How Accelerators Promote Regional Entrepreneurship

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Executive Summary

Introduction

For most policy makers, the answer to economic success hinges on building and sustaining a regional environment that is conducive to healthy, sustainable job growth and feeds into a larger ecosystem (Glaeser et al., 2010). This study analyzes the economic impact of accelerators at the regional level. In order to analyze the regional impact of accelerators, we focus on outcomes that matter at the level of the regional economy.

This report brings to bear a rich and novel dataset that compares the impact of accelerators on key outcomes including follow-on investment, exit outcomes, and employment growth through new hires. The research leverages detailed regional effects in the data. The analysis is based on hand-collected data on the complete population of startups that were accepted into and received financing from 25 accelerator cohorts over the period 2005-2011 and a comparable sample of startups that instead receive their first round of formal outside equity finance from established angel groups over this period. Startups are matched on geographic footprint and industry representation over the same time period. Outcomes are tracked through 2016. The final sample consists of n=736 startups.

Taken together, the results suggest that whether a startup hails from the same or distant region plays a large role in the early development of startups. This effect is amplified for startups in accelerators relative to those with angel group funding along multiple dimensions. This impact is evident in reaching startup milestones (follow-on VC financing or acquisition) and in attaining growth metrics (amount of follow-on VC financing and number of employees hired).

Summary of Key Findings

In summary, key findings of this analysis include the following:

- Accelerators invest in startups from a larger geographic swath than do angel groups. Accelerators invest in startups that come from a greater distance than those receiving angel group investments. The share of startups from the same region is smaller for accelerators than for angel groups (difference of means: 0.11, $p<0.002$). In line with this, startups in accelerators come from a further geographic distance than those receiving angel group funding. The average distance for the accelerator sample is 738.5 miles, compared to 478.3 miles average distance between startups and angel groups (difference of means: 260.17 miles, $p<0.01$).
- Local and distant startups are impacted differently by accelerators and angel groups in their ability to reach key milestones (getting follow-on VC investment and acquisition) and growth metrics (amount of VC financing and number of employees hired).
- Impact of distance on reaching milestones: VC investment and acquisition
    - All else equal, the average marginal effect of being in the same region for startups going through an accelerator is a 24 percentage points greater likelihood of getting follow-on VC funding ($p<0.01$) than if the startup is from a different region. In contrast, the average marginal effect of being in same region is not statistically significant for startups with angel group funding.
    - Location in the same region has a greater impact on the likelihood of

acquisition for a startup in an accelerator than for a similar startup in an angel group. A startup in an accelerator in the same geographic region is 9 percentage points ($p<0.01$) more likely to be acquired than a similar startup in an angel group; the impact for a startup in an accelerator in a different region is statistically insignificant.

- Impact of distance on achieving growth metrics: amount of VC funding raised and number of employees
    - The average marginal effect of being in the same region on the amount of follow-on funding also is amplified for startups in accelerators. A startup in an accelerator in the same geographic region receives 33 percent greater follow-on funding ($p<0.01$) compared to a startup in a different region; the impact for a startup in an angel group in the same or different region is statistically insignificant.
    - On average, startups in accelerators and startups in angel groups *both* hire more employees when they are in the same region as the accelerator or angel group, respectively. For startups in accelerators, being in the same region translates into an average of 8.5 more employees than if it was in a different region, while startups with angel group backing hire an average of 9.5 more employees relative to being in a different region.
    - The average marginal effect of being in the *same* region is 34% more employees for startups in an accelerator relative to those in angel group ($p<0.01$), while the average marginal effect for startups in a *different* region is 62% more employees than a similar startup in an angel group in a

distant region. Put differently, the results suggest that accelerators might have the largest impact on hiring for startups from distant regions.

I. Introduction

The growth of entrepreneurial accelerators that promise to "accelerate" the entrepreneurial process has become a global phenomenon that attracts ever-increasing attention in the popular imagination and the policy arena (Carr, 2012; Dempwolf, Auer, & D'Ippolito, 2014; Porat, 2014). An expanding body of scholarly work points to accelerators as a growing and significant part of the entrepreneurial ecosystem (Fehder & Hochberg, 2014; Hallen, Bingham, & Cohen, 2015; Porat, 2014; Winston Smith & Hannigan, 2014; Yu, 2015). At the same time, although entrepreneurial accelerators represent an emerging paradigm in early stage entrepreneurship, our scholarly and practical understanding of the impact of these accelerators on broader economic outcomes is lacking.

This study analyzes the important question: *What is the economic impact of accelerators at the regional level?* The answer to this question is salient to the extent that they inform policymakers. Which regional economic indicators matter most to policy-makers? For most policy-makers, the answer hinges on building and sustaining a regional environment that is conducive to healthy, sustainable job growth and feeds into a larger ecosystem (Glaeser, Kerr, & Ponzetto, 2010). While many factors come into play, the end goal focuses on the net gain of "good" jobs and the ability to retain young, educated, skilled workers (Chatterji, Glaeser, & Kerr, 2014). This becomes even more of a truism in an economy that is increasingly driven by knowledge-intensive industries. Thus, in order to analyze the regional impact of accelerators, we need to focus on outcomes that matter at the level of the regional economy.

To this end, this report offers a rich and novel dataset that compares the impact of

accelerators on key outcomes including follow-on investment, exit outcomes, and employment growth through new hires. The research leverages detailed regional effects in the data. These rich details are collected at the level of the startup, each member of the founding team, and subsequent hires. Importantly, the geographic distribution of the accelerators and the angel groups are regionally diverse, covering the entire United States. The data also includes the geographic information on founders and subsequent hires.

This report focuses on carefully analyzing prototypical accelerators—i.e., the longest running and most successful programs in the private sector-- and their ongoing impact on regional measures of entrepreneurship, with the goal of providing actionable models and insights that can be adapted and reproduced across a wide array of programs. These private sector programs provide a blueprint and serve as a model for other accelerators, including other private sector programs and nascent government sponsored accelerators. By analyzing these well-established and reproducible programs using novel data and careful econometric analysis this report provides insight and guidance for policymakers intending to understand the potential impact of well-run and established models of top accelerator programs.

The analysis is based on hand-collected data on the complete population of startups that were accepted into and received financing from the two longest running accelerators in the U.S. over the period 2005-2011 and a comparable sample of startups that instead receive their first round of formal outside equity finance from major angel groups over this period. Outcomes are tracked through 2016. The final sample consists of n=736 startups. The accelerator sample is drawn from the two archetypical accelerators, Y Combinator, founded in 2005, and Techstars, founded in 2006 (Geron, 2012; Gruber, 2011; Lennon, 2013). The comparable sample of startups that instead received their first round of outside equity finance from angel groups is

matched on geographic footprint and industry representation to those included in accelerator cohorts over the same time period.

II. Literature Review

What are Entrepreneurial Accelerators and How are They Distinct?

"Entrepreneurial accelerators" are formal programs that are focused explicitly on accelerating the process of launching a new venture (startup) at a very early stage. The growth of entrepreneurial accelerators that promise to "accelerate" the entrepreneurial process has become a global phenomenon that attracts ever-increasing attention in the popular imagination and the policy arena (Carr, 2012; Dempwolf et al., 2014; Porat, 2014). An increasing body of scholarly work points to accelerators as a growing and significant part of the entrepreneurial ecosystem (Cohen & Hochberg, 2014; Winston Smith & Hannigan, 2015).

The landscape of entrepreneurial accelerators is growing rapidly. To some extent, the very success of the "top" accelerators has led to many follow-on programs (Hoque, 2016). In a sense, entrepreneurs encounter an "accelerator marketplace" that can encompass a variety of organizations that might label themselves accelerators but vary greatly in quality and practice. The accelerator marketplace has grown to include hundreds of programs that claim to be accelerators (Clarysse, Wright, & Van Hove, 2015; Cohen & Hochberg, 2014; Miller & Bound, 2011; Solomon, 2015). Pointing to the growing appeal of the idea of "acceleration" a number of websites, such as FS6, AngelList, etc., serve as aggregators of accelerator programs. However, these sites list myriad types of startup assistance programs that are not accelerators under the rubric of "accelerators."

For example, many of these programs are incubators, co-working spaces, or very short duration (e.g., 3 days) programs that do not truly fit the paradigm of accelerators. As well, many

of these programs may be startups themselves, with little track record of helping founders actually launch their ventures (Hoque, 2016). The website http://www.seed-db.com/accelerators, which tracks accelerators worldwide, lists 225 accelerators worldwide; however, only 22 of these have had exits, and 7 of these were no longer in existence by 2016, leaving a total of 15 accelerators worldwide with positive exits since their inception (Seed-DB, 2016).

In general, accelerators are characterized by several distinct features that make them a novel organizational form. These distinguishing features include: formal application and selection mechanisms for entry; pre-determined cohorts with a fixed length of time (typically 3-4 months); and a formal ending point typically marked by a "Demo Day" event in which startups in a given cohort pitch to investors (Clarysse et al., 2015; Cohen & Hochberg, 2014). Most accelerators also take a small equity stake in the startup.

In summary, the following characteristics distinguish entrepreneurial accelerators from other types of startup assistance programs, e.g., incubators, Small Business Development Centers, etc., and from other types of investors, e.g. angel investors and seed funds:

- Formal application and selection mechanism
- Intensive, structured development program, with a pre-determined cohort, fixed length of time (typically 3-4 months), and active mentoring
- Provision of financial capital and related services, typically in exchange for a small equity stake in the startup
- Formal end of cohort period, typically marked by a "Demo Day" event in which startups in each cohort pitch to investors

Accelerators are distinct from other types of startup assistance programs (e.g., incubators, Small Business Development Centers, etc.) in important ways. Extensive literature has focused on technology incubators (Amezcua, Grimes, Bradley, & Wiklund, 2013; Colombo & Delmastro, 2002; Cooper, 1985; Phan, Siegel, & Wright, 2005; Rothaermel & Thursby, 2005a, b). In common with accelerators, incubators also bring together elements of technology, capital, know-how, and talent to help accelerate the commercialization of a new innovation, and by extension, the growth of a new firm (Smilor & Gill Jr., 1986). However, empirical settings include universities (Amezcua et al., 2013; Mian, 1996), business parks (Colombo & Delmastro, 2002), or business advisory services (Cumming & Fischer, 2010), sometimes with unclear results. In particular, university incubators and their role in technology transfer have been extensively studied (Mian, 1996; Rothaermel & Thursby, 2005b). Importantly, however, incubators do not typically have a set period of time after which firms must "graduate", leading to many firms that do not truly launch (Rothaermel & Thursby, 2005a). Likewise, traditional incubators do not share other key features of accelerators, such as equity investment and cohorts (Dee, Gill, Weinberg, & McTavish, 2015).

Accelerators are also distinct from other types of early equity investors. As startups launch, their need for increasing amounts of financial capital typically expands from largely informal, inside sources of growth capital—e.g., founders, family, and friends—to increasingly formal providers of outside financing, e.g., angel investors and then venture capitalists as equity investors (Cassar, 2004; Robb & Robinson, 2014; Winston Smith, 2012).

Angel investors provide early, arm's length funding to startups (Freear, Sohl, & Wetzel, 1994; Freear & Wetzel, 1990; Goldfarb, Hoberg, Kirsch, & Triantis, 2009; Wetzel, 1983; Wong, Bhatia, & Freeman, 2009). Angel groups consist of high net worth individuals who co-invest in

early stage ventures (DeGennaro & Dwyer, 2013; Kerr, Lerner, & Schoar, 2014; Wiltbank & Boeker, 2007). Kerr et al. (2014) find that financing by top angel groups increases survival and growth relative to new firms that do not receive angel group financing. While angel groups share features in common with accelerators—such as formal selection criteria and varying degrees of mentoring—the time frame over which angel groups invest is much longer than the limited period of accelerators, and they do not include features such as cohorts and demo days. Furthermore, angel groups' incentives differ from accelerators (Winston Smith & Hannigan, 2015).

A sentinel feature of accelerators is the explicit design of cohorts. These short "boot camp" periods allow portfolio firms to interact extensively with other founders. The peer effects literature shows that spatial and social proximity to peers increase the likelihood of a given activity (Marmaros & Sacerdote, 2006; Sacerdote, 2001; Wright & Mischel, 1987). A growing literature suggests that such peer effects are particularly important in entrepreneurship, for example, in the decision to enter into entrepreneurship (Kacperczyk, 2013; Nanda & Sørensen, 2010) and the evaluation of the viability of entrepreneurial ideas (Lerner & Malmendier, 2013). Accelerator cohorts provide an intense experience that mimics the university experience, leading to cultural capital derived from social bonding (Bourdieu, 1986). In recent work, Winston Smith and Gasiorowski (2017) find evidence that peer effects in cohorts influence exit and financing outcomes.

Scholarly research on accelerators is growing. A focus thus far has been on the role of accelerators in impacting the growth and trajectory of new ventures that make it through accelerator programs (Porat, 2014; Winston Smith & Hannigan, 2014). Recent work has demonstrated that accelerators influence both the incidence and timing of entrepreneurial

outcomes. Founders going through accelerators *exit* more quickly through acquisition and through quitting than comparable angel-group backed founders (Winston Smith & Hannigan, 2015). They also receive venture capital financing more quickly in the short run, but take longer to get follow-on investment in the longer term (Winston Smith & Hannigan, 2015). Accelerators may also be a complement to other forms of entrepreneurial experience (Hallen et al., 2015). Overall, in terms of the scholarly literature, although entrepreneurial accelerators represent an emerging paradigm in early stage entrepreneurship, our understanding of the impact of these accelerators on broader economic outcomes is at a nascent stage.

Entrepreneurial Accelerators and The Regional Economy: Is There an Impact?

To date, several studies consider the relationship between accelerators and the regional economy. Fehder (2015) studies one accelerator, MassChallenge, and finds that entrepreneurs from regions with richer entrepreneurial ecosystems benefit the most from the program. Gonzalez-Uribe and Leatherbee (2015) examine an accelerator program sponsored by the Chilean government. They find that startups benefit from the mentoring provided in accelerators and that these benefits spread to the local region. Also studying Startup Chile, Mejia and Gopal (2015) find that mentorship increases the likelihood of raising financing and longer term survival.

A related literature review examines the relationship between startup assistance programs more broadly and the regional economy. In a study of Flemish startups, Clarysse, Wright, Bruneel, and Mahajan (2014) find evidence that knowledge ecosystems flourish more smoothly than business ecosystems, suggesting that policy needs to be directed explicitly towards developing a business ecosystem if that is the desired goal. On a cautionary note, Dee et al. (2015) suggest that an overabundance of assistance programs in a given region leads to

competitive pressures. While these studies pertain broadly to startup assistance programs, some of these lessons may be generalizable to the potential impact of entrepreneurial accelerators on the regional economy. Taken together the studies above suggest that broader economic benefits of accelerators might be expected to accrue disproportionately to the region in which the startup is located but might also have deleterious effects as competition for promising startups increases.

III. Empirical Methodology

Sample and Data

This report offers novel microdata that analyze the impact of accelerators on key outcomes including follow-on investment, exit outcomes, and employment growth through new hires through evaluation relative to a comparable "baseline" group of startups that instead receive their first outside equity from angel groups. Startups at similar stages, in similar industries and geographic locations face these alternative sources of formal outside equity finance in the form of accelerators or professional angel groups. Technology and investor blogs, question and answer forums, and investors themselves increasingly point to the viability of accelerators and angel groups as viable alternatives for outside financing.

This dataset incorporates a substantial data collection effort that draws on a combination of web-scraped and hand-collected data. For all of the data collection, I triangulate several sources to trace the trajectory of start-ups from inception. These data sources include *LinkedIn*, *Crunchbase,* and *CB Insights,* as well as extensive searching of technology blogs and other press articles. I measure startup inception in two ways, i.e., as the founding date or alternatively as the date of entry into the accelerator or angel group. In many cases, these dates coincide. The final

sample of accelerator and angel group backed startups consists of n=736 startups.[1] I describe these two groups (accelerator and angel group) below.

The sample of accelerator-backed startups consists of the full census of startups going through 25 cohorts of 2 established accelerator programs (Techstars and YCombinator) over the period 2005-2011. Startups are first identified through listing on the accelerator websites and then corroborated with the additional sources listed above. Outcomes for all the startups are tracked through the end of 2016. The final accelerator-backed sample includes 405 startups, 933 founders, and a combined total of over 15,000 hires beyond the founding team. These startups hail from diverse geographic locations and multiple industries. The industries are parsed into six areas: Music, Gaming, and Media; Social Media, Location, and Mobile Apps; Payment and Commerce; Web Business; Underlying Technology, and Other.

This research paper constructs a comparable sample of startups—i.e., a "baseline" control group relative to the accelerator sample—that are backed instead by professional angel groups. Including this baseline sample of angel group backed startups thus allows for comparison of the impact of accelerators in relation to a long established alternative. For entrepreneurs seeking seed-stage equity finance, applying to a top angel group would be the closest alternative to applying to a top accelerator (Kerr et al., 2014).

The angel groups are chosen based on similar levels of selectivity as the accelerators and are matched on geographic location and industries in which they invest. There is no comprehensive ranking of angel groups, thus we ranked the angel groups by the number of deals each made over time using ThomsonOne's *VentureXpert* database. The final angel group sample consists of startups in which the 19 most active professional angel groups invested over a similar

[1] For greater detail on the data see (Winston Smith & Gasiorowski, 2017)and Winston Smith and Hannigan (2015).

range of industries and geographic locations as the accelerator sample over this time period. This list is broadly consistent with angel groups featured in the literature as "top" groups (CBInsights, 2014a; Kerr et al., 2014). This data is augmented by searching angel group websites. As with the accelerator sample, the data is further supplemented with *Crunchbase*, *LinkedIn, CB Insights,* and technology blogs and press articles. The final angel group sample includes 331 angel-group backed startups over this period.

It is worth commenting on the choice of sample. As noted previously, the report focuses on carefully analyzing prototypical accelerators—i.e., the longest running and most successful programs in the private sector--with the goal of providing actionable models and insights that can be adapted and reproduced across a wide array of programs (e.g., other private sector accelerators and more nascent government sponsored accelerators). With this end in mind, the accelerator sample is drawn from the two archetypal accelerators, Y Combinator (founded in 2005) and Techstars (founded in 2006). Further, it is important to keep in mind that the sample covers 25 distinct cohorts over the period 2005-2011 while allowing for sufficient time to follow the outcomes of interest, which is feasible precisely because these programs are the longest running (since 2005) and thus include a sufficient volume of companies going through the program.

I focus my analytical lens on this sample of accelerators for several reasons. First, these accelerators represent the industry standard in a still emerging paradigm. As the longest established accelerators in the U.S. they have implemented organizational models that are well-documented and can be replicated by other accelerators. They also are consistently ranked as the top accelerators, allowing isolation of these effects across regions and in circumstances that represent the industry standard (Geron, 2012; Gruber, 2011; Lennon, 2013). Second, these

accelerators have been established for a long enough period to follow the longer-lasting economic impact in the region. Third, there is substantial regional variation in where these accelerators are located and in the regions from which the startups originate.

Regional Characteristics of the Sample

The regional distribution of the accelerator cohorts, angel groups and associated startups are evident in Figures 1-4. Figure 1 and Figure 2 show the geographic location of the accelerator cohorts and the associated startups in the sample, respectively. These figures show that startups come from a wide range of geographic locations to be in a specific accelerator cohort. Figures 3 and 4 show comparable mapping of the geographic location of the angel groups and associated startups, respectively. The greater geographic draw of the accelerators, relative to the angel groups, is evident in Figure 2 relative to Figure 4.

Several broad characterizations emerge from the statistics on the regional breakdown of the sample. First, the sample includes a regionally diverse sample of accelerators and angel groups and regionally diverse set of startups. The regional distribution of startups in both the accelerator backed and angel group backed samples are summarized in Table 1 (unweighted) and Table 2 (IPTW weighted). Second, as evident in Figure 2 and Figure 4, startups vary in the propensity to relocate for accelerators and angel groups. In the whole sample, approximately 67% of the startups come from the same region as the accelerator, and approximately 79% of the startups come from the same region as the angel group.

Figure 1. Accelerator Locations (By Cohort). Location of accelerator cohorts. Size of circle is proportional to number of startups in cohorts.

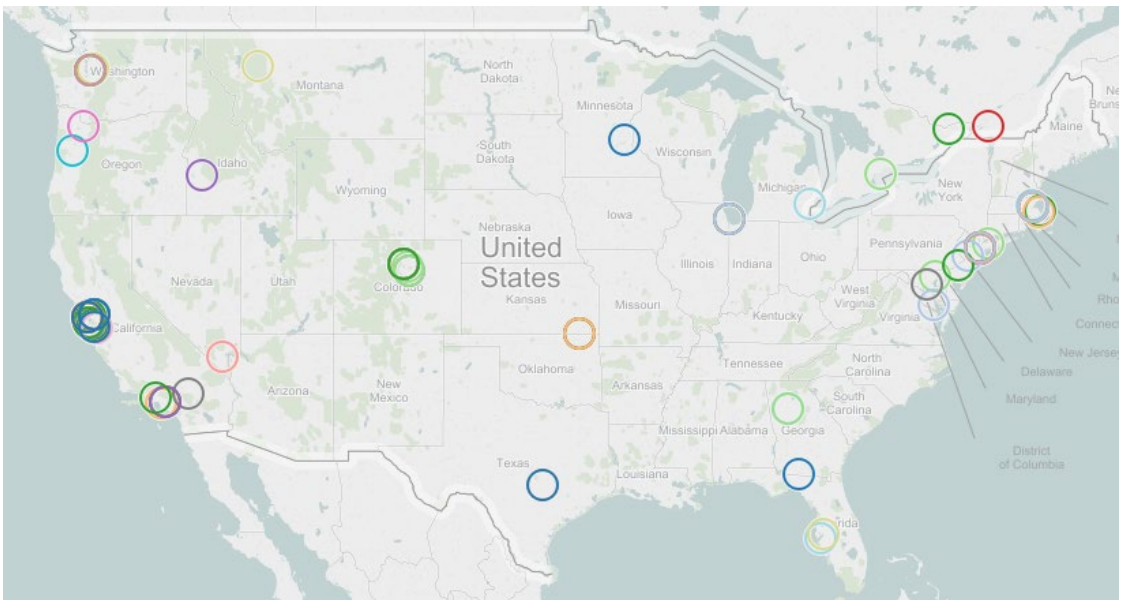

Figure 2. Startup Locations (By Cohort). Location of startup headquarters. Color of circle indicates accelerator cohort in which startup participated.

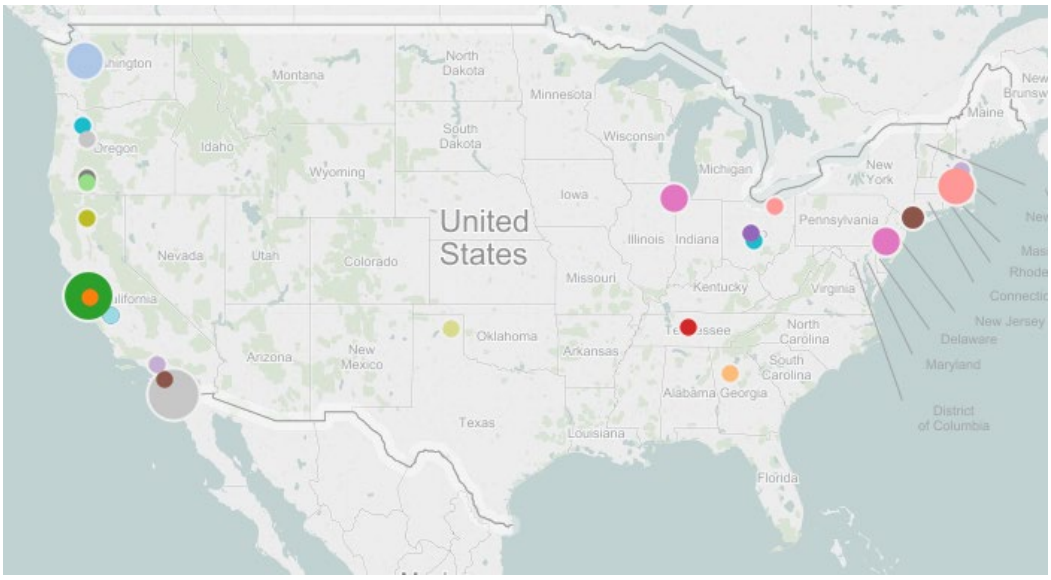

Figure 3. Angel Group Locations. Size of circle proportional to number of startups in angel group portfolio.

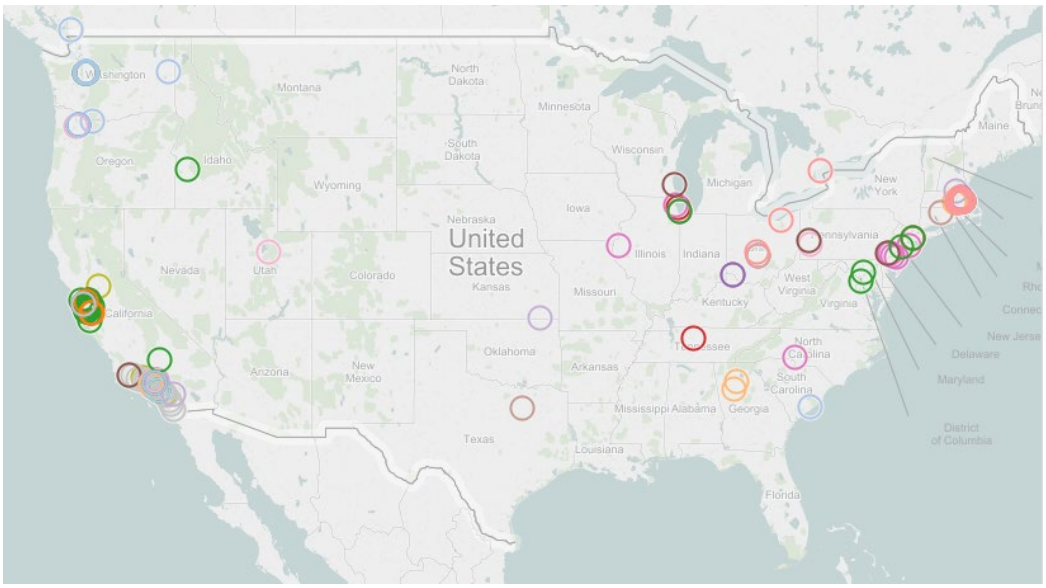

Figure 4. Startup Locations. Location of startup headquarters. Color of circle indicates angel group portfolio in which startup is included.

Dependent Variables

This analysis focuses on three main outcome variables that reflect key milestones for high growth potential new ventures. The first two reflect major startup milestones that define the trajectory of a new venture: receipt of follow-on funding from venture capital (VC) investors and exit through acquisition. The third outcome variable of interest is the number of jobs created by the newly launched startups, which captures part of the broader economic impact of these startups. Each of these dependent variables is described below.

Startup Milestones: Follow-on Funding and Acquisition

VCRound1. The first round of VC investment may be hardest for startups to receive (DeGennaro & Dwyer, 2013; Kerr et al., 2014) and thus this represents a distinct milestone for a startup. I focus on receipt of the first round of formal VC investment for this reason. *VCRound1* is a dummy variable equal to 1 when the startup receives the first round of formal VC investment and 0 otherwise.

Acquisition. A successful exit through acquisition allows entrepreneurs and investors to realize financial returns and thus represents an important outcome for a startup (Preston, 2004; Wiltbank & Boeker, 2007). *Acquisition* is a dummy variable equal to 1 when the startup exits through a viable acquisition offer and 0 otherwise.

Job Creation

Employment measures the number of employees beyond the initial founding team that have been hired by early 2016. This variable captures some of the broader impact of the new startup in terms of demonstrable economic measures.

Focal Independent Variables

The focal independent variables include dummy variables for accelerator or angel group

financing, startup locations, and proximity between the startup and either the accelerator or angel group. These are described below.

Accelerator is a dummy variable equal to 1 if the startup receives financing from an accelerator and equal to 0 if the startup received its initial financing from a top angel group. This is the focal independent variable beyond the regional variables above.

LocationMatch measures the proximity between the accelerator and the startup headquarters location as a dummy variable equal to 1 if the startup and the accelerator or angel group is in the same region. The literature on the geography of innovation suggests that the organization of firms within a region plays an important role in the output of that region (Saxenian, 1994).

StartupHQ are dummy variables for each of the startup headquarters locations. Startup locations are grouped into six regions: California, West (excluding California), Northeast, Southeast, Midwest, and Foreign.

LocSV and *LocBos* are dummy variables equal to 1 if the accelerator or angel group is in Silicon Valley or Boston, respectively. These variables are included to control for any specific "locational entrepreneurship premiums" that these entrepreneurial hotbeds may have (Guzman & Stern, 2015).

Control Variables

Several control variables capture additional factors at the founder and startup level that can be expected to influence timing of the various outcomes. Founder level controls include founder experience and size of the founding team. Startup level controls include age of the startup at the time of entry into the accelerator or angel group and the cohort size of the accelerator or portfolio size of the angel group.

Dummy variables for industry effects and year of entry are also included.

Matching Methodology

In order to account for potential self-selection into an accelerator or an angel group, I apply the inverse probability of treatment weights (IPTW) methodology to match to the observations in the accelerator and angel sample groups based on observable characteristics of each (Imbens, 2004). In this case, IPTW balances observations along observable dimensions that should influence the decision by the founders to enter an accelerator rather than an angel group. Observations without common observable characteristics are given zero weights (Wooldridge, 2007). Econometrically, IPTW consists of a two-step process with a first-stage logit predicting selection into the treatment group and the second stage incorporating these predictive weights to create a matched sample.

IPTW matching allows for causal inference based on matching observable characteristics in a "treated" and "untreated" or baseline sample (Hirano & Imbens, 2001; Imbens & Wooldridge, 2009; Robins, Hernán, & Brumback, 2000). In this report, the treated and control groups correspond to the accelerator and angel-group samples, respectively. The sample selection criteria explicitly match startups on key observable characteristics. Matching criteria include startup age, location, and industry, and the educational background of the founders. The rich granularity of this dataset allows for deep matching of the startups using startup and founder specific characteristics that may drive selection between these alternative sources of financing. The IPTW matching process results in 391 accelerator startups and 325 angel group startups for a total sample of n=716. Summary statistics for the full sample and the IPTW-weighted sample are given in Table 1 and Table 2, respectively.

Table 1. Summary Statistics-Accelerator and Angel Groups (No Weights)

	Accelerator				*Angel Group*			
	mean	sd	min	max	mean	sd	min	max
Outcomes								
Acquisition_Dum	0.199	0.400	0	1	0.121	0.326	0	1
Quit_Dum	0.224	0.418	0	1	0.057	0.233	0	1
Alive_Dum	0.457	0.499	0	1	0.384	0.487	0	1
GetVC_Dum	0.158	0.365	0	1	0.444	0.498	0	1
Total Funding ($M)	9.938	42.690	0	706	13.375	41.702	0	628
LInumemp	23.7	55.6	0	522	31.1	62.7	0	606
Startup Location Variables								
StartupHQCalifornia	0.533	0.500	0	1	0.462	0.499	0	1
StartupHQWest	0.166	0.372	0	1	0.142	0.350	0	1
StartupHQNortheast	0.209	0.407	0	1	0.236	0.425	0	1
StartupHQMidwest	0.023	0.150	0	1	0.109	0.312	0	1
StartupHQSouth	0.020	0.142	0	1	0.039	0.195	0	1
StartupHQForeign	0.046	0.210	0	1	0.009	0.095	0	1
Location Match	0.680	0.467	0	1	0.782	0.413	0	1
LocSV	0.602	0.490	0	1	0.299	0.459	0	1
LocBos	0.166	0.372	0	1	0.172	0.378	0	1
GeoDistance (miles)	738.5	1295.5	0	8033	478.3	1430.6	0	7955
Startup and Cohort Controls								
IndustryMediaMusicGaming	0.135	0.342	0	1	0.121	0.326	0	1
IndustrySocialLocationMobile	0.298	0.458	0	1	0.239	0.427	0	1
IndustryPaymentCommerce	0.184	0.388	0	1	0.142	0.350	0	1
IndustryWebBusiness	0.168	0.375	0	1	0.172	0.378	0	1
IndustryUnderlyingTech	0.161	0.368	0	1	0.196	0.398	0	1
IndustryOther	0.054	0.225	0	1	0.127	0.333	0	1
StartupAgeEnter_Yr	0.471	0.711	0	4	2.293	1.875	0	12
HaveFemale	0.056	0.230	0	1	0.006	0.078	0	1
Total Number of Founders	2.230	0.756	1	5	1.559	0.669	1	4
CohortCount	21.765	12.161	8	42	0.000	0.000	0	0
Observations	405				331			

** Summary statistics exclude 2 companies with valuations above $1Billion as of Jan. 2017*

Table 2. Summary Statistics-Accelerator and Angel Groups (IPTW weighted)

	Accelerator				Angel Group			
	mean	sd	min	max	mean	sd	min	max
Outcomes								
Acquisition_Dum	0.305	0.460	0	1	0.093	0.291	0	1
Quit_Dum	0.134	0.341	0	1	0.064	0.244	0	1
Alive_Dum	0.476	0.500	0	1	0.334	0.472	0	1
GetVC_Dum	0.310	0.463	0	1	0.509	0.500	0	1
Total Funding ($M)	5.900	29.668	0	706	12.346	35.503	0	628
LInumemp	21.9	43.2	0	522	29.0	59.8	0	606
Startup Location Variables	21.892	43.267	0	522	29.021	59.753	0	606
StartupHQCalifornia	0.328	0.470	0	1	0.428	0.495	0	1
StartupHQWest	0.098	0.297	0	1	0.230	0.421	0	1
StartupHQNortheast	0.223	0.416	0	1	0.213	0.409	0	1
StartupHQMidwest	0.294	0.456	0	1	0.061	0.240	0	1
StartupHQSouth	0.038	0.190	0	1	0.049	0.217	0	1
StartupHQForeign	0.019	0.138	0	1	0.014	0.117	0	1
Location Match	0.475	0.500	0	1	0.687	0.464	0	1
LocSV	0.642	0.480	0	1	0.314	0.464	0	1
LocBos	0.125	0.331	0	1	0.173	0.378	0	1
GeoDistance (miles)	606.4	1063.6	0	8033	590.1	1450.4	0	7955
Startup and Cohort Controls								
IndustryMediaMusicGaming	0.140	0.347	0	1	0.136	0.343	0	1
IndustrySocialLocationMobile	0.451	0.498	0	1	0.291	0.455	0	1
IndustryPaymentCommerce	0.130	0.337	0	1	0.141	0.348	0	1
IndustryWebBusiness	0.118	0.322	0	1	0.192	0.394	0	1
IndustryUnderlyingTech	0.116	0.320	0	1	0.157	0.364	0	1
IndustryOther	0.045	0.208	0	1	0.082	0.275	0	1
StartupAgeEnter_Yr	2.059	1.742	0	4	1.487	1.574	0	12
HaveFemale	0.078	0.269	0	1	0.006	0.077	0	1
Total Number of Founders	2.396	0.837	1	5	1.539	0.672	1	4
CohortCount	21.573	10.921	8	42	0.000	0.000	0	0
Observations	391				325			

** Summary statistics exclude 2 companies with valuations above $1Billion as of Jan. 2017*

IV. Econometric Analysis

The analysis addresses two types of questions: 1) the relative likelihood of achieving milestones; and, 2) the attainment of growth metrics such as the amount of follow-on funding raised and the number of employees hired. To address these distinct questions, econometric analysis involves discrete choice models to estimate likelihood of reaching acquisition and venture capital milestones, feasible generalized least squares (FGLS) to estimate the amount of follow-on funding raised, and the Poisson model to estimate the number of new hires. All models are estimated using standard errors clustered on cohort. This takes into account effects common to a given cohort in time and location (Greene, 2008).

Discrete Choice Outcomes: Venture Capital Funding and Acquisition

Achieving a given milestone is a dichotomous outcome, making a discrete choice model the most appropriate estimation approach (Wooldridge, 2002, Ch. 15). Logit analysis is used to estimate the probability of a startup reaching milestones: exit through acquisition and receipt of follow-on VC investment. Each startup is characterized by a vector of covariates, X, and the coefficient vector β. The following logit equation is estimated:

$$\Pr\left(Y=1\middle|x\right)=\frac{\exp\left(x\beta\right)}{1+\exp(x\beta)}$$

Amount of Funding Raised

Feasible generalized least squares (FGLS) estimation is used to estimate the amount of follow-on funding raised after the initial investment round. FGLS takes into account the heteroskedastic error structure across a given investor (i.e., angel group or accelerator) (Greene, 2008; Wooldridge, 2002).

Number of Employees

The Poisson model is used to analyze the number of employees associated with each startup. This is appropriate for counting nonnegative integers (Hausman, Hall, & Griliches, 1984; Wooldridge, 2002, Ch. 25). Maximum likelihood estimation is used to estimate this model. The Poisson model is specified as:

$$\Pr\left(Y = y_i \middle| x_i\right) = \frac{\exp^{-\lambda_i} \lambda_i^{y_i}}{y_i!}$$

In this case, λ_i is the average number of times an event occurs within a specified interval and y_i is a non-negative integer. The Poisson model can be rewritten in log-linear form as:

$$\ln \lambda_i = x_i \beta$$

V. Results

Taken together, the results suggest that whether a startup hails from the same or distant region plays a large role in the early development of startups. This effect is amplified for startups in accelerators relative to those with angel group funding along multiple dimensions. This impact is evident in reaching startup milestones (follow-on VC financing or acquisition) and in attaining growth metrics (amount of follow-on VC financing and number of employees hired). Details are given below.

Relative distance of startups

Characterizing the extent to which startups outside of the region are drawn to accelerators and angel groups within a region is important. The literature points to a strong geographic component to angel group investing: approximately 75- 80% of angel investments are within the same region according to the Halo Report (Angel Resource Institute, 2015). One notable feature of accelerators is that they stand to potentially broaden the geographic scope of funding for

startups. The results bear this out. *Primo facie*, accelerators invest in startups that come from a greater distance than those receiving angel group investments. As shown in Table 1, the share of startups from the same region is smaller for accelerators than for angel groups (difference of means: 0.11, $p<0.002$). In line with this, startups in accelerators come from a further geographic distance than those receiving angel group funding. The average distance for the accelerator sample is 738.5 miles, compared to 478.3 miles average distance between startups and angel groups (difference of means: 260.17 miles, $p<0.01$). Thus, the evidence suggests that accelerators invest in startups coming from a comparably larger geographic swath than do angel groups.

Impact of Distance on Reaching Funding and Acquisition Milestones

Given that startups are coming from greater distance to accelerators relative to angel groups it is crucial to understand, all else equal, which model is more effective at getting these distant startups to key milestones? This analysis focuses on two distinct milestones: the likelihood of receiving follow-on funding from VC investors and the likelihood of acquisition.

Overall, the literature suggests that VCs prefer to invest in relatively local startups. Investing in a local area provides multiple benefits for the investor, including decreased search costs, relative ease of communication, and greater ability to monitor portfolio companies (Chen, Gompers, Kovner, & Lerner, 2010). Moreover, both angel groups and accelerators develop ongoing ties with local VC investors. Startups coming from greater geographic distance might not be able to benefit from strong local ties in the same manner as startups nearer to the accelerator.

The results support this expectation. Results of the logit regressions on the probability of getting follow-on VC funding are presented in Table 3 (Column 1) and marginal effects

calculations are presented in Table 4 (Columns 1 and 2). All else equal, startups in an accelerator are less likely to receive follow-on funding. The average marginal effect on follow-on funding is -0.25 ($p<0.01$); in other words, the probability of receiving follow-on VC financing is 25 percentage points lower for a startup in an accelerator relative to a startup in an angel group. For all startups, the average marginal effect of being in the same region (LocationMatch), rather than a different region, as the accelerator or angel group is 0.11 ($p<0.01$), or an 11 percentage point increase in the likelihood of getting VC funding.

What is the relationship between being in an accelerator from the same or different region? All else equal, the average marginal effect of being in the same region for startups going through an accelerator is a 24 percentage points greater likelihood of getting follow-on VC funding ($p<0.01$) than if the startup is from a different region. In contrast, the average marginal effect of being in same region is not statistically significant for startups with angel group funding. An alternative way of looking at this is that a startup in an accelerator in the same geographic region is only 12 percentage points ($p<0.01$) less likely to receive follow-on funding compared to a similar startup in an angel group if the startup is in the same region as the accelerator, whereas a startup in an accelerator in a different region is 42 percentage points ($p<0.01$) less likely to get VC funding than a similar startup in an angel group.

Acquisition is another key milestone for startups. Results of the logit regressions on the probability of the startup experiencing an acquisition outcome are presented in Table 3 (Column 2) and marginal effects calculations are presented in Table 4 (Columns 3 and 4). The results suggest that location in the same region has a greater impact on the likelihood of acquisition for a startup in an accelerator than for a similar startup in an angel group. As summarized in Column 4, a startup in an accelerator in the same geographic region is 9

percentage points (p<0.01) more likely to be acquired than a similar startup in an angel group; the impact for a startup in an accelerator in a different region is statistically insignificant.

Table 3. Funding and Acquisition Milestones (Logit Regressions)

	Pr(GetVCFunding=1)		***Pr(Acquired=1)***	
	(1)	(2)	(3)	(4)
VARIABLES	GetVC_LogitsepVCpost_CBI	GetVC_LogitVCpost_CBI	GetAcq_LogitsepAcqDummy	GetAcq_LogitAcqDummy
accelerator	-1.8854***	-3.4934***	1.3056**	0.8656
	(-3.38)	(-3.35)	(2.28)	(1.00)
LocationMatch	0.7979*	-0.8957	0.1425	-0.2934
	(1.80)	(-0.87)	(0.39)	(-0.53)
accelerator#LocationMatch		2.4193**		0.7177
		(2.37)		(1.01)
StartupAgeAtEnter	-0.0006***	-0.0003	-0.0011	-0.0010
	(-2.92)	(-1.44)	(-1.07)	(-0.97)
SingleFounder	-0.9109**	-1.0486***	-1.1158***	-1.0919***
	(-2.16)	(-2.93)	(-3.35)	(-3.18)
SerialDum	1.3382**	1.5499***	-0.1092	-0.0681
	(2.26)	(3.00)	(-0.32)	(-0.21)
LocSV	0.5371	0.4446	0.4098	0.3410
	(0.99)	(0.86)	(0.86)	(0.76)
LocBos	-0.5516	-0.5050	-0.0314	0.0090
	(-0.96)	(-0.94)	(-0.06)	(0.02)
ln_Amount1_CBI	0.6016	0.3694	1.3428**	1.3122**
	(0.75)	(0.53)	(2.52)	(2.39)
Constant	13.8652***	14.4960***	-7.8187***	-12.3568***
	(7.83)	(7.51)	(-4.24)	(-7.15)
Year FE	*Yes*	*Yes*	*Yes*	*Yes*
Industry FE	*Yes*	*Yes*	*Yes*	*Yes*
Observations	497	497	497	497
log pseudolikelihood	-489.8	-474.2	-271.2	-270.2

Robust z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.10

Table 4. Marginal Effects: Funding and Acquisition Milestones (Logit)

	Pr(Get VC Funding=1)		***Pr(Acquired=1)***	
	(1)	(2)	(3)	(4)
	dydxLoc GetVC_Logit	dydxAcc GetVC_Logit	dydx LocAcq_Logit	dydxAcc Acq_Logit
VARIABLES	1.LocationMatch	1.accelerator	1.LocationMatch	1.accelerator
0.LocationMatch		-0.4218***		0.0468
		(-5.92)		(1.05)
1.LocationMatch		-0.1202**		0.0904***
		(-1.97)		(3.75)
0.accelerator	-0.0575		-0.0109	
	(-1.02)		(-0.48)	
1.accelerator	0.2441***		0.0327	
	(4.07)		(0.82)	
Observations	497	497	497	497

z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.10

Impact of Distance on Growth Metrics

Amount of Funding Raised

Venture capital investment allows a startup to grow. The results of the FGLS regressions on the amount of follow on funding (ln_FollowOnVCFunding) are summarized in Table 5 and marginal effects are provided in Table 6. All else equal, the average marginal effect of being in accelerator is -0.67 (p<0.01); in other words, the amount of follow-on VC financing is decreased by 67 percent relative to a startup in angel group. For all startups, the average marginal effect of being in the same region (LocationMatch) is 0.20 (p<0.01), or a 20 percent increase in the amount of VC funding received.

The average marginal effect of being in the same region on the amount of follow-on funding also is amplified for startups in accelerators. A startup in an accelerator in the same geographic region receives 33 percent greater follow-on funding (p<0.01) compared to a startup in a different region; the impact for a startup in an angel group in the same or different region is statistically insignificant.

Table 5. Amount of Funding (FGLS Regressions)

VARIABLES	(1) FollowFund_FGLSsep ln_FollowOn	(2) FollowFund_FGLS ln_FollowOn
1.accelerator	-0.6593***	-0.8480***
	(-5.48)	(-4.78)
1.LocationMatch	0.2297**	-0.0026
	(2.09)	(-0.02)
1.accelerator#1.LocationMatch		0.3289
		(1.55)
StartupAgeAtEnter	-0.0001	-0.0001
	(-1.37)	(-1.02)
SingleFounder	-0.0977	-0.0939
	(-0.78)	(-0.75)
SerialDum	0.4670***	0.4997***
	(3.29)	(3.48)
LocSV	0.3291***	0.3007***
	(2.89)	(2.62)
LocBos	0.5872***	0.5636***
	(3.34)	(3.16)
Constant	3.3106**	3.3637**
	(2.25)	(2.35)
Year FE	*Yes*	*Yes*
Industry FE	*Yes*	*Yes*
Observations	497	497
Number of Investor	23	23
log pseudolikelihood	.	.

z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.10

Table 6. Marginal Effects: Amount of Funding (FGLS)

	(1)	(2)
	dydxAcc	dydxLoc
	ln_FollowFund_FGLS	ln_FollowFund_FGLS
VARIABLES	1.accelerator	1.LocationMatch
0.LocationMatch	-0.848***	
	(-4.78)	
1.LocationMatch	-0.519***	
	(-3.56)	
0.accelerator		-0.003
		(-0.02)
1.accelerator		0.326**
		(2.35)
Observations	497	497

z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.10

Employment

Employment is a further outcome measure for startups. Hiring new employees is a key marker of startup growth potential (Haltiwanger, Jarmin, & Miranda, 2013). One important role that angel groups provide is access to local hires with the requisite skills through informal networks as well as more formal mechanisms such as hosting employment pages for startups in their portfolio. The accelerator experience might facilitate hiring as well. Facets of the accelerator model may expand the reach beyond the local region as the network of companies comes from a broader geographic range. As well, the cohort model requires direct engagement for several months, which enhances tacit benefits such as networking and mentoring.

The results suggest that accelerators are associated with employment growth. The results of the Poisson regressions on numbers of employees in LinkedIn are summarized in Table 7 and marginal effects are provided in Table 8. All else equal, the average marginal effect of being in accelerator is 0.381 ($p<0.01$); in other words, startups in an accelerator hire 46% more

employees than similar startups in angel groups. Locational effects also matter for employment: all else equal, the marginal effect of being in the same region as the accelerator or angel group is 0.372 ($p<0.01$); in other words, startups located in the same region hire 45% more employees.

What impact does being in the same region have on subsequent hiring? On average, startups in accelerators and startups in angel groups *both* hire more employees when they are in the same region as the accelerator or angel group, respectively. For startups in accelerators, being in the same region translates into an average of 8.5 more employees than if it was in a different region, while startups with angel group backing hire an average of 9.5 more employees relative to being in a different region.

This begs the question, what is the *relative* impact on hiring of being in the same location for a startup in an accelerator compared to a similar startup in an angel group? The average marginal effect of being in the *same* region is 34% more employees for startups in an accelerator relative to those in angel group ($p<0.01$), while the average marginal effect for startups in a *different* region is 62% more employees than a similar startup in an angel group in a distant region. Put differently, the results suggest that accelerators might have the largest impact on hiring for startups from distant regions.

Table 7. Number of Employees (Poisson Regressions)

VARIABLES	(1) NumEmp_Psep LInumemp	(2) NumEmp_P LInumemp
accelerator	0.3396***	0.4821***
	(3.14)	(2.93)
LocationMatch	0.3905***	0.4901***
	(3.44)	(2.71)
accelerator#LocationMatch		-0.1908
		(-0.97)
StartupAgeAtEnter	0.0005***	0.0004***
	(6.02)	(4.82)
SingleFounder	-0.2647	-0.2515
	(-1.23)	(-1.17)
SerialDum	0.0977	0.0820
	(0.44)	(0.39)
ln_AmountPerRoundCBI	0.9553***	0.9580***
	(14.03)	(13.41)
ln_NumRounds_CBI	0.6449***	0.6557***
	(2.89)	(2.90)
LocSV	-0.0694	-0.0624
	(-0.51)	(-0.47)
LocBos	0.2185	0.2122
	(1.19)	(1.16)
Constant	1.3543***	1.3291***
	(2.97)	(2.95)
Year FE	*Yes*	*Yes*
Industry FE	*Yes*	*Yes*
Observations	548	548
log pseudolikelihood	-17299	-17279

Robust z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.10

Table 8. Marginal Effects: Number of Employees (Poisson)

VARIABLES	(1) eydxAccLoc NumEmp_P margins	(2) eydxAcc NumEmp_P 1.accelerator	(3) eydxLoc NumEmp_P 1.LocationMatch
1.accelerator	0.381***		0.299**
	(3.58)		(2.26)
0.accelerator			0.490***
			(2.71)
1.LocationMatch	0.372***	0.291**	
	(3.11)	(2.34)	
0.LocationMatch		0.482***	
		(2.93)	
Observations	548	548	548

z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.10

Geographic Distance Measure

The results above summarized the impact of startups coming from the same or different region as the accelerator or angel group. An alternative measure of distance measures the geographic distance between the startup and the respective accelerator or angel group based on the latitude and longitude of each. The calculation is based on the great circle distance equation:

$$\text{distance} = 2\arcsin\left(\sqrt{\sin^2\left(\frac{\Delta lat}{2}\right)+\cos\left(lat_1\right)\cos\left(lat_2\right)\sin^2\left(\frac{\Delta long}{2}\right)}\right)$$

Latitude and longitude data for each dyad (startup-angel investor or startup-accelerator) are computed from location data using Google Maps GeoCoding API supported through the Google cloud platform (Google, 2016).

Results using the log of Geographic Distance instead of Location Match are provided in the Appendix Tables (Tables 9-14). These results are highly consistent with the results using Location Match.

VI. Discussion

The findings above suggest that geographic distance plays a substantial role in the early development of startups. Moreover, the impact is amplified for startups in accelerators relative to those in angel groups. The importance of these findings is several-fold.

Receipt of follow-on financing from VC investors is one key area where location plays a significant role. To the extent that startups seek follow-on financing, the results suggest that the choice of a distant accelerator might make it harder to attract follow-on VC funding. Specifically, the results indicate that location in the same region has a greater impact in terms of both the likelihood of receiving VC following and the amount of follow-on funding received for startups in accelerators than those with angel group backing.

There are several reasons why follow-on funding from VC investors may be particularly sensitive to startups coming to accelerators from a more distant location. First, VC investors rely on ongoing connections with their portfolio companies to monitor performance (Gompers, 1995; Kaplan & Strömberg, 2001). If startups come from a more distant region these ties may be harder to maintain after the cohort ends. Moreover, for startups in accelerators, VC investment occurs after Demo Day, when startups are more likely to be leaving the region. Finally, investors in angel groups have an incentive to provide some monitoring and oversight until an exit is achieved (Ibrahim, 2008), whereas accelerators provide intensive mentoring during the cohort but do not actively monitor startups post-graduation. VCs recognize that angel investors provide some of these monitoring benefits (Hellmann & Thiele, 2015). For more distant startups, VCs may rely more keenly on the assurance of monitoring by angel investors. Taken together, the results suggest that accelerators might look to ways to increase ties with a geographically diverse group of VCs. Indeed, some accelerators have taken steps in this

direction, such as introducing "road show" demo days to develop exposure to a greater group of potential investors and loosening or eliminating residency requirements during the cohort period (Dreamit Ventures, 2016).

The results suggest that location in the same region increases the likelihood of an acquisition for startups in accelerators to a greater extent than those with angel group backing. Acquisition requires synergy and fit along strategic, product market, or technological dimensions for the acquiring company. Several factors might contribute to the larger importance of being in the same region for startups in accelerators. The literature shows that the difficulties companies face in acquiring distant targets can be ameliorated through vicarious learning and soft information (Chakrabarti & Mitchell, 2013, 2016). Being located in the same region as the accelerator allows the accelerator to become more familiar with the startup and facilitates sharing of soft information of use to potential acquirers. Second, startups are an attractive target as "acqui-hires," i.e., acquisitions of a company for the purpose of acquiring the human talent (CBInsights, 2014b; Paka, 2015). Accelerators exhibit a strong preference for solid founding teams; they often focus on the team in the acceptance decision and the intensive mentoring in the cohort involves deepening of relationships between the team and the accelerator. Accelerators should be able to provide greater insights about the founding team and early hires for startups that are in the same region and have greater ongoing contact beyond the cohort period. Finally, the regions where accelerators are located may provide a larger playing field of potential acquirers, and the Demo Day pitch experience typically attracts both investors and acquirers.

With respect to subsequent employment, the effect of geographic distance is amplified for startups in accelerators compared to those with angel group backing. Overall, the results suggest that being in the same region as either the accelerator or the angel group is associated

with greater subsequent hiring than more distant startups. However, for startups that are in a different region, being in an accelerator facilitates hiring to a much greater extent than an angel group. Accelerators might increase distant hiring for several reasons. The literature on entrepreneurial hiring points to early hiring as an important predictor of growth (Fairlie & Miranda, 2017). Entrepreneurial hiring draws heavily on the extended network available to founders (Forbes, Borchert, Zellmer-Bruhn, & Sapienza, 2006). Most accelerators require startups to relocate for the period of the cohort. When startups come to an accelerator from a different region they have access to a larger network of potential hires because they can draw from both the new region where the accelerator is located and their home region. In contrast, a startup working with a distant angel group is unlikely to spend substantial time in that region and is less likely to build an extensive network there. Moreover, the cohort experience in an accelerator builds strong relationships amongst the founding teams and with accelerator partners and mentors. The social and cultural capital developed through a common selective experience is an important foundation for subsequent relationships such as in the labor market (Bourdieu, 1986). To the extent that successful startups can scale and create additional jobs, this finding has important implications. This finding suggests that accelerators might take this into account more explicitly.

The results in this report speak to the extent to which accelerators draw startups from a larger geographic footprint than angel groups on average. This has several important implications for further consideration. Given that startups participate in an accelerator for a short duration, the extent to which they remain in the accelerator region varies. As noted above, startups coming from further distance have the potential to draw upon multiple regional networks. At the same time, the larger distance makes it harder for investors from other regions

to closely monitor these young ventures. These tradeoffs are evidenced in the results. More broadly, recent research suggests that higher quality startups may "migrate" more often, but they are of similar quality to startups in the region to which they move (Guzman, 2017). Given the greater geographic draw of accelerators, regional ecosystems may be able to encourage high quality startups to remain.

VII. Conclusion and Policy Implications

Conclusion

The findings above suggest that geographic distance plays a substantial role in the early development of startups. Moreover, the impact is amplified for startups in accelerators relative to those in angel groups.

The importance of these findings is several-fold. To the extent that startups seek follow-on financing, the results suggest that the choice of a distant accelerator might make it harder to attract follow-on VC funding. Specifically, the results indicate that location in the same region has a greater impact in terms of both the likelihood of receiving VC following and the amount of follow-on funding received for startups in accelerators than those with angel group backing. There are several reasons why follow-on funding from VC investors may be particularly sensitive to startups coming to accelerators from a more distant location, including the need to for ongoing interaction with portfolio companies. For more distant startups, VCs may rely more keenly on the assurance of monitoring by angel investors.

The results suggest that location in the same region increases the likelihood of an acquisition for startups in accelerators to a greater extent than those with angel group backing. Acquisition requires synergy and fit along strategic, product market, or technological dimensions for the acquiring company. Several factors might contribute to the larger importance of being in the same region for startups in accelerators, including facilitating the sharing of soft information with potential acquirers, insight into founding teams for acqui-hires, and formal interaction with a plentitude of potential acquirers through Demo Day and other events.

Finally, with respect to subsequent employment, the effect of geographic distance is amplified for startups in accelerators compared to those with angel group backing. Overall, the results suggest that being in the same region as either the accelerator or the angel group is associated with greater subsequent hiring than more distant startups. However, for startups that are in a different region, being

in an accelerator facilitates hiring to a much greater extent than an angel group. Accelerators might increase distant hiring for several reasons, including the extended network that becomes available to startups in accelerators and the building of social and cultural capital generated in the cohort experience.

Policy Implications

1) The potential to attract startups from a larger geographic range is both an advantage and disadvantage for accelerators. It is essential to consider differential benefits of accelerators relative to angel groups for startups within the region and for startups that are new to the region. Understanding the tradeoffs is necessary.
2) There should be a focus on growing the larger entrepreneurial ecosystem. This includes investors and established companies to partner with and potentially acquire startups in the region.
3) Accelerators might look to ways to increase ties with a geographically diverse group of VCs. Indeed, some accelerators have taken steps in this direction, such as introducing "road show" demo days to develop exposure to a greater group of potential investors and loosening or eliminating residency requirements during the cohort period.
4) There should be a focus on building human talent. The importance of accelerators in hiring is underappreciated. Have systems in place to support hiring, not just fundraising.
5) These private sector programs help provide a blueprint for other accelerators, particularly more nascent government sponsored accelerators. Understanding the impact of established private sector accelerator programs on regional measures of entrepreneurship provides actionable models and insights that can be adapted across a wide array of programs, including government sponsored and non-profit accelerators.
6) Take the long view. Successful accelerators take time to establish themselves. This is particularly true when we consider the importance of the ties to the existing ecosystem of investors, acquirers, and partners.

VIII. Appendix: Tables 9-14

Table 9. (Appendix) Funding and Acquisition Milestones-Geographic Distance (Logit Regressions)

	Pr(Get VC Funding=1)		*Pr(Acquired=1)*	
	(1)	(2)	(3)	(4)
	GetVC_	GetVC_	GetAcq_	GetAcq_
	LogitgeoSep	Logitgeo	LogitgeoSep	Logitgeo
VARIABLES	VCpost_CBI	VCpost_CBI	AcqDummy	AcqDummy
accelerator	-1.5789***	-0.7931	1.2616**	1.3623*
	(-3.06)	(-1.21)	(2.01)	(1.79)
ln_GeoDist	-0.2389***	-0.0636	0.0684	0.0858
	(-4.24)	(-0.45)	(1.22)	(0.61)
accelerator#c.ln_GeoDist		-0.2228		-0.0246
		(-1.62)		(-0.16)
StartupAgeAtEnter	-0.0007***	-0.0006***	-0.0011	-0.0011
	(-3.77)	(-3.02)	(-1.08)	(-1.08)
SingleFounder	-0.7873	-0.8301*	-1.1714***	-1.1648***
	(-1.59)	(-1.71)	(-3.38)	(-3.10)
SerialDum	1.3129**	1.2808**	-0.2705	-0.2689
	(2.57)	(2.56)	(-0.74)	(-0.73)
LocSV	0.7525	0.7831	0.3017	0.3014
	(1.38)	(1.55)	(0.58)	(0.58)
LocBos	-0.5422	-0.4911	-0.0553	-0.0442
	(-0.84)	(-0.78)	(-0.11)	(-0.09)
ln_Amount1_CBI	1.3209	1.0621	1.3962***	1.3808**
	(1.48)	(1.17)	(2.64)	(2.41)
Constant	16.1213***	14.3795***	-6.6843***	-6.7676***
	(11.38)	(9.88)	(-3.20)	(-3.01)
Year FE	*Yes*	*Yes*	*Yes*	*Yes*
Industry FE	*Yes*	*Yes*	*Yes*	*Yes*
Observations	468	468	468	468
log pseudolikelihood	-423.7	-419.9	-258.0	-258.0

Robust z-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.10

Table 10. (Appendix) Marginal Effects: Funding and Acquisition Milestones-Geographic Distance

		Pr(Get VC Funding=1)			*Pr(Acquired=1)*	
	(1) dydxAccLocGetVC_Logitgeo	(2) dydxAccGetVC_Logitgeo	(3) dydxLocGetVC_Logitgeo	(4) dydxAccLocAcq_Logitgeo	(5) dydxAccAcq_Logitgeo	(6) dydxLocAcq_Logitgeo
VARIABLES	margins	1.accelerator	margins	margins	1.accelerator	margins
1.accelerator	-0.197***			0.069**		
	(-3.72)			(2.14)		
ln_GeoDist	-0.023***			0.004		
	(-4.53)			(1.09)		
at ln_GeoDist:						
0		-0.069			0.062**	
		(-1.45)			(2.03)	
1		-0.096**			0.064**	
		(-2.16)			(2.20)	
2		-0.127***			0.066**	
		(-2.92)			(2.32)	
3		-0.161***			0.067**	
		(-3.51)			(2.33)	
4		-0.198***			0.069**	
		(-3.80)			(2.21)	
5		-0.236***			0.071**	
		(-3.82)			(2.01)	
6		-0.277***			0.072*	
		(-3.70)			(1.77)	
7		-0.318***			0.074	
		(-3.55)			(1.54)	
8		-0.359***			0.075	
		(-3.40)			(1.34)	
9		-0.401***			0.077	
		(-3.27)			(1.17)	
0.accelerator			-0.005			0.003
			(-0.44)			(0.57)
1.accelerator			-0.038***			0.005
			(-5.90)			(0.99)
Observations	468	468	468	468	468	468

z-statistics in parentheses*** p<0.01, ** p<0.05, * p<0.10

Table 11. (Appendix) Amount of Funding-Geographic Distance

VARIABLES	(1) FollowFund_FGLSgeosep ln_FollowOn	(2) FollowFund_FGLSgeo ln_FollowOn
1.accelerator	-0.6631***	-0.5903***
	(-5.50)	(-2.95)
ln_GeoDist	-0.0801***	-0.0656*
	(-4.20)	(-1.90)
1.accelerator#c.ln_GeoDist		-0.0174
		(-0.43)
StartupAgeAtEnter	-0.0002**	-0.0002**
	(-2.17)	(-2.09)
SingleFounder	-0.0291	-0.0111
	(-0.23)	(-0.09)
SerialDum	0.4577***	0.4474***
	(3.05)	(2.97)
LocSV	0.3770***	0.3732***
	(3.30)	(3.24)
LocBos	0.5821***	0.5711***
	(3.31)	(3.21)
Constant	3.7255***	3.6286***
	(2.65)	(2.61)
Year FE	*Yes*	*Yes*
Industry FE	*Yes*	*Yes*
Observations	468	468
Number of Investor	23	23
log pseudolikelihood	.	.

z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.10

Table 12. (Appendix) Marginal Effects: Amount of Funding-Geographic Distance

	(1)	(2)	(3)	(4)
VARIABLES	margins	margins	1.accelerator	margins
1.accelerator	-0.658***			
	(-5.41)			
ln_GeoDist	-0.077***			
	(-3.90)			
at ln_GeoDist:			-0.590***	
0			(-2.95)	
			-0.608***	
1			(-3.58)	
			-0.625***	
2			(-4.33)	
			-0.643***	
3			(-5.05)	
			-0.660***	
4			(-5.42)	
			-0.677***	
5			(-5.24)	
			-0.695***	
6			(-4.69)	
			-0.712***	
7			(-4.08)	
			-0.730***	
8			(-3.55)	
			-0.747***	
9			(-3.12)	
0.accelerator				-0.066*
				(-1.90)
1.accelerator				-0.083***
				(-3.66)
Observations	468	468	468	468

z-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.10

Table 13. (Appendix) Number of Employees-Geographic Distance (Poisson)

VARIABLES	(1) NumEmp_ Psepgeo LInumemp	(2) NumEmp_ Pgeo LInumemp
accelerator	0.3483***	0.3525**
	(2.69)	(2.06)
ln_GeoDist	-0.0656***	-0.0648***
	(-3.83)	(-2.76)
Accelerator*ln_GeoDist		-0.0015
		(-0.06)
StartupAgeAtEnter	0.0003***	0.0003***
	(4.82)	(4.61)
SingleFounder	-0.2926	-0.2932
	(-1.28)	(-1.29)
SerialDum	-0.1436	-0.1438
	(-1.08)	(-1.08)
ln_AmountPerRoundCBI	0.9579***	0.9581***
	(18.04)	(17.84)
ln_NumRounds_CBI	0.5718***	0.5710***
	(2.62)	(2.61)
LocSV	-0.0558	-0.0552
	(-0.43)	(-0.43)
LocBos	-0.0830	-0.0823
	(-0.75)	(-0.73)
Constant	1.9164***	1.9130***
	(3.39)	(3.33)
Year FE	*Yes*	*Yes*
Industry FE	*Yes*	*Yes*
Observations	516	516
log pseudolikelihood	-15457	-15457

Robust z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.10

Table 14. (Appendix) Marginal Effects-Number of Employees-Geographic Distance (Poisson)

VARIABLES	(1) eydxAccLoc NumEmp_Pgeo margins	(2) eydxAcc NumEmp_Pgeo 1.accelerator	(3) eydxLoc NumEmp_Pgeo margins
1.accelerator	0.347***		
	(2.89)		
ln_GeoDist	-0.066***		
	(-3.96)		
at ln_GeoDist:			
0		0.353**	
		(2.06)	
1		0.351**	
		(2.27)	
2		0.350**	
		(2.50)	
3		0.348***	
		(2.72)	
4		0.347***	
		(2.91)	
5		0.345***	
		(3.00)	
6		0.344***	
		(2.98)	
7		0.342***	
		(2.83)	
8		0.341***	
		(2.62)	
9		0.339**	
		(2.38)	
0.accelerator			-0.065***
			(-2.76)
1.accelerator			-0.066***
			(-3.71)
Observations	516	516	516

z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.10

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