Is Innovation Really in a Place? Accelerator Program Impacts on Firm Performance

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Draft: March 5, 2018

We investigate the impact of a nascent urban entrepreneurial amenity, accelerator programs, upon start-up firm's private equity performance. Accelerators are firm development programs that utilize physical space, mentorship, capital, and community engagement to accelerate the financial feasibility of start-up firms. A sample of US accelerator treated and matched control firm's over the 2005 to 2015 period yields a study of 16,720 firms. Results indicate that there is statistically significantly more cumulative funding for accelerated firms, when taking into consideration the endogenous choice and selection of start-up firms into programs and series stage in cumulative funding. Secondly, we assess variation across accelerator participation timing and find that firms with pre-funding when coming into an accelerator leads to higher cumulative funding. Lastly, we document accelerator amenities like free physical space, program length, program cohort size, investor equity stake and scale of capital injection impacts cumulative funding. This study supports evidence of correlation between start-up firm performance, as measured by increased cumulative funding, and accelerator program amenities.

JEL: R11, R12, L26

Keywords: Entrepreneurship, accelerator programs, firm performance, innovation ecosystems

Bricks and Mortar and their impact on entrepreneurial development and economic growth has become an issue of 21st century public policy. Creating urban development, so-called innovation ecosystems, that support firm formation and success is at the core of a nascent development in urban planning and economic development programs (Jaroff, Frenchman and Rojas 2009, Marshall 1920, Porter 1990). Innovation ecosystem creation is justified by a broad body of research documenting the correlation between local entrepreneurship and economic growth (Delgado, Porter and Stern 2010a, Delgado, Porter and Stern 2010b, Gennaioli et al. 2012, Gennaioli et al. 2012, Glaeser et al. 1992, Glaeser, Kerr and Kerr 2012, Rosenthal and Strange 2003). Furthermore, new private and public sector programs aim to catalyze firm development to promote local economic development and curate so-called micro-innovation ecosystems. One such intervention is the rise of firm accelerators.

Accelerators are nascent firm development programs that utilize physical space, networks, mentorship, capital financing, and community engagement to accelerate the financial feasibility of a pool of firms. These programs are generally a private sector initiative that aims to transition firms out of early stage development challenges to advance their skills and networks through their programs. Importantly, accelerator programs are differentiated by accepting a cohort of firms from an applicant pool to a program that has a start and end date. Since the development of the first so-called accelerator program, there has been at least 500+ programs of their kind across the US. Publicly funded business development tools like incubators[1] do not have start and end dates and generally do not discriminate access

* Corresponding Author: Andrea Chegut: Massachusetts Institute of Technology, 77 Massachusetts Avenue, achegut@mit.edu. Acknowledgements: We are grateful for the financial support of MITs Sam Tak Lee Laboratory. In addition, we are grateful for the research assistance provided by Annie Ryan, James Scott, Yair Titelboim and Daniel Fink. We are also grateful for the comments received at the Frontiers of Entrepreneurship Conference.

[1]The key elements of accelerators differentiate them from other institutions in the entrepreneurial ecosystem such as incubators or angel investors. Incubators are primarily real-estate based ventures which offer office space at a reduced rent. Incubators, unlike accelerators, do not have a fixed start or end date. There is an ongoing entry or exit of the startups. According to Cohen (2013) the startups stay resident for about 1-5 years. Many incubators offer professional services such as legal, human resource or tax counseling, however, the startups must pay for these services (Allen and Mccluskey 1991). No investments are made in the startups by the incubator. If mentorship is provided it is minimal. The

based on firm characteristics, where these programs are in contrast to accelerators who are a private sector development initiated by the venture and angel capital community.[2] Cohen and Hochberg (2014) define accelerators as "A fixed-term, cohort-based program, including mentorship and educational components, that culminates in a public pitch event or demo-day."

Demand for accelerator programs are on the rise, as we see that entrepreneurial activity is increasing, there is more and more need for training, development and networks. Today the Kauffman Foundations Startup Activity Index has gone up three years in a row, reaching close to the peak before the Great Recession drop. In 2017 the Kauffman Foundations Startup Activity Index has gone up three years in a row, reaching close to the peak before the Great Recession drop (**?**). Moreover, capital financing of start-ups is growing. 2017 was the second biggest year of investments. Total annual funding increased 17% in 2017, as $71.9B was invested across 5,052 deals (Insights 2017). Much work has been done, to measure entrepreneurial activity, but there is limited evidence on the factors that tie entrepreneurial performance to the amenities and programming within these innovation ecosystems. Given the importance of start-ups on local economic development, our aim is to investigate the tools that are targeted to increase the chances that start-ups survive. In this way, this study examines the impact of accelerator experiences on the firm performance of private equity start-ups.

A body of research examines the impact of small and young firms on local economic growth. Small, new firms face many liabilities of newness as these young companies do not have sufficient financial capital for long-term survival, underdeveloped operational and managerial skills and those firms that lack legitimacy with customers, employees and other key stakeholders (Gavetti and Rivkin 2007, Levinthal 1997, Siggelkow 2001, Stinchcombe and March 1965).

stage of the venture is not crucial, varying from early to late (Cohen 2013).

[2]There is no hard or soft line about the financing sources of accelerator programs, but generally these programs are of a private enterprise nature as they offer capital in exchange for equity in the firms.

Some ventures may overcome these issues through the knowledge and networks of their founders (Dencker, Gruber and Shah 2009, Eesley and Roberts 2012, Eisenhardt and Schoonhoven 1990). However, many start-up founders do not have the knowledge, network, capital or physical space to overcome these challenges.

To investigate the impact of accelerator programs upon private equity start-up performance, we pair two unique US data sets. First we use the MIT Real Estate Innovation Labs accelerator database which includes details on equity provisions, capital investments and detailed programming by the accelerators for firms. Second, we match to CB Insights private company funding data to follow private equity firm performance over the 2005 to 2015 period. In this panel data set, we follow those firms over time that have had an accelerator experience and those that have not and control for firm funding, investor experience and investment stage characteristics as well as deal event timing conditions and the urban area context. In addition, our data enables us to understand the timing of the accelerator experience as well as characteristics of the accelerators themselves in providing amenities to these start-up firms. As part of our identification strategy, we have considered multiple aspects of the accelerator program experiences for firms and have controlled for where engaging in an accelerator experience is an endogenous choice and(or) selection through a 2SLS estimation procedure in a fixed-effect panel estimator framework.

For a sample of over 38,000 start-up deals and 16,720 firms, our results indicate that there is statistically significantly more funding for accelerated relative to non-accelerated firms, even when taking into consideration the endogenous choice and selection of start-up firms into programs. This finding is robust to the stages of private equity funding that firms proceed through. Furthermore, we assess variation across accelerator experiences and find that firms with prior funding before entering into an accelerator program leads to higher cumulative funding overall. In addition, we assess accelerator characteristics and identify that firms that experience longer acceleration program periods and not surprisingly more

capital in their program leads to higher cumulative funding later on. Perhaps, a so-called early signal of firm quality to later stage financiers. Moreover, the offering of physical space and on-site programming leads to higher cumulative funding, which suggests that the absence of programming and physical space, amenities that are not uniform across all accelerators, are important to firm formation and capital accumulation.

These results indicate that there is evidence of correlation between start-up firm performance and accelerator program activities. Furthermore, programming variation has significant impact on the life-long performance of the firms. In this way, when designing accelerator programs, we should take note of programming characteristics that may not help the firms over the course of their funding life-cycle. Moreover, these findings are relevant for the creation of innovation ecosystems and that the use of accelerators may be an important ingredient in the ecosystem's framework. However, other factors necessary for ecosystem creation like employment growth, employee skill diversity, the availability of necessary equipment and physical space after accelerator graduation are necessary for completing a more holistic picture of innovation ecosystem performance.

The remainder of our analysis is structured as follows. In section I we examine the body of literature that links innovation ecosystems to entrepreneurship. In section II we present the data and descriptive statistics of our analysis. In the third section, we present our estimation strategy and approach to measuring an endogenous choice to engage in entrepreneurial amenities. Lastly, in section IV we review our results and in section V, conclude.

I. Literature Review

This study draws upon different literature domains to inform our hypothesis about how accelerator experiences that have formed at a micro-urban scale can change the intersection of innovation, firm performance and place. Three domains regional and economic planning, entrepreneurship formation and ties to economic

growth and firm performance are all interrelated in understanding the production of goods and services.

A. Planning for Regional Growth

Innovation districts are growing in numbers; there are 41 established or planned innovation districts around the globe. Large scale Innovation Districts like 22@ Barcelona or the Boston Innovation District integrate a planned ecosystem of innovation, cutting edge patenting firms, universities and research centers that aim to transfer technology. Agglomeration of innovative firms, mixed-use retail amenities, small workshops, events, and services are all used to program a productive economic urban fabric. Innovation Districts are an evolution in urban planning and development away from science parks, industrial districts and new century cities. The observation of innovation districts and the first theories concerning their development give rise to the question of how do they arise and how do they support entrepreneurial growth.

Historically, nineteenth century and early 20th century, industrial districts were characterized by a high concentration of manufacturing enterprises that were engaged in similar or complimentary work (e.g., Manchester, Milan, Baltimore, Detroit). At this time, industry clustering had a unique advantage: the faster supply of materials and parts from one company to the other, a large industrial worker supply and neighborhood amenities to support their activities outside of manufacturing (Muller and Groves 1979). This shifted with the arrival of science or research parks that came with the arrival of the automobile oriented suburban and isolated laboratory and firm clusters. Suburban clusters were developed to commercialize research, attract scientists with an entrepreneurial attitude from industry and academia (Dahlstrand and Smith n.d.) and develop a secrecy culture stemming from patenting policies at this time (Katz and Bradley 2013). However, government and industry stakeholders began to undertake action to create new geographic clusters so-called New Century City developments ("NCC")

which were established within large-scale real estate development project areas and "driven by inter-organization and cross-industry collaboration to the open innovation ecosystem for R&D of the company towns of past" (Jaroff, Frenchman and Rojas 2009).

This trend has culminated in the arrival of innovation districts. Bugliarello (2004) identified the emergence of urban knowledge parks that represented a new tool for the transformation of cities into knowledge cities where urban parks "develop around a knowledge institution in a city, provide public space or spaces for community activities, and possess high levels of density." Florida (2014) found an emergent shift of high tech startup activity and venture investment to "urban centers and also to close-in, mixed-use, transit-oriented walk-able suburbs." Importantly, planning policy understood the formation of a new urban form to support the so-called "innovation district," but its emergence can either occur organically or in a planned way. Even if districts form naturally, e.g., Silcon Valley in California or Kendall Square in Massachusetts, to scale them up to a neighborhood size, a structured intervention is necessary (Cosgrave, Arbuthnot and Tryfonas 2013). Katz and Wagner (2014) lists the following institutions that drive the growth of innovation districts: Mayors and local governments, major real estate developers and land owners, managers of research campuses, anchor companies, advanced research institutions, advanced medical campuses, philanthropic investors, incubators, accelerators, and other economic cultivators, and social networking programmers. Thus, an important component of planning policy today is to focus on micro-agglomeration centers like accelerators, incubators and other centers for entrepreneurial development.

B. Entrepreneurship, Innovation and Local Growth

A body of research has investigated the economic consequences of innovation and entrepreneurship. While there is little doubt on the correlation between smaller firms and local growth, endogeneity issues exist in this context. Instead

of explaining the correlation by the impact of small, young firms on local growth, it might be the case that start-ups are attracted by rapid and fast-growing cities. Chatterji, Glaeser and Kerr (2013) who provide a review of recent studies on the clusters of entrepreneurship and innovation conclude that more research on the causal assessment of this relationship needs to be done. Yet, there are numerous urban economic studies that have contributed to our understand of the ties between innovation, entrepreneurship and economic growth.

Chinitz (1961) was the first who pointed to the important impact of local entrepreneurship on local growth, when he contrasted New York and Pittsburgh he concluded that Pittsburghs historical concentration in the steel industry suppressed entrepreneurial activity. While New Yorks early engagement in the decentralized garment industry encouraged vibrant entrepreneurship. A more recent and famous case-study was done by Saxenian (1994). When comparing the regional performance of Boston and Silicon Valley, Saxenian (1994) suggested that the regional structure and the local entrepreneurial culture encouraged Silicon Valley to crowd out Boston as the center for semiconductor manufacturing even though Boston had a more advantaged position after World War II. Empirical evidence confirms the findings of these two case-studies. The findings of Glaeser et al. (1992) display a strong correlation between small company size and subsequent growth in employment across sectors within U.S. cities. Rosenthal and Strange (2010) extend a core urban model by incorporating entrepreneurship in a way that the connection between entrepreneurship and local success and certain causes for entrepreneurship are captured, where employment growth is predicted by an abundance of small entrepreneurial firms both across cities and across industries within cities. Importantly, this finding is robust (Delgado, Porter and Stern 2010a, Delgado, Porter and Stern 2010b, Gennaioli et al. 2012). A recent study by Glaeser, Kerr and Kerr (2012) also shows that entrepreneurship spurs employment growth in U.S. cities since the 1970s where a large part of employment growth can be attributed to companies that became large employers rather

than to the "endless replication of small businesses."

Duranton (2007) developed a theoretical model that shifted the focus from entrepreneurship to innovation and its link to city performance. The underlying premise of the model is that the place where past breakthrough inventions occur determines the location of industries. Kerr (2009) evaluates the validity of this model. After identifying the top 1% of new patents in 36 patenting technologies for the time between 1975 and 1984, Kerr (2009) evaluates the subsequent patenting growth in the ten cities that have the highest concentration of top patents with the next ten cities with the second highest concentration. The development of the cities is quite similar for the considered time period, but over the next 20 years the patenting growth was 20% higher in the group of cities with the largest share of breakthrough patent inventions. Agrawal, Cockburn and Rosell (2010) analyze the traits of innovation in cities that are dominated by large companies, so-called "company towns." The findings show that large companies often become less inclined to conduct exploratory R&D efforts and more insular in their innovation. Agrawal et al. (2014) built on the previous study and analyze what an optimal mix of large and small companies leads to the most productive and innovative environment. The results show that a mixing of large innovative and a sufficient number of small innovative firms, that are often founded by former employees of incumbent firms, have a positive impact on patenting growth.

Beyond the optimal mix of large and small corporations, universities have the power to stimulate economic growth by being an anchor. Hausman (2013) analyses the extent to which universities impact local economic growth. The findings show that long-run employment and wages increase in industries close to local universities pre-existing strengths in innovation. Further studies by Moretti (2004) and Glaeser and Saiz (2004) examine the influence of local universities on economic growth and find an empirical relation between education and local success. Yet, this is most closely associated with positive spillover effects that are generated by clusters represent a general feature of the economic landscape **?**.

Marshall (1920) was the first who wrote about clusters and identified three advantages that occur in agglomeration economies: knowledge spillover, skilled labor pool, development of support industries and shared resource input. Porter (1990) built on Marshalls clustering theory by using empirical evidence to analyze how the localized benefits that Marshall introduced actually drive firms to agglomerate. He found that "enduring competitive advantages in a global economy lie increasingly in local things knowledge, relationships, motivation that distant rivals cannot match." Ellison and Glaeser (1997) develop a metric that captures the relation between the spatial concentration of an industry and the general population. Their findings show that 446 out of 459 manufacturing industries had a higher spatial concentration than the general population. However, Ellison and Glaeser (1997) state that this clustering "can either represent spillover across firms or an uneven distribution of productive factors across space." Chatterji, Glaeser and Kerr (2013) find that some key aspects of entrepreneurship and innovation have even a higher spatial concentration than general industry. This is especially the case for VC-backed investments; in 2011 40% of total VC-backed funding can be found in Silicon Valley and 10% in Boston and New York. This is true although these areas only account for 11% of the US population. Additionally, Chatterji, Glaeser and Kerr (2013) show that patenting is spatially concentrated during the period 1990-2005. Further empirical evidence on the spatial concentration of patenting in the US was done by (Kerr and Kominers 2010), (Carlino, Chatterjee and Hunt 2007) and (Murata et al. 2014).

C. Accelerator Program Impacts

Previously, we have discussed the urban context necessary for invention and innovation, but to genuinely intervene to catalyze growth, accelerator programs are increasingly being developed. Startups are exposed to a high risk of failure and limited growth as these young companies have not sufficient resources for long-term survival, have underdeveloped operational and managerial skills and lack

legitimacy with customers, employees and other key stakeholders (Gavetti and Rivkin 2007, Levinthal 1997, Siggelkow 2001). Some ventures may overcome these issues through the knowledge and networks of their founders (Dencker, Gruber and Shah 2009, Eesley and Roberts 2012, Eisenhardt and Schoonhoven 1990), but many founders do not have the knowledge or the networks. Importantly, there is a literature growing that works to understand the impact of accelerator programs on startup firm performance.

Hallen, Bingham and Cohen (2014) examine the impact of accelerator programs on the start-up companies. They compare the start-ups that received a treatment by an accelerator with start-ups that did not. To construct their sample they gathered information on 328 ventures, with 164 ventures participating in eight different accelerator programs and 164 non-accelerated matches. The results show that accelerator programs accelerate the time for reaching key milestones, such as raising VC funding, being acquired or increasing web traffic. However, this effect is observed unevenly across accelerators and no statistically significant overall effect was found.

Another study that examined the performance of accelerator and non-accelerator ventures was done by Smith and Hannigan (2015). They compare ventures that were accepted into and received financing from two of the leading accelerators, TechStars and Y Combinator, to similar ventures that did not participate in these programs but instead raised angel funding. The sample covers 619 companies, 389 accelerator-backed startups and 230 angel group backed startups, over the 2005 to 2011 period. Their findings show that accelerator-ventures achieve exit (acquisition or failure) faster than their matched, angel-funded counterparts. The accelerator start-ups had higher acquisition rates and higher failure rates than the angel-funded start-ups.

Fehder and Hochberg (2014) examine the local impacts of accelerator programs. More specifically, they assess whether accelerators have an effect on the level and availability of VC funding in their region. The initial sample consists of 59

accelerators that were founded in 38 metropolitan statistical areas (MSAs) in the US between 2005 and 2012. Their results show that MSAs where an accelerator is established subsequently have more seed and early-stage entrepreneurial financing activity. Furthermore, this activity appears not to be restricted to accelerated startups themselves, as much of the funding events involves investments made in companies that were not part of an accelerator program.

Barnes (2016) examines whether the increasing cohort-sizes have resulted in longer or shorter timeframes for companies to achieve an exit via acquisition or initial public offering. To answer that question Y Combinator is used as a single case study in which 991 YC companies for the time period 2005 to 2016 are analyzed. The results show that the time until an exit for Y Combinator startups is reducing even while the cohort sizes has been increased (the first cohort in 2005 consisted of 10 companies; over the last decade it has grown launching 200 companies a year). No statistically significant correlation is found between the cohort size and the initial money raised during the program.

Our contribution to the existing literature is that we analyze a larger body of accelerator programs namely xx accelerators within the US. Secondly we take into consideration the different stages of the financial lifecycle. Thirdly we add the

II. Start-up and Accelerator Data Characteristics

Data that identifies early, middle and later stage investors across capital sources for private equity firms is a challenge. Moreover, being able to identify by one source the early stage treatments of firms by accelerators or incubators was possible through the use of CB Insights data. CB Insights is a global data analytics firm leveraging machine learning algorithms that scans news media, firm and investor websites and parses that data into private equity firm identification, capital deal flows, news, job postings and social media impact.[3] We extract firm data

[3]The CB Insights houses data on over 118,000 firms and 191,861 deal transactions worth $1.8 tln. Their collection strategy is based on machine learning algorithms that crawl through media sources to identify private equity firms, their news and financing events. For more details on their data col-

from the CB Insights database - collecting data on some 89,000 private equity firms over the 2005 to 2015 period. We then identify within this sample every firm that has undergone an accelerator program per CB Insights identification. To eliminate erroneous flagging of accelerator programs we cross reference this firm list with the MIT Real Estate Innovation Lab's database of accelerator programs. We then pair this urban areas between the treatment and control groups, remove unicorns from the sample and identify any areas of missing data. After this identification procedure, just over 16,720 firms, approximately 38,865 funding events in 145 urban areas are identified. When broken down by accelerator experience 3,569 firms and 7,628 funding events are identified as going through an accelerator program and 13,151 firms and 31,237 funding events are for the control sample. Lastly, we verify for each non-accelerated firm that it did not go through an accelerator program by cross-referencing financing sources against our accelerator program database.

To parse our data, we are examining the impact of accelerators upon private equity firm performance in three ways. First, we are exploring the variation between accelerator treated and non-treated firms across deal frequency, quantity of investors per round, the cumulative number of investors for a firm, the total previous experience of those investors (as measured by frequency of investor experiences in the CB Insights database), cumulative funding that the firm has received as well as the amount of funding for each individual deal. Lastly, we are able to breakdown the distinction across equity and debt funding vehicles, as well as extent of funding within the debt or equity funding. Second, we examine the variation across accelerated firm experiences. We identified six patterns for firms that went through an accelerator treatment, which breaks down around the timing of funding before or after the accelerator experience and(or) the number of accelerator experiences. Third, we look at cross-sectional variation across accelerator programs. Using the Real Estate Innovation Lab's database of 512

lection strategy please see: https://www.cbinsights.com/research/team-blog/private-company-financing-data-sources-cruncher/.

unique US accelerator programs, we are able to pair, 56 number of accelerators that includes data on the amount of capital invested, the equity stake taken, the time spent in the program, the number of firms in the class as well as services provided by the accelerators that are publicly stated.[4]

A. Accelerator Treated and Control Firms

Table 1 documents the differences between accelerator treated and non-treated firms over the 2005 to 2015 period. Variation between the sample occurs with the number of deals, total investor experience, cumulative total funding and the amount of funding. The number of deals is just 30 percent more on average for accelerated firms. The number of round investors is about 62 percent less and the cumulative total of round investors is about 2.25 investors less. In contrast, the total investor experience (as measured by the cumulative number of deals accumulated in the CB Insights database), is approximately 69 deals more in experience for the accelerated sample. However, cumulative funding is almost $19.4 mln less for accelerated firms. Lastly, the amount of each deal is almost on average $7.73 mln less for accelerator treated firms.

Table 2 shows what type of funding is received by the accelerated treated and control firms per deal. Grant funding is raised by 5.1% of control firms and just 3.2% of accelerated firms. In 64.4% of the deals accelerated firms raise seed or angel funding while only 17.5% of the control firms receive that early stage financing. The next stage in the funding life-cycle of start-ups is "Series A", which is raised by 21.2% of the control firms and 7.9% of the accelerated firms. To finance their growth strategy Series B, Series C, and Series D is raised by 14.3%, 8.5%, 4.4% and 3.0% of the control firms whereas fewer accelerated firms get to that later stage financing rounds (2.8%,0.5%, 0.3% and 0.3% respectively). The funding type "Exited represents "IPO" (Initial Public Offering), "M&A" (Merg-

[4]We flag firms that have had an exit experience within the database, and set the exit funding amount equal to zero. We do this because exit funding is equal to firm valuation at the time of exit and we are tracking capital accumulation as our dependent variable.

ers and Acquisitions), Partnership, Portfolio Merger, Spinoff-Spinout, Secondary Market, PIPE (Private Investment in Public Equity) and Death represent ways to exit a firm. Approximately, 4.7% of accelerated companies had an exit as opposed to 9.3% control companies. The distribution of the received funding types implies that the accelerated companies are at earlier stages of the start-up growth life-cycle than the control firms. This finding is in line with the common strategy followed by start-ups and accelerators which supports the application or acceptance of early stage firms.

Table 1—: Differences Between Control and Accelerated Samples

	(1) Control	(2) Accelerated Firm	(3) (1) vs. (2)	(4) p-value
No of Deals	3.90	3.59	0.30	0.00
	(0.01)	(0.03)	(0.03)	
No of Round Investors	2.63	2.01	0.62	0.00
	(0.01)	(0.03)	(0.03)	
Cumulative No of Investors	6.70	4.45	2.25	0.00
	(0.04)	(0.06)	(0.09)	
Total Investor Experience	198.73	267.33	-68.60	0.00
	(1.77)	(4.44)	(4.21)	
Cummulative Funding	22.36	2.96	19.40	0.00
	(0.31)	(0.11)	(0.63)	
Current Deal (millions)	9.22	1.49	7.73	0.00
	(0.14)	(0.06)	(0.30)	
N	31237	7628	38865	
Proportion	0.80	0.20		

Standard errors in parentheses.

B. Timing of Accelerator Treatment

This section looks at the variation within the accelerator treated firms by their variation in accelerator treatment frequency, accelerator timing and (pre-)follow-on-funding timing. Within this stage we have identified six patterns of accelerator treated firms. Table 3 shows the accelerated firms which were grouped according to these classifications and their firm experience measured as Number of Deals, Number of Round Investors, Cum. Investors, Total Investor Experience, Cum. Funding and Funding Amount. The companies that were accelerated but received funding before and after the time of the accelerator program had on average

Table 2—: Funding Types

	Control Firm		*Accelerated Firm*		*Total*	
Simplified Round	No.	%	No.	%	No.	%
Grant	1607	5.1	246	3.2	1853	4.8
Convertible Note	413	1.3	239	3.1	652	1.7
Seed / Angel	5,473	17.5	4,912	64.4	10,385	26.7
Series A	6,631	21.2	603	7.9	7,234	18.6
Series B	4,454	14.3	214	2.8	4,668	12.0
Series C	2,648	8.5	75	1.0	2,723	7.0
Series D	1,365	4.4	38	0.5	1,403	3.6
Series E+	948	3.0	21	0.3	969	2.5
Other Venture Capital	1,773	5.7	23	0.3	1,796	4.6
Private Equity	368	1.2	3	0.0	371	1.0
Growth Equity	299	1.0	7	0.1	306	0.8
Debt	1,633	5.2	310	4.1	1,943	5.0
Exited	2,894	9.3	357	4.7	3,251	8.4
Other	731	2.3	580	7.6	1,311	3.4
Total	31,237	100.0	7,628	100.0	38,865	100.0

5.6 deals where 2.2 investors were involved in each deal on average, with an average 6.6 investors with a total investor experience of 317 deals and received a total funding of $6 mln on average. The firm experience of the companies that were accelerated but either received only funding before or after the acceleration treatment is lower. The lowest numbers are yielded by the companies that were accelerated once or multiple times but which never raised any type of funding. In contrast the companies that were accelerated multiple times and raised funding after the accelerator had the following firm experience: 5.2 deals, 2.3 investors per deal, 6.3 investors overall, 284.3 deals in total investor experience and $4.7 mln total funding.

C. Accelerator Amenities

This section looks at the variation across accelerator treated firms and the differences in accelerator treatments themselves. Table 4 shows that an accelerator

Table 3—: Accelerated Firm Experience

FirmClassification	Mean	StdDev	Min	Max
Accelerated once: pre-funding only	3.41	2.46	2.00	15.00
Accelerated once: pre- and follow-on	5.61	2.84	3.00	18.00
Accelerated once: follow-on only	3.55	1.59	2.00	9.00
Accelerate once: no funding	1.13	0.39	1.00	4.00
Accelerate multiple: no funding	2.40	0.68	2.00	5.00
Accelerate multiple: pre- or follow-on	5.20	2.08	2.00	14.00
Total	3.59	2.38	1.00	18.00

(a) Number of Deals

FirmClassification	Mean	StdDev	Min	Max
Accelerated once: pre-funding only	1.79	2.41	1.00	37.00
Accelerated once: pre- and follow-on	2.26	2.75	1.00	37.00
Accelerated once: follow-on only	2.39	2.97	1.00	38.00
Accelerate once: no funding	1.02	0.26	1.00	7.00
Accelerate multiple: no funding	1.21	1.00	1.00	12.00
Accelerate multiple: pre- or follow-on	2.36	2.86	1.00	22.00
Total	2.01	2.57	1.00	38.00

(b) Number of Round Investors

FirmClassification	Mean	StdDev	Min	Max
Accelerated once: pre-funding only	4.04	4.58	1.00	38.00
Accelerated once: pre- and follow-on	6.67	6.58	1.00	42.00
Accelerated once: follow-on only	4.86	5.80	1.00	58.00
Accelerate once: no funding	1.02	0.26	1.00	7.00
Accelerate multiple: no funding	1.87	1.28	1.00	14.00
Accelerate multiple: pre- or follow-on	6.35	6.44	1.00	45.00
Total	4.45	5.63	1.00	58.00

(c) Total Investors

FirmClassification	Mean	StdDev	Min	Max
Accelerated once: pre-funding only	287.47	388.43	1.00	2073.00
Accelerated once: pre- and follow-on	317.37	416.51	1.00	2407.00
Accelerated once: follow-on only	319.05	426.41	1.00	2724.00
Accelerate once: no funding	128.59	212.35	1.00	1795.00
Accelerate multiple: no funding	141.23	244.60	1.00	1552.00
Accelerate multiple: pre- or follow-on	284.32	407.15	1.00	2996.00
Total	267.33	387.79	1.00	2996.00

(d) Investor Experience

FirmClassification	Mean	StdDev	Min	Max
Accelerated once: pre-funding only	2.76	8.01	0.01	78.00
Accelerated once: pre- and follow-on	6.08	15.57	0.01	310.09
Accelerated once: follow-on only	2.75	7.89	0.01	132.50
Accelerate once: no funding	0.09	0.28	0.01	5.45
Accelerate multiple: no funding	0.20	0.58	0.01	7.02
Accelerate multiple: pre- or follow-on	4.76	13.72	0.01	123.78
Total	2.96	9.97	0.01	310.09

(e) Cumulative Firm Funding (millions)

hosts on average 34.63 firms per class. The minimum number of firms per class is 5 while the maximum is 85. The treatment of the accelerator is provided to 1.65 classes or 63.06 firms per year on average. The length of the accelerator program meaning the time a class spends within the accelerator is 3.46 months on average. The minimum length of the accelerator program observed in this study is 2 months and the maximum time a class spent within an accelerator was 12 months. The capital that the accelerator invested is $90,877 per firm on average. The amount invested into companies lies between 0 and $200k. The equity which is taken by the accelerator for the investment made is on average 6% while the maximum lies at a 10% equity stake. Lastly, firms offer co-working space in 47 percent of treated firms and in other instances 11 percent of firms receive shared office space.

The MIT Real Estate Innovation Lab has compiled a dataset of accelerator program and locational characteristics. Accelerator programs are commonly defined by four characteristics and the amenities provided to their "classes" for the duration of their program. Variation in the programs are linked to their general accelerator firm portfolio characteristics, which is the accelerator programs duration, capital amount investment, equity provision in return for the investment and number of firms admitted per class accepted class. Moreover, there is variation in the amenities provided to the firms in three core areas, educational assistance, mentorship, physical space and free services provided. In this way, there is variation in what the programs provide the firms that enter and graduate from their programs. Lastly, there is a differential on what happens to the relationship between the accelerator and the firm after it has left the program. Namely, how does the firm continue to engage in the accelerator program. In this way, it is primarily devoted to maintaining contact or in the form of follow-on-funding with the firm through an alternate fund.

In addition, to cross-sectional variation in accelerator programs. There is also regional differences in the programs. Regional variation is significant in three core

Table 4—: Accelerator Characteristics

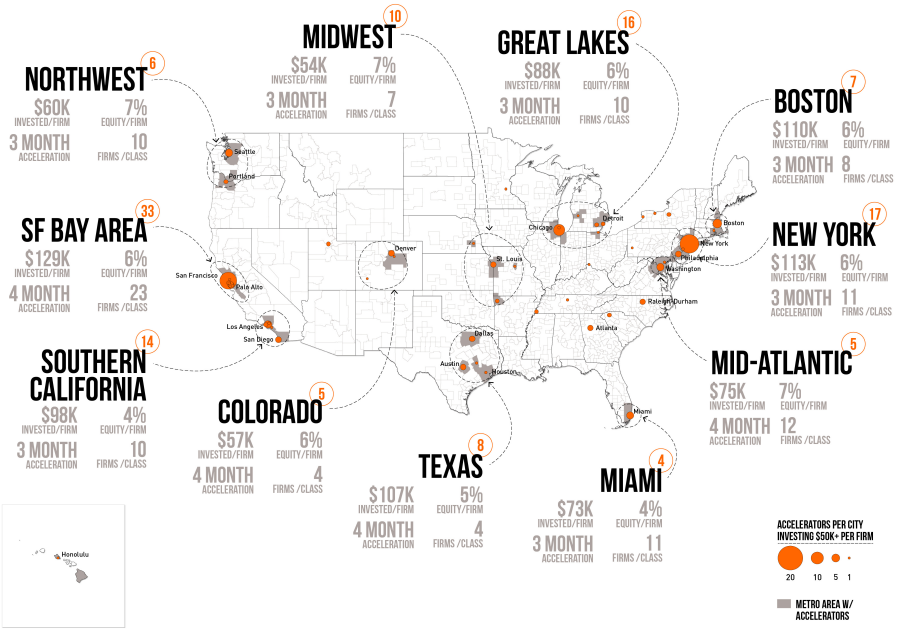
Variable	Mean	Std. Dev.	Min.	Max.	N
Firms per Class (Max)	34.63	33.30	5	85	2322
Classes Per Year (max.)	1.65	0.69	1	4	2322
Total Firms per Year	63.06	68.29	5	170	2322
Accelerator Length (Months)	3.46	1.20	2	12	2322
Capital Invested per Firm (US$)	90,877	42,157	0	200000	2322
Equity (In percent)	0.06	0.01	0	0.1	2322
Demo Day	0.95	0.22	0	1	2322
Co-working Space	0.47	0.50	0	1	2322
Shared Office Space	0.11	0.32	0	1	2322
Discount on Office Space	0.02	0.14	0	1	2322
Lab Space	0.01	0.09	0	1	2322

areas, the capital amount invested, the equity provision in return for investment and the number of firms per class. The San Francisco Bay Area stands out as an accelerator market, with 33 private sector accelerators, with $129K in capital invested per firm, with an equity stake of six percent in exchange, and an average of 23 firms per class. This area stands out due to two particular programs, Y Combinator, which is the largest accelerator in the US, followed only by Techstars for their sheer number of accelerated firms. The Midwest has approximately, 10 accelerators, gives $54k per firm in exchange for seven percent of equity and has importantly some of the fewest numbers of firms per class. This is similar to Colorado and Texas.

III. Methodology

Unfortunately, we do not observe a natural experiment that can identify firms that went through accelerator experiences and those that had the real propensity to do so but did not seek or were not accepted to be in one. Thus our identification strategy relies on documenting observable differences between the accelerator treated and non-treated firms. However, the propensity for seeking and being accepted for treatment is endogenous. Thus, to ensure comparability

Figure 1. : Geographic Variation in Accelerators



Note: Figure 1 depicts the geographic distribution of accelerator programs across the United States. In addition, it documents regional variation in the average investment per firm, equity stake, number of firms per cohort and duration of the accelerator programs.

between accelerator treated firms and the control firms, we employ the following identification strategies.Second, we understand that the seeking of being in an accelerator or acceptance for being in an accelerator are endogenous.

A. Identifying Entrepreneurial Acceleration

First, we create a matched sample on the basis of urban area and detailed industry classification.[5] As described in Section II, we first collect a sample of accelerator treated firms that have been identified by CBInsights as having gone through an accelerator program. Then we pair control firms by having firms in the same urban areas and at least 5 firms in the same detailed industry classification. This sampling procedure ensures that we measure firms propensity to access capital regionally and within the same detailed industrial classification.

Conditional upon such observable characteristics, we thus eliminate differences between regional and sector access to accelerator programs. We also include urban area fixed effects to attribute geographical differences in construction costs as well as fixed effects for building use.

To operationalize our estimation strategy we first estimate our model utilizing our dataset as a pooled cross section. In this model, cumulative funding for private equity firms are explained by their funding characteristics as detailed in the equation below:

$$\log CF_{i,t} = \alpha + \phi A_i + \theta X_{i,t} + \delta T_i + \lambda R_i + \epsilon_i, \tag{1}$$

where CF is the logged cumulative funding for firm i in period t. Our principal variable of interest is a binary variable for accelerator treatment A_i, which equals one if firm i has undergone an accelerator program, and zero otherwise. X_i

[5]Urban Areas are defined per the US Census Bureau as geographical areas of densely developed territories encompassing residential, commercial and other non-residential urban land uses for areas with 50,000 or more people. Industry classification is defined as the three levels of sector, industry and sub-industry definitions provided by CBInsights.

captures factors contributing to the firms accumulation of funding as a vector of control variables. It includes the firm's number of deals, number of current round investors, the cumulative number of investors to date, the investors deal experience and also the current round of investment in period t. T_i is a vector of time dummies, with a value of one in the quarter a current deal event is happening for firm i and zero otherwise. R_i is a vector of urban-area fixed-effects and sector fixed-effects, representing the region and sector of capital formation for firm i. The estimated parameters are ϕ, θ, δ, and λ, α is a constant and ϵ_i is a vector of regression disturbances for firm i. Our estimation procedure for Equation (1) employs OLS corrected with firm clustered standard errors. However, this pooled-cross section approach is subject to omitted-variable bias, where we cannot control for unobserved firm characteristics.

In a second procedure, we view the accelerator treatment as a natural experiment, where the accelerator program is seen as an exogenous event that changes the cumulative funding environment of the accelerator treated firms and not those in the control group. Unfortunately, in a panel estimator where we want to absorb individual firm fixed-effects, we cannot observe treated effects, as the estimations will be dropped from the specification. Thus, to control for systematic differences between the accelerator treated and control group we are employing a fixed-effects panel estimator where we define a policy period for each accelerator treatment group. In this way, we re-define our treatment variable as an accelerator event period, where it is unity for when the firm i is in a time period subject to an accelerator experience and zero otherwise.

$$\log CF_{i,t} = \alpha + \beta E_{i,t} + \theta X_{i,t} + \delta T_{i,t} + F_i + \epsilon_{i,t}, \tag{2}$$

where CF_i is the logged cumulative funding for firm i in period t. Our new principal variable of interest is the policy event period defined as the accelerator

experience $E_{i,t}$, which equals one if firm i is in the accelerator program in period t, and zero otherwise. Similar to specification for Equation (1), X_i captures factors contributing to the firms accumulation of funding as a vector of control variables. It includes the firm's number of deals, number of current round investors, the cumulative number of investors to date, the investors deal experience and also the current round of investment in period t. T_i is a vector of time dummies to capture macro-economic conditions in the capital markets, with a value of one in the quarter a current deal event is happening for firm i and zero otherwise. F_i is a vector of firm dummies, that controls for individual firm fixed-effects that also absorbs urban area and industry fixed-effects like in the specification of Equation (1). The estimated parameters are β, θ, δ, α is a constant and $\epsilon_{i,t}$ is a vector of regression disturbances for firm i in period t. Our estimation procedure for Equation (2) employs OLS corrected with firm clustered standard errors. In this specification, the timing of an accelerator experience is taken into explcit consideration, but it does not take into account the endogenous seeking or acceptance of engaging in an accelerator experience.

B. Endogenous Seeking and Acceptance

In some cases, the accelerator experience may not be an exogenous event. First, the choice to apply and be accepted into an accelerator experience is conditional upon the availability of accelerators and accelerator class spots to the firm, as well as their existing financial capital and growth needs. Second, the current early stage capital market conditions within ones urban area may also impact a firm's choice for applying and being accepted into an accelerator program. In this case we move towards applying instrumental variable (IV) methods by applying 2SLS to our pooled-cross section and fixed-effects panel estimator.

To instrument for the endogenous choice of applying and being accepted into an accelerator, we estimate the propensity of being accepted into an accelerator program based on the number of accelerators in an urban area at the time of the

accelerator experience and the number of firms admitted per class in an urban area, which both give an indication of the acceptance rate. At the same time, the capital markets are competing with accelerator programs by offering experienced investors and other financial capital within in the urban area. We choose this level of aggregation as early stage investing is based on relationships and networking in a local environment. The logit model is specified as follows:

$$Pr(E_{i,t} = 1|Z_{i,t}) = E(E_{i,t}|Z_{i,t}) = a + bZ_{i,t} + \nu_{i,t} \tag{3}$$

where $E_{i,t}$ is the accelerator experience in any time period and Z includes urban area level variables such as the number of accelerators present at time t, the total number of firms accepted by the accelerators present at time t, the total capital invested by the accelerators and their average program length. We also include the urban area total investor experience and cumulative funding at time t. In the second stage of the 2SLS estimation, we instrument the accelerator experience variable $E_{i,t}$ in equation 2 by substituting in its place the predicted value $\widehat{Pr(E_{i,t})}$ obtained from the logit regression in 3. Specifically, the second stage regression can now be written as:

$$\log CF_{i,t} = \alpha + \gamma \widehat{Pr(E_{i,t})} + \theta X_{i,t} + \delta T_{i,t} + F_i + \epsilon_{i,t}, \tag{4}$$

C. Within Accelerator Experiences

In the third stage of our analysis, we examine within the accelerator sample the variation in accelerator experience timing by adding to the specified model a decomposition factor of when acceleration occurs in the funding cycle. In the final stage, we amend the specification to control for variation in the accelerator

experiences that each firm is treated with. The full specification is operationalized as follows:

$$\log CF_{i,t} = \alpha + \chi W_{i,t} + \lambda C_{i,t} + \theta X_{i,t} + \delta T_{i,t} + F_i + \epsilon_{i,t}. \tag{5}$$

Similar to specification for Equation (2) where CF_i is the logged cumulative funding for firm i in period t. X_i captures factors contributing to the firms accumulation of funding as a vector of control variables. It includes the firm's number of deals, number of current round investors, the cumulative number of investors to date, the investors deal experience and also the current round of investment in period t. T_i is a vector of time dummies to capture macro-economic conditions in the capital markets, with a value of one in the quarter a current deal event is happening for firm i and zero otherwise. W_i is a vector of accelerator timing experiences. C_i is a vector of accelerator characteristics, program length, capital invested in each firm, equity stake taken in the firm and the number of classes per year. T_i is a vector of time dummies, with a value of one in the quarter a current deal event is happening for firm i and zero otherwise. R_i is a vector of urban-area fixed-effects and sector fixed-effects, representing the region and sector of capital formation for firm i. The estimated parameters are χ, θ, δ, and λ, α is a constant and ϵ_i is a vector of regression disturbances for firm i. Our estimation procedure for Equation (5) employs OLS corrected with firm clustered standard errors.

IV. Estimation Results

A. Variation Between Accelerator Treated and Control Firms

The first four columns of Table 5 present the regression results for Models (1) to (4), relating the logarithm of cumulative funding per firm to the accelerator

treatment variable and a set of funding, investor and investment round characteristics with urban area and time-fixed effects. Results are clustered by firm. The model explains up to 71 percent of the variation in the log cumulative funding.

Column (1) reports the results for the most parsimonious model, where funding, investor and investment round characteristics, urban area and deal quarter fixed-effects are included in the model. The results of this analysis suggest that as the number of deals increases the cumulative funding amount increases by about 9.6 percent, when more round investors are included in the deal cumulative funding increases by 4.7 percent. As a firm increases its number of investors, the total cumulative funding increases by 8.1 percent. Lastly, as the total number of deals an investor has done increases, it increases cumulative funding by .06 percent. Relative to Convertible Notes, private equity investment leads to over 300 percent more in cumulative funding and as expected increases from Series A to E+ increase the total cumulative funding amount. In contrast, relative to Convertible Notes, Grant funding and Seed or Angel Funding decrease the total cumulative funding amount by 40 and 84 percent, respectively.

In Column (2), we introduce the accelerator treatment variable into the specification, where accelerated firms experience approximately 181 percent less cumulative funding then control firms over the sample period. The number of deals and round investors has a decreased impact on cumulative funding by 13 and 34 percent, respectively. Grant investments lead to less cumulative funding by 66 percent and seed/angel investments lead to 62 percent less funding.

In Column (3), we estimate a fixed-effect panel estimator as specified in Equation 2 on smaller sub-sample of our firms, where we are able to identify the accelerator experience for each firm over time. In this case, we find that the accelerator experience variable increases cumulative funding by 42 percent. However, at the point of means this cumulative funding increases drops to just 7.6 percent. In addition, the other funding variables change in under the panel specification. Namely, as the number of round investors increases cumulative funding

increases by 4.9 percent. Lastly, grant investments are no longer statistically significant, but seed/angel investments lead to just 4 percent less funding.

In Column (4), we estimate a 2SLS model to account for the endogenous choice of entering into an accelerator program as specified by Equation 4. The results of taking into account the endogenous choice of entering into an accelerator program suggest that cumulative funding increases by 94 percent, but at the point of means funding increases by just 16 percent. In this way, the probability of undergoing an accelerator experience yields similar results to specification in Column (3).

As a robustness check we investigate the role of the stage in funding upon this analysis. Accelerated firms have a small population as accelerator programs did not begin until 2005 and the number of firms that they accelerator treats per year is not numerous enough to go through all of the stages of development. Thus, we estimate our final specification as specified by Equation 4 after each stage of series funding, e.g., Series A, Series B, etc.. The results suggest that there is significant variation in those firms that have gone through an accelerator experience as the cumulative funding increases across the stages of private equity investment. In Column (1), we document that there is no statistically significantly different cumulative funding experience for firms that are in the Seed/Angel stage of investment. In addition, the financial variables are in line with the results from Table 5. In Column (2), there is a similar experience. However, in Columns (3) and (4), we find that the marginal increase in cumulative funding occurs for firms who have reached the Series B and Series C levels of funding.

B. Variation Within Accelerator Treated Experiences

The first two columns of Table 7 present the regression results for specification 5, relating the logarithm of cumulative funding per firm to a set of funding, investor and investment round characteristics with urban area and time-fixed effects. Results are clustered by firm. The model explains up to 76 percent of the variation in the log cumulative funding. Importantly, these specifications examine

Table 5—: Cumulative Funding for Accelerator Treated & Non-Treated Firms

(Dependent Variable: Logarithm of Cumulative Funding)

VARIABLES	(1) No Treatment	(2) Treatment	(3) Experience	(4) 2SLS
Accelerated Firm		-1.811***		
		[0.030]		
Accelerator Experience			0.423***	
			[0.046]	
Pr(AcceleratorExperience)				1.030***
				[0.233]
Number of Deals	0.096***	0.135***	-0.376***	-0.368***
	[0.007]	[0.006]	[0.034]	[0.027]
Number of Round Investors	0.047***	0.034***	0.049***	0.048***
	[0.004]	[0.003]	[0.003]	[0.004]
Cumulative No of Investors	0.081***	0.071***	0.079***	0.080***
	[0.003]	[0.003]	[0.003]	[0.004]
Total Investor Experience	0.01***	0.03***	0.03***	0.02***
	[0.003]	[0.003]	[0.002]	[0.003]
Investment Round(Relative to Grant Funding)				
Convertible Note	0.402***	0.661***	0.029	0.021
	[0.086]	[0.078]	[0.065]	[0.083]
Seed / Angel	-0.444***	0.043	-0.401***	-0.421***
	[0.056]	[0.054]	[0.055]	[0.071]
Series A	1.850***	1.736***	0.499***	0.493***
	[0.055]	[0.053]	[0.052]	[0.068]
Series B	2.441***	2.275***	0.783***	0.801***
	[0.056]	[0.055]	[0.052]	[0.067]
Series C	2.691***	2.504***	0.763***	0.775***
	[0.058]	[0.057]	[0.052]	[0.068]
Series D	2.699***	2.513***	0.588***	0.610***
	[0.064]	[0.063]	[0.057]	[0.072]
Series E+	2.592***	2.412***	0.255***	0.287***
	[0.076]	[0.074]	[0.065]	[0.081]
Other Venture Capital	1.894***	1.833***	0.329***	0.366***
	[0.067]	[0.066]	[0.057]	[0.073]
Private Equity	3.424***	3.177***	0.485***	0.444***
	[0.103]	[0.101]	[0.109]	[0.151]
Growth Equity	3.489***	3.231***	0.503***	0.472***
	[0.098]	[0.098]	[0.097]	[0.114]
Other	0.739***	1.152***	0.092	0.131*
	[0.083]	[0.077]	[0.061]	[0.078]
Debt	1.778***	1.761***	0.344***	0.381***
	[0.070]	[0.066]	[0.054]	[0.070]
Exited	1.966***	1.899***	0.118**	0.145**
	[0.063]	[0.060]	[0.052]	[0.068]
Constant	-1.038***	-0.924***	0.362**	0.410***
	[0.203]	[0.171]	[0.151]	[0.134]
Observations	38,865	38,865	38,865	29,714
R-squared	0.646	0.713	0.607	0.614
Adj R2	0.64	0.71	0.61	0.61
Number of Company Observations			16,720	12,633

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 6—: Cumulative Funding for Accelerator Treated & Non-Treated Firms

(Dependent Variable: Logarithm of Cumulative Funding)

VARIABLES	(1) Seed/Angel	(2) Series A	(3) Series B	(4) Series C
Pr(AcceleratorExperience)	-0.52	0.34	0.98***	0.95***
	[0.841]	[0.525]	[0.377]	[0.301]
Number of Deals	-0.28***	-0.59***	-0.61***	-0.65***
	[0.104]	[0.063]	[0.040]	[0.034]
Number of Round Investors	0.06***	0.06***	0.05***	0.05***
	[0.012]	[0.008]	[0.006]	[0.005]
Cumulative No of Investors	0.16***	0.13***	0.11***	0.10***
	[0.014]	[0.009]	[0.007]	[0.005]
Total Investor Experience	0.00***	0.00***	0.00***	0.00***
	[0.000]	[0.000]	[0.000]	[0.000]
Investment Round(Relative to Grant Funding)				
Convertible Note	0.24	0.32**	0.32**	0.33**
	[0.157]	[0.143]	[0.153]	[0.154]
Seed / Angel	0.21*	0.37***	0.48***	0.53***
	[0.114]	[0.108]	[0.117]	[0.118]
Series A	0.45***	1.11***	1.39***	1.56***
	[0.147]	[0.116]	[0.124]	[0.125]
Series B	0.79***	1.14***	1.56***	1.83***
	[0.262]	[0.192]	[0.132]	[0.132]
Series C	0.67***	0.80***	1.07***	1.71***
	[0.242]	[0.230]	[0.203]	[0.141]
Series D	-0.29	0.86***	1.44***	1.87***
	[0.625]	[0.187]	[0.187]	[0.300]
Series E+	0.78**	0.93***	1.07***	1.20***
	[0.340]	[0.269]	[0.250]	[0.257]
Other Venture Capital	0.23	0.36	0.48*	0.52*
	[0.324]	[0.287]	[0.284]	[0.289]
Growth Equity	0.96	1.34**	1.51***	1.61***
	[0.599]	[0.525]	[0.375]	[0.299]
Other Capital Forms	-0.02	0.02	0.05	0.07
	[0.149]	[0.141]	[0.150]	[0.153]
Debt	0.05	0.23*	0.30**	0.33**
	[0.146]	[0.134]	[0.140]	[0.144]
Exited	0.68**	0.91***	1.14***	1.21***
	[0.292]	[0.232]	[0.263]	[0.255]
Constant	-2.03**	-1.06**	-0.66***	-0.05
	[0.909]	[0.436]	[0.205]	[0.185]
Observations	8,477	14,196	17,912	20,073
R-squared	0.586	0.640	0.660	0.670
Number of Company Observations	5,806	9,349	10,246	10,612
Adj R2	0.58	0.64	0.66	0.67

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

the subset of accelerator treated firms over the 2005 to 2015 period.

In Column (1), we examine the impact of accelerator timing upon the cumulative funding of startup firms treated by accelerators. Relative to firms that accelerated multiple times, and received no pre- or follow-on funding, firms that accelerated once with pre-funding received 134 percent more in cumulative funding. In line with expectations, firms that accelerated once, but that did not receive follow-on funding had no statistically significantly differentiating cumulative funding events.

In Column (2), we asses the impact of accelerator program amenities, in this case the total number of firms that an accelerator program treats per year is correlated with .03 percent less cumulative funding. In addition, the more time accelerator programs treat firms, leads to 8.3 percent more in cumulative funding for every month extra in an accelerator. Capital investment is statistically significant, but economically negligible. Lastly, the equity stake taken be the accelerator program impacts cumulative funding negatively, where a one percent increase in an equity stake results in 104 percent decrease in cumulative funding for the average accelerator treated firm.

In Column (3), we asses the impact of accelerator space amenities, the presence of space amenities is a statistically significant factor for cumulative funding. Accelerator programs that provide co-working or shared office space for the duration of their program see firms with cumulative funding around 21 and 18 percent more, respectively. Moreover, accelerator programs that supply lab space for the firms accumulate approximately 110 percent more in funding. However, accelerator programs that only offer discounts to office space do not show a statistically or economically significant impact on cumulative funding. Lastly, accelerator programs that offer a demo day, where firms are able to show-case their end of program achievements to investors receive an average of 43 percent more in cumulative funding.

Table 7—: Variation Across Accelerator Timing and Amenities
(Dependent Variable: Logarithm of Cumulative Funding)

	(1)	(2)	(3)
VARIABLES	Timing	Program	Space Amenities
Number of Deals	0.19***	0.09***	0.09***
	[0.017]	[0.024]	[0.024]
Number of Round Investors	0.04***	0.08***	0.07***
	[0.011]	[0.026]	[0.026]
Cummulative No of Investors	0.14***	0.14***	0.14***
	[0.010]	[0.024]	[0.024]
Total Investor Experience	0.04***	0.07***	0.06***
	[0.005]	[0.014]	[0.014]
Investment Round(Relative to Grant Funding)			
Convertible Note	0.02	2.01***	1.81***
	[0.126]	[0.672]	[0.661]
Seed / Angel	-0.33***	1.63***	1.61***
	[0.089]	[0.619]	[0.608]
Series A	1.50***	3.02***	2.99***
	[0.104]	[0.673]	[0.662]
Series B	1.81***	3.32***	3.33***
	[0.137]	[0.811]	[0.810]
Series C	1.72***	3.74***	3.64***
	[0.194]	[1.017]	[1.029]
Series D	1.14***		
	[0.289]		
Series E+	0.36		
	[0.406]		
Other Venture Capital	1.31***	3.52***	3.77***
	[0.261]	[0.667]	[0.667]
Other Capital Forms	0.01	1.99***	2.04***
	[0.102]	[0.734]	[0.725]
Debt	0.07	1.54*	1.58*
	[0.114]	[0.916]	[0.891]
Private Equity	1.43		
	[1.028]		
Growth Equity	3.27***		
	[0.214]		
Exited	-0.10		
	[0.130]		

Accelerator Timing(Relative to Accelerated multiple: no funding)			
Accelerated once: pre-funding only	1.35***	1.41***	1.38***
	[0.121]	[0.152]	[0.149]
Accelerated once: pre- and follow-on	1.24***	1.23***	1.21***
	[0.112]	[0.151]	[0.150]
Accelerated once: follow-on only	0.62***	-0.01	-0.03
	[0.090]	[0.100]	[0.097]
Accelerate once: no funding	-0.03	-0.07	-0.07
	[0.086]	[0.095]	[0.092]
Accelerate multiple: pre- or follow-on	0.60***	0.33***	0.33***
	[0.107]	[0.125]	[0.123]
Program			
Total Firms Per Year		-0.03***	-0.01***
		[0.004]	[0.005]
Accelerator Length (Months)		0.08***	0.11***
		[0.024]	[0.026]
Capital Invested Per Firm		0.01***	0.01***
		[0.000]	[0.000]
Equity		-10.44***	-7.96***
		[2.484]	[2.787]
Space Amenities			
Coworking Space			0.21**
			[0.092]
Shared Office Space			0.18*
			[0.104]
Discount Office Space			-0.19
			[0.165]
Lab Space			1.10**
			[0.537]
Demo Day			0.43***
			[0.137]
Constant	-5.18***	-5.25***	-5.95***
	[0.660]	[0.853]	[0.853]
Observations	7,628	2,322	2,322
R-squared	0.706	0.765	0.768
Adj R2	0.69	0.72	0.73

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

V. Conclusion

The rise of accelerator programs offers a new unique set of urban amenities for entrepreneurial firms and their laborers. Principally, accelerators expand financial capital offerings for start-ups, but they also provide in many cases numerous other amenities like educational programs, physical space, networks, mentorship, capital financing, and community engagement. Ultimately, the programs' goals are to spur entrepreneurial development and garner financial success through an alignment of financial incentives, e.g., equity.

Results documented here suggest that accelerator programs have an economically significant impact on the cumulative funding of early stage start-ups, where our models explain up to 71 percent of the variation in cumulative funding for start-ups in general. However, we also find that the choice to engage in an accelerator program is an endogenous choice made by firms. In addition, the selection of firms by accelerator programs is also an endogenous choice. In this way, we employ a 2SLS strategy, to instrument for engaging in an accelerator experience and measuring both accelerator and control firm's propensity to pursue accelerator funding. Based on these findings we see that the contribution of accelerator experiences to cumulative funding is financially positive, increasing cumulative funding by 16 percent at the point of means, or by approximately $500K over the firm's life-cycle.

Furthermore, we have identified that the timing of entering an accelerator is important. Pre-funding via grants or other seed/angel investments are a signal to accelerator programs that other investors or capital providers have reviewed the business and deemed it of investment quality. We also measure the impact of follow-on funding. Follow-on funding does not harm firms, it is just estimated that the marginal effects for signaling pre-funding capital are the most important for cumulative funding investments.

Lastly, we also analyze data on accelerator amenities like the number of firms that are in an accelerator cohort, the length of the accelerator program, the fi-

nancial capital invested in each firm, the equity stake taken by the accelerator in exchange for their capital or programmatic contributions as well as the supply and type of physical space the accelerator program provides. Importantly, for accelerator programmed firms, the number of firms that you interact with per year decreases your cumulative funding, the length of the program and firm engagement activities increases cumulative funding, whilst the increased amounts in equity taken early on in a start-ups life decreases their overall cumulative funding. Furthermore, the impact of enabling a place for innovation to really happen, has a statistically and economically significant impact on cumulative funding, where these firms receive approximately 18 to 21 percent more in cumulative funding if given the early physical space to grow their businesses. These findings are important for accelerator program formation, as these programs are meant to be helpful to the lifetime cumulative funding of firms, but if they are taking more equity early on in the firm's formation, then these firms will receive lower funding overall. Moreover, if accelerator programs are offering these amenities to too many firms, then the overall cumulative funding of firm's also decreases, albeit in an economically insignificant way.

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