The Impact of Student Debt on High Value Entrepreneurship and Venture Success: Evidence from No-Loans Financial Aid Policies

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Abstract

Does having student loans negatively impact recent graduates' likelihood of creating high-impact entrepreneurial ventures? We answer this question by utilizing "no-loans" financial aid policies by universities as a natural experiment. We empirically examine whether graduates of universities that replace loans with grants in financial aid packages are more likely to become entrepreneurs and are eventually successful in raising venture capital (VC) financing. In particular, we test whether such a policy impacts cohorts that are already enrolled in college prior to the implementation of such policies (to eliminate potentially confounding effects through enrollment choice). We find that graduates from universities that establish no-loans financial aid policies are more likely to start entrepreneurial ventures and these ventures are more likely to get subsequent VC backing and more VC dollars. Further, ventures started by graduates of universities that establish no-loans financial aid policies are backed by high reputation venture capitalists, which is indicative of a higher likelihood of subsequent success. Moreover, such ventures have larger levels of sales and employment five years after founding. Our results are stronger for high-tuition universities, universities that have a greater extent of R&D activity, and that grant a greater number of doctoral degrees. Overall, our results document a significant adverse effect of student loans on a crucial engine of economic growth - high impact, venture capital backed startups - highlighting a major policy-relevant concern related to student loans.

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1 Introduction

Student debt in the United States hit at a record high value of $1 Trillion in 2011 and has been steadily increasing ever since.[1] A significant chunk of this exposure is held by U.S. federal and state governments. Meanwhile, policymakers have also shown interest in the rate of entrepreneurship and start-up activity in the economy. Entrepreneurship, particularly in high-technology areas, has been a solid and reliable engine of economic growth and employment, making it a significant policy focus. For instance, a recent study released by the Kauffman Foundation reports that companies that are less than one year old with one to four employees have created, on average, more than 1 million jobs per year over the past three decades.[2]

This impetus on entrepreneurship has made the question of how student debt can affect high growth venture creation an important one.[3] Krishnan and Wang (2017) [41] argue that college loans and student debt make it costlier for individuals to enter uncertain entrepreneurship activities, given the significant costs of default on these loans in the case of business failure. Given that failure is the most common outcome of venture-backed startups (e.g., Hall and Woodward (2010) [29]), this is a substantial cost to bear, even in expectation.[4] Another possibility is that student debt can make individuals more financially constrained, which in turn makes it harder to start-up a firm.

Policymakers already use this argument as a justification of important policy decisions. In fact, the Office of the President cited enhancement of entrepreneurship as one of the benefits of the executive actions by President Barack Obama to reduce student loan repayment burdens in 2011.[5] Further, media reports suggest that this issue is debated by a broader audience.[6] In spite of such actions at the highest levels of government, there is scant systematic evidence relating student debt to high growth, high impact entrepreneurship and entrepreneurial success. In this paper, we try to

[1] See, for instance, the *USA Today* article, "Student loan outstanding will exceed $1 trillion this year," by Dennis Cauchon, October 25, 2011.

[2] See, Kauffman Foundation Research Series: Firm Formation and Economic Growth, *The Return to Business Creation,* 2013, by Ian Hathaway, Jordan Bell-Masterson, and Dane Stangler.

[3] The President's Jobs Council recently released its recommendations for nurturing high growth enterprises that create new jobs. See, http://files.jobs-council.com/jobscouncil/files/2011/10/JobsCouncil_InterimReport_Oct11.pdf for details. One of the recommendations from this council was to "reduce student loan burden."

[4] See also the *Wall Street Journal* article, "The Venture Capital Secret: 3 Out of 4 Startups Fail," by Deborah Gage, September 20, 2012.

[5] "Reducing Student Loan Burdens for America's Entrepreneurs," by Aneesh Chopra (U.S. Chief Technology Officer) and Jim Shelton (Assistant Deputy Secretary for Innovation and Improvement at the U.S. Department of Education), *Office of Science and Technology Policy, Executive Office of the President.*

[6] See, for instance, the *Wall Street Journal* article, "How Student Debt Harms the Economy," by Mitchell Daniels, January 27, 2014.

bridge this gap by analyzing the relation between student debt and high-impact entrepreneurship. In particular, for a sample of high technology companies, we study how entrepreneurs' student loans affect the likelihood of their ventures obtaining venture capital financing and the quality of venture capital backing for such firms. We also study eventual business outcomes like sales and assets for such firms.

Student loans can impact entrepreneurship rates through various mechanisms. In the context of individuals, for whom default and personal bankruptcy can be extremely costly, student loans can impose a significant cost of undertaking risky endeavors such as starting up businesses.[7] In particular, negative shocks to a startup's cash flows can reduce the payoff to the entrepreneur, which makes it hard for the entrepreneur to make student loan repayments and thus exacerbates the cost of student debt liabilities.[8] This cost of student debt, magnified by the high failure likelihood in high impact, venture capital backed entrepreneurship, reduces tolerance for failure and therefore, as shown by Manso (2011) [43], stifles innovative entrepreneurship. We term this the "cost of business failure" effect of student debt. These effects are likely to be even stronger for venture backed startups. Innovative and riskier ventures typically seek venture capital (usually in the high technology space). Such ventures carry technology related risks and risks related to venturing into new markets. These risks, in addition to those related to any business start, make the cost of business failure effect outlined above even more severe for high impact ventures seeking venture capital financing.

Student debt may also be related to high-impact entrepreneurship through other mechanisms. One possibility is that student debt can make it harder to start-up a business (as opposed to making failure after startup more costly) due to difficulty in accessing financing. We term this the "startup financing constraint" effect. However, in recent years, this is a smaller concern for high-technology firms as technological advances like cloud computing and 3D printing have made it significantly cheaper to start high-technology ventures. Beyond alternative mechanisms, any analysis relating

[7] For instance, Hall and Woodward (2010) [29] show that venture capital backed entrepreneurial firms have a 75 percent failure rate.

[8] In the U.S., student debt is difficult to discharge through personal bankruptcy procedures. Further, defaulting on student loans has tangible costs for borrowers. They can get penalized by facing garnishment of future wages and tax refunds, increases in loan balances due to the collection costs, movement of the loan to a third party collection agency, and lawsuits by the Department of Education. Beyond this, bankruptcy itself can be costly and can affect individual credit scores which in turn impacts ability to get employment, rental housing, and get credit (e.g., credit cards, mortgage, etc.).

student debt to entrepreneurship has to consider endogeneity issues. In particular, student debt may reflect unobservable characteristics such as family wealth and socio-economic conditions. Our tests reveal the causal effect of student debt on high-impact entrepreneurship and the mechanisms driving such a relationship.

Two major hurdles in a study like ours are: finding a source of exogenous variation for student loans and creating a dataset that will allow us to relate high-impact venture backed entrepreneurship with student loans of entrepreneurs. We overcome the first hurdle by using "No-Loans" financial aid policies set up by various schools as our source of exogenous variation for student loans. Since 1998, over 70 universities in the U.S. have replaced loans with grants in their financial aid packages, at least for certain groups of students (e.g. low income families). This lowers student debt burdens of graduating students significantly. No-loans financial aid policies impacted the loan component of financial aid negatively, but not overall financial aid. However, these policies were not designed with entrepreneurship as the central focus, but rather financial affordability of higher education. Thus, we expect no-loans financial aid policies to increase high-impact entrepreneurship by reducing student debt burden. In these tests, we restrict the sample to students that were already enrolled in college prior to the policy change to eliminate any effect of the financial aid policy change on college choice. We note that such policies are implemented by wide variety of schools ranging from Princeton University to the College of Holy Cross, and so are not driven by university rankings. Moreover, all our regressions have university and state-year fixed effects to account for university-specific or state-year-specific effects. Furthermore, we utilize trend effect dummies in our regressions which do not indicate any prior trends in schools' trajectory of producing entrepreneurs prior to the implementation of no-loans financial aid policies. Additionally, our matching procedure creates a control group of universities that is similar to our treated group in terms of their pre-policy level of entrepreneurial activities, bachelor degrees granted and tuition.

The other significant hurdle in a study such as ours is getting data on individual entrepreneurial ventures and linking them to university loan policies of students' alma mater. We combine data from various sources to conduct our analyses. First, we obtain entrepreneur and venture specific data from Crunchbase, a source of data that contains details of entrepreneurs and ventures. We obtain data on financial aid policies and other variables for universities of entrepreneurs from the Integrated Post-Secondary Education Database System (IPEDS) provided by the Department of Education.

Data on venture backing is obtained from VentureXpert and firm-level performance variables like sales and employment are obtained from the National Establishment Time-Series (NETS) database. Our overall matched sample consists of 144 universities, 5,736 associated entrepreneurs, and 10,844 entrepreneurial firms for years between 1987 to 2012.

We start by providing the evidence that our instrument for student loans, i.e., no-loans financial aid policies are associated with a statistically significant reduction in the fraction of students graduating from an institution with student loans. In particular, implementing such a policy at a school decreases the fraction of students graduating with loans by 5.5 percentage points. We also show that our results are unrelated to the total financial aid provided by an educational institution. Thus, our results are consistent with no-loans financial aid policies reducing student loans without reducing total financial aid.

We find that no-loans financial aid policies are positively related to the propensity to start a (high-technology) firm and to receive venture backing within 3 (and 5) years after graduating from college. Economically, schools implementing no-loans financial aid policies have 1.98 more entrepreneurs (who start a venture within 5 years after graduation) after the policy change among cohorts that were already enrolled prior to the policy change. This is high relative to the unconditional mean of 0.54 entrepreneurs who start a firm within 5 years after graduation. Importantly, universities with no-loans policies have a post-policy change increase of 0.68 entrepreneurs (who start a venture within 5 years of graduation) whose ventures subsequently receive venture capital. This is large compared to the unconditional sample mean of 0.17 for this variable.

Graduates of schools that implement no-loans financial aid policies also receive significantly more venture capital dollars. Furthermore, graduates of no-loans financial aid policy schools that start a venture after graduation are also more likely to get backing from higher reputation venture capitalists. Higher reputation venture capitalists have been shown to select higher quality firms and create more value for their portfolio companies in the literature (see, e.g., Chemmanur, Krishnan, and Nandy, 2011 [15]; Puri and Zarutskie, 2012 [48]; Sorensen, 2007 [50]). We show that our venture backing results hold for university-year level analysis as well as individual level analysis. The individual level analysis only includes entrepreneurs, and indicates that the increase in venture capital backing for graduating entrepreneurs after no-loans policies is not simply driven by the creation of more entrepreneurs after such policies are implemented.

We then examine when the impact of student loans on high-impact entrepreneurship is more important. For more expensive schools, we expect the impact of lower loan fractions in financial aid policies to be more important. Consistent with this expectation, we find that the positive relation between high technology entrepreneurship by college graduates and no-loans financial aid policies is stronger for universities with higher levels of in-state tuition cost. We also expect that universities with more research activity are more likely to have knowledge spill overs into entrepreneurial ventures (e.g., Jaffe, Trajtenberg, and Henderson, 1993 [32]). For such schools, the impact of student loans may be more important. Consistent with this expectation, we find that the positive relation between high technology entrepreneurship by college graduates and no-loans financial aid policies is stronger for universities with more R&D spending, universities that grant more doctoral degrees, and located in California and Massachusetts. Moreover, R&D activity also strengthens the positive impact of no-loans policies on venture capital backed entrepreneurship.

Finally, for the sample of ventures (founded by recent graduates) that survive for at least 5 years after founding, we show that firm sales is 132% higher and firm employment is 105% higher for ventures started by entrepreneurs graduating from no-loans institutions. Our results thus provide evidence indicating that such university policies can have a positive economic impact for the economy. In particular, no-loans financial aid policies of schools support more risk-taking by entrepreneurs graduating from these schools and can lead to higher impact entrepreneurship.

Our contribution is to highlight the impact of student loans on an important aspect of economic value creation, namely, the creation of high impact, high technology, and venture-backed startups. Prior literature (Krishnan and Wang, 2017 [41]; Ambrose, Cordell, and Ma, 2015 [5]) has analyzed entrepreneurship in a broad sense, and due to data limitations and limitations related to identification, does not delve deeply into the *type* of entrepreneurs impacted by student loans or their outcomes. We overcome this gap in the literature by creating a new dataset and utilizing a relatively new identification strategy. Moreover, our results have implications for policymakers and practitioners. First, our results indicate that university financial aid policies can have impact on the economy. Second, our results indicate that excessive dependence on student loans may end up stifling innovative ventures, which can be very harmful for the economy in the long run. Finally, since no-loans policies are geared more toward lower income groups, such policies may help in building long-term wealth and promoting risk-taking in this group, which may have implications

for long-term income inequality.

2 Related Literature

We contribute to three distinct literatures. First, we contribute to the literature on entrepreneurship; particularly to the strand that analyzes how an entrepreneur's background and situation impacts her ability to build a successful enterprise. The phenomenon of entrepreneurship has received increasing interest in recent years, as growing evidence suggests that entrepreneurial activity is associated with economic growth (King and Levine, 1993 [39]; Jayaratne and Strahan, 1996 [33]; Aghion and Griffith, 2008 [4]). It has also been argued that entrepreneurship plays a central role in stimulating innovation and therefore drives the process of Schumpeterian "creative destruction," whereby new products and technologies continue to displace old ones, thus keeping the economy from stagnation (Acs and Audretsch, 1988 [2]; Henderson and Clark, 1990 [30]; Christensen, 2013 [16]; Cetorelli and Strahan, 2006 [14]). Thus, if entrepreneurial activities indeed lead to economic growth, it is crucial for us to understand the underlying dynamics that drive such activities. Moreover, recent evidence indicates that the reward to entrepreneurs who build venture backed startups is zero in almost 75% of the outcomes (Hall and Woodward, 2010 [29]).[9] This large failure rate in entrepreneurship can exacerbate the negative impact of fixed obligations such as student debt on such activities, especially given that student debt is much harder to discharge through bankruptcy in the U.S. Studies in this area also analyze employer conditions (Lin, Picot, and Yates, 1999 [42]), financing (e.g., Kerr, Kerr, and Nanda, 2015 [38]; Bernstein, Giroud, and Townsend, 2016 [10]; Tian, 2011 [52]), location (Delgado, Porter, and Stern, 2010 [18]), and human capital (e.g., Glaeser and Kerr, 2009 [25]; and Ewens and Marx, 2015 [23]). There is no study that we are aware of, however, that studies the link between student debt and high impact entrepreneurship.

Second, our study contributes to the literature on household finance (see, e.g., Campbell (2006) [12]). This literature has thus far focused on issues such as economic impact of household debt (e.g. Atif, Sufi, and Verner, 2017 [45]), portfolio decisions of households (e.g., Carlin and Manso, 2011 [13], and Ivkovic, Siam, and Weisbenner, 2008 [31]), and mortgage and credit card debts (e.g., Bertaut, Haliassos, and Reiter, 2009 [11], and Agarwal, Driscoll, and Laibson, 2013 [3]). This

[9]Kerr and Nanda (2009) point out that in recent years there has been a gradual slowdown in entrepreneurial activity as measured by the relative entry counts of startups.

literature also utilizes data from the SCF to analyze household finance issues related to ownership of certain types of securities (see, e.g., Bergstresser and Cohen (2015) [9]). See Guiso and Sodini (2013) [28] for a detailed survey of this field of research. However, this strand of literature has tended to largely ignore student debt, and we contribute by analyzing two aspects of household finance. First, the extent of student debt held by households, and second, the risk of career paths chosen by household individuals (in particular, whether or not they engage in high impact entrepreneurship).

Third, we contribute to the extensive literature on the impact of education financing on educational enrollment, attainment and other related outcomes. Eaton, Howell, and Yannelis (2017) [21] find private equity investments in for-profit colleges lead to expanded enrollement and higher profits, but increase student debt and lower performance. Armona, Chakrabarti, and Lovenheim (2018) [6] show similar results that students at for-profit colleges have more student debt and worse labor market outcomes compared to those who attend comparable selective public schools. Fos, Liberman, and Yannelis (2017) [24] show a negative relationship between student debt and graduate school enrollment. Ellwood and Kane (2000) [22] and Belley and Lochner (2007) [8] argue that family income is significantly related to college attendance rates. Stinebrickner and Stinebrickner (2008) [51] conclude that some college students are credit constrained, though they argue that this does not account for family income differences in college persistence. In related work, Marx and Turner (2018) [44] find that Pell grant aid substantially reduces borrowing but has modest effect on educational attainment. Kargar and Mann (2018) [37] find that student loans in private colleges are related to excessive tuition charges. Several other studies have found a positive relation between state subsidies and scholarships and college attendance and enrollment (see, e.g., Dynarski, 2003 [20]; Cornwell, Mustard, and Sridhar, 2006 [17]; Kane, 2003, 2007 [34, 35]; Abraham and Clark, 2006 [1]).

Various studies have documented a significant positive value of higher education. For instance, Goldin and Katz (2008) [26] and Avery and Turner (2012) [7] document that the earnings premium of a college degree relative to a high-school degree has substantially increased over time. Kangasharju and Pekkala (2002) [36] study the role of education on self-employment in Finland. Pekkarinen, Uusitalo, and Kerr (2009) [47] study the impact of school reform and its impact on intergenerational income mobility. Others have analyzed the career effects of how higher education is financed. Rothstein and Rouse (2011) [49] find results that are consistent with ours, namely

that debt causes graduates to choose substantially higher-salary jobs and reduces the probability that students choose low-paid "public interest" jobs. They interpret their evidence as arising from credit constraints. Similarly, Minicozzi (2005) [46] finds that higher educational debt is associated with higher initial wage rate the year after finishing school and lower wage growth over the next four years. Dynarski and Scott-Clayton (2013) [19] provide a detailed survey of this literature as well as institutional details of financing of higher education in the United States.

The paper that is the closest to our study is a contemporaneous working paper by Ambrose, Cordell, and Ma (2015) [5] and by Krishnan and Wang (2017) [41]. However, the primary focus in Ambrose, Cordell, and Ma (2015) [5] is on the relation between student debt and aggregate county level business formation. Unlike their paper, we also try to understand whether the relation between student debt and entrepreneurship is causal and provide evidence on the possible mechanisms behind this relation. Our analysis, unlike both aforementioned papers, is focused on high-impact, innovative, and venture capital backed entrepreneurship. This is an important distinction as the prevailing view is that innovative entrepreneurship is a strong driver for economic growth.[10]

3 Hypothesis Development

Manso (2011) [43] shows that risky activities such as innovation and entrepreneurship need a certain extent of tolerance for failure. In particular, innovative and high impact entrepreneurship is characterized by unexpected negative developments, need to pivot or overhaul business models, and experimentation, which may in turn adversely affect the cash flows generated by the business. Moreover, entrepreneurship carries with it a high overall likelihood of failure (e.g., Hall and Woodward, 2010 [29]). Entrepreneurs thus need the flexibility to weather income shocks due to such failures. However, having student debt on their personal balance sheets can significantly reduce such flexibility. Given the uncertainty in both the timing and level of cash flows generated by

[10] The literature on venture capital finds that venture capital financed firms are particularly innovative and impactful. For example, Bernstein, Giroud and Townsend (2015) [10] show that VC involvement in firms leads to an increase in both innovation and the likelihood of a successful exit. Kortum and Lerner (2000) [40] show that increases in venture capital activity in an industry increase patenting rates significantly. Chemmanur, Krishnan, and Nandy (2011) [15] find that VC-backed firms experience greater growth. Puri and Zarutskie (2012) [48] show that VC-financed firms achieve larger scale and experience lower failure rates. Sorensen (2007) [50] show that companies funded by more experienced VCs are more likely to go public. Additionally, Gornall and Strebulaev (2015) [27] provide evidence that venture capital backed companies are an important part of the economy. In particular, they find that, in public US companies founded after 1974, VC-backed companies comprise 63% of the market cap, 38% of employment, and 85% of R&D spending.

a new business, entrepreneurs may not be able to support repayments on student loans if their expectations regarding income from their businesses do not materialize. Not repaying student debt obligations can induce significant short- and long- run costs on the borrower. As a result, student loans can reduce tolerance for failure, especially in innovative entrepreneurship. Thus, our cost of business failure hypothesis predicts that student loans will be negatively related to high-impact, high technology entrepreneurship. Moreover, venture capitalists, who typically invest in more innovative industries, are more likely to invest in companies that are run by entrepreneurs with a lower extent of student loans.

Based on the above arguments, we expect a greater proportion of universities' graduating student body engages in high impact entrepreneurship when the universities implement no-loans financial aid policies. Moreover, lower student loans resulting from such policies allow entrepreneurs to invest in riskier projects and projects that produce more innovative products and enter unexplored markets. As a result, such firms are more likely to be favored by venture capitalists as they specialize in investing in innovative business models. Furthermore, we expect that ventures started by entrepreneurs graduating from no-loans universities are likely to get more venture capital dollar investments and such entrepreneurs are more likely to get backing from higher reputation venture capitalists. Prior literature (e.g., Chemmanur, Krishnan, and Nandy, 2011 [15]) finds higher reputation venture capitalists are more likely to invest in higher value startups and help further enhance their outcomes.

Next, we expect that student loans impact entrepreneurship more for universities with higher levels of tuition costs. Thus, we expect the impact of no-loans financial aid policies on university entrepreneurship and entrepreneurial success to be stronger in more expensive universities. Finally, we expect R&D activity in universities to spill over into high technology ventures started by the graduates from such universities (e.g., Jaffe, Trajtenberg, and Henderson, 1993 [32]). As a result, we expect the impact of no-loans financial aid policies on university entrepreneurship and entrepreneurial success to be stronger in universities that engage in more R&D activity.

4 Data, Sample Selection, and Variable Descriptions

Our data comes from several sources. We collect entrepreneurial data from Crunchbase, a database that provides information on predominantly high technology entrepreneurial ventures. This database comprises company profiles (especially on startups) and information on the startup founding team. In particular, we start with an initial sample of startups with data on founding years and founders' education. We augment the Crunchbase data with internet search for data on education of entrepreneurs. We restrict our our sample to entrepreneurs who obtained their undergraduate degrees from universities within the U.S.

We also utilize data from VentureXpert to gather information on venture capital investment into our sample firms including the name of the VCs investing, VC investment amount, and venture capitalist reputation. We match the Crunchbase data with VentureXpert using fuzzy string matching algorithms on firm names augmented with additional hand cleaning. For our main analysis, we aggregate our sample entrepreneurs to the university-year (year of completion) level and then merge this data with university characteristics data from the Integrated Postsecondary Education Data System (IPEDS), which is a longitudinal dataset maintained by the U.S. Department of Education. The IPEDS contains university enrollment, completion, and student aid data for academic years from 1986-87 through 2011-12.

We then create a matched sample by selecting appropriate control universities that are comparable to the treated universities that implemented no-loans financial aid policies based on their prior entrepreneurial activities, degrees granted, and tuition.[11] First, we select universities for which the average number of entrepreneurs graduating in the five years prior to the policy implementation is within 50% of a treated university as of the policy year.[12] From this pool of potential control universities, we select a university for which the number of bachelor degrees granted are the closest to the treated university. In case of multiple such matches, we use a control university with the closest in-state tuition to the treated university. Our final matched sample comprises 80 treated universities and 64 unique control universities spanning years between 1987 to 2012.

The final main source of data for our study is the National Establishment Time-Series (NETS)

[11] We also report our tests on the treated sample in our Appendix, and find that these results are qualitatively similar to the results that include the control sample.

[12] Here, we use entrepreneurship within five years after graduation. We explain this more in the discussion of variables.

database. This database contains information on more than 54.7 million establishments between January 1990 and January 2013, and provides firm-specific information including industry, location, employment, and sales. We match the entrepreneurial ventures in our sample to NETS based on firm name using a fuzzy string matching algorithm and restrict the start year of the firm to be within 5 years after the respective entrepreneur's graduation year. For each sample firm, we also randomly select three control firms from the complete NETS database that is in the same industry and started in the same year as the sample firm.

In our first set of results, we test the impact of no-loans financial aid policies on financial aid. The dependent variables are *Total Aid* and *Fraction of Students Taking Loans*. *Total Aid* is the log of the sum of student loan, federal, state, and institutional grant provided to students as financial aid. *Fraction of Students Taking Loans* is the fraction of undergraduates at a university receiving student loans.

Our measures of entrepreneurship are *Fraction of Entrepreneurs 3 Years After Graduation* and *Fraction of Entrepreneurs 5 Years After Graduation*. *Fraction of Entrepreneurs 3 Years After Graduation* is the number of entrepreneurs who started a venture within three years of graduation divided by the total number of undergraduate degrees granted in a given university-year. Similarly, *Fraction of Entrepreneurs 5 Years After Graduation* is the total number of entrepreneurs who started a venture within five years of graduation divided by the total number of undergraduate degrees granted.

We construct a series of measures for venture capital backed entrepreneurship. *Fraction of VC-Backed Entrepreneurs 3 Years After Graduation* is the fraction of entrepreneurs who started a venture within three years of graduation whose subsequently obtained venture capital financing out of total number of undergraduate degrees granted in a given university-year. *Total Venture Capital Invested (for Ventures Starting within 3 Years after Graduation)* is the log of one plus the total amount (in thousand) of venture capital dollars raised for ventures that started by entrepreneurs within three years after their graduation. *Fraction of High Reputation VC-backed Ventures Starting within 3 Years after Graduation* is the fraction of entrepreneurs who started a venture within three years of graduation and were subsequently financed by at least one high-reputation venture capitalist divided by the total number of undergraduate degrees granted in a given university-year. A venture capitalist is defined as high-reputation in a given year if its market share of total

funding raised over the prior 5 years is greater than the 50th percentile of all venture capitalists in VentureXpert database. *Fraction of High Reputation VC-backed Ventures Starting within 3 Years after Graduation in VC-backed Ventures* is the fraction of entrepreneurs who started a venture within three years of graduation and has got financed by at least one high-reputation venture capitalist (at anytime) divided by the number of VC backed entrepreneurs started who started within 3 years of graduation. Other "*5 Years*" variable are defined similarly for entrepreneurs that started a venture within five years of graduation.

Our main explanatory variable is *Policy*, which is dummy variable that is defined by one if a university implements no-loans financial aid policy in a given year. We also create pre-trend variables *PrePolicy1*, *PrePolicy2*, and *PrePolicy3*, which are defined as one if the current year is one year, two years, and three years, respectively, before the first year of the adoption of no-loans financial aid policy by a university.

We also control for other university characteristics in our analysis. *Tuition and Fees* is the log of in-state tuition and fees for full-time undergraduates (in real 2012 dollars). *Total Revenue* is the log of total amount of university revenue (in real 2012 dollars). It includes revenues from fees and charges, appropriations, auxiliary enterprises, and contributions and other non-exchange transactions. *Bachelors*, *Masters*, and *Doctoral Degrees* are the log of number of Bachelors, Masters, and Doctoral degrees granted respectively.

For interaction tests, we construct *High Tuition*, which is defined as one if tuition is higher than the 75th percentile of our sample, and 0 otherwise. *High R&D*, which is a dummy variable defined as one if research-related share of expenses is greater than 75 percentile of our sample, and 0 otherwise. Similarly, *High Doctoral Degrees* is defined as one if number of doctoral degrees granted is greater than the 75th percentile of our sample, and 0 otherwise. *MA or CA* is a dummy variable defined as one if a university is located in Massachusetts or California, and 0 otherwise.

In our individual level tests, we define *D(VC-Backed Entrepreneurship 3 Years After Graduation)* as a dummy variable, which is equal to one if an entrepreneur starts a venture within three years of graduation and subsequently receives venture capital financing. *Number of VCs investing in Entrepreneur* is the total number of venture capitalists that finance an entrepreneur's venture(s). [13] *D(High Reputation VC-backed Ventures)* is a dummy variable indicating whether an

[13] An entrepreneur could have multiple startups in our sample.

entrepreneur's venture gets financed by a high-reputation venture capitalist.

Finally, we use NETS data to analyze entrepreneurial firm performance. We measure firm performance by sales and employment. Specifically, *ln(Sales After 5 Years of Founding)* is the log of one plus the entrepreneurial firm's sales after five years of its founding. *ln(Employment After 5 Years of Founding)* is the log of one plus the entrepreneurial firm's total number of employees after five years of its founding. In certain regressions, we also control for the sales and employment of control firms. These control firms are randomly selected from the complete NETS database conditional on being in the same industry and starting in the same year as the sample firm. Each sample firm is then matched with three control firms. *ln(Sales of Control Firms in 5 Yrs)* is the log of one plus the average sales of the three control firms after five years of their founding. Similarly, *ln(Employment of Control Firms in 5 Yrs)* is the log of one plus average number of employees of the control firms.

5 Empirical Methodology and Results

5.1 Identification - No-Loans Financial Aid Policies

Over the course of the last decade, various schools in the U.S. have established no-loans financial aid policies. These policies are motivated by concerns of college affordability, particularly for lower income group students. As Rothstein and Rouse (2011) point out, schools do not implement these policies with any explicit intent to impact post-graduate careers. Instead, the motivation was purely to lower financial barriers to higher education. The academic prestige and cost of schools implementing this policy varies widely. We obtain our sample of no-loans schools and the years of implementation through hand collection of data through Internet searches.

We use a reduced form approach in our analysis, given that we do not have data on individual level student loans. We document how the presence of a no-loans financial aid policy impacts graduates' loan taking propensity and subsequent choice to become an entrepreneur (and successfully get VC backing) at the university-year level. We directly address certain concerns with our approach. First, students may choose to go to universities that implement no-loans financial aid policies. To avoid any contamination through such effects, our regression models restrict the sample to cohorts that entered college prior to the implementation of no-loans financial aid policy at a school. Thus

students could not choose their institution based on its choice of financial aid policy. Instead, they benefit from such a policy during the time after the policy is implemented, providing a plausibly exogenous variation in their student loans.

Second, there may be a concern that only certain types of institutions can afford to implement such policies. We address this potential selection effect in various ways. First, we control for university fixed effects in all our regression models to account for time-invariant university characteristics. University characteristics are generally expected to move slowly through time, thus this control should wipe out a majority of university-specific unobservable effects. Second, we control for trend variables before the implementation of no-loans financial aid policies to test the parallel trends assumptions in our regression models. As reported below, we do not have prior trends in universities that implement no-loans financial aid policies. Third, we create the control group of universities to ensure that there are no particular biases in the sample. As described above, our matched control group of universities are matched on trends of entrepreneurship, thus mitigating any effects of unobservable variables correlated with the propensity to implement no-loans financial aid policy. Finally, we note that such policies are implemented by wide variety of schools ranging from Princeton University to the College of Holy Cross, and so are not likely driven by university rankings.

Figure 1 to 3 provide additional evidence for our identification strategy. The vertical axes of these figures reflect the residuals after controlling for university observable characteristics, and university and state-year fixed effects. Thus, we eliminate any university characteristic-driven trends. Each figure shows the trends of both the treated and untreated universities four years before and after the no-loans financial aid policy, and Year 0 is the policy implementation year. For each control university, we assign the year of policy implementation for the corresponding treated university as its Year 0. For the illustration of comparison, we equalize the value of the control university to the corresponding treated university at Year 0, but ensure that the scales match for both graphs.

Figure 1 reports that the trends of the fractions of students taking loans prior to the no-loans financial aid policy year is similar for treated and untreated schools, reassuring us of the comparability of our untreated sample. Moreover, the figure shows that the fraction of students taking loans declines after the policy year for treated universities, but not for the untreated universities. Figure

2 and 3 report the trends for the entrepreneurship and VC-backed entrepreneurship measures for treated and untreated universities. Both figures show parallel trends prior to no-loans financial aid policies, supporting the identification in our diff-in-diff framework. Further, compared to the untreated sample, both entrepreneurs and VC-backed entrepreneurs of the treated universities increase after the policy, providing evidence that no-loans financial aid policies positively impact VC-backed entrepreneurship.

5.2 Description of the Data and Summary Statistics

Table 1 reports descriptive statistics of our sample at the university-year level. Panel A summarizes universities' financial aid statistics. The median total financial aid including both grants and loans is about $12 million. On average, 44% undergraduates take loans to finance their college education. Panel B shows that, on average, a university produces 0.35 entrepreneurs each year who start their ventures within three years of graduation, and 0.54 entrepreneurs who start their ventures within five years of graduation. Furthermore, 0.10 entrepreneurs who start ventures within three years of graduation get venture capitalist financing. 0.09 are backed by a high-reputation venture capitalist. Similarly, 0.17 entrepreneurs who start a venture within five years of graduation get venture capital, and 0.15 are backed by high-reputation VCs. The average amount VCs invest in entrepreneurs who start a venture within three years of graduation in a university is about $4.2 million. That amount is $6.9 million for those who start a venture within five years of graduation.

Panel C reports the entrepreneurial activities as a fraction of graduates. All numbers in this panel are multiplied by 1000 for ease of viewing. On average, entrepreneurs who found a start-up within three years of graduation comprise 0.02% of the total graduating population. This statistic is 0.032% for those who start a venture within five years after their graduation. A smaller fraction, 0.01% (founded within five years) of graduates got VC backing.

Panel D summarizes university characteristics. The median amount of in-state tuition and fees is $14,480. At the median, universities grant 1,273 Bachelors degrees, 455 Masters degrees and 75 Doctoral degrees.

5.3 Impact of No-Loans Financial Aid Policy on Total Financial Aid and Loan

We start by examining the impact of no-loans financial aid policy on total financial aid and the propensity of students to take loans for education. To ensure the exogeneity of no-loans financial aid policy, we restrict our sample to students who enrolled in college prior to the year it implemented no-loans financial aid policy.[14]

For our exclusion restriction to hold, we expect that no-loans financial aid policy impacts student loan negatively, but does not impact overall financial aid. We estimate the following OLS model,

$$y_{it} = \alpha + \beta_1 Policy_{it} + \sum_{j=1}^{3} \beta_2^j PrePolicyj_{it} + \gamma X_{it} + \lambda_i + \kappa_{st} + \epsilon_{it} \quad (1)$$

y_{it} is *Total Aid* or *Fraction of Students Taking Loans*. X_{it} are control variables, including university-year characteristics such as tuition and fees, revenue etc. We also include three year pre-trends (*Pre-policy* variables). λ_i are university fixed effects and κ_{st} are state-year fixed effects. We include pre-trend dummy variables to ensure that our results are not driven by any trend effects prior to the university's implementation of no-loans financial aid policy. All regression standard errors in our analyses are clustered at the university level.

The results for OLS estimations of the model above are reported in Table 2. Column (1) shows that no-loans financial aid policy does not have a statistically significant relation with the total financial aid amount in a school-year. This result indicates that the policy does not affect the total availability of financial aid to students, and that the reduction in loan amount was not offset by a similar reduction in overall financial aid amount. Column (2) finds that no-loans financial aid policy is associated with a decrease of 5.5 percentage points in the percentage of students taking loans. At the average number of *Bachelors degree* in the sample, it corresponds to 118 less students having loans. Consistent with our expectation, no-loans financial aid policy is associated with a lower fraction of student who take loans. We also note that the pre-policy trend variables are not statistically significant, further validating our identification strategy. In particular, there is no difference in financial aid trends prior to policy implementation between treatment and control groups. Other control variables have intuitive coefficient estimates as well. Total financial aid and

[14]For instance, if a university implemented no-loans financial aid policy in 1998, we only include students who enrolled before 1998.

fraction of students taking student loans are higher for schools with higher tuition and fees.

The results above support our identification strategy of using no-loans financial aid policies as a natural experiment for providing variation in student loans.[15]

5.4 Impact of No-Loans Financial Aid Policy on Entrepreneurship

In this section, we examine the impact of student debt on entrepreneurial activity of university graduates. We use a similar OLS model as before, with the dependent variable changed to *Fraction of Entrepreneurs 3 Years After Graduation* or *Fraction of Entrepreneurs 5 Years After Graduation*.

The results of this analysis are reported in Table 3. We find that universities that implement no-loans financial aid policies graduate more subsequent entrepreneurs. This effect is statistically and economically significant. The sample average number of entrepreneurs who start a venture within five years of graduation is 0.54. Universities that have implemented no-loans financial aid policies produce 1.98 more entrepreneurs (using Column (2)). That is almost four times of the sample average. We also find that college tuition and fees are negatively related to entrepreneurship. As before, the statistically insignificant coefficient estimates on the *PrePolicy* variables indicate that there is no prior trend differences prior to the implementation of no-loans policies between treatment and control universities. Additionally, in unreported tests, we find that the coefficient on *Policy* is statistically different from that on *PrePolicy3*.

5.5 Impact of Student Debt on VC-Backed Entrepreneurship

We then examine the impact of student debt on venture capital backed entrepreneurship. We use a similar specification as before, with the dependent variable *Fraction of VC-Backed Entrepreneurs 3 Years After Graduation* or *Fraction of VC-Backed Entrepreneurs 5 Years After Graduation*. The results, reported in Table 4, are consistent with student loans dampening the emergence of entrepreneurs that subsequently get venture capital backing. Universities with no-loans financial aid policies produce 0.68 more venture capital backed entrepreneurs (using Column (2)). Given the average in our sample is 0.17, these results are both statistically and economically significant.

[15] We also provide corroborating out-of-sample evidence in our Unpublished Appendix Table A1. It was reproduced with permission from Auter, Hull, Krishnan, Rhodes (2017) and shows that no-loans financial aid policy decreases individual student loan amounts using data from the Gallup-Purdue survey.

In Table 5, we conduct a similar analysis with *Total Venture Capital Invested* as the dependent variable. We find that graduates from universities with no-loans financial aid policies are likely to raise more venture dollars. This effect is economically large and (from the results in Column (1) of Table 5) associated with an increase of 190% in venture capital raised. This corresponds to an increase of $8 million invested by venture capitalists (using the mean VC amount raised over 3 years as our base case). Finally, we use VC reputation as our dependent variable. Results reported in Table 6. Both Panel A and Panel B show that graduates from universities with no-loans financial aid policies have a higher chance to be backed by high reputation venture capitalists. Panel A reports results for high reputation venture backed entrepreneurs as a fraction of all university graduates in a year as the dependent variable and Panel B reports the results for high reputation venture backed entrepreneurs as a fraction of all venture backed entrepreneurs in a year as the dependent variable. In all but one of the specifications, we find a significant positive relation between no-loans financial aid policies and the reputation of VCs backing ventures started by graduates.

These findings consistently show that student loans negatively impact high impact entrepreneurship and subsequent quantity and quality of venture capital backing of such ventures. The literature has shown that venture capital financing, especially high reputation VCs, is indicative of quality and subsequent success. For example, Chemmanur, Krishnan, and Nandy (2011) [15] find that higher reputation VC-backed firms experience greater growth through both screening and monitoring. Sorensen (2007) [50] shows that companies funded by more experienced VCs are more likely to go public from both their experience and market sorting. Thus, our findings of student loan negatively impacting VC-backed entrepreneurs indicate that student loans dampen the development of high quality entrepreneurship.

5.6 Impact of Student Debt on High Impact Entrepreneurship - Cross Sectional Heterogeneity

In this section, we try to get a better understanding of the cross-sectional heterogeneity in the negative relation between student debt and entrepreneurship that we find above. This can help us provide additional evidence regarding the mechanism underlying the negative relation between student loans and high impact entrepreneurship. We interact *High Tuition* with *Policy* in all specifications in Table 7 and 8. Universities that are engaged in a greater extent of R&D activities

are likely to have knowledge spill overs to the local economy (e.g., Jaffe, Trajtenberg, and Henderson, 1993 [32]), and thus more likely to produce entrepreneurs. We interact *High R&D* with *Policy*. Similarly, we also interact *High Doctoral Degrees* (and *MA or CA*) with *Policy*.

The results of these interaction tests are reported in Tables 7 and 8 with fraction of entrepreneurs and fraction of VC backed entrepreneurs as the dependent variables, respectively. In Table 7, the coefficient estimate on the interaction term between *High Tuition* and *Policy* is statistically significantly and positive, consistent with the impact of student loans being more important in more expensive schools. Further, we find that the impact of no-loans financial aid policy is greater for universities actively engaged in R&D activities, grant more doctoral degrees or are located in entrepreneurial hubs (California and Massachusetts).

Table 8 reports similar, though statistically weaker, results for fraction of venture capital backed entrepreneurship. In particular, we find that the positive impact of no-loans financial aid policy on the creation of ventures that get subsequent venture backing is stronger for universities that are engaged in R&D activities and those that have higher tuition costs.[16]

5.7 Impact of Student Debt on VC-Backed Entrepreneurship - Individual Level Analysis

We also examine the impact of student debt on VC-backed entrepreneurship through no-loans financial aid policy on individual level. Specifically, we run the same specification as before with individual level data. In addition, we now control for industry fixed effects in our analysis. In Column (1) of Table 9, we find that individuals graduating from universities with no-loans financial aid policies are more likely to get subsequent venture capital backing. Further, they are more likely to get backing by more venture capitalists as shown in Column (2). Though the result is not statistically significant for the high-reputation venture capital dummy, our findings are broadly consistent with previous findings on university level.

These results provide additional evidence for our cost of business failure hypotheses. They also rule out the possibility that our venture capital results at the university level are driven by the fact that venture backed entrepreneurship increases with no-loans financial aid policies simply as a

[16] We find similar results in Appendix Table A1 and A2 where we conduct similar tests but do not include interaction of *High Tuition* and *Policy* in the specification.

result of increase in overall entrepreneurship.

5.8 Impact of Student Debt on Entrepreneurial Firm Performance

In this section, we test the impact of student debt on individual entrepreneurial firm performance. We estimate the an OLS model similar to earlier where the dependent variables are *ln(Sales After 5 Years of Founding)* or *ln(Employment After 5 Years of Founding)*. These variables are available for only those firms that survive for at least 5 years after founding. In these regressions, we control for university, year, and 6 digit SIC code fixed effects.[17] We note that due to hand-matching between the NETS and our Crunchbase-IPEDS-VentureXpert dataset, we end up with fewer observations because we cannot find matching observations in some cases.

Table 10 reports the results of these tests. Column (3) and (4) show the results including control firm variables *ln(Sales of Control Firms in 5 Yrs)* and *ln(Employment of Control Firms in 5 Yrs)* respectively, while Column (1) and (2) do not include them. Overall, we find that conditional on surviving, entrepreneurial firms' sales and employment after five years of founding are higher if its founder graduating from a university where no-loans financial aid policies were in place. Economically, sales is 132% higher for firms that were founded by entrepreneurs graduating from no-loans financial aid policy schools. Similarly, 5-year employment is 105% higher. These results provides further evidence that student debt not only hinders entrepreneurial activity, but negatively affects economic growth by impacting high performance entrepreneurship that can create more employment.

6 Conclusion

Student debt can impose a significant burden on entrepreneurship. We use universities' implementations of no-loans financial aid policies as a natural experiment to understand the causal impact of student debt on VC-backed entrepreneurship. We first show universities that replace loans with grants in their financial aid packages do not reduce overall financial aid available to students, but see declines in the percentage of students who have student loans. This result validates our identification strategy. We find that graduates of universities that implement no-loans financial aid

[17] We did not include state-year fixed effects as in previous specifications because we lose power in estimation with too many fixed effects for a relatively small number of observations.

policies are more likely to start entrepreneurial ventures, and their ventures are more likely to raise venture capital financing, and raise a larger amount of VC dollars. Additionally, ventures started by graduates from no-loan policy financial aid policy schools are backed by high reputation venture capitalists, which is indicative of higher likelihood of subsequent success. Our results are stronger for high-tuition universities, universities with greater extent of R&D activities, and universities that grant a greater number of doctoral degrees. Using firm-year level data, we find that ventures started by graduates from no-loan policy schools have higher sales and employment five years after founding.

We contribute to the literature by highlighting the impact of student loans on an important aspect of economic value creation, namely, the creation of high impact, high technology, and venture-backed startups. Prior literature (Krishnan and Wang, 2017 [41]; Ambrose, Cordell, and Ma, 2015 [5]) has analyzed entrepreneurship in a broad sense, and due to data limitations and limitations related to identification, does not delve deeply into the *type* of entrepreneurs impacted by student loans or their outcomes. We overcome this gap in the literature by creating a new dataset and utilizing a relatively new identification strategy. Moreover, our results have implications for policy-makers and practitioners. First, our results indicate that university financial aid policies can have an important impact on the economy. Second, our results indicate that excessive dependence on student loans may end up stifling innovative ventures, which can be very harmful for the economy in the long run. Finally, since no-loans policies are geared more toward lower income groups, such policies may help in building long-term wealth and promoting risk-taking in this group, which may have implications for long-term income inequality.

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Table 1: Summary Statistics

This table reports the summary statistics for key variables. Panel A summarizes universities financial aids. *Total Aid* is the log of aggregation of student loan, federal, state, and institutional grant (dollars in thousands). *Fraction of Students Taking Loans* is the fraction of undergraduates receiving student loans. Panel B summarizes entrepreneurship. *Entrepreneurs 3 Years after Graduation* is the number of entrepreneurs who started a venture within three years of graduation. *VC-Backed Entrepreneurs 3 Years After Graduation* is the number of entrepreneurs who started a venture within three years of graduation and has got venture capital financing (at anytime). *Total Venture Capital Invested (for Ventures Starting within 3 Years after Graduation)* is the aggregated amount (in thousands) of venture capitalist dollars raised for ventures that started within three years of graduation of entrepreneurs. *High Reputation VC-backed Ventures Starting within 3 Years after Graduation* is the number of entrepreneurs who started a venture within three years of graduation and has got financed by at least one high-reputation venture capitalist (at anytime). All five year variables are defined similarly with a entrepreneur started a venture within five years of graduation. Panel C shows university characteristics. *Tuition and Fees* is the log of in-state tuition and fees for full-time undergraduates (in real 2012 dollars in thousands). *Bachelor*, *Master*, and *Doctor Degrees* are the log of number of bachelor, master, and doctor degrees granted respectively. Panel D compares universities that have no-loans financial aid policies with those that do not.

Panel A. Financial Aid Variables

	Mean	Std.Dev.	Median	Obs
Total Aid ($ in thousands)	16,786.41	15,680.80	12,083.74	1667
Fraction of Students Taking Loans	0.44	0.17	0.41	1830

Panel B. Entrepreneurship after Graduation

	Mean	Std.Dev.	Median	Obs
Entrepreneurs 3 Years after Graduation	0.35	0.96	0.00	3741
Entrepreneurs 5 Years after Graduation	0.54	1.35	0.00	3741
VC-Backed Entrepreneurs 3 Years After Graduation	0.10	0.39	0.00	3741
VC-Backed Entrepreneurs 5 Years After Graduation	0.17	0.54	0.00	3741
Total Venture Capital Invested ($ in thousands) for Ventures Starting within 3	4,242.33	51,045.24	0.00	3741
Total Venture Capital Invested ($ in thousands) for Ventures Starting within 5	6,945.24	62,380.71	0.00	3741
High Reputation VC-backed Ventures Starting within 3 Years after Graduation	0.09	0.36	0.00	3741
High Reputation VC-backed Ventures Starting within 5 Years after Graduation	0.15	0.50	0.00	3741

Panel C. Fraction of Entrepreneurship after Graduation (multiplied by 1,000)

	Mean	Std.Dev.	Median	Obs
Fraction of Entrepreneurs 3 Years After Graduation	0.20	0.66	0.00	3737
Fraction of Entrepreneurs 5 Years After Graduation	0.32	0.91	0.00	3737
Fraction of VC-Backed Entrepreneurs 3 Years After Graduation	0.07	0.32	0.00	3737
Fraction of VC-Backed Entrepreneurs 5 Years After Graduation	0.10	0.43	0.00	3737
Fraction of High Reputation VC-backed Ventures Starting within 3 Years after Graduation	0.06	0.30	0.00	3741
Fraction of High Reputation VC-backed Ventures Starting within 5 Years after Graduation	0.09	0.40	0.00	3741
High Reputation VC-backed Ventures Starting within 3 Years after Graduation as a Fraction of VC-backed Ventures	74.33	260.66	0.00	3741
High Reputation VC-backed Ventures Starting within 5 Years after Graduation as a Fraction of VC-backed Ventures	108.64	308.84	0.00	3741

Panel D. University Variables

	Mean	Std.Dev.	Median	Obs
Tuition and Fees ($ in thousands)	17.52	13.05	14.48	3692
Bachelor Degrees	2,144	2,216	1,273	3737
Master Degrees	837	1,022	455	3630
Doctor Degrees	168	205	75	3468

Table 2: The Impact of No-loans Financial Aid Policy on Total Financial Aid and Fraction of Students Taking Loans

This table reports the OLS regression results of financial aid on no-loans financial aid policy. *Total Aid* is the log of aggregation of student loan, federal, state, and institutional grant. *Fraction of Students Taking Loans* is the fraction of undergraduates receiving student loans. *Policy* is a dummy varible that is defined by one if a university has implemented no-loans financial aid policy in a given year. *PrePolicy1*, *PrePolicy2*, and *PrePolicy3* are defined by one if it is one year, two years, and three years respectively before the first year of the adoption of no-loans financial aid policy by a university. *Tuition and Fees* is the log of in-state tuition and fees for full-time undergraduates (in real 2012 dollars). *Total Revenue* is the log of total amount of university revenue (in real 2012 dollars). *Educ Share* is education-related share of expenses. *Bachelors*, *Masters*, and *Doctoral Degrees* are the log of number of Bachelors, Masters, and Doctoral degrees granted respectively. University, state-year fixed effects are included in all regressions. Standard errors are clustered at university level and reported in parentheses. ***, ** and * represent statistical significance at 1%, 5%, and 10% levels respectively.

	(1)	(2)
	Total Aid	Fraction of Students Taking Loans
PrePolicy3	0.015	-0.021
	(0.038000)	(0.014181)
PrePolicy2	0.021	-0.022
	(0.050308)	(0.015672)
PrePolicy1	-0.016	-0.025
	(0.059126)	(0.020547)
Policy	0.049	-0.055**
	(0.074718)	(0.023352)
Tuition and Fees	0.560***	0.192**
	(0.182246)	(0.078393)
Total Revenue	0.015	0.022
	(0.021821)	(0.014385)
Educ Share	-0.032	-0.118
	(0.406303)	(0.107039)
Bachelor Degrees	0.235	0.063
	(0.161579)	(0.052538)
Master Degrees	0.001	-0.022
	(0.056617)	(0.018929)
Doctor Degrees	0.025	-0.002
	(0.026945)	(0.017103)
University FE	Yes	Yes
State-Year FE	Yes	Yes
R^2	0.977	0.885
Observations	1343	1438

Table 3: The Impact of No-loans Financial Aid Policy on Entrepreneurship after Graduation

This table reports the OLS regression results of entrepreneurship on no-loans financial aid policy. *Fraction of Entrepreneurs 3 Years After Graduation* is the fraction of entrepreneurs who started a venture within three years of graduation out of total number of undergraduate degrees granted in a given university-year. Similarly, *Fraction of Entrepreneurs 5 Years After Graduation* is the fraction of entrepreneurs who started a venture within five years of graduation out of total number of undergraduate degrees granted. *Policy* is a dummy varible that is defined by one if a university has implemented no-loans financial aid policy in a given year. *PrePolicy1*, *PrePolicy2*, and *PrePolicy3* are defined by one if it is one year, two years, and three years respectively before the first year of the adoption of no-loans financial aid policy by a university. *Tuition and Fees* is the log of in-state tuition and fees for full-time undergraduates (in real 2012 dollars). *Total Revenue* is the log of total amount of university revenue (in real 2012 dollars). *Educ Share* is education-related share of expenses. *Bachelors*, *Masters*, and *Doctoral Degrees* are the log of number of Bachelors, Masters, and Doctoral degrees granted respectively. University, state-year fixed effects are included in all regressions. Standard errors are clustered at university level and reported in parentheses. ***, ** and * represent statistical significance at 1%, 5%, and 10% levels respectively.

	(1) Fraction of Entrepreneurs 3 Years After Graduation	(2) Fraction of Entrepreneurs 5 Years After Graduation
PrePolicy3	0.000099	0.000269
	(0.000128)	(0.000171)
PrePolicy2	0.000145	0.000365
	(0.000153)	(0.000237)
PrePolicy1	-0.000018	0.000256
	(0.000176)	(0.000223)
Policy	0.000560**	0.000925**
	(0.000259)	(0.000381)
Tuition and Fees	-0.000578***	-0.000839***
	(0.000180)	(0.000245)
Total Revenue	-0.000016	0.000014
	(0.000076)	(0.000099)
Educ Share	0.000374	0.000775
	(0.000641)	(0.001066)
Bachelor Degrees	-0.000048	-0.000098
	(0.000048)	(0.000079)
Master Degrees	0.000000	0.000007
	(0.000033)	(0.000045)
Doctor Degrees	-0.000046	-0.000064
	(0.000035)	(0.000054)
University FE	Yes	Yes
State-Year FE	Yes	Yes
R^2	0.519	0.547
Observations	3292	3292

Table 4: The Impact of No-loans Financial Aid Policy on VC-Backed Entrepreneurship

This table reports the OLS regression results of VC-backed entrepreneurship on no-loans financial aid policy. *Fraction of VC-Backed Entrepreneurs 3 Years After Graduation* is the fraction of entrepreneurs who started a venture within three years of graduation and has got venture capital financing (at anytime) out of total number of undergraduate degrees granted in a given university-year. "5 Years" variable are defined similarly only if a entrepreneur started a venture within five years of graduation. *Policy* is a dummy varible that is defined by one if a university has implemented no-loans financial aid policy in a given year. *PrePolicy1*, *PrePolicy2*, and *PrePolicy3* are defined by one if it is one year, two years, and three years respectively before the first year of the adoption of no-loans financial aid policy by a university. *Tuition and Fees* is the log of in-state tuition and fees for full-time undergraduates (in real 2012 dollars). *Total Revenue* is the log of total amount of university revenue (in real 2012 dollars). *Educ Share* is education-related share of expenses. *Bachelors*, *Masters*, and *Doctoral Degrees* are the log of number of Bachelors, Masters, and Doctoral degrees granted respectively. University, state-year fixed effects are included in all regressions. Standard errors are clustered at university level and reported in parentheses. ***, ** and * represent statistical significance at 1%, 5%, and 10% levels respectively.

	(1) Fraction of VC-Backed Entrepreneurs 3 Years After Graduation	(2) Fraction of VC-Backed Entrepreneurs 5 Years After Graduation
PrePolicy3	0.000087	0.000210
	(0.000102)	(0.000140)
PrePolicy2	0.000083	0.000061
	(0.000072)	(0.000081)
PrePolicy1	-0.000027	0.000065
	(0.000117)	(0.000151)
Policy	0.000228**	0.000315**
	(0.000112)	(0.000144)
Tuition and Fees	-0.000205**	-0.000269***
	(0.000081)	(0.000099)
Total Revenue	-0.000011	-0.000003
	(0.000030)	(0.000033)
Educ Share	0.000056	0.000140
	(0.000271)	(0.000380)
Bachelor Degrees	-0.000018	-0.000030
	(0.000014)	(0.000021)
Master Degrees	-0.000013	-0.000008
	(0.000014)	(0.000019)
Doctor Degrees	-0.000005	-0.000003
	(0.000013)	(0.000019)
University FE	Yes	Yes
State-Year FE	Yes	Yes
R^2	0.441	0.432
Observations	3292	3292

Table 5: The Impact of No-loans Financial Aid Policy on Total Amount of Venture Capital Invested

This table reports the OLS regression results of total amount of venture capital invested on no-loans financial aid policy. *Total Venture Capital Invested (for Ventures Starting within 3 Years after Graduation)* is the log of one plus the aggregated amount (in thousand) of venture capitalist dollars raised for ventures that started within three years of graduation of entrepreneurs. "5 Years" variable are defined similarly only if a entrepreneur started a venture within five years of graduation. *Policy* is a dummy varible that is defined by one if a university has implemented no-loans financial aid policy in a given year. *PrePolicy1*, *PrePolicy2*, and *PrePolicy3* are defined by one if it is one year, two years, and three years respectively before the first year of the adoption of no-loans financial aid policy by a university. *Tuition and Fees* is the log of in-state tuition and fees for full-time undergraduates (in real 2012 dollars). *Total Revenue* is the log of total amount of university revenue (in real 2012 dollars). *Educ Share* is education-related share of expenses. *Bachelors*, *Masters*, and *Doctoral Degrees* are the log of number of Bachelors, Masters, and Doctoral degrees granted respectively. University, state-year fixed effects are included in all regressions. Standard errors are clustered at university level and reported in parentheses. ***, ** and * represent statistical significance at 1%, 5%, and 10% levels respectively.

	(1) Total Venture Capital Invested (for Ventures Starting within 3 Years after Graduation)	(2) Total Venture Capital Invested (for Ventures Starting within 5 Years after Graduation)
PrePolicy3	-0.297	1.083
	(0.479073)	(0.694682)
PrePolicy2	0.284	0.221
	(0.527247)	(0.570663)
PrePolicy1	0.637	0.778
	(0.737608)	(0.764884)
Policy	1.071*	1.149*
	(0.644879)	(0.658086)
Tuition and Fees	-0.937*	-0.434
	(0.496263)	(0.495607)
Total Revenue	0.121	0.110
	(0.201111)	(0.247254)
Educ Share	0.032	0.725
	(1.914306)	(1.764355)
Bachelor Degrees	-0.053	-0.033
	(0.148709)	(0.166537)
Master Degrees	-0.139	-0.129
	(0.089313)	(0.127910)
Doctor Degrees	0.002	0.019
	(0.119234)	(0.155273)
University FE	Yes	Yes
State-Year FE	Yes	Yes
R^2	0.434	0.498
Observations	3292	3292

Table 6: The Impact of No-loans Financial Aid Policy on Reputation of Venture Capitalists Invested in Startups

This table reports the OLS regression results of venture capitalist's reputation on no-loans financial aid policy. In Panel A, the dependent variables are fraction out of total bachelor's degrees granted. In Panel B, the dependent variables are fraction out of total VC-backed entrepreneurs. Specifically, *Fraction of High Reputation VC-backed Ventures Starting within 3 Years after Graduation* is the fraction of entrepreneurs who started a venture within three years of graduation and has got financed by at least one high-reputation venture capitalist (at anytime) out of total number of undergraduate degrees granted in a given university-year. *High Reputation VC-backed Ventures Starting within 3 Years after Graduation as a Fraction of VC-backed Ventures* is the fraction of entrepreneurs who started a venture within three years of graduation and has got financed by at least one high-reputation venture capitalist (at anytime) out of number of entrepreneurs started within 3 years of graduation and get VC financed in a given university-year. Other "5 Years" variable are defined similarly only if a entrepreneur started a venture within five years of graduation. *Policy* is a dummy varible that is defined by one if a university has implemented no-loans financial aid policy in a given year. *PrePolicy1*, *PrePolicy2*, and *PrePolicy3* are defined by one if it is one year, two years, and three years respectively before the first year of the adoption of no-loans financial aid policy by a university. *Tuition and Fees* is the log of in-state tuition and fees for full-time undergraduates (in real 2012 dollars). *Total Revenue* is the log of total amount of university revenue (in real 2012 dollars). *Educ Share* is education-related share of expenses. *Bachelors*, *Masters*, and *Doctoral Degrees* are the log of number of Bachelors, Masters, and Doctoral degrees granted respectively. University, state-year fixed effects are included in all regressions. Standard errors are clustered at university level and reported in parentheses. ***, ** and * represent statistical significance at 1%, 5%, and 10% levels respectively.

Panel A

	(1) Fraction of High Reputation VC-backed Ventures Starting within 3 Years after Graduation	(2) Fraction of High Reputation VC-backed Ventures Starting within 5 Years after Graduation
PrePolicy3	0.000089	0.000174
	(0.000102)	(0.000131)
PrePolicy2	0.000077	0.000054
	(0.000072)	(0.000077)
PrePolicy1	-0.000017	0.000064
	(0.000119)	(0.000141)
Policy	0.000191*	0.000283**
	(0.000100)	(0.000130)
Tuition and Fees	-0.000186**	-0.000245***
	(0.000075)	(0.000092)
Total Revenue	-0.000000	0.000007
	(0.000022)	(0.000027)
Educ Share	0.000075	0.000113
	(0.000235)	(0.000340)
Bachelor Degrees	-0.000017	-0.000027
	(0.000013)	(0.000019)
Master Degrees	-0.000013	-0.000007
	(0.000014)	(0.000018)
Doctor Degrees	-0.000002	-0.000001
	(0.000012)	(0.000017)
University FE	Yes	Yes
State-Year FE	Yes	Yes
R^2	0.437	0.416
Observations	3292	3292

Panel B

	(1) High Reputation VC-backed Ventures Starting within 3 Years after Graduation as a Fraction of VC-backed Ventures	(2) High Reputation VC-backed Ventures Starting within 5 Years after Graduation as a Fraction of VC-backed Ventures
PrePolicy3	-0.017331	0.111539
	(0.055069)	(0.069090)
PrePolicy2	0.026618	0.021196
	(0.054682)	(0.062613)
PrePolicy1	0.092914	0.083601
	(0.083204)	(0.077115)
Policy	0.104463	0.136039**
	(0.065989)	(0.066075)
Tuition and Fees	-0.097990*	-0.053556
	(0.052473)	(0.051844)
Total Revenue	0.009318	0.020316
	(0.021606)	(0.025324)
Educ Share	0.022127	0.019499
	(0.183267)	(0.179594)
Bachelor Degrees	-0.009277	-0.006030
	(0.017331)	(0.020636)
Master Degrees	-0.013167	-0.012426
	(0.010114)	(0.014419)
Doctor Degrees	-0.000455	-0.001532
	(0.013958)	(0.018937)
University FE	Yes	Yes
State-Year FE	Yes	Yes
R^2	0.450	0.506
Observations	3292	3292

Table 7: The Impact of No-loans Financial Aid Policy on Entrepreneurship - by School Characteristics

This table reports the OLS regression results of entrepreneurship on no-loans financial aid policy with interaction terms. *Policy* is a dummy varible that is defined by one if a university has implemented no-loans financial aid policy in a given year. *High Tuition*, which is defined by one if tuition is higher than the 75th percentile of our sample. *High R&D*, which is a dummy variable defined by one if research-related share of expenses is greater than 75 percentile of our sample. Similarly, *High Doctoral Degrees* is defined by one if number of doctoral degrees granted is greater than the 75th percentile of our sample. *MA or CA* is a dummy variable defined by one if a university is located in Massachusetts or California. *Tuition and Fees* is the log of in-state tuition and fees for full-time undergraduates (in real 2012 dollars). *Total Revenue* is the log of total amount of university revenue (in real 2012 dollars). *Educ Share* is education-related share of expenses. *Bachelors*, *Masters*, and *Doctoral Degrees* are the log of number of Bachelors, Masters, and Doctoral degrees granted respectively. University, state-year fixed effects are included in all regressions. Standard errors are clustered at university level and reported in parentheses. ***, ** and * represent statistical significance at 1%, 5%, and 10% levels respectively.

	(1) Fraction of Entrepreneurs 3 Years After Graduation	(2) Fraction of Entrepreneurs 5 Years After Graduation	(3) Fraction of Entrepreneurs 3 Years After Graduation	(4) Fraction of Entrepreneurs 5 Years After Graduation	(5) Fraction of Entrepreneurs 3 Years After Graduation	(6) Fraction of Entrepreneurs 5 Years After Graduation
Policy*High R&D	0.000716***	0.000777**				
	(0.000251)	(0.000328)				
Policy*High Doctoral Degrees			0.000482*	0.000770**		
			(0.000268)	(0.000372)		
Policy*MA or CA					0.000984*	0.001068
					(0.000558)	(0.000765)
Policy*High Tuition	0.000675*	0.000961*	0.000890**	0.001191**	0.000704*	0.001001*
	(0.000371)	(0.000550)	(0.000386)	(0.000557)	(0.000373)	(0.000539)
Policy	-0.000112	-0.000011	-0.000197	-0.000258	-0.000130	-0.000030
	(0.000142)	(0.000203)	(0.000176)	(0.000228)	(0.000148)	(0.000225)
High R&D	0.000079	0.000125				
	(0.000060)	(0.000081)				
Tuition and Fees	-0.000419***	-0.000613***	-0.000420***	-0.000608***	-0.000439***	-0.000628***
	(0.000132)	(0.000180)	(0.000137)	(0.000185)	(0.000142)	(0.000192)
Total Revenue	-0.000001	0.000046	0.000002	0.000051	0.000003	0.000052
	(0.000066)	(0.000089)	(0.000070)	(0.000090)	(0.000067)	(0.000090)
Educ Share	0.000709	0.001177	0.000440	0.000861	0.000474	0.000884
	(0.000584)	(0.001013)	(0.000576)	(0.000984)	(0.000565)	(0.000992)
Bachelor Degrees	-0.000033	-0.000080	-0.000036	-0.000083	-0.000038	-0.000087
	(0.000045)	(0.000076)	(0.000046)	(0.000078)	(0.000046)	(0.000077)
Master Degrees	0.000011	0.000016	-0.000000	0.000001	0.000004	0.000006
	(0.000031)	(0.000043)	(0.000033)	(0.000046)	(0.000032)	(0.000044)
Doctor Degrees	-0.000023	-0.000038	-0.000030	-0.000041	-0.000031	-0.000047
	(0.000032)	(0.000053)	(0.000034)	(0.000054)	(0.000031)	(0.000053)
University FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.544	0.562	0.537	0.561	0.542	0.560
Observations	3292	3292	3292	3292	3292	3292

Table 8: The Impact of No-loans Financial Aid Policy on VC-Backed Entrepreneurship - by School Characteristics

This table reports the OLS regression results of VC-backed entrepreneurship on no-loans financial aid policy with interaction terms. *Policy* is a dummy varible that is defined by one if a university has implemented no-loans financial aid policy in a given year. *High Tuition*, which is defined by one if tuition is higher than the 75th percentile of our sample. *High R&D*, which is a dummy variable defined by one if research-related share of expenses is greater than 75 percentile of our sample. Similarly, *High Doctoral Degrees* is defined by one if number of doctoral degrees granted is greater than the 75th percentile of our sample. *MA or CA* is a dummy variable defined by one if a university is located in Massachusetts or California. *Tuition and Fees* is the log of in-state tuition and fees for full-time undergraduates (in real 2012 dollars). *Total Revenue* is the log of total amount of university revenue (in real 2012 dollars). *Educ Share* is education-related share of expenses. *Bachelors*, *Masters*, and *Doctoral Degrees* are the log of number of Bachelors, Masters, and Doctoral degrees granted respectively. University, state-year fixed effects are included in all regressions. Standard errors are clustered at university level and reported in parentheses. ***, ** and * represent statistical significance at 1%, 5%, and 10% levels respectively.

	(1) Fraction of VC-Backed Entrepreneurs 3 Years After Graduation	(2) Fraction of VC-Backed Entrepreneurs 5 Years After Graduation	(3) Fraction of VC-Backed Entrepreneurs 3 Years After Graduation	(4) Fraction of VC-Backed Entrepreneurs 5 Years After Graduation	(5) Fraction of VC-Backed Entrepreneurs 3 Years After Graduation	(6) Fraction of VC-Backed Entrepreneurs 5 Years After Graduation
Policy*High R&D	0.000243**	0.000246*				
	(0.000101)	(0.000125)				
Policy*High Doctoral Degrees			0.000063	0.000108		
			(0.000122)	(0.000139)		
Policy*MA or CA					0.000339	0.000387
					(0.000266)	(0.000329)
Policy*High Tuition	0.000301**	0.000321*	0.000374***	0.000398**	0.000305**	0.000321*
	(0.000119)	(0.000165)	(0.000132)	(0.000175)	(0.000127)	(0.000168)
Policy	-0.000039	0.000009	-0.000004	0.000017	-0.000046	-0.000008
	(0.000062)	(0.000075)	(0.000123)	(0.000128)	(0.000059)	(0.000078)
High R&D	0.000005	0.000028				
	(0.000027)	(0.000037)				
Tuition and Fees	-0.000138**	-0.000195**	-0.000141**	-0.000196**	-0.000148**	-0.000203**
	(0.000063)	(0.000084)	(0.000066)	(0.000087)	(0.000068)	(0.000090)
Total Revenue	-0.000003	0.000006	-0.000004	0.000007	-0.000003	0.000007
	(0.000028)	(0.000031)	(0.000029)	(0.000031)	(0.000029)	(0.000031)
Educ Share	0.000152	0.000260	0.000076	0.000164	0.000093	0.000181
	(0.000249)	(0.000364)	(0.000249)	(0.000355)	(0.000242)	(0.000353)
Bachelor Degrees	-0.000013	-0.000025	-0.000014	-0.000026	-0.000015	-0.000027
	(0.000013)	(0.000020)	(0.000013)	(0.000021)	(0.000013)	(0.000021)
Master Degrees	-0.000011	-0.000007	-0.000013	-0.000011	-0.000012	-0.000010
	(0.000014)	(0.000019)	(0.000014)	(0.000019)	(0.000014)	(0.000018)
Doctor Degrees	0.000004	0.000006	-0.000000	0.000003	0.000001	0.000004
	(0.000013)	(0.000020)	(0.000013)	(0.000020)	(0.000013)	(0.000020)
University FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.451	0.436	0.447	0.434	0.451	0.436
Observations	3292	3292	3292	3292	3292	3292

Table 9: The Impact of No-loans Financial Aid Policy on VC-Backed Entrepreneurship - Individual Level Analysis

This table reports the OLS regression results of VC-backed entrepreneurship on no-loans financial aid policy at individual level. *D(VC-Backed Entrepreneurship 3 Years After Graduation)* as a dummy variable, which is equal to one if an entrepreneur started a venture within three years of graduation and subsequently got venture capital financing. *Number of VCs investing in Entrepreneur* is the total number of venture capitalists that financed an entrepreneur's venture(s). *D(High Reputation VC-backed Ventures)* is a dummy variable indicating whether an entrepreneur's venture has ever got financed by a high-reputation venture capitalist. *Policy* is a dummy varible that is defined by one if a university has implemented no-loans financial aid policy in a given year. *PrePolicy1*, *PrePolicy2*, and *PrePolicy3* are defined by one if it is one year, two years, and three years respectively before the first year of the adoption of no-loans financial aid policy by a university. *Tuition and Fees* is the log of in-state tuition and fees for full-time undergraduates (in real 2012 dollars). *Total Revenue* is the log of total amount of university revenue (in real 2012 dollars). *Educ Share* is education-related share of expenses. *Bachelors*, *Masters*, and *Doctoral Degrees* are the log of number of Bachelors, Masters, and Doctoral degrees granted respectively. University, state-year fixed effects are included in all regressions. Standard errors are clustered at university level and reported in parentheses. ***, ** and * represent statistical significance at 1%, 5%, and 10% levels respectively.

	(1) D(VC-Backed Entrepreneurship 3 Years After Graduation)	(2) Total Number of VC Backings	(3) D(High Reputation VC-backed Ventures)
PrePolicy3	0.007	0.009	0.009
	(0.022668)	(0.023740)	(0.024785)
PrePolicy2	0.067	0.081	0.054
	(0.042137)	(0.049582)	(0.045963)
PrePolicy1	0.038	0.044	0.041
	(0.028887)	(0.031637)	(0.028769)
Policy	0.054*	0.064*	0.032
	(0.032614)	(0.035649)	(0.032012)
Tuition and Fees	-0.062	-0.091*	-0.063
	(0.053041)	(0.050723)	(0.056784)
Total Revenue	-0.021	-0.020	-0.018
	(0.017022)	(0.019443)	(0.014949)
Educ Share	-0.165	-0.202	-0.143
	(0.120818)	(0.154586)	(0.110821)
Bachelor Degrees	0.002	-0.001	-0.002
	(0.056653)	(0.064150)	(0.054729)
Master Degrees	-0.059*	-0.070*	-0.061*
	(0.035077)	(0.037794)	(0.036022)
Doctor Degrees	-0.006	-0.028	0.016
	(0.023805)	(0.024961)	(0.022234)
Constant	1.494**	1.875***	1.383**
	(0.581700)	(0.683435)	(0.548476)
University FE	Yes	Yes	Yes
State-Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
R^2	0.187	0.174	0.186
Observations	4758	4758	4758

Table 10: The Impact of No-loans Financial Aid Policy on Entrepreneurial Firm Performance

This table reports the OLS regression results of entrepreneurial firm's performance on no-loans financial aid policy at individual level using NETS. *ln(Sales After 5 Years of Founding)* is the log of one plus an entrepreneurial firm's sales after five years of its start. *ln(Employment After 5 Years of Founding)* is the log of one plus an entrepreneurial firm's number of employees after five years of its start. *ln(Sales of Control Firms in 5 Yrs)* is the log of one plus the average sales of three control firms after five years of their start. Similarly, *ln(Employment of Control Firms in 5 Yrs)* is for average number of employees. *Policy* is a dummy varible that is defined by one if a university has implemented no-loans financial aid policy in a given year. *PrePolicy1*, *PrePolicy2*, and *PrePolicy3* are defined by one if it is one year, two years, and three years respectively before the first year of the adoption of no-loans financial aid policy by a university. *Tuition and Fees* is the log of in-state tuition and fees for full-time undergraduates (in real 2012 dollars). *Total Revenue* is the log of total amount of university revenue (in real 2012 dollars). *Educ Share* is education-related share of expenses. *Bachelors*, *Masters*, and *Doctoral Degrees* are the log of number of Bachelors, Masters, and Doctoral degrees granted respectively. University, year and industry fixed effects are included in all regressions. Standard errors are clustered at university level and reported in parentheses. ***, ** and * represent statistical significance at 1%, 5%, and 10% levels respectively.

	(1) ln(Sales After 5 Years of Founding)	(2) ln(Employment After 5 Years of Founding)	(3) ln(Sales After 5 Years of Founding)	(4) ln(Employment After 5 Years of Founding)
PrePolicy3	0.560	0.453	0.546	0.456
	(0.425)	(0.361)	(0.423)	(0.361)
PrePolicy2	-0.067	-0.018	-0.080	-0.022
	(0.405)	(0.305)	(0.414)	(0.304)
PrePolicy1	-0.012	0.000	-0.024	-0.001
	(0.495)	(0.421)	(0.498)	(0.419)
Policy	0.841**	0.719**	0.819**	0.717**
	(0.354)	(0.306)	(0.360)	(0.306)
ln(Sales of Control Firms in 5 Yrs)			0.011	
			(0.019)	
ln(Employment of Control Firms in 5 Yrs)				0.023
				(0.077)
Tuition and Fees	-0.451	-0.480	-0.444	-0.478
	(1.163)	(1.012)	(1.160)	(1.014)
Total Revenue	0.112	0.147	0.108	0.146
	(0.230)	(0.197)	(0.233)	(0.198)
Educ Share	4.420**	3.223**	4.431**	3.212**
	(2.144)	(1.505)	(2.154)	(1.512)
Bachelor Degrees	-0.394	-0.562	-0.438	-0.565
	(1.656)	(1.183)	(1.639)	(1.183)
Master Degrees	0.193	0.116	0.179	0.109
	(1.035)	(0.816)	(1.035)	(0.821)
Doctor Degrees	-0.605	-0.225	-0.555	-0.217
	(0.604)	(0.453)	(0.604)	(0.454)
University FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
SIC6	Yes	Yes	Yes	Yes
R^2	0.820	0.740	0.779	0.738
Observations	640	640	638	638

Unpublished Internet Appendix

Table A1. Student Debt and No-loans Financial Aid Policy

This table is reproduced with permission from Auter, Hull, Krishnan, Rhodes (2017). It reports the impact of no-loans financial aid policy on student loan amount, provides further evidence for our exclusion restriction. It utilizes data from Gallup-Purdue Index with a random sample of individual respondents with a bechelor's degree or higher, aged 18 and older. The dependent variable is log of one plus student debt amount. *Policy* is a dummy varible that is defined by one if a university has implemented no-loans financial aid policy in a given year. *PrePolicy1*, *PrePolicy2*, *PrePolicy3* and *PrePolicy4* are defined by one if it is one year, two years, and three and four years respectively before the first year of the adoption of no-loans financial aid policy by a university. *Bachelors Degree* is the log of number of Bachelors degrees granted. *Age* is the age of indiviudal. *Female* and *US Born* are dummy variables. It also controls for race, education, and parents' education fixed effects. University and year fixed effects are also included. Standard errors are reported in parentheses. ***, ** and * represent statistical significance at 1%, 5%, and 10% levels respectively.

	(1) Student Debt
PrePolicy4	0.065
	(0.461)
PrePolicy3	-0.160
	(0.574)
PrePolicy2	-0.233
	(0.443)
PrePolicy1	0.336
	(0.557)
Policy	-0.802**
	(0.351)
Bachelors Degrees	0.321*
	(0.172)
Age	-0.056***
	(0.007)
US Born	0.012
	(0.204)
Female	-0.032
	(0.088)
Constant	7.007***
	(1.336)
University FE	Yes
Year FE	Yes
R^2	0.220
Observations	16,656

Table A2. The Impact of No-loans Financial Aid Policy on Entrepreneurship - by School Characteristics

This table reports the OLS regression results of entrepreneurship on no-loans financial aid policy with interaction terms. *Policy* is a dummy varible that is defined by one if a university has implemented no-loans financial aid policy in a given year. *High Tuition*, which is defined by one if tuition is higher than the 75th percentile of our sample. *High R&D*, which is a dummy variable defined by one if research-related share of expenses is greater than 75 percentile of our sample. Similarly, *High Doctoral Degrees* is defined by one if number of doctoral degrees granted is greater than the 75th percentile of our sample. *MA or CA* is a dummy variable defined by one if a university is located in Massachusetts or California. *Tuition and Fees* is the log of in-state tuition and fees for full-time undergraduates (in real 2012 dollars). *Total Revenue* is the log of total amount of university revenue (in real 2012 dollars). *Educ Share* is education-related share of expenses. *Bachelors*, *Masters*, and *Doctoral Degrees* are the log of number of Bachelors, Masters, and Doctoral degrees granted respectively. University, state-year fixed effects are included in all regressions. Standard errors are clustered at university level and reported in parentheses. ***, ** and * represent statistical significance at 1%, 5%, and 10% levels respectively.

	(1) Fraction of Entrepreneurs 3 Years After Graduation	(2) Fraction of Entrepreneurs 5 Years After Graduation	(3) Fraction of Entrepreneurs 3 Years After Graduation	(4) Fraction of Entrepreneurs 5 Years After Graduation	(5) Fraction of Entrepreneurs 3 Years After Graduation	(6) Fraction of Entrepreneurs 5 Years After Graduation	(7) Fraction of Entrepreneurs 3 Years After Graduation	(8) Fraction of Entrepreneurs 5 Years After Graduation
Policy*High Tuition	0.000913**	0.001229**						
	(0.000424)	(0.000618)						
Policy*High R&D			0.000864***	0.000987**				
			(0.000303)	(0.000420)				
Policy*High Doctoral Degrees					0.000514*	0.000813**		
					(0.000278)	(0.000370)		
Policy*MA or CA							0.001203*	0.001379
							(0.000615)	(0.000875)
Policy	0.000107	0.000227	0.000131	0.000336	0.000192	0.000261	0.000120	0.000325*
	(0.000152)	(0.000214)	(0.000153)	(0.000217)	(0.000178)	(0.000230)	(0.000115)	(0.000186)
Tuition and Fees	-0.000421***	-0.000609***	-0.000525***	-0.000763***	-0.000572***	-0.000810***	-0.000555***	-0.000793***
	(0.000135)	(0.000182)	(0.000151)	(0.000207)	(0.000181)	(0.000237)	(0.000168)	(0.000228)
Total Revenue	0.000001	0.000051	-0.000009	0.000034	-0.000010	0.000036	-0.000005	0.000041
	(0.000071)	(0.000094)	(0.000068)	(0.000092)	(0.000074)	(0.000096)	(0.000069)	(0.000093)
Educ Share	0.000415	0.000821	0.000733	0.001211	0.000400	0.000807	0.000456	0.000859
	(0.000592)	(0.001013)	(0.000617)	(0.001064)	(0.000626)	(0.001057)	(0.000603)	(0.001049)
Bachelor Degrees	-0.000038	-0.000087	-0.000040	-0.000090	-0.000046	-0.000097	-0.000046	-0.000099
	(0.000045)	(0.000077)	(0.000048)	(0.000080)	(0.000050)	(0.000084)	(0.000049)	(0.000081)
Master Degrees	0.000001	0.000002	0.000011	0.000015	-0.000003	-0.000003	0.000003	0.000004
	(0.000032)	(0.000045)	(0.000032)	(0.000044)	(0.000034)	(0.000047)	(0.000033)	(0.000045)
Doctor Degrees	-0.000038	-0.000055	-0.000025	-0.000041	-0.000036	-0.000050	-0.000035	-0.000052
	(0.000032)	(0.000052)	(0.000035)	(0.000057)	(0.000037)	(0.000057)	(0.000033)	(0.000056)
High R&D			0.000088	0.000138				
			(0.000061)	(0.000084)				
University FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.532	0.555	0.537	0.556	0.524	0.550	0.534	0.553
Observations	3292	3292	3292	3292	3292	3292	3292	3292

Table A3. The Impact of No-loans Financial Aid Policy on VC-Backed Entrepreneurship - by School Characteristics

This table reports the OLS regression results of VC-backed entrepreneurship on no-loans financial aid policy with interaction terms. It does not include tuition interation in all regressions compared to previous interaction tests. *Policy* is a dummy varible that is defined by one if a university has implemented no-loans financial aid policy in a given year. *High Tuition*, which is defined by one if tuition is higher than the 75th percentile of our sample. *High R&D*, which is a dummy variable defined by one if research-related share of expenses is greater than 75 percentile of our sample. Similarly, *High Doctoral Degrees* is defined by one if number of doctoral degrees granted is greater than the 75th percentile of our sample. *MA or CA* is a dummy variable defined by one if a university is located in Massachusetts or California. *Tuition and Fees* is the log of in-state tuition and fees for full-time undergraduates (in real 2012 dollars). *Total Revenue* is the log of total amount of university revenue (in real 2012 dollars). *Educ Share* is education-related share of expenses. *Bachelors*, *Masters*, and *Doctoral Degrees* are the log of number of Bachelors, Masters, and Doctoral degrees granted respectively. University, state-year fixed effects are included in all regressions. Standard errors are clustered at university level and reported in parentheses. ***, ** and * represent statistical significance at 1%, 5%, and 10% levels respectively.

	(1) Fraction of VC-Backed Entrepreneurs 3 Years After Graduation	(2) Fraction of VC-Backed Entrepreneurs 5 Years After Graduation	(3) Fraction of VC-Backed Entrepreneurs 3 Years After Graduation	(4) Fraction of VC-Backed Entrepreneurs 5 Years After Graduation	(5) Fraction of VC-Backed Entrepreneurs 3 Years After Graduation	(6) Fraction of VC-Backed Entrepreneurs 5 Years After Graduation	(7) Fraction of VC-Backed Entrepreneurs 3 Years After Graduation	(8) Fraction of VC-Backed Entrepreneurs 5 Years After Graduation
Policy*High Tuition	0.000377***	0.000404**						
	(0.000135)	(0.000182)						
Policy*High R&D			0.000309**	0.000316**				
			(0.000120)	(0.000149)				
Policy*High Doctoral Degrees					0.000077	0.000123		
					(0.000135)	(0.000153)		
Policy*MA or CA							0.000433	0.000487
							(0.000276)	(0.000344)
Policy	0.000035	0.000085	0.000069	0.000125	0.000159	0.000191	0.000062	0.000106
	(0.000077)	(0.000092)	(0.000068)	(0.000086)	(0.000143)	(0.000136)	(0.000060)	(0.000083)
Tuition and Fees	-0.000141**	-0.000196**	-0.000185**	-0.000245***	-0.000205**	-0.000263**	-0.000198***	-0.000256***
	(0.000066)	(0.000087)	(0.000072)	(0.000091)	(0.000084)	(0.000102)	(0.000076)	(0.000094)
Total Revenue	-0.000004	0.000007	-0.000007	0.000002	-0.000008	0.000002	-0.000006	0.000004
	(0.000029)	(0.000031)	(0.000029)	(0.000032)	(0.000031)	(0.000033)	(0.000029)	(0.000031)
Educ Share	0.000073	0.000158	0.000163	0.000271	0.000060	0.000146	0.000086	0.000173
	(0.000253)	(0.000363)	(0.000260)	(0.000377)	(0.000268)	(0.000377)	(0.000255)	(0.000368)
Bachelor Degrees	-0.000015	-0.000027	-0.000016	-0.000028	-0.000019	-0.000031	-0.000018	-0.000031
	(0.000013)	(0.000021)	(0.000014)	(0.000021)	(0.000014)	(0.000022)	(0.000014)	(0.000022)
Master Degrees	-0.000013	-0.000011	-0.000011	-0.000008	-0.000015	-0.000013	-0.000013	-0.000010
	(0.000014)	(0.000019)	(0.000015)	(0.000019)	(0.000015)	(0.000020)	(0.000014)	(0.000019)
Doctor Degrees	-0.000001	0.000001	0.000003	0.000005	-0.000003	0.000000	-0.000001	0.000002
	(0.000013)	(0.000020)	(0.000014)	(0.000020)	(0.000014)	(0.000020)	(0.000013)	(0.000020)
High R&D			0.000009	0.000032				
			(0.000027)	(0.000038)				
University FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.447	0.433	0.446	0.433	0.439	0.429	0.446	0.433
Observations	3292	3292	3292	3292	3292	3292	3292	3292

A4. The Impact of No-loans Financial Aid Policy on Entrepreneurship - Treated Sample

This table reports the OLS regression results of entrepreneurship on no-loans financial aid policy using the treated universities as the sample. *Fraction of Entrepreneurs 3 Years After Graduation* is the fraction of entrepreneurs who started a venture within three years of graduation out of total number of undergraduate degrees granted in a given university-year. *Fraction of VC-Backed Entrepreneurs 3 Years After Graduation* is the fraction of entrepreneurs who started a venture within three years of graduation and has got venture capital financing (at anytime) out of total number of undergraduate degrees granted in a given university-year. *Fraction of High Reputation VC-backed Ventures Starting within 3 Years after Graduation* is the fraction of entrepreneurs who started a venture within three years of graduation and has got financed by at least one high-reputation venture capitalist (at anytime) out of total number of undergraduate degrees granted in a given university-year. *High Reputation VC-backed Ventures Starting within 3 Years after Graduation as a Fraction of VC-backed Ventures* is the fraction of entrepreneurs who started a venture within three years of graduation and has got financed by at least one high-reputation venture capitalist (at anytime) out of number of entrepreneurs started within 3 years of graduation and get VC financed in a given university-year. *Policy* is a dummy varible that is defined by one if a university has implemented no-loans financial aid policy in a given year. *PrePolicy1*, *PrePolicy2*, and *PrePolicy3* are defined by one if it is one year, two years, and three years respectively before the first year of the adoption of no-loans financial aid policy by a university. *Tuition and Fees* is the log of in-state tuition and fees for full-time undergraduates (in real 2012 dollars). *Total Revenue* is the log of total amount of university revenue (in real 2012 dollars). *Educ Share* is education-related share of expenses. *Bachelors*, *Masters*, and *Doctoral Degrees* are the log of number of Bachelors, Masters, and Doctoral degrees granted respectively. University, state-year fixed effects are included in all regressions. Standard errors are clustered at university level and reported in parentheses. ***, ** and * represent statistical significance at 1%, 5%, and 10% levels respectively.

	(1)	(2)	(3)	(4)
	Fraction of Entrepreneurs 3 Years After Graduation	Fraction of VC-Backed Entrepreneurs 3 Years After Graduation	Fraction of High Reputation VC-backed Ventures Starting within 3 Years after Graduation	High Reputation VC-backed Ventures Starting within 3 Years after Graduation as a Fraction of VC-backed Ventures
PrePolicy3	0.000272	0.000206	0.000200	0.014970
	(0.000196)	(0.000170)	(0.000170)	(0.083281)
PrePolicy2	0.000340*	0.000217	0.000203	0.044358
	(0.000177)	(0.000149)	(0.000152)	(0.079752)
PrePolicy1	0.000160	0.000057	0.000065	0.108508
	(0.000258)	(0.000158)	(0.000166)	(0.113111)
Policy	0.001165***	0.000518**	0.000471*	0.205644*
	(0.000443)	(0.000260)	(0.000259)	(0.121371)
Tuition and Fees	-0.000856***	-0.000303**	-0.000281**	-0.114048
	(0.000306)	(0.000142)	(0.000137)	(0.094055)
Total Revenue	-0.000101	-0.000041	-0.000035	-0.003879
	(0.000088)	(0.000041)	(0.000033)	(0.027747)
Educ Share	0.000813	0.000283	0.000331	0.180826
	(0.001212)	(0.000509)	(0.000445)	(0.362086)
Bachelor Degrees	-0.000063	-0.000019	-0.000015	-0.018724
	(0.000056)	(0.000020)	(0.000018)	(0.022777)
Master Degrees	0.000113	0.000014	0.000009	0.009242
	(0.000078)	(0.000044)	(0.000044)	(0.031900)
Doctor Degrees	-0.000074	-0.000000	0.000004	0.002267
	(0.000094)	(0.000039)	(0.000036)	(0.029139)
University FE	Yes	Yes	Yes	Yes
State-Year FE	Yes	Yes	Yes	Yes
R^2	0.573	0.421	0.409	0.525
Observations	1846	1846	1846	1846

Figure 1. Fraction of Students Taking Loans

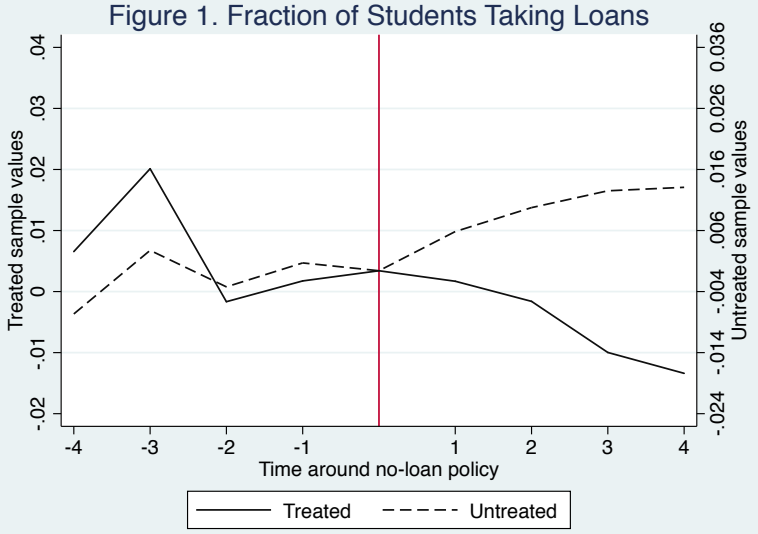

Figure 2. Fraction of Entrepreneurs 3 Years After Graduation

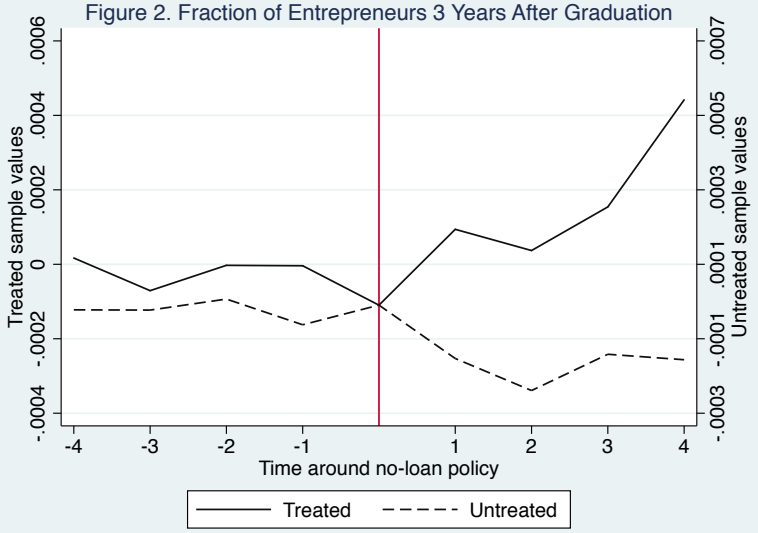

Figure 3. Fraction of VC-Backed Entrepreneurs 3 Years After Graduation