university level decreases student intention to start a business and improves self–assessed entrepreneurial skill. Hsu et al. (2007), examine entrepreneurship patterns of MIT alumni, but they do not focus on entrepreneurship programs. Eesley et al. (2016) examine alumni of China's Tsinghua University and show that emphasis on entrepreneurship improves student awareness on the importance of patents.

Also related is the literature that evaluates the impact of public efforts to promote entrepreneurship. Lerner (1999, 2002) examines government initiatives to increase innovation and entrepreneurship. Hsu et al. (2007) compares the effect of VC and SBA funding and Brander, Du, and Hellmann (2014) examines the effect of public venture capital. These analyses overall also point in the direction of little and uneven effects of public support for entrepreneurship. The paper proceeds as follows. The next section describes the Stanford University Entrepreneurship Initiatives and the alumni survey. Section 3 lays out the estimation and identification strategy. Section 4 presents some descriptive patterns and the empirical results and Section 5 concludes.

2. Stanford University Entrepreneurship Initiatives and the Alumni Survey

2.1 The Center for Entrepreneurial Studies and the Stanford Technology Venture Program

Stanford University is well known for its supportive environment for student and faculty entrepreneurship. The stories of the founding of Hewlett-Packard and Google are two among many prominent examples. In recent decades, Stanford University further expanded and formalized its support for entrepreneurship and established two programs - the Center for Entrepreneurial Studies and the Stanford Technology Venture Program- in the mid 1990s. The Center for Entrepreneurial Studies (CES) was founded in 1996 at the Graduate School of Business to address the needs facing entrepreneurs and the entrepreneurial community. The program utilizes the expertise on campus and Silicon Valley to provide courses and networking opportunities, as well as support research. For students, the CES offers a variety of courses and experiential learning that touch upon all aspects of entrepreneurship. The courses cover topics ranging from management, finance, technology, law, education, design, etc. However, the courses are primarily accessible to business school students only. Furthermore, students have the opportunity to take experiential learning classes where they can learn the day-to-day activities of a start-up and test out new business concepts. The Stanford Technology Venture Program (STVP) is the entrepreneurship center founded in 1995 at the Engineering School. Similarly, STVP offers courses and extracurricular programs to students as well as supporting research on high-technology entrepreneurship. In addition to offering entrepreneurship related courses to engineering students, STVP houses several fellowship programs where students can obtain in-depth knowledge and first-hand experience of technology start-ups. However, the courses offered through STVP are more focused on technology ventures, and the range of courses offered by STVP is smaller compared to the CES.

2.2 The Stanford University Innovation Survey

The main objective of the Stanford University Innovation Survey was to document the economic impact Stanford Alumni have played in terms of entrepreneurship and innovation. However, what makes the survey particularly useful for analysis is its coverage of all students regardless of entrepreneurship status. One of the main challenges entrepreneurship data face is the fact that data is often only available for those who enter into entrepreneurship or become publicly listed. Especially, when one relies on administrative data, information on those who do not become entrepreneurs or do not go public are hard to collect. A benefit of the Stanford Innovation Survey is its coverage of all Stanford students regardless of entrepreneurship status. Hence, this survey is unlikely to suffer from success bias compared to most datasets that condition on venture capital funding or an initial public offering. Also, since the surveyed alumni are not selected based on successful entry into entrepreneurship, unlike samples that focus on innovators or venture-backed founders, the results do not suffer from biases due to sampling on the dependent variable. Prior studies have found samples of alumni from research universities (MIT, Stanford, Harvard and Chicago) useful in making theoretical contributions regarding how the broader social environment influences entrepreneurs (Dobrev and Barnett 2005, Lazear 2004, Burt 2001, Roberts 1991, Hsu et al. 2007, Roberts and Eesley 2009). Results based on this type of sample may generalize to other samples of selective-admission college-educated alumni.

The survey was conducted over a well-defined population of comparable individuals in multiple industries, and it was administered through official university channels and hence more trustworthy to the respondents. By surveying the entire population (all living alumni who graduated between the 1930s and 2010s), we were able to poll all alumni who could have founded a firm. The 2011 survey generated 27,783 individual responses for a response rate of 19.5%. The response rates are similar across gender, departments, and graduation year. If we take graduates from 1933-1971, the response rate was 22% and graduates from 1972-2010, the response rate was 18 percent, indicating that older graduates were not less likely to respond. Appendix Table 1 shows a multivariate regression predicting response to further assess response rate characteristics among the alumni sample. The dependent variable is equal to one if the individual responded to the survey and zero otherwise. Due to the large sample size, some variables are statistically significant. The first column indicates that women were 5.1% more likely to respond than men overall. Those in more recent graduation years were 0.9% less likely to respond. Graduates of the Education and Medical schools were more likely to respond and those from Law and Engineering were less likely to respond. Finally, we include fixed effects for graduation year, and a full set of interactions between gender and graduation year and school. In this model, we do not detect significant differences for the main effects of gender and school (see Eesley and Miller, 2012 for more detailed benchmarking and response rate analyses). Out of the respondents, nearly 8,000 reported being entrepreneurs who founded any type of organization (for-profit or non-profit) and 4,290 said they had founded an incorporated business. The Stanford survey not only asks one's entrepreneurship status, but also whether one invested in start-ups as an angel investor or venture capitalist. Responses include data on 2,798 individuals who were early employees (16 percent of the alumni), 349 venture capital investors, and 2,572 angel investors. Some 3,600 respondents, 18 percent, said they had been on a private company board of directors. The survey also collected information on when each startup was created and whether it failed, or exited through an IPO or was acquired by another firm. The survey asks about performance measures, i.e., the revenue and number of employees in the most recent year the firm was alive. When available, these figures are verified by matching the firm names to the Dun and Bradstreet database. We examine the performance of each entrepreneur's first start-up when these measures are available.

Other valuable information include whether the respondent's parent had any entrepreneurship experience. The literature has found parental entrepreneurship status to be one of the strongest determinants of entrepreneurship in different countries. The survey also asks how optimistic the respondent is. In particular, it asks respondents to rate the degree to which one agrees with the statement: "Overall, I expect more good things to happen to me than bad." We use these variables and age, ethnicity, gender, and nationality variables to control for the underlying characteristics of the respondent. In the empirical analysis we focus on students who graduated from Stanford on or after 1980 to minimize recall bias and on or before 2005 to provide some time for entrepreneurship activity. Table 1 presents summary statistics of the main variables.

3. Estimation and Identification Strategy

The base regression framework is the following:

$$y_{ijk} = \alpha + \beta Prog_{ijk} + \mathrm{X_{ijk}}\pi + \mu_j + \theta_k + \varepsilon_{ijk} \quad (1)$$

where y_{ijk} represents the entrepreneurship status of or startup performance of Stanford University alumni i who attended school j and graduated in year k. $Prog_{\mathrm{ijk}}$ is a dummy variable indicating participation in the either the CES or STVP. In some specifications we include both program dummies. $\mathrm{X_{ijk}}$ is the vector of control variables that include the foreign dummy, gender dummy, parental entrepreneurship dummy, and the age fixed effects. Also included are a dummy variable for students who participate in both programs and a dummy variable for students who were Stanford undergraduates that became business school graduates at Stanford University. μ_j is the set of school fixed effects, i.e., dummy variables indicating whether the student attended the business school, engineering school, medical school, etc. We control for Stanford cohort specific effects non-parametrically by including Stanford graduation year fixed effects θ_k. The main coefficient of interest is β, which captures the effect of the entrepreneurship programs on the outcome of interest. When the dependent variable is binary, we still estimate equation (1) in a linear regression model to facilitate comparison with the 2SLS results. Estimation using a non-linear probability model returns similar results.

We are interested in the causal effect of the entrepreneurship programs on entrepreneurship status and innovation. However, equation (1) suffers from endogeneity. Students who were thinking of becoming an entrepreneur would likely have enrolled in the classes and programs offered by the University's entrepreneurship programs. To deal with endogeneity, we instrument program participation with program availability. Specifically, the Center for Entrepreneurial Studies (CES) was established in 1996, and new sets of courses on entrepreneurship became available to students in the latter cohorts. Students who attended the GSB after the CES was established could take entrepreneurship related courses unlike their earlier cohorts or students from other schools. Other students in the university could only take GSB courses, if the instructor approved. However, as we show later, participation by students from other schools was minimal.

We use an instrumental variable strategy where we instrument program participation with the GSB dummy interacted with the dummy for cohorts who graduated Stanford on 1997 or after. Since school fixed effects and cohort fixed effects are included, the variation used to generate the plausibly exogenous variation in program participation is the difference in program participation of only the GSB students before and after CES was introduced. Critical to the validity of this assumption is that students who graduated from the GSB after the program was introduced were no different than students who graduated before. If more entrepreneurial students started to attend Stanford University and the GSB because entrepreneurship programs became available, the identifying assumption would be violated. We provide evidence that this was not the case, especially for the CES, in the empirical analysis.

In practice, we perform the following 2SLS regression where the first stage is

$$Prog_{ijk} = \alpha + \beta GSB_{\mathrm{j}} * Post1997_{\mathrm{k}} + \gamma GSB_{\mathrm{j}} * Time_{\mathrm{k}\geq 1997} * Post1997_{\mathrm{k}} + \mathrm{X_i}\pi + \mu_j + \theta_k + \varepsilon_{ijk}$$

and the second stage is the same as equation (1) but now with predicted program participation

$$y_{ijk} = \alpha + \beta \widehat{\mathrm{Prog_i}} + \mathrm{X_i}\pi + \mu_j + \theta_k + \varepsilon_{ijk} \quad .$$

The $GSB_{\mathrm{j}} * time_{\mathrm{k}} * D_{\mathrm{k}\geq 1997}$ term flexibly captures increasing student participation rates as the program becomes more established over the years. $Time_{\mathrm{k}\geq 1997}$ is simply a linear time trend normalized at 1997.

In the robustness, we also use a more succinct version with $GSB_{\mathrm{j}} * Post1997_{\mathrm{k}}$ as the instrumental variable, as well as a version where we use the full set of interaction terms to flexibly capture the difference in program roll out over the years. In such specifications, the first stage is

$$Prog_{ijk} = \alpha + \sum_{k} \beta^{k} GSB_{\mathrm{j}} * Cohort_{\mathrm{k}} + \mathrm{X_i}\pi + \mu_j + \theta_k + \varepsilon_{ijk}$$

Similarly, when we examine the effect of the engineering school initiative we perform the same regressions but instead instrument STVP participation with $ENG_{\mathrm{j}} * Post1998_{\mathrm{k}}$, the engineering school dummy interacted with the post 1998 dummy, and $ENG_{\mathrm{j}} * Time_{\mathrm{k}\geq 1998} * Post1998_{\mathrm{k}}$. We note that when we examine the effects of the CES and STVP separately, the control group is students from the other schools, i.e., students from the other five schools of Stanford University.

4. Empirical Results

4.1 Descriptive patterns

Figure 1 illustrates the participation rate in CES by cohort among three different groups – those who graduated from the business school, engineering school, and the other schools grouped in one category. Participation in the CES jumps up starting with the 1997 graduating cohort. Recall the CES was introduced in the 1996-7 academic year. Hence it seems natural that CES participation rises with the 1997 graduating cohorts. The fact that participation is not zero among the earlier cohorts implies that those who graduated earlier could participate in the CES program not just when they were students. Indeed there are programs where alumni can participate in the CES. Given that many alumni remain in Silicon Valley for their careers, this is very likely. What is noteworthy is that participation among students from other schools remains very low. This property of the CES lends itself as a good design to compare the effect of CES participation using a difference in difference framework.

Figure 2 overlays the participation rate in STVP. Participation in STVP jumps for the engineering school students starting with the 1998 cohort. However, the increase in participation is substantially smaller in magnitude compared to the CES participation among business school students. Also, business school students participate in the STVP program, notably starting with the 2000 cohorts.

Figure 3 illustrates the entrepreneurship rate since the 1980s. The entrepreneurship rate hovers around 0.4 to 0.5 among the 1980s cohort and declines afterwards. The business school students in general have a higher entrepreneurship rate than those from the other schools. The trends across all three school categories seem similar after the mid 1990s. Figure 4 presents years to first entrepreneurship after graduation. There is a declining trend across all three schools, indicating that students that become entrepreneurs are starting sooner. Starting in the mid-1990s business school students seem to be starting startups earlier than students from the other schools. Figure 5 examines the log revenue in 2011 for surviving startups. Revenue generally declines in firms created by more recent graduates from the engineering and other schools. However, revenue remains steady, and actually, seems to increase with cohort among business school students. Overall, the figures indicate that CES participation rose substantially among business school graduates after the mid 1990s, and that years to first startup and revenue of first startup by business school graduates may have diverged from graduates from the other schools. In the following sections, we examine whether these patterns are statistically meaningful.

4.2. Results on Entrepreneurship

Table 2 examines the relationship between program participation and various measures of entrepreneurship in an OLS framework. Column (1) examines entrepreneurship, defined as the founding of any new organization. CES and STVP participation are related to about a 13 percent and 10 percent higher entrepreneurship rate. Both estimates are statistically significant at the 5 percent level. However, we find no effect on the number of patents. In terms of the type of organization that is being found, the strongest effect is on incorporated companies. We also find that program participation in either program is positively associated with becoming an angel or VC investor. CES participation is strongly related to becoming an early employee of a startup as well. The OLS regressions in Table 2 all control for ethnicity (white, black, Asian, Hispanic, and other), foreign citizenship, gender, and parental entrepreneurship status, and include cohort, school, and age fixed effects. We also control for the small number of students who participate in both programs and students who were Stanford University undergraduates and business school graduates. However, the OLS estimates are likely biased upwards because of individual level omitted variables. Students with high entrepreneurial ability and motivation are likely to participate in the entrepreneurship programs even among students in the same cohort in the same school. Our identification strategy aims to alleviate endogeneity by taking advantage of the fact that students from the business schools were exposed to the entrepreneurship program after 1996 but students from the other schools were not able to participate in these programs (other than in rare cases where students petitioned to take classes). Stanford University's business school admits only graduate students and aims to retain exclusivity even within campus by limiting cross enrollment (which helps the Graduate School of Business retain its cachet and justify the high tuition costs). In other words, we utilize a difference in difference framework to examine how take-up in the CES changed among Stanford students and then ultimately to entrepreneurship and innovation related activities. We employ a similar strategy to estimate the impact of STVP.

Figures 1 and 2 visually present how participation in the CES and STVP evolved across different schools. In Table 3 columns (1) and (2), we present estimates from a regression of CES participation on the business school graduate dummy interacted with the post 1997 dummy. School, age, and graduating year fixed effects are included in column (1), and column (2) additionally controls for the individual characteristics. The coefficient estimate is significant at 0.255, indicating that on average 25.5 percent of the business school (GSB) students participated in the CES program after its introduction. However, as figure 1 indicates, the jump is not a step function. Participation jumps up a bit initially and continues to increase over the years. This reflects both the growth of the program curriculum, increasing advertisement from the school, and student interest. Hence, in column (3) we capture this trend by additionally including a GSB specific time interacted with the post 1997 dummy. The initial jump is reduced to about 9 percent and participation increases each year by about 4 percentage points. In columns (4) to (6) we examine STVP participation. STVP participation among engineering students is smaller in magnitude, at about 6 percent, after program introduction. And as column (6) indicates the coefficient estimates on the engineering school specific time trend is indistinguishable from zero. Table 3 presents the first stage of the 2SLS regression strategy and the results confirm that there is a strong and significant first stage effect of program introduction on program participation. We use the variables in column (3) and (6) as the base specification for the instrumental variable strategy, but also use a simpler version of the instrumental variable, i.e., school dummy interacted with the post dummy, and a more complicated version, i.e., school dummy interacted with year dummies, as robustness checks.

The identification assumption that uses the Table 3 results as the first stage of the 2SLS regression requires that unobserved student characteristics that affect entrepreneurship did not change differentially before and after the programs were introduced in the relevant schools. In Table 4 we examine this for a set of observable individual characteristics. In column (1) we examine whether parental entrepreneurship changed differentially with the introduction of the program across schools. The literature has found that parental entrepreneurship is a strong determinant of entrepreneurial choice. We find no significant differences in parental entrepreneurship status between the GSB students before and after 1997, or the engineering school students before and after 1998. In columns (2) to (6), we examine the share of white students, foreign students, Indian students, and Chinese students. Indian and Chinese students have played an important role in Silicon Valley entrepreneurship as highlighted by Saxenian (1999). None of the coefficient estimates are significant at the 5 percent level. Finally, in column (7) we examine a measure of optimism. We use the answers to the statement, "Overall, I expect more good things to happen to me than bad", in a 1 to 5 scale. Again, there is no evidence of any jump or differential trend among students entering the GSB or Engineering School. Table 4 results indicate that selection is unlikely to be a major concern in the first stage results of Table 3.

Table 5 presents the 2SLS results. In Panel A, we instrument CES participation with the business school interacted with the post 1997 dummy. Now we find a negative effect of CES program on entrepreneurship. Participation in CES results in a 35 percent reduction in the probability of entrepreneurship. The 2SLS estimates represents the local average treatment effect, i.e., the impact of those who participate in the CES program only because it was available. Panel B indicates that the impact of STVP on entrepreneurship is not significant. In Panel C, we examine the impact of CES and STVP in the same regression and use both sets of instrumental variables. The large negative result for CES remains. The negative impact of CES holds for both the startup of incorporated and unincorporated firms, as well as future investor status or becoming an early employee in a startup. There is some evidence that participation in the STVP increases the probability of founding a non-profit.

The finding that entrepreneurship education reduces the incidence of entrepreneurship likely reflects that these programs enable students to better realize whether he or she is of the entrepreneurial type. If this is the case, one would expect to see better startup performance by those who eventually decide to become entrepreneurs.

4.3. Results on the Characteristics and Performance of Startups

We next examine how the university entrepreneurship programs affect the characteristics and performance of the first startup after graduation. In particular, we examine the time to first startup, probability of failure, survival as a private entity, successful exit through an IPO or M&A, number of employees, revenue, and patenting. These results are conditional on entrepreneurship, hence reflect the impact that the programs directly have on these outcomes as well as the selection effect induced by the programs, i.e., the program may have induced potentially low entrepreneurial ability students to not pursue entrepreneurship. We first examine OLS results in Table 6. The CES program is associated with about 1.8 year reduction in the timing to first startup and considerably larger revenue among firms that were alive by the time of the survey. The STVP program is not systematically related to any of the firm characteristics or performance measures, other than weakly reducing the timing to startup by about 0.75 year.

Table 7 presents the 2SLS estimates. The impact of both programs on time to startup becomes larger in magnitude to -11 years for the CES and -25 years for the STVP. Focusing on the CES effects, we find that participation in the CES decreases the probability of failure by 38.5%, increases the probability that a firm remains private and alive by 58%, and reduces the probability that the firm will be acquired by 21%. Also, the log revenue of the startup in the year of survey increases substantially by 7.7. On the other hand, other than a reduction in M&A of the startup, there is no significant impact of STVP on firm performance. Could perhaps include a discussion note that these may be upper bounds on the estimate due to the high quality of the network, instruction and reputation at Stanford and location in Silicon Valley. Also, students at this early stage in their careers may experience a relatively bigger boost even relative to similar training provided to older, more experienced individuals who already have an extensive social network and industry experience. If we are to find an effect of such programs, then at the earlier stages of individuals careers may be a more promising place to look.

In Table 8 we examine the robustness of the results. In Panel A, we drop respondents who had participated in both programs and in Panel B we add an additional control for our measure of optimism. The estimates are very similar to those above. In Panels C and D, we use different instrumental variables. In Panel C we use just the program dummy interacted with the post year dummy. In Panel D, we use the program dummy interacted with the set of post year dummies. Again, the results are similar qualitatively and in magnitude. Lastly, we use a narrower sample in Panel E, i.e., only respondents who graduated between 1992 and 2002. Using the narrower sample allows us to focus on the years around the introduction of the new initiatives. However, we lose statistical power as the sample becomes smaller. The signs of the coefficient estimates in Panel E are generally the same to what we found before. However, only the coefficient estimate on years to entrepreneurship is statistically significant.

Finally, another concern with our base specification is that there might be unobserved school specific factors that change over the years and affect entrepreneurial activities at the school level. Since we cannot include school-time specific dummy variables, we instead control for school specific time trends, i.e., each school dummy interacted with graduation year in Panel F. Including this time trend allows us to capture unobserved school specific factors in a particular way, but only through the restricted parametric linear form. The effect of CES on entrepreneurship in column (1) is still negative and nearly halves in magnitude, but is no longer statistically significant. However, the impact on years to entrepreneurship is now positive at 10 years and statistically significant. This indicates that the results on years to entrepreneurship are very sensitive to the different model specifications. The column (4) results on probability of firms staying private is positive at 0.64, which is similar to the previous estimates, and just misses the 10 percent significance cut off. The impact on firm revenue is also similar to before and significant at the 5% level.

Overall, the 2SLS results from Table 7 and Table 8 imply that CES participation does not increase the rate of entrepreneurship and may actually decrease entrepreneurship. However, the negative or null impact on entrepreneurship results in better performance of startups. Startups are more likely to stay alive and surviving startups tend to perform better.

We further explore which margins might be at work to increase firm performance. Many factors including, financing, industry, or networking could affect firm performance. The survey collects data on one of the respondent's startups. If the respondent founded multiple startups, the survey randomly asks the respondent additional details about one firm. We examine the information on financing, in particular, total financing up till the survey date and initial financing, but find no significant results. These results are presented in Appendix Table 2. We also examine industry choice and networking activity. The 2SLS results in Table 9 indicate that CES participation increases startup of internet related businesses. We do not find any significant impact of STVP on the industry type of startups. Lastly, we find that CES participation significantly increases utilization of Stanford alumni networks via regional alumni clubs and to find business partnerships.

5. Conclusion

Entrepreneurship education programs and university entrepreneurship centers have proliferated over the past decade. Prior literature analyzing the impact of such programs, has been sparse, providing little in the way of quantitative assessments of their impact on students and alumni. Related work examining the social influence of classmates with entrepreneurial experience, venture competitions, compulsory entrepreneurship courses, and non-university entrepreneurship training programs show somewhat mixed results (Lerner and Malmendier, 2013; Graevenitz et al., 2010). Yet, this work suggests that such programs may reduce entrepreneurship rates and have little impact on venture performance (Fairlie et al., 2015; Howell, 2016). However, such pioneering work leaves open the question of whether such results are due to the educational content, structure of the programs, small numbers of observations, or whether more formalized entrepreneurship centers may exhibit a more positive impact on students and alumni.

This paper contributes to this increasingly important area of literature by examining two major entrepreneurship initiatives at Stanford University and their influence on entrepreneurial activity among alumni. We find that program participation is positively associated with entrepreneurial activities. Yet, when self-selection of more entrepreneurial students into these programs is taken into account, we find that these programs have a negative to zero impact on entrepreneurship. We do find, however, that the business school initiative resulted in a decreased probability of startup failure and increased firm revenue. These findings suggest that university entrepreneurship programs may provide important feedback on students' potential as entrepreneurs. By weeding out lower quality ventures and increasing social networking among regional alumni, university entrepreneurship programs may improve the quality of those who decide to start firms. Thus, we also contribute by showing suggestive evidence for regional networking with fellow alumni for partnerships, advice, or other resources as an important, previously overlooked mechanism in university entrepreneurship programs. Future work may also wish to examine entrepreneurial behavior in the context of larger organizations in addition to founding new ventures. Many of the students who participate in these programs do not go on to create startups, yet they may act in an entrepreneurial way within the context of established organizations. This type of outcome has not been previously explored, yet the possibility is suggested by our findings that related career choices such as being an early employee or investor also appear to be associated with participation in the programs.

Relative to prior work on university entrepreneurship and alumni, we examine entrepreneurial actions rather than intentions (Graevenitz et al., 2010) and we examine entrepreneurial activity related to coursework rather than driven by social influence (Lerner and Malmendier, 2013). Relative to the work on business training or venture feedback (Fairlie et al., 2015; Howell, 2016), we find some positive impacts of university entrepreneurship education. This difference in results may be due to the greater length or depth of engagement in the university programs relative to business training or venture competitions. Some of the difference could also be due to a bigger learning impact in the younger university sample. It could also be due to differences in the content and structure of these programs as well as the ability to network among university alumni. Future work is merited to explore these issues in greater detail given the different outcomes between university entrepreneurship programs and other business training or competition formats. In conclusion, if university students and alumni entrepreneurs are the next generation of potential entrepreneurs, such university entrepreneurship initiatives may play an important role in funneling the winds of creative destruction (Schumpeter, 1942).

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Figure 1. Center for Economic Studies participation rate by graduation year

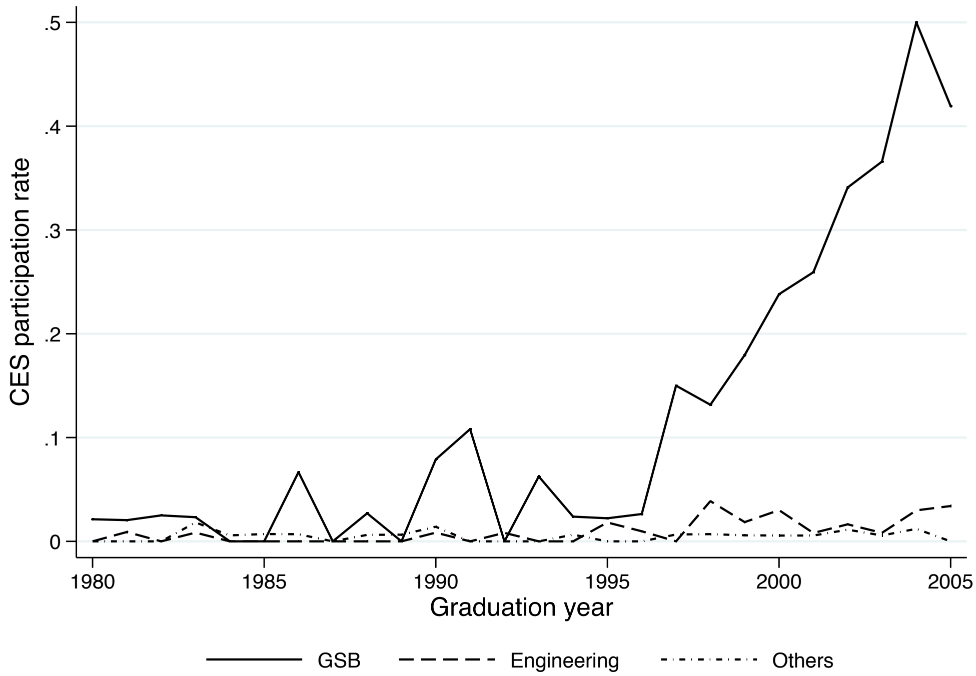

Figure 2. Center for Economic Studies and Stanford Technology Venture Program participation rate

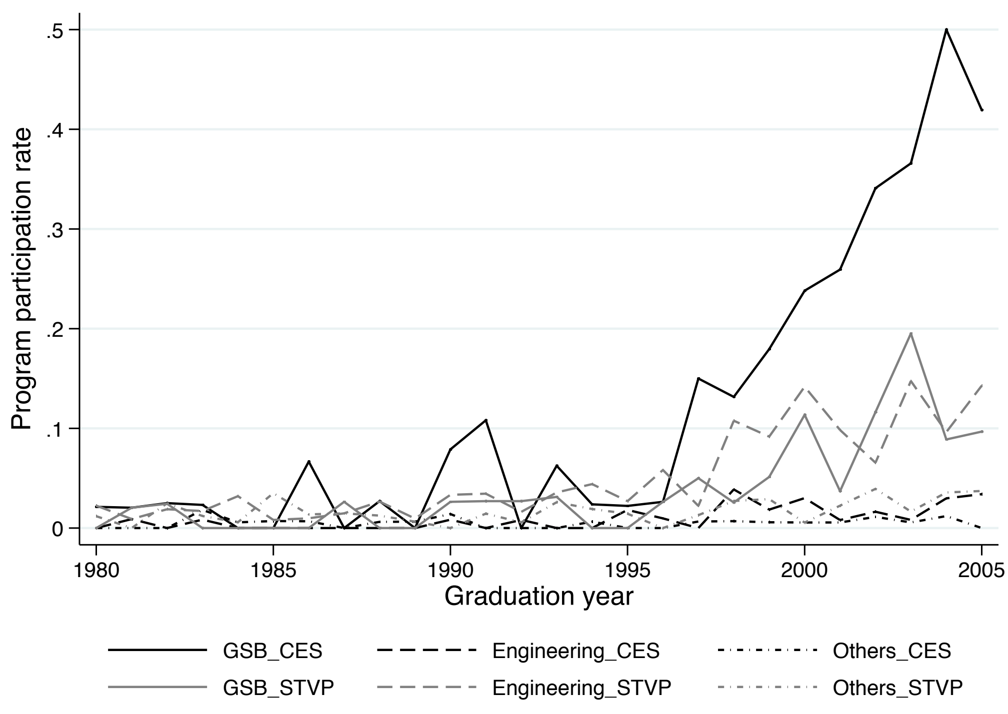

Figure 3. Entrepreneurship rate by school by graduation year

Figure 4. Years to first entrepreneurship – Due to structure of the data?

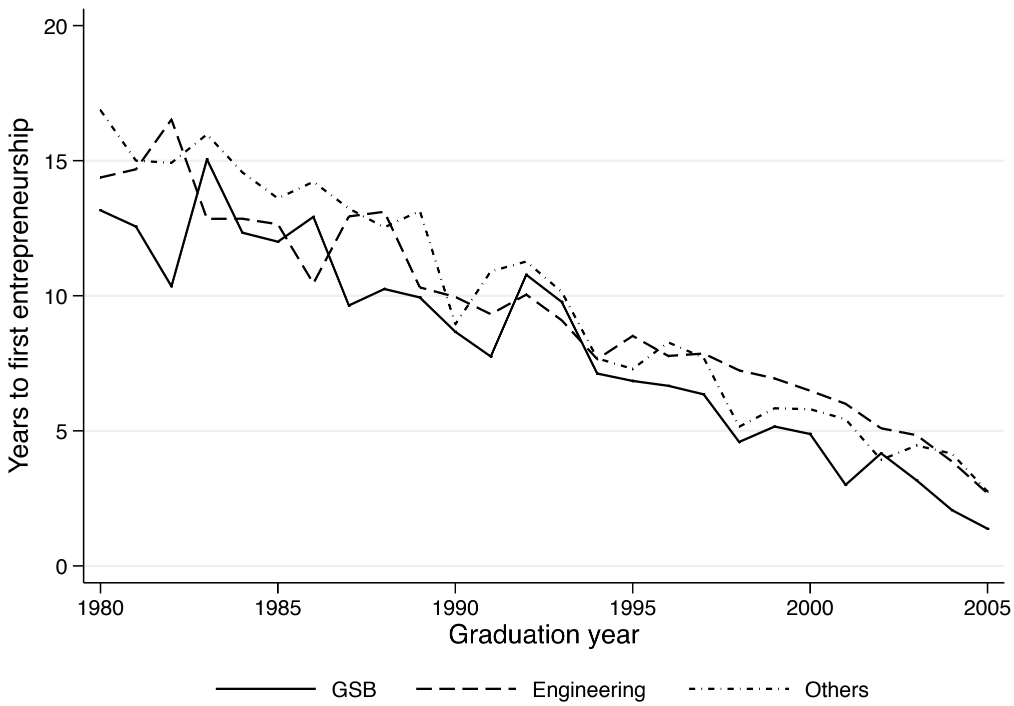

Figure 5. Log revenue of first startup (measure ???

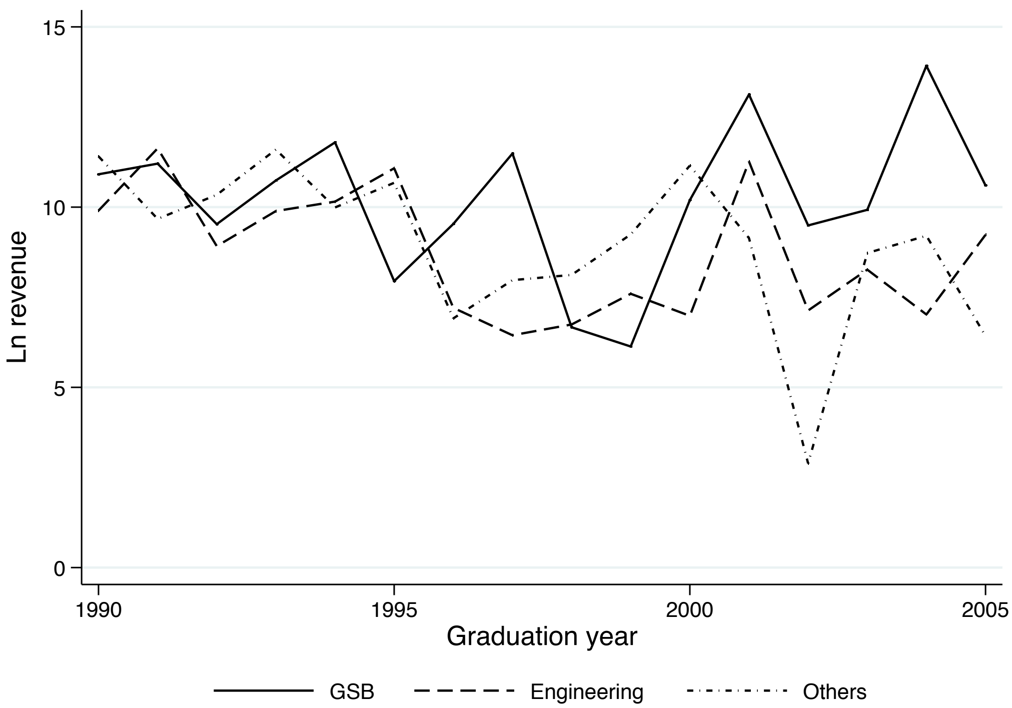

Table 1. Summary statistics

Variable	Mean	Std. Dev.	Min	Max	Obs
Panel A. Main sample					
Participate in Center for Entrepreneurial Studies	0.0182988	0.1340392	0	1	6995
Participate in Stanford Technology Ventures Program	0.0311105	0.1736288	0	1	6943
Graduate School of Business student	0.1152252	0.3193163	0	1	6995
Engineering School student	0.3705504	0.4829867	0	1	6995
First year graduated from Stanford	1993.024	7.675716	1980	2005	6995
Entrepreneurship - founded a new organization	0.2974982	0.4571902	0	1	6995
Number of patents	2.605179	27.60914	0	2000	6285
Founded a non-profit	0.0510365	0.2200878	0	1	6995
Founded an incorporated company	0.161258	0.3677951	0	1	6995
Founded an unincorporated company	0.1476769	0.3548048	0	1	6995
Invest as an angel investor of venture capitalist	0.0993567	0.2991617	0	1	6995
Been an early employee at an entrepreneurial firm	0.1205147	0.3255857	0	1	6995
Stanford Alumni Association	0.6587185	0.4741743	0	1	6836
Stanford Alumni Regional Club	0.3604039	0.4801527	0	1	6834
School specific Alumni Group	0.2073365	0.4054281	0	1	6897
Use Stanford alumni network for funding	0.0459638	0.2094217	0	1	6962
Use Stanford lumni network for cofounders	0.075431	0.2641046	0	1	6960
Use Stanford alumni network to find customers	0.0580877	0.233926	0	1	6955
Use Stanford alumni network to find partnerships	0.0784511	0.2688995	0	1	6947
Use Stanford alumni network to find advisors	0.1452079	0.3523357	0	1	6928
Panel B. First startup variables					
Years to first founding after graduation	10.32	6.88	0	31	2101
Startup fails	0.2571968	0.437192	0	1	2119
Startup alive - no exit	0.5955639	0.4908984	0	1	2119
Exit through IPO	0.0188768	0.1361221	0	1	2119
Exit through acquisition	0.1005191	0.3007619	0	1	2119
Ln(revenue) in 2011	9.571727	5.824071	0	27.72633	1399
Ln(number of employee) in 2011	1.800295	1.471483	0	9.546884	1880
Ln(total number of patent issued)	0.3275461	0.9111791	0	10.30899	1592

Table 2. Effect of entrepreneurship initiatives – OLS Estimates

VARIABLES	(1) Entrepreneurship	(2) Number of patents	(3) Found nonprofit	(4) Found incorporated comp.	(5) Found unincorporated comp.	(6) Angel or VC investor	(7) Early employee of startup
Participate in CES	0.130**	0.255	0.0308	0.178***	0.0213	0.150***	0.103**
	(0.0516)	(0.990)	(0.0272)	(0.0490)	(0.0418)	(0.0485)	(0.0481)
Observations	6,995	6,285	6,995	6,995	6,995	6,995	6,995
R-squared	0.125	0.024	0.028	0.114	0.060	0.055	0.103
Participate in STVP	0.0966***	0.613	0.0342*	0.0819***	0.0501*	0.0602**	0.0163
	(0.0323)	(0.731)	(0.0185)	(0.0292)	(0.0270)	(0.0254)	(0.0244)
Observations	6,994	6,285	6,994	6,994	6,994	6,994	6,994
R-squared	0.126	0.024	0.029	0.113	0.062	0.102	0.067
Participate in CES	0.126**	0.292	0.0345	0.181***	0.0281	0.161***	0.111**
	(0.0522)	(1.020)	(0.0281)	(0.0500)	(0.0432)	(0.0498)	(0.0494)
Participate in STVP	0.103***	0.673	0.0371*	0.0928***	0.0508*	0.0667**	0.0159
	(0.0327)	(0.739)	(0.0190)	(0.0298)	(0.0274)	(0.0260)	(0.0245)
Observations	6,943	6,249	6,943	6,943	6,943	6,943	6,943
R-squared	0.127	0.024	0.029	0.116	0.061	0.105	0.069
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stanford graduation year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Individual controls include ethnicity, foreign and gender dummies, and parental entrepreneurship status. Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3. Program take-up

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	CES	CES	CES	STVP	STVP	STVP
GSB*Post1997	0.252***	0.255***	0.0935**			
	(0.0252)	(0.0273)	(0.0446)			
Engineering*Post1998				0.0630***	0.0584***	0.0705***
				(0.0118)	(0.0122)	(0.0213)
GSB*Time trend*Post1997			0.0414***			
			(0.0104)			
Engineering*Time trend*Post1998						-0.00335
						(0.00509)
Individual controls	No	Yes	Yes	No	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Age fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Stanford graduation year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,254	6,995	6,995	8,272	6,994	6,994
R-squared	0.175	0.184	0.204	0.039	0.042	0.042

Notes: Individual controls include ethnicity, foreign and gender dummies, and parental entrepreneurship status. Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4. Selection into schools

VARIABLES	(1) Parental entrepreneurship	(2) White	(3) Foreign	(4) Indian	(5) Chinese	(6) Female	(7) Optimism
GSB*Post1997	0.0189	-0.0525	0.0795	-0.00381	0.00718	-0.0416	0.0234
	(0.0543)	(0.0642)	(0.0653)	(0.0226)	(0.0371)	(0.0632)	(0.0829)
Engineering*Post1998	0.00736	0.00707	-0.0100	-0.00179	0.000194	0.0121	-0.0152
	(0.0110)	(0.0128)	(0.0129)	(0.00447)	(0.00796)	(0.0127)	(0.0164)
GSB*Time trend*Post1997	0.0240	0.0404	-0.0451	-0.0144	0.0482*	-0.0648*	0.0923
	(0.0331)	(0.0422)	(0.0423)	(0.0171)	(0.0285)	(0.0388)	(0.0599)
Engineering*Time trend*Post1998	-0.000176	-0.0152*	0.0135	0.00593	0.000351	0.00982	0.000576
	(0.00731)	(0.00924)	(0.00916)	(0.00400)	(0.00645)	(0.00854)	(0.0128)
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stanford graduation year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,995	6,995	6,995	6,995	6,995	6,995	6,949
R-squared	0.021	0.059	0.040	0.023	0.038	0.149	0.016

Notes: Individual controls include ethnicity, foreign and gender dummies, and parental entrepreneurship status. Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5. Effect of entrepreneurship initiatives – 2SLS Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Entrepreneurship	Number of patents	Non-profit	Incorporated company	Unincorporated company	Angel or VC investor	Early employee
CES	-0.350**	13.23	-0.0514	-0.337**	-0.366***	-0.233*	-0.244*
	(0.161)	(12.35)	(0.0745)	(0.138)	(0.133)	(0.137)	(0.137)
First-stage F statistic	37.85						
Observations	4,403	3,862	4,403	4,403	4,403	4,403	4,403
R-squared	0.135	0.029	0.034	0.112	0.053	0.125	0.080
STVP	0.581	9.224	0.376*	-0.179	-0.145	-0.468*	-0.405
	(0.398)	(20.47)	(0.195)	(0.312)	(0.299)	(0.252)	(0.297)
First-stage F statistic	12.55						
Observations	6,187	5,592	6,187	6,187	6,187	6,187	6,187
R-squared	0.072	0.027	-0.034	0.077	0.045	-0.061	-0.012
CES	-0.416**	8.953	-0.0726	-0.345**	-0.373***	-0.173	-0.199
	(0.164)	(8.143)	(0.0742)	(0.140)	(0.132)	(0.141)	(0.141)
STVP	0.637	11.23	0.410**	-0.119	-0.145	-0.470*	-0.374
	(0.407)	(20.01)	(0.200)	(0.319)	(0.303)	(0.259)	(0.301)
First-stage F statistic	6.33						
Observations	6,943	6,249	6,943	6,943	6,943	6,943	6,943
R-squared	0.075	0.020	-0.046	0.084	0.039	0.012	0.023
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stanford graduation year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Individual controls include ethnicity, foreign and gender dummies, and parental entrepreneurship status. Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6. Impact on the characteristics and performance of first startup– OLS Estimates

VARIABLES	(1) Years to entrepreneurship	(2) Startup failure	(3) Firm alive - no exit	(4) IPO	(5) M&A	(6) Ln(number of employee)	(7) Ln(firm revenue)	(8) Ln(patents)
CES	-1.844***	-0.0761	0.0776	0.0171	-0.00146	0.601	3.830**	0.175
	(0.600)	(0.0735)	(0.0886)	(0.0313)	(0.0568)	(0.416)	(1.619)	(0.160)
Observations	1,290	1,290	1,290	1,290	1,290	733	526	1,144
R-squared	0.797	0.124	0.185	0.066	0.157	0.271	0.262	0.147
STVP	-0.751*	0.00272	0.0657	0.00232	-0.0469	-0.133	-1.570	0.191
	(0.415)	(0.0545)	(0.0563)	(0.0169)	(0.0314)	(0.187)	(1.300)	(0.156)
Observations	1,701	1,701	1,701	1,701	1,701	951	704	1,564
R-squared	0.803	0.107	0.171	0.073	0.115	0.217	0.250	0.197
CES	-1.566***	-0.0691	0.0385	0.0357	0.00894	0.670*	2.134	0.0254
	(0.509)	(0.0674)	(0.0808)	(0.0354)	(0.0543)	(0.391)	(1.359)	(0.160)
STVP	-0.806**	-0.0195	0.0831	0.00111	-0.0419	-0.104	-2.121*	0.215
	(0.400)	(0.0527)	(0.0552)	(0.0161)	(0.0303)	(0.176)	(1.238)	(0.149)
Observations	2,090	2,090	2,090	2,090	2,090	1,168	860	1,908
R-squared	0.803	0.102	0.178	0.051	0.127	0.224	0.233	0.184
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Founded year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Individual controls include ethnicity, foreign and gender dummies, and parental entrepreneurship status. Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 7. Impact on the characteristics and performance of first startup– 2SLS Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Years to entrepreneurship	Startup failure	Firm alive - no exit	IPO	M&A	Ln(number of employee)	Ln(firm revenue)	Ln(patents)
CES	-11.42***	-0.385**	0.581**	0.0527	-0.209**	0.878	7.690**	0.127
	(2.514)	(0.192)	(0.226)	(0.0562)	(0.100)	(0.740)	(3.119)	(0.346)
First-stage F statistic	19.68							
Observations	1,290	1,290	1,290	1,290	1,290	733	526	1,144
R-squared	0.756	0.112	0.161	0.064	0.144	0.270	0.249	0.147
STVP	-25.10**	0.271	0.551	-0.0705	-0.743**	-1.719	-4.023	0.190
	(10.29)	(0.491)	(0.563)	(0.115)	(0.377)	(2.280)	(12.86)	(1.229)
First-stage F statistic	3.9							
Observations	1,701	1,701	1,701	1,701	1,701	951	704	1,564
R-squared	0.381	0.093	0.137	0.062	-0.080	0.174	0.244	0.197
CES	-10.66***	-0.323*	0.554***	0.0538	-0.209*	1.372*	6.232**	0.287
	(2.912)	(0.179)	(0.199)	(0.0549)	(0.113)	(0.777)	(2.815)	(0.389)
STVP	-24.64***	0.0543	0.607	-0.0540	-0.583*	-0.734	-1.569	-0.00367
	(9.042)	(0.446)	(0.517)	(0.106)	(0.299)	(1.866)	(10.96)	(1.107)
First-stage F statistic	2.5							
Observations	2,090	2,090	2,090	2,090	2,090	1,168	860	1,908
R-squared	0.441	0.095	0.128	0.046	0.026	0.213	0.222	0.181
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Founded year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Individual controls include ethnicity, foreign and gender dummies, and parental entrepreneurship status. Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8. Robustness tests

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	Entrepreneurship	Years to entrepreneurship	Startup failure	Firm alive - no exit	Ln(firm revenue)	Entrepreneurship	Years to entrepreneurship	Startup failure	Firm alive - no exit	Ln(firm revenue)
A. Drop participants in both programs										
CES	-0.378**	-10.36***	-0.331*	0.546**	7.762**					
	(0.160)	(2.311)	(0.185)	(0.222)	(3.147)					
STVP						0.549	-24.76**	0.240	0.564	-4.590
						(0.395)	(10.21)	(0.486)	(0.562)	(13.06)
Observations	4,383	1,279	1,279	1,279	524	6,172	1,694	1,694	1,694	701
R-squared	0.132	0.765	0.112	0.162	0.248	0.076	0.390	0.097	0.136	0.238
B. Control for optimism										
CES	-0.321**	-11.57***	-0.382**	0.578**	7.627**					
	(0.162)	(2.512)	(0.193)	(0.228)	(3.250)					
STVP						0.387	-31.07**	0.224	0.773	-3.367
						(0.402)	(13.88)	(0.589)	(0.697)	(13.72)
Observations	4,355	1,281	1,281	1,281	523	6,127	1,689	1,689	1,689	700
R-squared	0.161	0.758	0.111	0.161	0.254	0.116	0.158	0.100	0.103	0.264
*C. Use program*post as IV*										
CES	-0.308*	-12.25***	-0.191	0.374	7.321					
	(0.183)	(2.682)	(0.214)	(0.237)	(4.666)					
STVP						0.536	-29.39***	0.124	0.811	-3.277
						(0.396)	(11.29)	(0.519)	(0.625)	(12.71)
Observations	4,403	1,290	1,290	1,290	526	6,187	1,701	1,701	1,701	704
R-squared	0.138	0.748	0.122	0.177	0.251	0.078	0.219	0.104	0.091	0.247
*D. Use set of program*year dummies as IV*										
CES	-0.330**	-10.67***	-0.337*	0.516**	7.906***					
	(0.148)	(2.411)	(0.193)	(0.219)	(2.941)					
STVP						0.184	-14.05***	-0.0963	0.301	-1.499
						(0.340)	(5.105)	(0.390)	(0.432)	(8.153)
Observations	4,403	1,290	1,290	1,290	526	6,187	1,701	1,701	1,701	704
R-squared	0.136	0.762	0.116	0.167	0.247	0.103	0.677	0.105	0.163	0.250
E. Narrower sample: 1992 to 2002										
CES	-0.235	-18.21***	0.0278	0.234	15.07					
	(0.309)	(5.285)	(0.341)	(0.387)	(11.20)					
STVP						0.549	-17.07*	-0.385	0.758	4.454
						(0.677)	(9.988)	(0.722)	(0.836)	(14.28)
Observations	1,887	443	443	443	183	2,652	618	618	618	233
R-squared	0.128	0.515	0.251	0.280	0.276	0.064	0.268	0.137	0.144	0.347
F. School specific time trends 1992 to 2002										
CES	-0.161	9.938***	-0.429	0.644	9.267**					
	(0.313)	(3.349)	(0.382)	(0.430)	(4.249)					
STVP						1.089	5.274	0.618	0.0616	7.163
						(0.934)	(6.036)	(0.743)	(0.743)	(16.63)
Observations	4,403	1,290	1,290	1,290	526	6,187	1,701	1,701	1,701	704
R-squared	0.147	0.790	0.110	0.155	0.238	-0.029	0.802	0.040	0.172	0.176

Notes: Individual controls include ethnicity, foreign and gender dummies, and parental entrepreneurship status. Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 9. Impact on startup industry

VARIABLES	(1) Biomed	(2) Consulting	(3) Electronics	(4) Finance	(5) Internet	(6) Manufacturing	(7) Software
Dcentent	-0.0705	-0.668	-0.0374	0.326	0.618**	-0.0379	-0.0965
	(0.123)	(0.456)	(0.106)	(0.302)	(0.310)	(0.0381)	(0.310)
Observations	434	434	434	434	434	434	434
R-squared	0.360	0.170	0.186	0.230	0.228	0.312	0.261
Dstvp	1.289	-1.478	-0.699	0.152	-0.256	-0.217	-0.0386
	(0.855)	(1.378)	(0.766)	(0.625)	(0.687)	(0.198)	(1.057)
Observations	590	590	590	590	590	590	590
R-squared	-0.815	-0.337	-0.063	0.110	0.099	0.045	0.303
Dcentent	-0.0611	-0.441	-0.0837	0.342	0.605*	-0.0274	-0.378
	(0.168)	(0.412)	(0.162)	(0.310)	(0.316)	(0.0471)	(0.361)
Dstvp	1.134*	-1.500	-0.655	-0.239	-0.0467	-0.0821	0.567
	(0.613)	(1.294)	(0.618)	(0.578)	(0.556)	(0.112)	(0.929)
Observations	737	737	737	737	737	737	737
R-squared	-0.452	-0.232	-0.004	0.110	0.160	0.131	0.195
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stanford graduation year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Individual controls include ethnicity, foreign and gender dummies, and parental entrepreneurship status. Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 10. Alumni network utilization

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Stanford Alumni Association	Stanford Alumni Regional Club	School specific Alumni Group	Use Stanford alumni network for funding	Use Stanford lumni network for cofounders	Use Stanford alumni network to find customers	Use Stanford alumni network to find partnerships	Use Stanford alumni network to find advisors
CES	0.128	0.481**	-0.175	-0.0904	0.193	0.295	0.662***	0.221
	(0.194)	(0.235)	(0.204)	(0.186)	(0.201)	(0.197)	(0.239)	(0.238)
Observations	1,255	1,254	1,267	1,282	1,282	1,284	1,283	1,279
R-squared	0.093	0.065	0.409	0.184	0.157	0.143	0.121	0.141
STVP	-0.301	0.589	-0.407	0.139	-0.0318	0.0655	-0.478	-0.226
	(0.541)	(0.555)	(0.480)	(0.286)	(0.413)	(0.336)	(0.406)	(0.482)
Observations	1,651	1,659	1,674	1,687	1,686	1,689	1,690	1,684
R-squared	0.035	0.057	0.042	0.040	0.080	0.055	-0.044	0.038
CES	0.154	0.211	-0.0842	-0.162	0.0706	0.185	0.659***	0.337
	(0.180)	(0.214)	(0.196)	(0.181)	(0.196)	(0.193)	(0.253)	(0.238)
STVP	-0.361	0.720	-0.443	0.00740	-0.0185	-0.147	-0.556	-0.217
	(0.488)	(0.507)	(0.429)	(0.275)	(0.385)	(0.324)	(0.408)	(0.443)
Observations	2,037	2,042	2,060	2,079	2,079	2,082	2,081	2,074
R-squared	0.027	0.051	0.273	0.118	0.101	0.084	-0.022	0.078
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stanford graduation year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Individual controls include ethnicity, foreign and gender dummies, and parental entrepreneurship status. Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table 1. Logit regressions on responder status

	Pr(respond)	Pr(respond)	Pr(respond)	Pr(respond)
Gender (female=1)	1.051**			1.143
	(0.018)			(0.514)
Earth Sciences			1.074	0.535
			(0.053)	(0.550)
Education			1.183***	0.662
			(0.039)	(0.905)
Engineering			0.883***	0.280
			(0.020)	(0.236)
Law			0.741***	0.565
			(0.027)	(0.185)
Medicine			1.698***	0.170
			(0.048)	(0.162)
Humanities & Sciences			0.508***	
			(0.011)	
Graduation Year		0.991***		
		(0.000)		
Gender*Graduation year FE				YES
Gender*school FE				YES
Graduation Year FE				YES
Constant	0.141***	5.69e+06***	0.292***	0.273
	(0.001)	(5,022,770)	(0.006)	(0.223)
Observations	133,916	139,004	143,632	70,926

*** p<0.001, ** p<0.01, * p<0.05 The omitted school category for comparison is the Graduate School of Business. Response rates are lower in the Humanities and Sciences due to only being permitted to send one reminder to these graduates. The final column drops H&S alumni from the model and finds no statistically significant differences in response likelihood among graduates of the remaining schools.

Appendix Table 2. Effect on total and initial funding

VARIABLES	(1) Ln(total funding)	(2) Ln(initial funding)	(3) Ln(total funding)	(4) Ln(initial funding)	(5) Ln(total funding)	(6) Ln(initial funding)
CES	0.0992	0.630			0.413	1.064
	(0.389)	(0.788)			(0.373)	(0.855)
STVP			0.0355	1.526	0.132	2.193
			(0.767)	(2.353)	(0.732)	(2.594)
Observations	1,271	572	1,676	789	2,066	967
R-squared	0.140	0.269	0.091	0.061	0.093	0.009
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Age fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Founded year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Individual controls include ethnicity, foreign and gender dummies, and parental entrepreneurship status. Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.