Very Early Venture Finance:
An Evaluation of Pitch Competitions
Project Proposal

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Business plan competitions are a new and ubiquitous feature of the entrepreneurial financing landscape. There is little evidence about whether this early stage resource is useful to startups. Understanding the effect of pitch competitions is relevant to public policy, as local and federal governments fund many programs with the intent of fostering high-growth entrepreneurship in a specific region or sector.

Generously funded by a $24,500 grant from the Kauffman Foundation, I am exploring the effect of pitch competitions using novel application and scoring data from about one hundred programs in 17 states. The data include over 4,000 firms and 1,200 judges. I use the term "pitch competitions" because all the programs in my data include a competitive, scored business plan or pitch component. Sponsors include private companies, foundations, governments, and universities. Some programs are tied to a self-described accelerator, and most include cash prizes. None take an equity stake in the winners.

The central research questions are as follows:

1. Do startups that select into competitions benefit from participating? From winning?
2. If some of the programs are helpful, what is the mechanism?
   (a) Do programs substitute for or complement conventional early stage investment?
   (b) Do programs reduce investor-entrepreneur search costs.
   (c) Are the resources provided to winners and participants helpful?

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3. How do effects vary regionally and by sector?

4. Can startup success be predicted by:

   (a) Judge profession (e.g. investor, entrepreneur)?

   (b) Characteristic (e.g. sector)?

   (c) Criteria scores (e.g. team, business plan)?

5. Are successful startups associated with high variance or consensus in expert predictions?

6. Do startups benefit from receiving structured feedback?

   (a) Can startups benefit from negative feedback by failing faster?

I believe that this project speaks directly to two questions in the NBER Entrepreneurship and Economic Growth Conference Call for Papers: (a) "How do policy initiatives, such as tax and investment incentives, incubators, and related programs affect regional patterns in firm dynamics?" and (b) "What is the role of risk attitudes, as well as attitudes towards failure, in generating high rates of entrepreneurship?" In this proposal, I briefly discuss the literature on this topic, the data, and plans for analysis.

1 Setting and Related Literature

Pitch competitions are an intermediary between entrepreneurs and investors; they potentially act as certifiers, conveners, and/or educators. The number of business plan competitions, along with the public and private funding directed to them, has exploded in recent years. Meanwhile, conventional early stage finance - angel and VC investment - has shifted to later stage deals in recent years (Figure 1). Some industry stakeholders suggest that pitch competitions and related resources help fill an early stage financing "gap."

Pitch competitions are organized and sponsored by governments at the federal, state, and city level, as well as by angel investor groups, universities, large corporations, foundations, and others. One count suggests that there were 260 business plan competitions in 50 U.S. states in 2015 with $23 million in prize money, and a further 122 international events with $25 million in prize money.[2] For example, MIT hosts at least four such competitions, and UC Berkeley hosts at least three. In the U.S., public support for pitch competitions is growing, making understanding whether they are effective (and under what circumstances they are most effective) a pressing question. For example, a clean energy focused competition sponsored by the U.S. Department of Energy is expanding in 2016 to eight competitions with $2.5 million in allocated funding.[3] The White House's "Startup America" initiative, launched in 2011, specifically champions accelerators and competitions.[4]

[2] See http://www.bizplancompetitions.com.

[3] http://energy.gov/eere/articles/energy-department-announces-25-million-inspire-collegiate-clean-energy-entrepreneurs

[4] https://www.whitehouse.gov/startup-america-fact-sheet

Pitch competitions are typically one- or two-day programs in which new ventures present a business model, market analysis, and technology description in either written or presentation format to a panel of judges. Judges are usually investors, serial entrepreneurs, or otherwise associated with the local entrepreneurial or sector-specific ecosystem. Judges typically participate to source deals, clients, jobs, or to "give back" to the entrepreneurial ecosystem.

Some competitions are tied to an accelerator, incubator, or business school course that provides educational and other resources to new ventures. A wide variety of institutions describe themselves as "accelerators," but Cohen (2013) provides this thoughtful definition: "programs of limited-duration—lasting about three months—that help cohorts of startups with the new venture process." Specifically, they:

> "help ventures define and build their initial products, identify promising customer segments, and secure resources, including capital and employees...most programs end with a grand event, a 'demo day' where ventures pitch to a large audience of qualified investors."

There is no formal tally, but one list identifies 601 self-described accelerators as of October, 2015.[5] Figure 2 shows the accelerators and funded accelerator startups in the Crunchbase database. Hochberg (2015) identified 180 active accelerators in 2013, a number that grew steadily from roughly zero in 2006.

Some accelerators, like Y Combinator, take a small equity stake in participants and provide working space. I do not include any such accelerators in my data, as they are more appropriately compared with angel and early stage VC investors. Most of the self-described accelerators in my data provide training and formal networking.

Many public- and foundation-sponsored competitions focus on sectors perceived to have high social returns to innovation and to receive inadequate private funding. For example, in my sample the Imagine H2O Infrastructure Challenge is exclusively for water-related startups. In theory, an accelerator and associated competition will be most helpful for participating ventures on the margin; those whose NPV is just barely negative without a boost of non-dilutive equity and PR exposure from the prize. It should be noted that this notion of "helpful" is in the public funding sense. An accelerator like Y Combinator, which is wholly private and takes equity investment in its startups, should be expected to seek the highest NPV companies.

The literature on startup resources has focused on private investment, especially venture capital (VC). There is abundant evidence that startups benefit from VC (Hellmann and Puri 2000, Sørensen 2007). There is initial evidence of the positive effects of angel investment (Kerr, Lerner, and Schoar 2014). Venture capitalists screen investment opportunities based on high-powered incentives, and stage investment both to mitigate agency problems and to transform negative NPV projects into a series of positive NPV experiments (Kerr, Nanda, and Rhodes-Kropf 2014). There is some evidence that investors cannot identify ex-ante which startups will be successful (Kerr, Nanda, and Rhodes-Kropf 2014, Kerr, Lerner, and Schoar 2014). If pitch competitions perform a certification function, they do so through the wisdom of a group of judges, who are not directly remunerated for their participation.

[5] Compiled on AngelList.

There is a small but growing literature on accelerators and business plan competitions. Hochberg (2015) introduces and defines accelerators. Much of the work establishing causal program effects examines competitions in the developing world. For example, McKenzie (2015) finds positive effects of a grant competition in Nigeria. He establishes causality because awards were randomly allocated for a subset of high-scoring applicants. González-Uribe and Leatherbee (2015) also find positive effects of a mentorship program in Chile, but no effects of associated accelerator services (cash and co-working space). Fehder and Hochberg (2014) compare regions with and without accelerators. They find that the presence of an accelerator in a region increases financing events for non-accelerated firms.

A few papers evaluate accelerators by comparing participant ventures with non-participating ventures. Hallen, Bingham and Cohen (2013) compare accelerated- and non-accelerated VC-funded firms, and find that that firms from prestigious accelerators ones raise money and exit faster. Winston-Smith and Hannigan (2013) match ventures that participated in TechStars and Y Combinator with similar firms, and also find that the accelerated ventures raise funding faster and are either acquired or fail faster. In contrast to these two papers, Yu (2014) finds that accelerated firms fail faster and raise less money than their matched counterparts.

Finally, there is a large literature on the effects of government grants and other types of subsidies. These papers have found disparate effects in mostly non-U.S. settings (Lach 2002, Takalo et al. 2013, and Almus and Czarnitzki 2003). In related work, I evaluate the impact of U.S. government grants to high-tech energy startups, and find strong positive effects of small, exploratory grants, but not later stage grants (Howell 2015). The evidence suggested that resources seeking to help startups overcome barriers to growth and financing are most effective at a very early stage.

2 Data

This project will make use of novel, comprehensive application, judge, and scoring data for about 100 pitch competitions. Table 1 contains summary statistics about the data I have analyzed thus far. Some of the programs are the culmination of an accelerator (e.g. Cleantech Open), some are formal pitch competitions (e.g. Angel Capital Summit), and some are local business plan competitions aimed at students (e.g. Illinois Clean Energy Student Challenge). The focus also varies. Some are vertically oriented towards biotech, water, or clean energy (e.g. Imagine H2O Infrastructure challenge), while others are regionally oriented (e.g. Arizona Innovation Challenge).

I observe all firms that apply as well as basic information about the firms, including address, website, sector, technology description, and founder names. I observe judge-specific scores for each round if the competition has multiple rounds, including criteria scores (most competitions ask judges to score firms based on team, technology, market potential, and other dimensions). Competitions use different score scales, so in an initial approach I scale the scores by quintile. Table 3 shows program characteristics and scaled scores. I observe the judge's name in most competitions, and have started to assign the judges to four professional groupings: investor (angel or VC); entrepreneur (self-described founder or startup CEO); corporate executive (affiliated with a large public corporation, which includes corporate venture group representatives); andservice professional (lawyer, consultant, and accountant).

I am in the process of adding additional competitions, such as the prestigious MIT Clean Energy Prize, but thus far the primary sources are twofold. First, the Cleantech Open, a large energy-focused accelerator and/or prize competition, has provided me with all of their application and judging data since the inception of the program, which began in the Northeast in 2005 and has since expanded to eight regions in the U.S. I have judging data for nearly all region-years from 2009 to 2013, comprising 21 competitions. Second, ValidEval, a competition and judging software platform, provided me with data for all 67 of its client competitions. In both cases, the data on applicants, judges, and scores is strictly proprietary.

The data is skewed towards clean energy and Colorado. Clean energy is a particularly interesting sector for evaluating innovation subsidy and support. Clean energy technologies are challenging to fund privately; they tend to be capital-intensive at early stages with long lead times. The cost of experimentation in this sector is often high. Also, clean energy has social benefits that - in the absence of a carbon tax - exceed its private benefits. The Colorado focus is because ValidEval is headquartered there, and has sought out local clients. As Colorado has a rich entrepreneurship ecosystem, but one that is less saturated with investors than Silicon Valley or Route 128, it is a useful place to examine the effectiveness of pitch competitions. In sum, my data is likely to be dominated by marginal firms. This seems the most likely sample in which to find *causal* positive effects of these programs.

As shown in Table 1, I have coded professions for about 250 of the judges. I have done an initial matching of the program data to investments, using CB Insights, i3 (Cleantech Group), and Crunchbase. These are described in Table 3. I am also beginning to match firms to AngelList data, which will tie firms to specific angel investors and thus help identify whether any predictive power of scores is explained by attending judges investing in the company. Ongoing work will incorporate the rest of the program data, and match it to firm outcomes. A particularly time-intensive piece will be to identify failure dates for startups/teams that abandoned their company/idea. In most cases, this will require contacting the founder personally.

3 Analysis

The initial analysis will use subsequent private financing as the outcome of interest. This is because (a) data is readily available; (b) private investment is a good indicator of commercial potential for high-growth startups; and (c) the objective of most programs is to help startups access subsequent private capital, so this outcome variable permits an evaluation of program effectiveness and mechanisms.

From the perspective of enabling high quality startups to raise private finance, it is not obvious that these programs will be helpful. First, since participation reveals information about the firm and its technology, high quality startups may not apply because they wish to protect intellectual property. Second, the judges may not have access to sufficient information or incentives to effectively judge startups. Third, the program's social goals may distort firms away from private sector commercialization. Fourth, the skills required to win a competition may be unrelated to those required to raise private finance and grow a company, leading competitions to distract firms from productive activities and therefore have a negative effect on firm outcomes.

I will test the effect of the programs on participants and winners, as well as the predictive power of scores, using a regression discontinuity approach. I control for score and winning, and in some specifications only use middle scores to eliminate strong and weak performers. Thus far I have used variations on the following random effects logistic specification, where i indicates a firm and j indicates a program:

$$\begin{aligned} logit\left(Pr\left(Finance_i^{Post}=1 \mid X_{i,j},\varepsilon_{ij}\right)\right) &= \alpha+\beta_1 Overall\ score_{i,j}+\beta_2\left(\mathbf{1} \mid Win_{i,j}\right) \\ &\quad +\beta_3\left(\mathbf{1} \mid Finance_i^{Prev}\right)+\gamma'\left(\mathbf{1} \mid Program_{j\in J}\right)+\varepsilon_{i,j} \end{aligned} \tag{1}$$

The outcome measure is binary indicator for whether the firm ever received private investment after the event. It is either angel and VC investment or non-angel/VC investment. I term the latter "other private funding" (see Table 2 for deal types). I include the firm's overall score in the competition. I use program random effects, which controls for the specific event and thus also time and state. Random effects models are more efficient; they use all the data available rather than dropping the groups without positive outcomes. The strong assumption of this model is that omitted variables are uncorrelated with explanatory variables. My main results are very similar using fixed effects logit and OLS with program and/or judge fixed effects. In all specifications I cluster errors by program. I calculate pseudo-R^2 for the random effects models using the McKelvey and Zavoina formula.[6]

Additional specifications use judge-specific overall scores and judge-specific criteria scores. For example, a variant to test the predictive power of judges (k) by profession, I use the following:

$$\begin{aligned} logit\left(Pr\left(Finance_i^{Post}=1 \mid X_{i,j},\varepsilon_{ij}\right)\right) &= \alpha+\beta_1 Judge\ score_{ijk}\cdot\mathbf{1} \mid Investor\ Judge_k \\ &\quad +\beta_2 Judge\ score_{ijk}\cdot\mathbf{1} \mid Entrepreneur\ Judge_k \\ &\quad +\beta_3 Judge\ score_{ijk}\cdot\mathbf{1} \mid Executive\ Judge_k \\ &\quad +\beta_4 Judge\ score_{ijk}\cdot\mathbf{1} \mid Service\ Prof\ Judge_k \\ &\quad +\beta_5 Overall\ score_{i,j}+\beta_6\left(\mathbf{1} \mid Win_{i,j}\right) \\ &\quad +\beta_7\left(\mathbf{1} \mid Finance_i^{Prev}\right)+\gamma'\left(\mathbf{1} \mid Program_{j\in J}\right)+\varepsilon_{i,j} \end{aligned} \tag{2}$$

I expect that if the programs act primarily to reduce investor-entrepreneur search costs, they will be most effective when investors comprise a large share of judges, and losing firms will benefit from reaching a pitch stage (e.g. the semifinals) relative to firms who barely did not make the pitch stage. If receiving non-diluting money is what makes the competitions useful, winning will be most impactful when the size of the award is relatively large, and program effectiveness will not depend on the presence of in-kind resources like mentorship or training.

A different lens through which to examine any positive effect is through the programs' relationship to private funding. Competitions may substitute for conventional early stage financing and mentoring from angel and VC investors, or they may fill a funding gap between founding and a stage at which conventional investors will consider the new venture. Since the prizes are relatively small, if the programs substitute for conventional funding they should

[6]This measures model fit as the share of variance in the dependent variable y that the estimate accounts for $\left(R^2=\frac{var(y)}{vary(y)+var(\varepsilon)}\right)$.

be most effective for capital-light (software) ventures. If the programs fill a gap, particularly allowing ventures to prototype their idea, then they may be equally or more helpful for capital-intensive (hardware) companies. I can partially address this question by examining sector-specific program effects. If the programs are most useful for hardware technologies and capital-intensive sectors, then the programs are more likely acting as a springboard, filling a gap between the lab and the private investors. Ongoing work will examine the effect of the programs on reaching revenue, which will help assess whether the programs substitute for conventional early stage financing.

Finally, I am interested in whether startups benefit from structured feedback by failing faster. One approach to this is to sort competitions by their feedback format. In particular, I have certain competitions in which firms received structured feedback in one year but not other years. Specifically, some competitions used the ValidEval judging platform in one year but not in any other years. For example, in 2011 the Cleantech Open used ValidEval, but did not in any other years. Normally the signal is simply winning or losing, but in 2011 firms received detailed feedback, including their score relative to their peers. For startups that lost the competition and subsequently went out of business, I can compare the time-to-fail in 2011 with 2010 and 2012. This is an event study with a difference-in-differences flavor. The key assumption is that the economic environment for funding clean energy was the same or trending across the three years.

Tentative Initial Findings

An extremely preliminary analysis that faces *serious* econometric limitations and uses only about $\frac{1}{3}$ of the data, finds the following:

- Winning makes a competitor 70-90% more likely to raise angel/VC.
- Winning makes a competitor 3 times as likely to raise other financing (licenses, partnerships, debt).
- An extra quintile of score increases chance of angel/VC by 32%; other financing by 28%.
- Pitching and participating in competition with cash prizes more helpful for angel/VC.
- In-kind resources (mentoring, training, free legal services) if anything have a negative effect on subsequent funding.
- Judge-specific scores are slightly less informative than overall scores.
- All criteria scores are slightly informative. Specifically:
  - Traction/Validation more relevant for angel/VC.
  - Technology/Product more relevant for other financing.
- Investors are better than other judge types at predicting angel/VC.

- Winning has a larger impact on subsequent investment for hardware and energy firms, supporting the "springboard" hypothesis.
- Variance in judge scores for a firm is not relevant.
- The award amount is not relevant.
- Number of winners in a competition is not relevant (consistent with Pavel 2015).

It is possible that the attending judges are themselves occasionally investing in startups, generating a mechanical relationship between scores and subsequent investment. The angel-specific investment data from AngelList will hopefully shed light on this possibility.

Conclusion

Evaluating the effects of these programs on participants and winners will inform both practice and theory. While at a very early stage, I hope that this project will shed light on important open questions in entrepreneurial finance. Two parts of the project that I think are particularly suitable to this Call for Papers are the analysis of geographic variation in selection into competitions and program effects, and the effect of judge feedback on startup outcomes.

Table 1: Summary Statistics on Events and Firms

Events		*Firms*		*Judges*	
# competitions	88; (today 35)	# Unique firms	3,502; (today 2,098)	# Unique judges	1,135
# rounds	146	# Firms in >1 competition	580	# Judges participating in >1 competition	146
# competitors per event	38 (sd=51)	# Company-phase observations	3,804		
States of competitions		*Firm Sectors (thus far)*		*Judge professions (thus far)*	
California, Colorado, Texas		# Energy firms	669	Investor	68
Massachusetts, New York, Utah, Florida, Virginia		# Software firms	767	Entrepreneur (founder/startup CEO)	39
Arizona, Illinois, Missouri, Minnesota		# Biotech/health firms	229	Corporate executive	36
Ohio, Wisconsin, Indiana, DC, Louisiana		# Water/waste/ag firms	84	Service (lawyer, consultant, accountant)	90

Note: This table summarizes

Table 2: Summary Statistics of Investment Matching

Number of Deals		*Firms by Deal Status*	
Angel/Seed	461	# Firms matched to financing	647
Venture capital series A-B	352	# Firms received angel/VC	391
Venture capital series C+	93	# Firms angel/VC post-event	150
Acquisition	102	# Firms first angel/VC post-event	104
Partner/license	223	# Firms received other investment	465
IPO	8	# Firms other investment post-event	136
Post IPO finance	17	# Firms first other investment post-event	105
Debt	206		
Grant	114		
Other	230		
Total	1,808		

Note: This table summarizes

Table 3: Summary Statistics of Program Characteristics and Quintile Scaled Scores

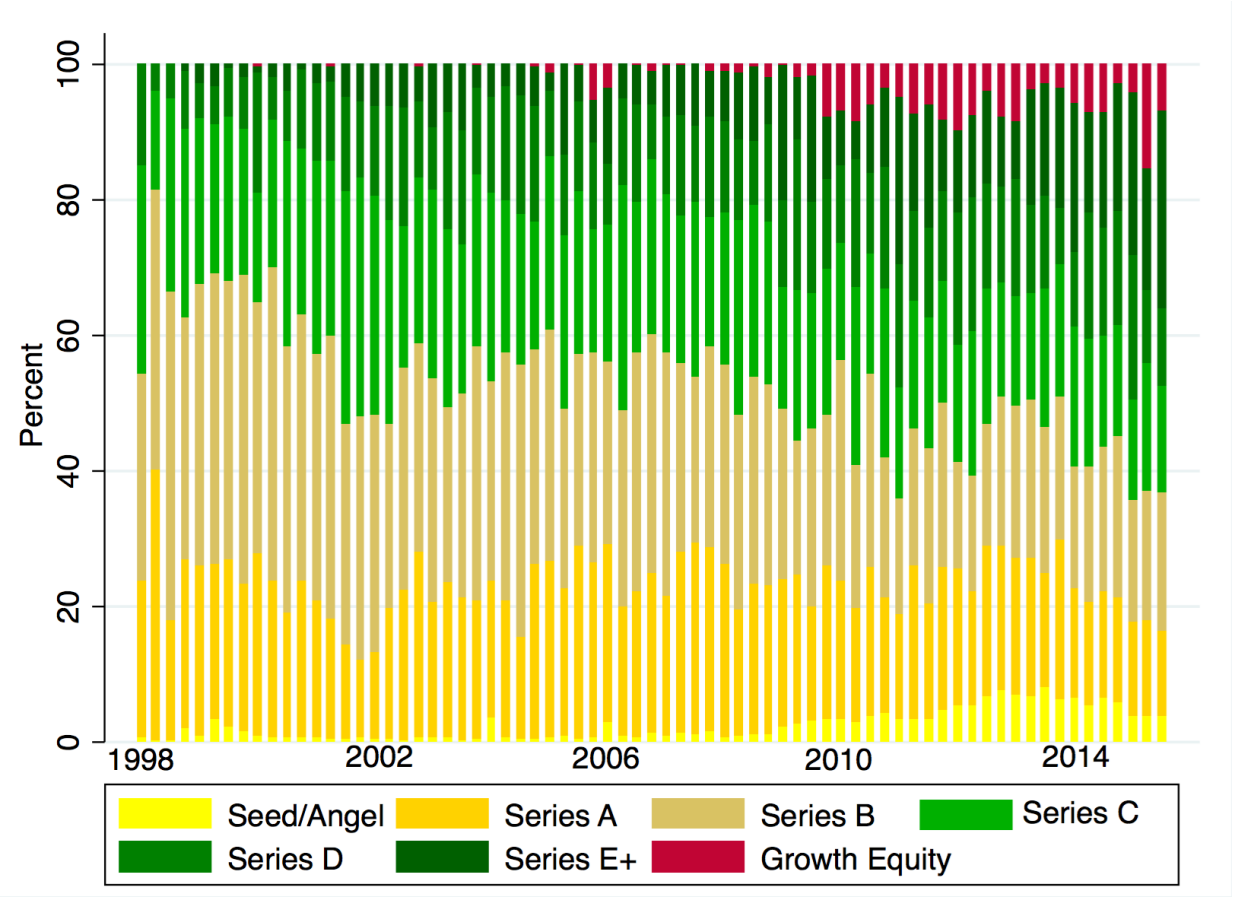
Program Characteristics	
# events with winners who receive cash prizes	34
# events with winners who receive in-kind prizes	22
# firms pitched (i.e. reached pitch stage, or all applicants pitch)	1,115
# firms in accelerator as part of program	872

Quintile Scaled Scores

	Mean (sd)	N	Min	Max
Overall program score	2.94 (1.41)	3,647	1	5
Judge score	2.84 (1.44)	13,681	1	5
Judge criteria scores	2.86 (1.44)	70,577	1	5
Judge business model criterion score	2.88 (1.44)	10,939	1	5
Judge financial criterion score	2.84 (1.45)	6,896	1	5
Judge market attractiveness criterion score	2.88 (1.44)	11,570	1	5
Judge team criterion score	2.88 (1.44)	10,721	1	5
Judge technology/product criterion score	2.88 (1.44)	11,356	1	5
Judge validation/traction criterion score	2.95 (1.42	2,695	1	5

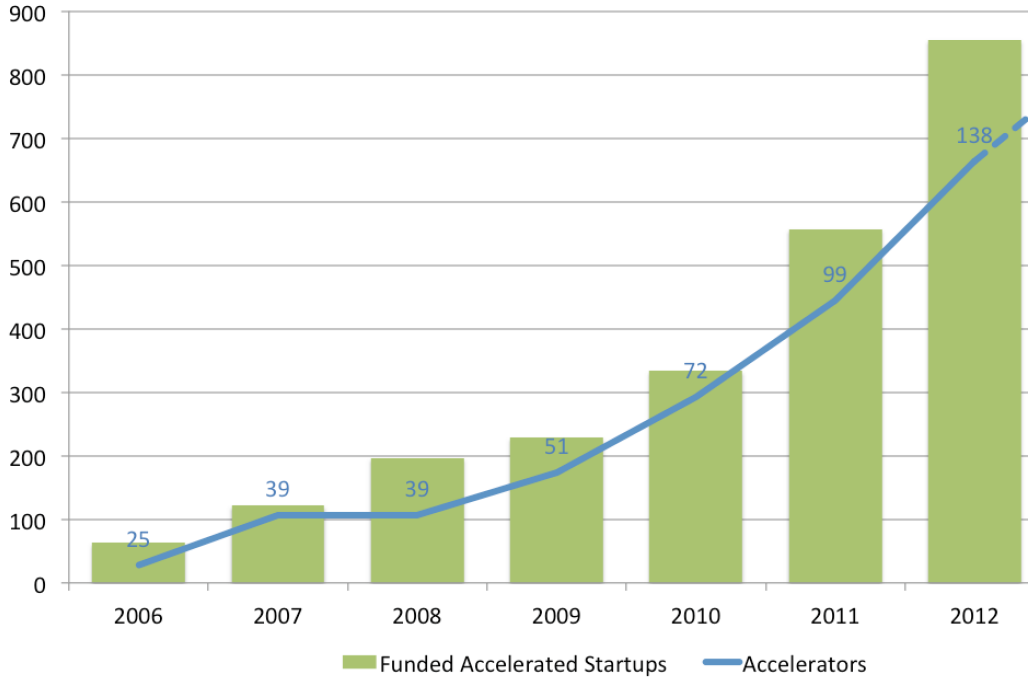
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Figure 1: U.S. angel/VC investment by stage



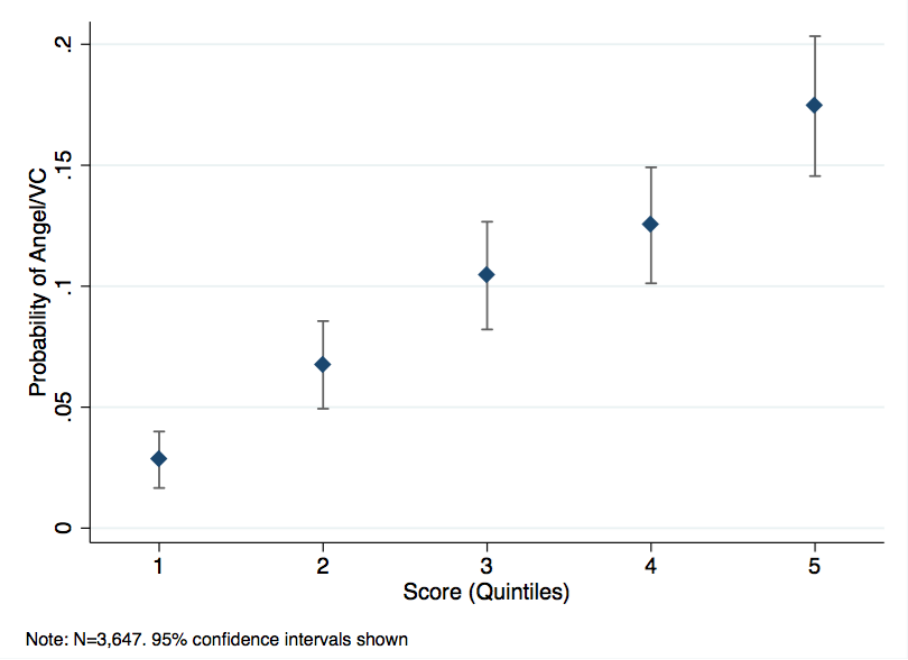
Note: This figure shows the percentage of U.S. angel/VC investment in total dollars at each stage. Data is quarterly from 1998 Q1 to 2015 Q2. Source: CB Insights; author's analysis.

Figure 2: Accelerators and funded accelerated startups



Note: This figure shows the number accelerators and funded accelerated startups in Crunchbase's database between 2006 and 2012.

Figure 3: Probability of Subsequent Angel or VC Investment by Overall Score



Note: This figure shows the probability that a firm receives angel or venture capital investment after it participates in the program or competition, by its overall score in that competition.

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