

Accelerators, Startup Performance, and Crises.

By

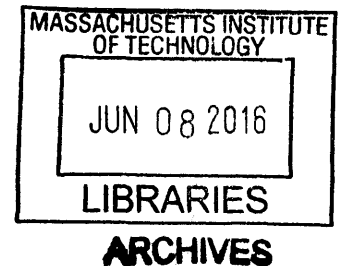
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Abstract

New accelerator programs have developed globally over the last decade. The accelerator concept is widely discussed in the media and receives increasing interest from researchers. However, the performance and impact of accelerators is often debated.

This paper's objective is to offer a qualitative overview of different accelerator types and empirical analysis of the performance of two popular accelerators: Y Combinator and Techstars. Based on characteristics of the accelerators and the economic environment, this paper presents a first attempt to understand the influence of economic shocks on accelerated startups in the context of the recent Great Recession (2007-2009).

Three core findings were identified in this research. First, the death rate of startups accelerated during the recession is significantly greater than of startups accelerated before or after the recession. This finding questions the added value of attending an accelerator program during a recession and calls for crisis-specific initiatives to increase the resilience of the accelerated startups. Second, the scarce VC funding in a location during the crisis is associated with the increased death rates. Third, the two accelerators seem to have changed their business model, increasing the number of later stage startups (i.e., those with prior funding) accepted in their programs.

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List of Abbreviations

AIC	Akaike Information Criterion
AUC	Area Under the Curve
CAGR	Compound Annual Growth Rate
IPO	Initial Public Offering
ICT	Information and Communications Technology
KPI	Key Performance Indicator
LQ	Location Quotient
MSA	Metropolitan Statistical Area
MVP	Minimum Viable Product
SaaS	Software as a Service
USA	United States of America
US	United States
USD	United States Dollar
VC	Venture Capitalist

1. Introduction

The phenomenon of the accelerator is rising with an increasing number of active accelerator programs in the United States and around the globe. Startup accelerators have been around for over a decade, starting with Y Combinator's creation in 2005. Since then hundreds of accelerators have been set up trying to help startups to grow.

According to Crunchbase and seed-db.com over 5600 companies have been accelerated in more than 230 accelerator programs worldwide up to this date. The accelerated companies raised total funding of \$13 billion and achieved almost 700 exits amounting to a value of \$3.6 billion. Observing the development of the accelerator industry, one also recognizes a steep growth in the number of accelerator across the United States - from 1 program in 2005 to 170 in 2014 (See Exhibit 1 in the Appendix). In 2015, the number of accelerator programs stayed constant and suggests that a somehow market saturation was reached.

Due to the fast growth of their startups, the accelerator model has received increasing attention by media and researchers. For example, Cohen, Hochberg, and Fehder (2015) created a seed accelerator ranking to encourage a larger conversation and research about accelerators, their effects, and their future. There is much confusion and discussion around how performance should be measured for an accelerator. Entrepreneurs cannot properly assess which accelerators fit best their needs because it is difficult to measure the performance of accelerators. This is caused by the private nature of the institution and scarcity of publicly available data. The ranking by Cohen et al. (2015) provides some information on the relative success of the programs and ranks the different accelerator programs in three buckets – Silver, Gold, and Platinum.

As an aspiring entrepreneur I find it difficult to compare the value-added and performance of accelerator programs, not to mention which accelerator to choose for my potential startup. It is my motivation to better understand the performance of accelerator programs and to examine the relationship between accelerators, the

performance of accelerated startups, and economic shocks. My research question is how the survival of startups accelerated by Y Combinator and Techstars varies during a crisis period relative to the non-crisis periods. In order to study this relationship, this paper outlines different accelerator types, analyzes the performance of two of the most popular startup accelerators (Y Combinator and Techstars), and study accelerator performance during the business cycle.

The findings suggest that the Great Recession (especially in 2008) had a severe negative impact on the survival, number of investment rounds, and total funding of accelerated startups. For example, the death rate as of 2016 of firms accelerated during 2008 by Y Combinator was on average 50% (versus an average death rate of 27% in 2006 and 2007 years). The analysis suggests that a scarce funding environment had a significant negative impact on the survival of accelerated startups. Furthermore, I observe that there is a shift in the profile of accelerated startups. At first, accelerators accepted startups with no prior funding, but in the last four years an increasing number of startups with prior funding were accelerated. This indicates either a change of the investor accelerator business model as accelerators start cherry picking the best startups or startups (in particular industries) are able to raise money earlier during their life cycle. Finally, I find some preliminary evidence that startups tend to participate in accelerator programs in locations with high concentration of similar and related firms (i.e., locations with strong industrial clusters).

The rest of the thesis is organized as follows: Section 2 describes different types of accelerators and provides a deep dive on investor accelerators. Section 3 explains the relationship between accelerators, the venture capital market, and the recent economic crisis (2007-2009). In Section 4, I use descriptive statistics to analyze the performance of startups accelerated by Y Combinator and Techstars. Section 5 focuses on how startups are impacted by the recent economic crisis. Afterwards I set up logistic regression models for both accelerators, Y Combinator and Techstars, with startup survival as the dependent variable. In Section 6, I discuss the implications and limitations as well as opportunities for future research.

2. An Introduction to Accelerators

2.1 The History of Accelerators

Cohen and Hochberg's (2014) concise definition of the term accelerator, "A fixed-term, cohort-based program, including mentorship and educational components, that culminates in a public pitch event or demo-day" (p. 4), includes all key features of an accelerator and will be used throughout this thesis.

The concept of technology accelerators is derived from the known concept of incubators. A more detailed differentiation between incubators and accelerator is provided later on in this research. Both concepts try to leverage entrepreneurial talent and speed up the company's development as well as the technological development by creating synergies between know-how, experience, capital, and network. The concept of technology accelerators is implemented by offering assistance and support services to young startups in order to develop their business (Grimaldi & Grandi, 2005). Accelerators are funded privately, backed by governments, corporations or universities (Hallen, Bingham, & Cohen, 2016).

Cohen and Hochberg (2014) estimate the number of acceleration programs somewhere in between 300 and over 2,000 across all six continents. Jed Christiansen records 235 accelerators programs worldwide in his database on seed-db.com. The number of accelerator programs grew during the period from 2005 to 2014 with an annual compounded growth rate (CAGR) of 76.9% to a total of 170 accelerator programs in the United States (see Exhibit 1 in the Appendix). Globally, 5,693 companies were accelerated, 694 exits of accelerated companies for \$ 3.6 billion, and combined all accelerated companies raised a total of \$ 13 billion in funding (Christiansen, 2016; Crunchbase, 2016). A similar growth curve can be observed in the European technology scene, but yet it does not reach similar heights.

A growing number of startups goes through accelerator programs (see Exhibit 7 in the Appendix for Y Combinator and Exhibit 14 in the Appendix for Techstars). For example, Y Combinator started its first cohort with eight startups in 2005 and has accelerated more than 750 startups until today. Also, these two pioneer accelerators,

Y Combinator and Techstars, started business in the United States in 2005 and 2007 respectively, whereas the main wave of programs in Europe started only in 2008.

2.1.1 What Do Accelerators Do?

The above named key features, defined by Cohen and Hochberg (2014), are common in each accelerator program. A more differentiated and detailed analysis of different types of accelerators follows in the section 2.3 Types of Accelerators. Accelerators usually accept annually or semi-annually a certain number¹ of startups to their acceleration program upon the startups' applications. The acceleration program lasts for short time period of around three months. This time period is an intense working period during which the accelerator offers a selected number of services to the startup in order to accelerate the startups' growth and therefore making them more attractive for outside investors such as business angels and venture capitalists (VCs). To give a short overview (Cohen & Hochberg, 2014; Miller & Bound, 2011) of the variety of services of an accelerator, the following services are provided upon acceptance to a program:

- Pre-seed funding
- Time-limited support including events, workshops and mentoring on several topics
 - Legal advice
 - Business development
 - Product development
- Startups are supported in cohorts or classes
- Networking with potential investors, talent and alumni
- Demo day

¹ This number can vary and lies between approximately 10 and 120.

2.1.2 Rise of Accelerators

Analyzing the development of the two most prestigious and oldest accelerators, Y Combinator and Techstars, one gains a good understanding of potential benefits of accelerators. These two organizations have taken very different paths in the last decade and both have been successful.

In 2005, Paul Graham in Cambridge, Massachusetts, founded Y Combinator before it was moved to the prestigious Silicon Valley. In 2007, David Cohen and Brad Feld created Techstars in Boulder, Colorado, after failing to convince Graham to set up a second Y Combinator in Boulder (Cohen & Hochberg, 2014). Y Combinator chose to stay exclusively in the Silicon Valley and to increase its cohort size from approximately 13 startups per cohort on average between 2005 and 2008 to around 65 startups per cohort between 2012 and 2015 (see Exhibit 7 in the Appendix). Whereas Techstars expanded geographically and has programs in 14 cities and with the Global Accelerator Network even more accelerators that follow their model – approximately 50 programs in 63 cities on six continents (Cohen & Hochberg, 2014). With this approach Techstars grew the number of accelerated startups per year from 13 startups on average between 2007 and 2009 to 98 startups on average between 2013 and 2015 (see Exhibit 14 in the Appendix). Y Combinator considers all kinds of technology startups for acceptance into their program. Techstars takes a similar approach, but also created programs that were more focused on a specific industry, e.g., Barclays Fintech Accelerator by Techstars. Since then most other accelerators are somehow oriented towards Y Combinator and Techstars accelerator model. Some chose to focus on only one industry, e.g. Fintech Innovation Lab, and others consider more industries and build a broader network, e.g., Startupbootcamp.

The development of European accelerators lags a bit behind the US' development. The first European accelerator, Seedcamp, was founded in 2007 in London. According to Crunchbase more than 180 startups went through the Seedcamp accelerator program, hosting 20 startups per cohort semiannually, over the last eight years. Seedcamp has forward integrated within the investment process. This means that it started off being a pure accelerator, but has developed into seed-stage venture

capitalist fund with an accelerator covering pre-seed investments. This is a development that cannot only be observed in Europe, but also in the US. For example, Y Combinator has opened a fund that considers follow on investments in Y Combinator accelerated startups. This approach is debatable, as it can send mixed signals to investors regarding startups that do not receive a follow on investment by Y Combinator itself. In 2010, another important European accelerator, Startupbootcamp, opened its doors in Copenhagen. It has hosted more than 200 startups across Europe and the United States. Its model is comparable to the Techstars' one, as both set up industry focused accelerator programs across Europe and the US. By now Startupbootcamp has run accelerator programs in 14 different cities on three different continents.

Overall one can observe a fast growth of accelerators in the United States and Europe. After successfully running several smaller cohorts with startups from one particular industry, many accelerators choose between two different expansion strategies. First, the accelerator decides to increase its cohort size as well as to consider startups from other industries and then forward integrates into a hybrid model of an accelerator and an early stage venture capitalist. Or second, the accelerator chooses to keep the cohort size constant, but expanding geographically and creating accelerator programs for different industries depending on the location's cluster specialization. For example, Techstars set up a mobility accelerator in Detroit to accelerate startups in the logistics and transportation industry and connect them to potential customers and investors within the industry (Techstars, 2016).

2.2 Accelerator versus Incubator versus Business Angel

Cohen and Hochberg (2014) explain that there is a lack of a consistent definition of accelerator programs, since accelerators have similarities to both, incubators and business angels. This leads sometimes to confusion among individuals and media, but also gives a hard time to researchers, since they need to state their personal decision/definition and select appropriate programs accordingly. In this section the

differences between accelerators and the two other models are carved out. See Table 1 below for a summary of all three models. The differentiation is based on an approach by Cohen (2013), she compares the three models based on the variables duration, cohorts, business model, selection, and education, mentorship and networking. As mentioned above Cohen and Hochberg (2014) came up with a comprehensive definition for the term accelerator, which is also based on the Cohen's research (2013) and also reveal differences between all three models.

2.2.1 Accelerator versus Incubator

The accelerator can be seen as a modification of a traditional incubator. The main differentiators of accelerators are limited program length, defined startup cohorts entering the program, and accelerators profit orientation (Caley & Kula, 2013; Isabelle, 2013; Miller & Bound, 2011).

At an incubator the time spend within the incubator's facilities varies and can amount several years (Rothaermel & Thursby, 2005). Accelerator programs, on the other hand, normally last only for several months (Hallen, Bingham, & Cohen, 2016)².

The formation of cohorts within accelerators leads to a strong professional and personal network among the founders within a cohort. At incubators founders also build new connections, but the ties built within a cohort are much stronger according to Cohen (2013). Furthermore, incubators select companies to join them on a rolling basis, whereas accelerators have between one and four cohorts a year and therefore follow strict admission deadlines. Thus, accelerators' marketing efforts are focused around these deadlines in order to attract as many good applicants as possible. Top accelerators attract companies from all over the world and founders are willing to relocate once being accepted to an accelerator (Cohen, 2013).

² Most accelerator programs last three months for no particular reason; it can be assumed that the acceleration period was "simply" copied from existing accelerator programs (e.g. Y Combinator and Techstars started with offering three-month-programs).

One can observe all three business models – i.e. investment for equity stake, rent based, and non-profit³ – at incubators and accelerators. However, accelerators tend to be more profit and investment driven than incubators. The incubator model was originally created to support and build regional ecosystem and was non-profit based. Many founders of accelerators are former entrepreneurs and current business angels that want to support young startups to take off the ground (Cohen, 2013).

There are some key differences, but also similarities regarding the offered services at accelerators and incubators. Accelerators focus on short and intensive learning opportunities in the form of events and workshops. Whereas incubators facilitate simpler and cheaper access to professional services such as legal or accounting services (Cohen, 2013). Mentorship is a key part for both institutions, but due to the short acceleration period there is an intense focus on mentorship and some startups meet up to 75 different potential mentors for different topics. At incubators the mentorship is by far not as intensive and normally mentors receive some sort of compensation from the startup directly.

Table 1: Differences among Accelerators, Incubators and Business Angels

	Accelerators	Incubators	Business Angels
Duration	3 months	1-5 years	Ongoing
Cohorts	Yes	No	No
Business model	Investment; non-profit	Rent; non-profit	Investment
Selection frequency	Competitive; cyclical	Non competitive	Competitive; ongoing
Venture stage	Early	Early; late	Early
Education	Seminars; workshops	On request, HR/legal/accounting	None
Venture location	Usually on-site	On-site	Off-site
Mentorship	Intense, by self and others	Minimal, and for a remuneration	On request, by investor

Source: Cohen (2013).

³ Non-profit accelerators and incubators attract public and private institutions as supporters to finance their operations. Private institutions are incentivized to support the non-profit accelerator or incubator by receiving the opportunity to build connections with startups and potentially invest for an equity stake in the startup. Public institutions are incentivized to support the non-profit accelerator or incubator by fostering the regional ecosystem and support regional entrepreneurs.

2.2.2 Accelerator versus Business Angel

Whereas the comparison to an incubator is obvious, it does not seem that obvious that accelerators share common attributes with business angels. First, they both invest in pre-seed and seed stage ventures and both can act as investors and therefore have aligned incentives with founders, who want to expand their company and grow (Cohen, 2013). Second, many founders of accelerators used to be or still are active as business angels, but they rarely have experience in running an incubator. Third, startups that are going through accelerator programs have tried or plan on raising funds from business angels, but they do not consider applying to incubators after being accelerated (Cohen, 2013). Thus, business angels seem to be more complementary to accelerators, as accelerators help them to identify rising stars for potential investments.

Besides the similarities, the duration of both institutions differ quite a bit. Accelerators run for three months, whereas angels invest on a two- to four-year time horizon. And according to interviews conducted by Cohen (2013) many former business angels formed accelerators, since they wanted to put more structure around their investment activities and have closer contact to founders and startups. Thus, accelerators increase their influence through an intense acceleration period filled with mentoring, workshops, pitches, and more.

Angels' major challenge is identifying the best investment opportunities among a large group of startups searching for capital. This can be seen as placing risky "bets" on the three to five most promising investment opportunities. Accelerators spread this risk by accepting/investing in more companies at the same time (Cohen, 2013). The economies of an accelerator are covered in detail in the section 2.5 The Economics of Accelerators.

Lastly, there is a gap between angels and accelerators regarding mentorship, networking, and indirect learnings provided by them. Accelerators focus on these three services full-time during the acceleration period, whereas angels usually act as angels only part-time and have to spread their resources across all of their investments. Thus, accelerators have more resources, i.e. capital and human resources, providing those services. The angel might have a board seat and can

directly influence the founders in their meetings, but the influence limited (Cohen, 2013).

In conclusion, all three approaches share similarities. Specifically, they want to have positive influence on the startup and help it to achieve further growth. Also, they are to some extent focused on early stage ventures. Although their motivation is aligned, the execution is not and accelerators stand out by providing intensive mentorship, education, and networking. This can only be done by limiting the time of engagement to a couple of months and focusing all resources available on the current cohort. The common demo-day at the end of an acceleration further differentiates the accelerator from incubators and business angels. Interestingly, accelerators seem to have more in common with angels than with incubators based on Cohen's analysis (2013). From here onwards the paper will solely focus on accelerators.

2.3 Accelerator Types

2.3.1 Ecosystem Builders

An Ecosystem builder is a tool used by government agencies to reduce early stage failures of startups. Agencies have an interest in supporting local, regional, or national startups activity in order to foster the regions competitiveness in terms of technology and jobs. For this reason, ecosystem builders focus often on potential job creations of the startup, when selecting. Compared to investor accelerators and corporate accelerators they are less risk averse and prefer investing in very early stage companies. At this point startups have rarely developed a complete value proposition and a team might only be in the ideation stage. The strength of ecosystem builders is their well-developed curriculum comprising mentorship and educational services. The latter are normally organized as workshops and training sessions to help on ideation and finding the best value proposition. Mentorship is provided by consultants or business developers to support commercialization by helping with defining the right product-market fit and designing a go-to-market strategy (Clarysse, Wright, & Hove, 2015).

EforAll, for example, is an ecosystem builder that is dedicated to revitalize mid-sized US inner cities that are suffering of poverty and unemployment by supporting local entrepreneurs. EforAll is based in Lowell, where they support 15 to 20 entrepreneurs through mentorships and workshops. Also, they have access to a \$ 30,000 funding pool at the end of the three-month acceleration period. EforAll is funded by different private institutions, foundations, and the City of Lowell (EForAll, 2016). Inner cities (economically distressed parts of a city) are a prevalent problem in the US, and ecosystem builder accelerators could help integrate the inner city with the rest of the city (Delgado & Zeuli, 2016).

The ecosystem builder's funding comes from local, regional, or national government agencies, e.g. formations of accelerators are financially supported under the umbrella of the technological support programs of the European commission. The economics of this model are rather unclear and operations are designed to satisfy the needs of the main stakeholders. This leads to an inefficient and fuzzy business model that is unsustainable. However, it remains to be answered how profit oriented ecosystem builders need to be (Clarysse et al., 2015).

2.3.2 Matchmakers

Corporate accelerators are used by large corporates to connect customers with early stage startups in order to create a triple win situation. For example, Accenture runs the Fintech Innovation Lab in order to provide a platform where Fintech startups and the financial industry can collaborate on current innovations, which strengthen the client relationships of Accenture. Thus, startups can connect to potential customers or partners and corporates see the newest industry trends, might become a strategic investor or partner with a startup. Corporate accelerators are looking for startups that have a certain track record, e.g. a working prototype or an experienced team. Corporate executives within the parent company and executives run the selection process from the industry the accelerator is focusing on. Mentorship is provided by the corporation, mainly helping startups to understand the right decision making unit within the potential partner companies (Clarysse et al., 2015).

The funding comes from the corporation on a year-to-year basis and only soft key performance indicators (KPI) are adopted such as showcase events and newsletters (Zott, 2007). Corporate accelerators rarely take an equity stake in the selected startups, but add value by helping startups to connect to potential partners and customers. Thus, a lot of the effort during the acceleration period is put on networking and connecting the right corporate customers to the best fitting startups.

2.3.3 Investors

Investor accelerators are often founded by former entrepreneurs and business angels, such as Paul Graham from Y Combinator (Cohen & Hochberg, 2014). They focus on bridging the financing gap many startups are facing between pre-seed, seed and series A funding. Selection is therefore focused on finding startups that will take on follow on capital and are interesting for venture capitalist after graduating from the accelerator program. This is more often the case with later stage startups that have raised some pre-seed funding, achieved already a small prove of concept or have a working prototype. Also, the rise of accelerators has led to high competitiveness among applicants and more mature startups are applying as well, thus, investor accelerators can pick more developed companies that are more likely to raise follow on capital.

As described in Section 2.1, investor-led accelerators tend to focus on industry vertical, e.g. technology, rather than broadening their focus. This allows accelerators to build up in-depth knowledge, expertise and experience (i.e. often the accelerator's founders had a professional career in that vertical) on a certain vertical to maximize the potential of the chosen startups. Due to the lasting hype of accelerators, investor accelerators now focus even more specifically on a subcategory of the chosen industry, e.g. Fintech or Software as a Service (SaaS) companies. The funding and business model is structured after a classic venture capitalist fund and attracts mainly private investors, business angels, and larger corporations. Active angel investors being part of the management team's network often provide mentorship and might play a future investment role for the startup (Clarysse et al., 2015).

Having described key similarities and differences between the three archetypes of accelerators, one quickly realizes that the different motivations of the accelerator's key stakeholders are the major difference between them. Ecosystem builders support the regional economy and aim to create jobs. Corporate accelerators are built upon a triple win situation that strengthens their client relationship. And, investor accelerators follow a similar motivation as venture capitalist, meaning they are profit oriented and create a return for their investors.

This raises a question of how to measure performance in each of these three different accelerator types. First, ecosystem builders aim to support and improve the local entrepreneurial ecosystem. Thus, the number of created jobs and sustainable ventures, for example, might be a good KPI to measure the success of the ecosystem builder. However, this would not capture all impact aspects. As the motivation is to strengthen the ecosystem, one might want to consider also the total number of startups created in the region or the number of venture capital investment in the region and so on. This also means that one should not measure their performance on a profit basis (Clarysse et al., 2015). Second, looking at corporate accelerators it is already much more difficult to define KPIs that measure success, since the goal is to strengthen customer relationships. Also, they need to fulfill expectations on both sides of the platform, for startups and clients, in order to attract high potential startups and clients that are interested in cooperating with innovative ventures. One approach could be to measure the number successfully built partnerships between clients and startups. Here it is important to monitor the partnerships in order to manage expectations on both sides. Compared to the other types it is easier to measure the performance of investor accelerators, because they are profit oriented and need to create return for their investors (Clarysse et al., 2015). This can be measured with several KPIs:

- Number of firms funded
- Number of jobs created
- Total funding of portfolio companies
- Total revenue of portfolio companies

- Survival rate (percentage of portfolio companies that are still operating)
- Average number of follow-on rounds raised by portfolio companies
- Number of exits
- Return on investment etc.

However, there is not much research conducted on how the different accelerator types perform and how their performance should be assessed. Although it is a rising topic in research and more researchers are focusing on related topics, most of them mention that the low amount of public data and its poor quality constrains their research efforts. Thus, research aiming to measure the performance or relative performance of accelerators directly collaborates with selected accelerator programs in order to receive better quality data (Fehder & Hochberg, 2015). Also, the topic gains more importance and attention among researchers in the US, European researchers lack behind. This leads to a discrepancy between the performance analysis conducted on American versus European accelerators.

Table 2: Accelerator Types and Their Key Attributes

	Ecosystem builders	Matchmaker	Investors
<i>Strategy</i>	<ul style="list-style-type: none"> • Government agencies are key stakeholders • Goal is to stimulate startup activity and build an ecosystem 	<ul style="list-style-type: none"> • Corporates are key stakeholders • Goal is to provide a service for customer base → matching potential customers with startups • No profit orientation 	<ul style="list-style-type: none"> • Investors are key stakeholders • Goal is to look for investment opportunities
<i>Program</i>	<ul style="list-style-type: none"> • Fixed program length • Mentors comprise serial entrepreneurs and business developers • Straight forward curriculum 	<ul style="list-style-type: none"> • Fixed program length • Internal experts from corporates are used as coaches and mentors 	<ul style="list-style-type: none"> • Fixed program length • Mentors comprise serial entrepreneurs and business angels (often from specific sector)
<i>Selection</i>	<ul style="list-style-type: none"> • Open application • Cohort based selection • Prefer venture teams in a very early stage 	<ul style="list-style-type: none"> • Open application • Cohort based selection • Prefer venture teams in “later” stages with proven track record 	<ul style="list-style-type: none"> • Open application • Cohort based selection • Prefer venture teams in “later” stages with proven track record
<i>Funding structure</i>	<ul style="list-style-type: none"> • Funding from local, national and international schemes • Still experimenting with funding structure and revenue model → need a sustainable approach 	<ul style="list-style-type: none"> • Funding from corporates • Rarely seed investment or equity engagement 	<ul style="list-style-type: none"> • Funding from private investors, such as angels, VCs or corporate VCs • Standard seed investment and equity engagement
<i>Examples</i>	EForAll, Bethnal Green Ventures, Le Camping, Climate-KIC	Microsoft Ventures Accelerator, Fintech innovation lab	Techstars, Y Combinator, Startupbootcamp, Seedcamp

Source: Clarysse et al., 2015.

2.4 Deep Dive: Investor Accelerator

After having differentiated the accelerator model from other institutions and having defined the different types of accelerators this section focuses solely on investor accelerators. First, the business model of investor accelerators is outlined. Second, the revenue and costs of an investor accelerator are explained. Lastly, I explain my

qualitative findings from interviewing the investor accelerator Innovation Warehouse, which underpins the literature review on this topic.

2.4.1 Business Model

The business model of an investor accelerator can be simply described as investors (limited partners) investing in the accelerator program which functions as a small fund. This fund acts very similar to a venture capitalist. The major stake of the fund is invested in equity stakes of the accepted cohort and the rest is used to cover running costs of the accelerator such as employee salaries or event organization. In return to the seed investment the accelerator receives an equity stake in the startup. These investments can be structured in different ways and it depends on each accelerator how they prefer structuring their investment. For example, the accelerator might prefer common stock or prefer to invest with a convertible note. A convertible note is short-term debt that converts in to equity or more specifically into preferred shares, upon closing a follow-on round of financing. It basically means that investors are giving the startup a loan, but instead of asking for their money back with interest, they receive preferred stock when further financing is secured (Clarysse et al., 2015; Financial Times, 2016). For example, Techstars offers automatically a \$ 100,000 convertible note to each startup upon acceptance in exchange for 6% common stock.

As mentioned above, the investor accelerator business model is very similar to the typical venture capital (VC) business model. Since there is very limited amount of research completed on the economics of accelerators, one relies on research conducted on venture capital funds. The findings from the venture capital research will be adapted to the accelerator business model. The business model is structured in so-called venture cycles, which means one cycle includes raising funds from investors, investing the raised funds into the accepted startups, supporting them throughout the program, helping them to raise follow-on rounds, exiting successful deals, returning capital to investors and then accelerators raise additional funding to start a new fund and this when a new venture cycle starts (Gompers & Lerner, 2001).

After the accelerator's managing directors have raised sufficient funding from investors the accelerator cycle starts by selecting startups for the first cohort. Investors usually act as limited partners (LP) and do not have any operational role within the accelerator. Limited partners can be different kind of institutions such as endowments, insurance companies, pension funds, venture capitalist, and business angels (Preqin, 2012, 2014; Rao, 2014). These investors do not actively engage in the day-to-day operations of the accelerator, but profit from the returns made from the investments based on how much they invested into the accelerator's fund. However, invested venture capitalists or business angels might act as mentors or be interested in investing into accelerated startups after the completion of the program or the demo day (Samila & Sorenson, 2010, 2011). In order to make profit on its investments the accelerator needs to convert its illiquid shares in the private companies into a realized return (Gompers & Lerner, 2001). This can be an acquisition or an initial public offering (IPO) of the accelerated startup. An investment is written off, if a startup falls into insolvency. Different to venture capitalists, accelerators do not take board seats and do not actively influence the startups after they left the accelerator, but they might help them to raise follow on rounds thereafter (Gompers & Lerner, 2001).

2.4.2 The Economics of Accelerators

Not only the business model of an investor accelerator is similar to that of an early stage VC fund, but also their economics. For venture capital funds a standard rule implies that the fund itself (General Partners of the fund) invests 1% of the total fund size and limited partners add the remaining 99% (Mulcahy, 2014). Proceeds are therefore distributed respectively, after the initial investment is paid out. Then managing partners of the VC receive a carried interest and limited partners receive the remaining profits (Kaplan & Schoar, 2005). On top of that, funds request an annual management fee. This money is used to cover operating costs of the fund, such as employee salaries and rent (Feld & Mendelson, 2013). The following example illustrates this process more precisely.

Limited partners invest \$500 million in a venture capital fund; general partners of the venture capitalist contribute another \$5 million which is 1% of the LPs' amount. The management fee amounts \$10 million, 2%, of the LPs' money invested. The money is not invested, but used to cover operation expenses. Let say that the fund invests over a time horizon of 10 years and at disbursement the fund's capital amounts \$1000 million, \$500 million go directly to the investors, \$5 million to the venture capitalist's general partners and one is left with \$495 million of profit. These profits are now paid out based on the original agreement, e.g. 20% of carried interest, which leaves the investors with 80%, \$396 million, and the fund's partners with 20%, \$99 million.

This works similarly for accelerators, but there are some major differences. Accelerators usually do not take an annual management fee, as the 1-3% fee would not cover the operating expenses of coaching one or two cohorts a year. Entrepreneurs and venture capitalist on Quora.com mention that is rather a 50% management fee plus 20% carried interest in order to cover all operating costs (Quora, 2016a). Other accelerators, such as Techstars, apparently do not take a management fee, but also do not separate operational costs and the amount invested in startups. 500 Startups, for example, takes a seed investment, but for the coaching in the acceleration period startups are charged fees(Quora, 2016b). Thus, 500 Startups covers partly its operating costs with the charged fees. Y Combinator tries to run a lean cost structure by not offering office space in order to save the rent. However, they started off investing capital from VCs and business angels, but nowadays as Sam Altman, president of Y Combinator, mentioned they invest their own capital and therefore keep all proceeds. As one can see different accelerators take different approaches. However, the 1-3% management fee typically charged by venture capitalist would not be sufficient to cover operating costs for an accelerator.

2.4.3 Qualitative Analysis: Interview to Innovation Warehouse

I conducted an interview with the startup accelerator Innovation Warehouse based in London, United Kingdom. The interview was held with Adam Shpiro, International

Business Development Manager at Innovation Warehouse and the son of Innovation Warehouse's founder and CEO Ami Shpiro. The interview was structured into four different parts – accelerator profile, business model, selection process, and performance metrics – in order to build a sound understanding of the accelerator's operations and how the economics in an accelerator function. The first part, accelerator profile, aims to collect simple information on the accelerator's background that I could not find in an online research. The business model part of the interview aims to gather information on the accelerator's vision and motivation, its revenue model and investors as well as the importance of partnerships. Understanding the key factors within the selection process of an accelerator is important as the selection process is closely linked to the business model. Lastly, most of the research in this work aims to understand how well different accelerators are performing, thus, it is critical to gather information on how accelerators measure their performance internally (See Exhibit 5 in the Appendix for the interview instrument used).

Innovation Warehouse was founded by Ami Shpiro, CEO, in London in 2010. It employs 10 individuals in four different functions: investment, acceleration programs, community, and business development. On top of that the accelerator engages an advisory board and a number of mentors to support support startups or help with investment decisions.

The original motivation behind Innovation Warehouse is to create an environment that supports high growth startups with expertise, but also investment. A quite unique aspect about Innovation Warehouse is that once a startup was accepted to the accelerator program the investment team of the accelerator still needs to make a decision if an investment is taken or not. Thus, there is no investment upon acceptance and, if an investment is taken there is no standard term sheet, but it is discussed and decided together with the entrepreneurs how to structure the terms of the investment.

Differentiating its value proposition from competitors, Adam mentioned that they see themselves as an innovative and entrepreneurial ecosystem for growth startups that

provides certain services, such as co-working space, acceleration, investments, and mentorship. Thus, acceleration is one part, but not the only one of this ecosystem. Also, they focus on creating a serious, but at the same time collaborative environment in which startups can focus on growing their business.

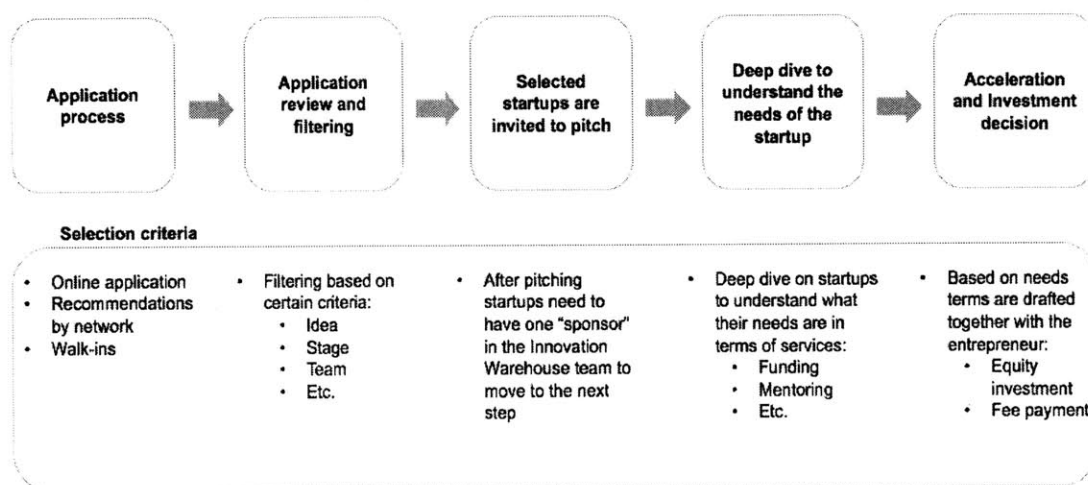
As explained in Section 1, accelerators tend to expand in two different ways, either they increase the cohort size or they expand geographically meaning that they set up new acceleration programs in different city. Innovation Warehouse chooses the latter option and is currently looking to expand on a geographical level, but they have decided which location shall be next. They are considering starting an accelerator in either Asia, Israel or other parts of Europe in order to build a collaborative co-investing network that sits across key urban locations. Innovation Warehouse already has strong ties and partnerships with several institutions in Israel to have access to the strong Israeli entrepreneurial ecosystem. They see a high value for startups joining their program in getting access to the broad international network of Innovation Warehouse in the future.

Innovation Warehouse offers three major service to startups – co-working, acceleration (including mentorship programs), and investments. Based on these services they have three key revenue streams: co-working, acceleration programs, and investments. The entrepreneur can decide whether she wants to pay a fee for these services, give up equity in exchange or a flexible combination. The latter two services are often converted into equity. Innovation Warehouse aims to create a balance between running a sustainable business that creates profits and investing in startups.

Going back to Cohen's and Hochberg's definition of an accelerator program, Innovation Warehouse's accelerator program and its selection process are aligned with it. It is straight forward and similar from what I have seen in my research of other accelerator programs. Upon acceptance Innovation Warehouse offers intense mentorship during the acceleration period, educational workshops, and weekly pitch events as well as demo days for startups. Nonetheless, there are two main differences between the formal definition of an accelerator. Namely, Innovation

Warehouse does not accept startups on a cohort basis to their acceleration program, but on a rolling basis and there is no fixed period during which startups stay within the program, but it is decided on a case-to-case basis how long the startups stay. The selection to the accelerator and a potential investment is a five-staged process illustrated in Figure 1 below. After receiving an application, it is reviewed and based on its idea, team, and life-cycle stage the company is invited to pitch in front of the Innovation Warehouse team (e.g. during the weekly pitch event). Innovation Warehouse does accept single founders, but like many accelerators they prefer founding teams. Also, they prefer to see some work experience, which does not mean they have to be a serial entrepreneur. Also, they focus on companies that have already some kind of minimum viable product (MVP) or some product traction in order to further support them on the commercialization of their business. This implies that the startup has attracted some kind of prior pre-seed funding, for example by family and friends or business angels. The two most important decision making criteria to accept a startup are a winning team in an interesting and evolving market. In order to attract the right startups to apply Innovation Warehouse hosts a variety of events and workshops in the London technology community and by today their brand also plays an important role in attracting interesting candidates for the accelerator.

Figure 1: Innovation Warehouse’s Selection Process



Innovation Warehouse has raised a fund from investors, mainly from business angels and high-net-worth individuals, to invest into the accelerated startups, if decided to do so after the selection process. The fund's structure is aligned with industry standards meaning that they take a 2-3% annual management fee and have a 20% carried interest in the profits of the investments. The terms of the investments are entrepreneur friendly and discussed with the entrepreneur on a case-to-case basis.

Innovation Warehouse tracks its performance based on five different KPIs – jobs created, total funding raised by startups, return on investment (ROI), revenues created by Innovation Warehouse, and survival rates of startups. The performance measurement is split into two parts, first the performance of startups and then performance of Innovation Warehouse. Of course these two are linked, but are reviewed separately. On the startup performance side, Innovation Warehouse measures how many jobs were created by the startups, how much funding they raised, and if the companies still existed or not. On the accelerator performance side, they keep track of the revenues by services and the ROI of their investments. This seems to be a quite standard approach among accelerators.

Overall, Innovation Warehouse has a quite unique model of accelerating startups and includes aspects of two accelerator types mentioned in Section 2.3 – investor and ecosystem building accelerators. They are very focused on supporting the entrepreneurial ecosystem and also connecting startups to potential clients or partners within the community. As Innovation Warehouse invests in most of the accelerated startups and they run a profit oriented business, I still consider them as an investor accelerator.

3. Accelerators, Venture Capital, and Crises

This section aims on explaining the relationship between venture capital investments, impact of crisis, startup performance, and the implications for investor accelerators.

The venture capital industry is known for its high volatility, which spreads across the funds flowing to venture capitalist, the venture capitalists' investments in portfolio companies, and the performance of venture firms and its portfolio companies (Gompers, Kovner, Lerner, & Scharfstein, 2008). According to Gompers and Lerner (1998) and Jeng and Wells (2000) the volatility in the venture capital market is linked to valuation in public equity markets. Meaning that there is a connection between increases in IPO valuations and a growing amount of venture capital funds. Also, there is a positive relationship between venture capital returns and market returns (Cochrane, 2005; Kaplan & Schoar, 2005; Ljungqvist & Richardson, 2003). Thus, overreactions to public market signals drive venture capital investments. During the time of crisis venture capitalists raise less funds and less money is available to invest in startups (Kaplan & Schoar, 2005) Both observations, VC market following public markets and less VC money is invested during crisis periods can be effortlessly observed in Exhibit 3 and 4 in the Appendix.

A scarce funding environment has a negative impact on startup performance, as it is more difficult for startups to raise funds and consequently survival is put in jeopardy. Delgado, Porter, and Stern (2010) find that startups in a strong industrial cluster, such as information and communications technology (ICT) in Silicon Valley or Biopharmaceuticals and Medical Devices in Boston, are more likely to survive. Strong clusters can also be more resilient to economic crisis because they exploit economies of agglomerations (Delgado, Porter, & Stern, 2016a). Looking at Exhibit 4 and 5 in the Appendix, one can see that venture capital investments decreased during the recession in Silicon Valley, but to a lesser extent than other regions.

Putting these three things together, one can see that crisis has a negative impact on public markets, whose development is followed by venture capital market in terms

of funds raised and capital invested. Thus, there is less capital available for startups and it is more difficult for startups to attract investors, consequently the risk of closure increases.

One of investor accelerators key goal is to accelerate growth of the accepted startups and facilitate fund raising through connecting the startups to the accelerator's network of investors. During crisis years this is more difficult, because less investor money is available to be invested in startups. This raises the hypothesis, if accelerators are able to protect the accelerated startups in terms of survival from a scarce funding environment or does the economic crisis affect accelerated startups?

4. Quantitative Findings

In order to assess the performance of accelerators I gathered data from the Crunchbase database and filtered by all investments of two accelerators – Y Combinator and Techstars. I chose Y Combinator and Techstars for the analysis, since a part of my research focuses on the impact of the economic crisis on accelerated startups and these are the only two accelerators that have been active before the economic crisis in 2008.

Y Combinator is solely active in the United States, whereas Techstars is active internationally, but runs most of its accelerator programs in the US. This does not mean that they only accept startups from their respective continent, but that the acceleration program takes place there. For example, Y Combinator requires all accepted startups, local or international, to incorporate their business in the United States and relocate to the Silicon Valley during the acceleration period. Crunchbase provides good information related to the startups that were accepted to accelerators, but as mentioned above these counts only for startups that received an equity investment by the accelerator. The database provides information on startups including funding and founding dates, amount of funding, country of origin, number of funding rounds, current status, and category they are operating in. In Exhibit 6 in

the Appendix all variables are defined. Due to the private nature of the startup industry, the accuracy and correctness of information is strictly based on what is recorded and published by Crunchbase. In order to be able to build a sounder analysis I crossed the data from Crunchbase with data I collected from different websites, mainly the accelerators' websites. With this approach I was able to allocate the different startups to their corresponding cohort and if applicable to their corresponding program location (e.g. Techstars has several programs based out of different locations).

The quantitative findings first focus on the descriptive data analysis of Y Combinator and then of Techstars. Both parts of the analysis are two folded outlining the profile of the respective accelerator and deep diving into the quantitative performance analysis based on four KPIs: startup status, number of funding rounds, total funding raised, and if the accelerator acted as a first investor into the respective startups. As Techstars has 14 different locations, I provide an additional analysis describing, if startups from a certain industry choose accelerators in clusters that are strongly specialized in the startup's industry.

4.1 Quantitative Findings for Y Combinator

4.1.1 Profile

As mentioned above, Y Combinator was founded in 2005 in Mountain View, California. Y Combinator has accepted 21 cohorts since then, one during the summer and one during winter of each year. The winter cohorts generally start in January of the year, whereas the summer cohorts start in June and runs during the summer. The last cohort recorded in the analysis is the Summer 2015 cohort. Unfortunately, Crunchbase has only 22 startups from the Summer 2015 cohort recorded. The size of the cohorts increased over the last ten years, it started with eight startups per cohort and increased to around 100 startups nowadays. During this time period Crunchbase recorded 753 equity investments by Y Combinator of which 10 cannot be allocated to a specific cohort. Y Combinator has an original focus

on web and mobile applications, but nowadays funds all types of startups. The most famous alumni of the program are AirBnB, Reddit, Dropbox, and Sribd (NESTA, 2014). Over the past ten years Y Combinator has become an institution in the Silicon Valley due to its success of accelerating some of the fastest growing startups in the world. Y Combinator offers a number of important services to the accepted startups, such as dinners, events, office hours, and its famous alumni network (Miller & Bound, 2011).

The weekly dinners are not only co-working session from 6pm to midnight, but also meet-ups at which famous entrepreneurs present and talk about their success and failures and different teams from the current cohort present their most recent progress. Ian Hogarth, a British Y Combinator alumnus, describes it as a co-working time when teams help each other and solve problems together, but which is also competitive, as every time reports its weekly progress (Miller & Bound, 2011).

Events are a core of the Y Combinator program, especially the so-called Angel day and Demo day. The Angel day is scheduled six weeks into the program to pair each startup with two angel investors that shall help preparing for the final pitch at the Demo day. The Demo day is the final day of the program where all startups pitch to around 400 potential investors. However, approximately one third of Y Combinator's cohort already raised angel money by then (Miller & Bound, 2011).

The office hours with Y Combinator's founders and partners is an essential part of the program, as it is the time when founders receive personal advice from experienced founders that have seen hundreds of startups fail as well as succeed. According to Miller and Bound (2011) is the success of the startups from Y Combinator and the success of Y Combinator itself closely connected to the skills and experience of the its partners.

The alumni network of Y Combinator is valuable to the startups, as alumni are proactively giving advice at the Alumni Demo day prior to the Demo day. Also, every Y Combinator startup can reach out to alumni who are highly responsive and happy to help solving problems. It can be understood as an university alumni network and

was originally not planned as being part of the program, but evolved due to alumni's engagement with Y Combinator (Miller & Bound, 2011).

Lastly, the Y Combinator program lasts three months and upon acceptance Y Combinator takes a 7% equity stake in the startups and in return distributes \$120,000 (used to be only between \$14,000 and \$20,000).

4.1.2 Descriptive Analysis

The following analysis focuses on determining the performance of the different cohorts and outlining the funding dynamics within the cohorts. The analysis is four folded and based on four key performance indicators: startup status (dead, acquired, or operating), number of funding rounds, total funding amount, and if the Y Combinator acted as the first investor into the startup or not.

4.1.2.1 Startup Status: Dead, Acquired or Operating

As one can see in Figure 2 below (also see Exhibit 7 in the Appendix), the cohort size has significantly increased over the last ten years and has now reached a size of approximately 100 startups per cohort. The analyzed dataset records information of 753 startups of which 10 cannot be allocated to a specific cohort. Across all cohorts, there are 81 dead startups, 100 startups were acquired, and 572 startups are still operating as of 2016. Thus, 89% of these startups were either acquired or are still operating and 11% of the startups were closed. Cohorts from the years 2014 and 2015 are quite young and a full success analysis cannot be executed – i.e. 100% of the startups were either acquired (6%) or are still operating (94%). Until 2014, 494 startups went through the accelerator program of which 16% were closed, 19% were acquired, and 65% are still operating.

Before 2014, none of the cohorts has an operating rate of above 90%. In the overall development one can see that operating rates were at approximately 50% at the beginning, dropped during the years 2007, 2008, 2009, and 2010, and then

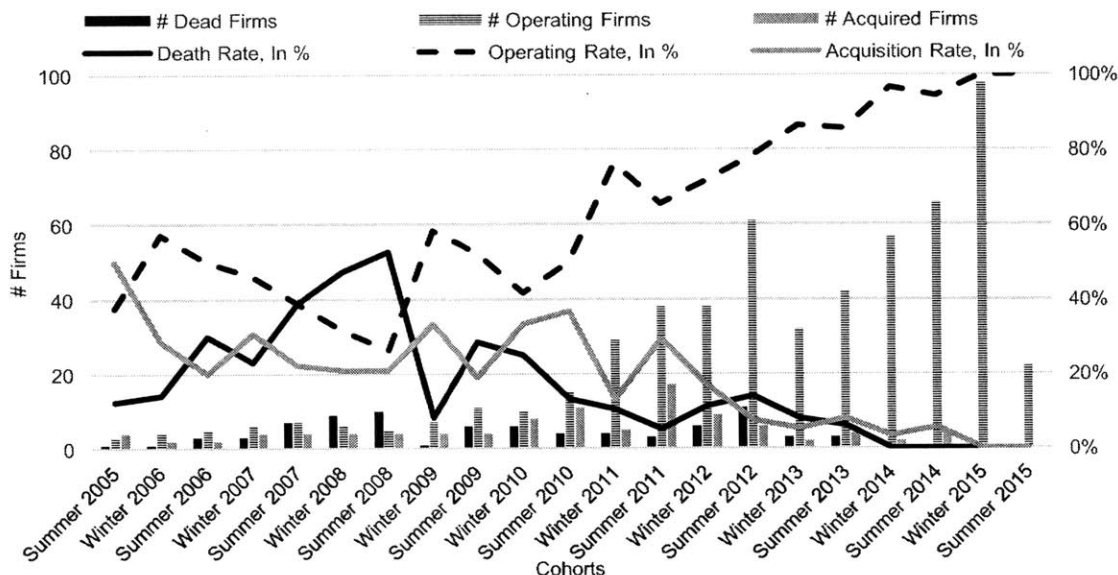
recovered again to approximately 70-80% on average in the years 2011, 2012, and 2013. The cohorts with the highest operating rate are the most recent cohorts with approximately 85-95%. These operating rate are still likely to drop a little, as the companies are not much older than three to four years on average. The cohorts winter 2009 and 2011 seem to have performed outstandingly well. Especially, the winter cohort of 2009 considering that most of the startups were launched during the economic crisis.

The NBER's Business Cycle Dating Committee determined that the Great Recession years were December 2007 through June 2009. In the analysis this corresponds to the 2008 and 2009 cohorts. During this time period the highest death rates were reached by the two consecutive cohorts winter 2008 (47%) and summer 2008 (53%). In Figure 2 (also see Exhibit 7 in the Appendix) one can observe that during 2008 the average death rate is 50%, significantly greater than in any other year. The crisis seems to impact the operating status of startups significantly.⁴

Thus, one can observe the operating rate dropping in the years 2007, 2008, 2009, and 2010. It is probably not a coincidence that these are the years of the recent financial and economic crisis. However, it remains difficult to identify the exact reasons for this development. There are different hypotheses that would need to be tested, such as the following. Did Y Combinator selected worse startups during these years? Was there less funding available in the market for Y Combinator graduates? Did demand in certain industries decrease and startups could not survive due to low demand? Or was it a combination of all these? Besides the reasons for the drop in survival rates it is interesting to observe that the winter 2009 cohort is performing extremely well, but it needs to be mentioned that not all startups in this cohort seem to be recorded in the Crunchbase database.

⁴ This relationship will be analyzed later on with a regression model.

Figure 2: Y Combinator, Cohort Analysis by Startup Status as of 2016



Notes: Author's calculation; Source: Crunchbase (2016), ylist.com (2016); Operating Firms variable means firm is alive (=1, if alive and =0, if acquired or dead) as of 2016; Operating Rate variable is the ratio of the number of operating firms in a cohort and the total number of firms in a cohort.

4.1.2.2 Rounds of Investment

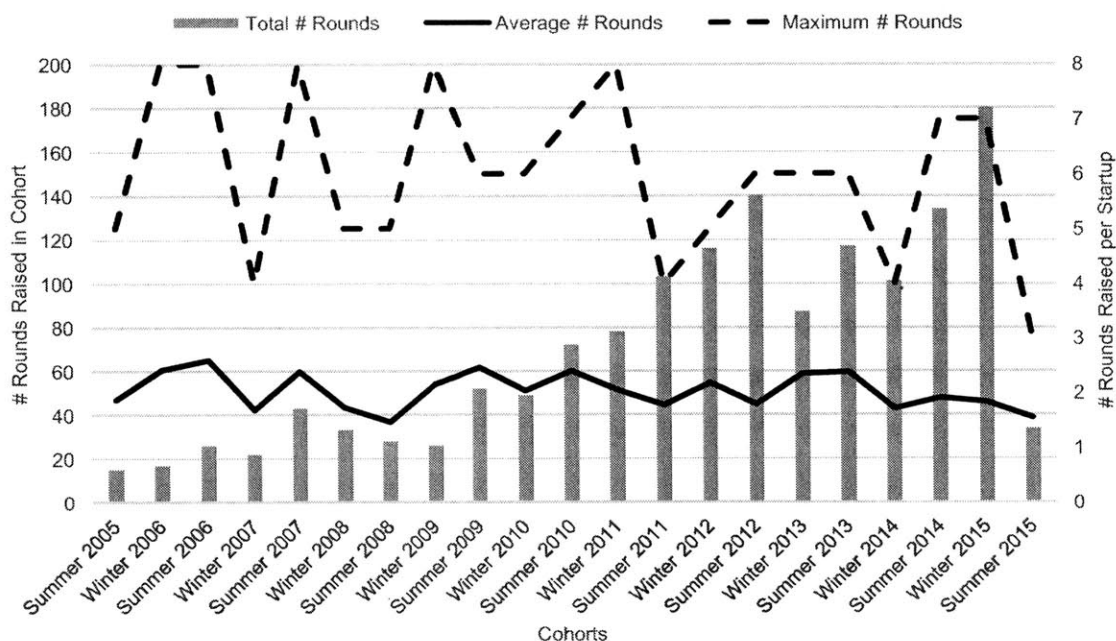
Looking at Figure 3 (also see Exhibit 8 in the Appendix) one can observe that the 753 startups accepted to Y Combinator's accelerator raised a total of 1491 investment rounds. This includes 18 rounds from startups that could not be allocated to one specific cohort. On average the startups (excluding the 18 rounds that cannot be allocated) raised 2.04 rounds per startup. The range amounts seven rounds reaching from a minimum of one to a maximum of eight (see Exhibit 8 in the Appendix). The mode of the distribution amounts one and the standard deviation 1.31. The median of all observations is 2.0, whereas the top quartile is 3.0 and the bottom quartile is 1.0. This already indicates the distribution is right skewed and this is proven by the distribution's skew factor of 1.71 (see histogram in Exhibit 9 in the Appendix). The highest average of investment rounds was reached by the cohorts: summer 2006 (2.60), summer 2007 (2.39), summer 2009 (2.48), and summer 2013 (2.39). Their standard deviation and skew factor are above average which indicates

that they had a few top performers in the cohort that raised an over proportional amount of funding rounds. Cohorts with an high average of investment rounds usually have one or two companies that raised 4 or more rounds. Thus, most of the companies receive one or two investments, but then they do not secure any further funding, either because they are not of interest for investors or because they do not need to.

Now, going into more detail and analyzing the companies within the cohorts where the maximum amount of investment rounds is eight (Cohorts: winter 2006, summer 2006, summer 2007, winter 2009, and winter 2011), one can conclude that these cohorts had a few very well performing startups among them. These include the success stories of Scribd (six rounds), Xobni (eight rounds), Dropbox (six rounds), Cloudant (eight rounds), Airbnb (eight rounds), Clustrix (eight rounds), Pebble (four rounds), DrChrono (eight rounds), MemSQL (four rounds), and Fivestars (five rounds). This shows that very successful companies, such as Airbnb or Dropbox raised more than four rounds until today, thus, raising more than four rounds could be used as a success indicator. However, companies like DrChrono have raised eight rounds, but are by far not as successful as other companies named above. This makes sense, as some companies might have troubles raising one larger round and instead raise several smaller rounds over time. Thus, one cannot generalize success based on raising four financing rounds or more.

Observing the overall development one can see that the average amount of investment rounds decreases during the recent economic crisis and especially in 2008, but the difference is not as recognizable as for the operating rates. Naturally, the average number of rounds decreases in more recent cohorts, since these startups do not have the need of raising multiple rounds yet. In general, one cannot verify that the amount of investment rounds is an indicator for success, because some startups might only need 2 or 3 financing rounds to become profitable, whereas others need 7 or 8. Furthermore, there is no indication of the size of the financing round, which is a better indicator for success.

Figure 3: Y Combinator, Cohort Analysis by Rounds of Investment as of 2016



Notes: Author’s calculation. Source: Crunchbase (2016), ylist.com (2016); Total # Rounds variable shows the total number of rounds raised by a cohort as of 2016; Average # Rounds variable indicates the average number of rounds raised in a cohort as of 2016; Maximum # Rounds variable indicates the maximum number of rounds raised by a startup in a cohort as of 2016.

4.1.2.3 Total Funding

As one can observe in Exhibit 10 in the Appendix, the 753 startups in the dataset raised a total amount of \$ 8.3 billion. This includes \$ 5.1 million from 10 startups that could not be allocated to one specific cohort. On average the startups raised \$ 16.9 million per startup (excluding the 10 startups that could not be allocated). However, the dataset does not record information on total funding for 251 startups, thus, this analysis only represents 492 instead of 743 startups. The range of total funding across all startups is obviously large, reaching from a minimum of \$ 10,000 to a maximum of \$ 2.4 billion (Airbnb). The distribution of all startups is highly right skewed with a value of 16.4, a standard deviation of \$ 122.8 million and a median value of \$ 1.6 million. This seems reasonable regarding the investment economics of accelerators and seed investors, as most of their investments fail, but the ones that succeed raise a lot of funding and reach high valuations. Overall the more recent

cohorts have raised less total funding on average, which makes sense since its startups have not been around for a long time.

The highest average of total funding of a cohort was raised by the winter 2009 cohort with \$ 400 million. This high amount of average funding per startup is driven by the \$2.4 billion raised by Airbnb. The lowest average of total funding was raised by the cohort just before with \$ 1.7 million. The main difference between these two cohorts seems to be Airbnb or more general one startup with a very high amount of total funding. Both are quite right skewed and have a similar skew factor with a value of 2.45 and 2.7 respectively. Almost all cohorts a quite right skewed in terms of total funding. However, the cohort of summer 2006 is left skewed and the cohort of summer 2005 is almost evenly distributed. These two cohorts have a small cohort size and only three and four startups respectively have recorded information in the Crunchbase database. Both cohorts hosted successful startups such as Reddit (summer 2005), Loopt (summer 2005), Scribd (summer 2006), and Xobni (summer 2005). All four companies have raised more than \$ 39 million each.

Going more into detail and analyzing the companies within the cohorts, one can observe that well performing cohorts in terms of total funding have one or two top performers that raised more than \$ 100 million of funding. For example, most of the money raised in the winter 2009 cohort was raised by Airbnb and the bottom 75% of companies of this cohort⁵ raised only \$ 6.7 million. Besides Airbnb, only the startup Heyzap raised more than \$ 1.0 million in funding. A similar case can be made for the cohort in the summer of 2007, where Dropbox raised total funding of \$ 1.1 billion, but only the companies Cloudant, Disqus, and Songkick raised more than \$ 10 million in total funding each. In the summer 2008 cohort only three companies raised more than \$ 1.0 million with the maximum being \$ 10.1 million. Taking a look at Exhibit 7 in the Appendix one can observe that this cohort has the highest death rate with 53%. In the winter cohort of 2007 a similar development can be observed with

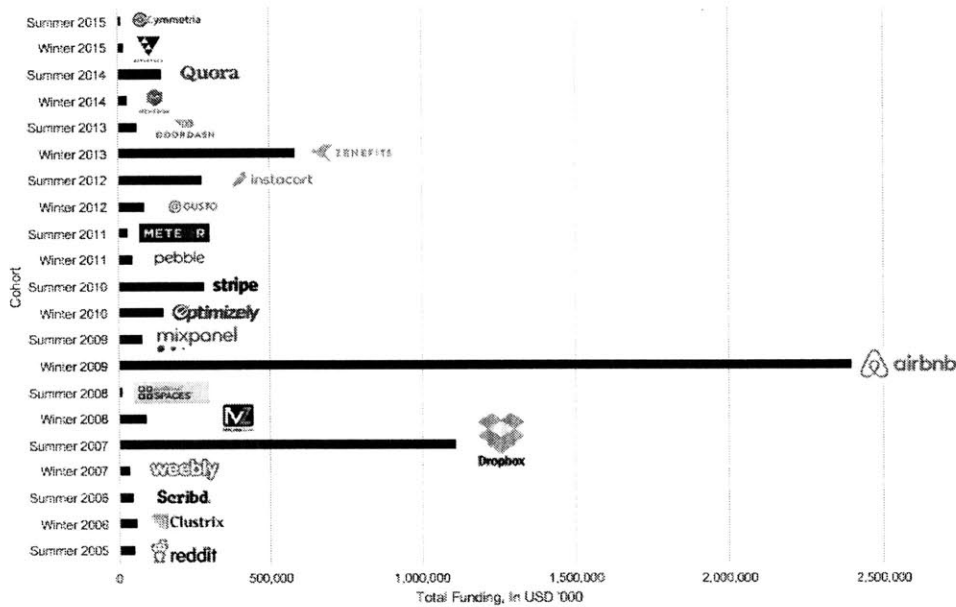
⁵ The winter 2009 cohort records only 12 startups – the cohort size in 2009 was approximately 20 startups – and the dataset only has information on total funding of six of these startups.

only one company raising more than \$ 1.0 million (Weebly raised \$ 35.7 million). Figure 4 lists all startups that raised the maximum funding in their cohort.

Thus, one can observe that well performing cohorts in terms of total funding have at least one company among them that raised more than \$ 100 million in funding (see Figure 4 and 5). Almost every cohort has at least one startup that raised more than \$ 30 million, ignoring more recent cohorts, as their funding needs do not reach these levels yet. Overall a clearer decrease in total funding during the crisis years (2008 and 2009) is only not recognizable because some top performers (such as Airbnb, Optimizely, and Mixpanel) are increasing the total funding average of their cohort. This is underpinned by the fact that the cohorts of winter 2008, summer 2008, and summer 2009 perform worse than the average in terms of total funding per startup⁶. Thus, the performance in terms of total funding is not only highly driven by the top performers in the cohort, but also the effect of the crisis seems to be a factor. This might also be due to the fact that less venture capital is invested during these crisis year (see Exhibit 4 and 5 in the Appendix).

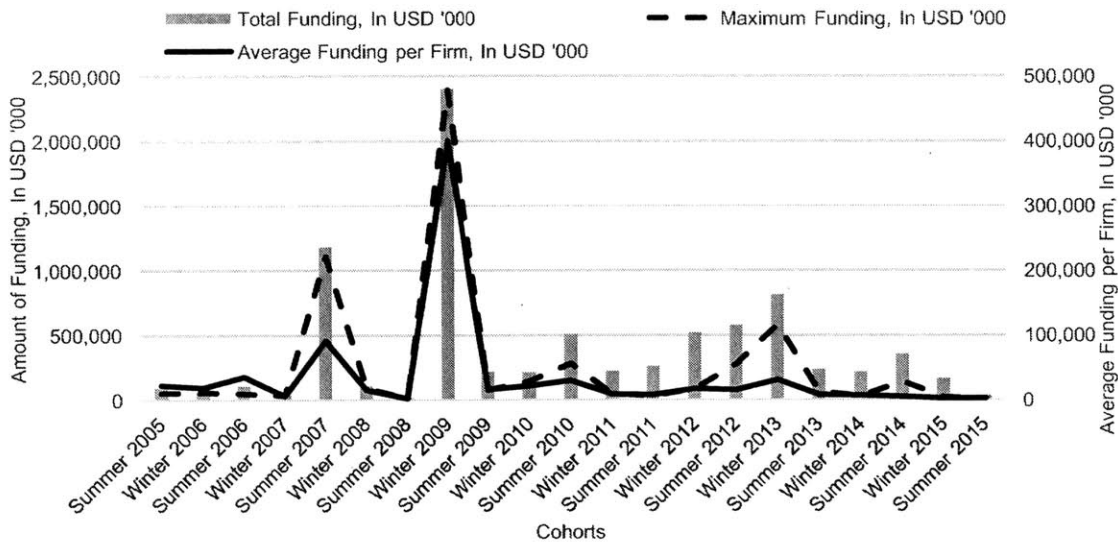
⁶ These three cohorts also have high death rates (see Exhibit 7 in the Appendix).

Figure 4: Y Combinator, Cohort Analysis by Startup with Maximum Funding as of 2016



Notes: Author's calculation; Source: Crunchbase (2016), ylist.com (2016); Graph shows the startups that raised the maximum of total funding within their cohort as of 2016; Maximum Funding variable indicates the maximum funding raised by a startup within its cohort as of 2016.

Figure 5: Y Combinator, Cohort Analysis by Total Funding as of 2016



Notes: Author's calculation; Source: Crunchbase (2016), ylist.com (2016); Total Funding variable shows the total amount of funding raised by a cohort as of 2016; Average Funding per Firm variable indicates the average number of funding raised per startup in a cohort as of 2016; Maximum Funding variable indicates the maximum funding raised by a startup in a cohort as of 2016.

4.1.2.4 Accelerator Acts as First Investor

As one can see in Exhibit 11 in the Appendix, there are 664 startups (88%) in which cases Y Combinator acted as a first equity investor and 89 startups (12%) in which a different investor took the first investment (e.g. family and friends, business angels, different accelerators, or seed stage venture capitalist). One can easily observe in Figure 7 below that the selection of Y Combinator has changed over the past 10 years, as the percentage of startups where Y Combinator was the first investor has decreased over time and they seem to favor startups that have already attracted some funding. This seems to be aligned with the increased amount in equity investment to \$ 120,000 for 7% equity per company that was established in 2014 (Altman, 2014). This is due to increased living costs in the Bay area, but it remains to be proven if companies that already attracted funding before wanted a better valuation when being accepted to Y Combinator. This new deal replaced the old deal of \$ 17,000 for 7% of equity plus a convertible note of \$ 80,000 that converted at the valuation of the next round.

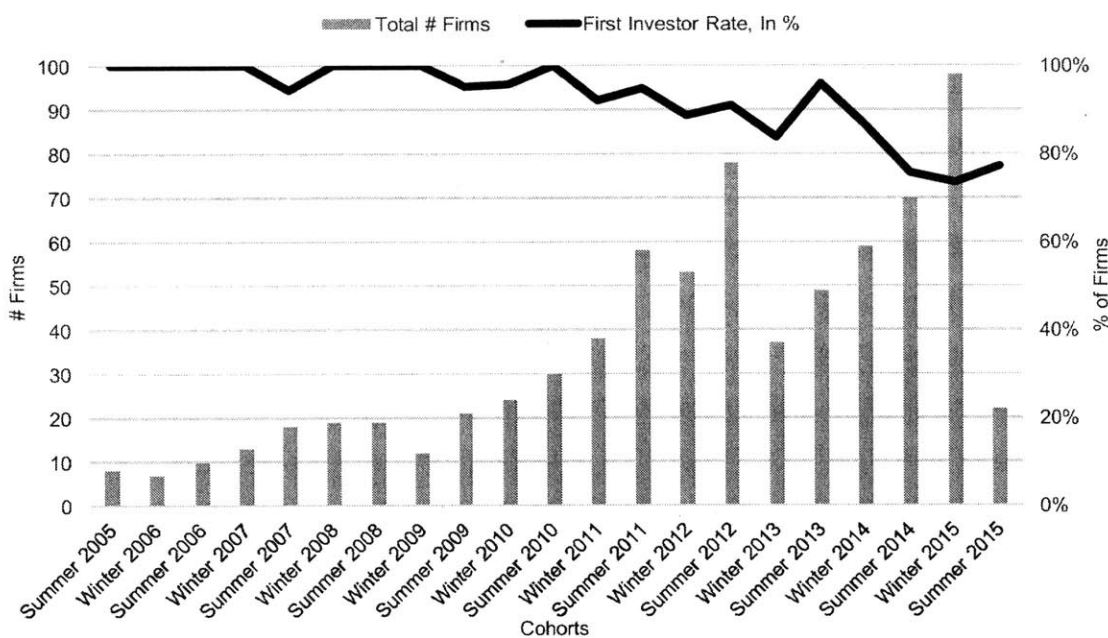
Of the companies where Y Combinator acted as the first investor 12% are closed, 15% were acquired, and 73% are still operating (see Exhibit 12 in the Appendix). Companies that attracted investments before achieve a higher overall operating rate of 94% (see Exhibit 13 in the Appendix). However, it is difficult to compare these two numbers, as the more recent cohort⁷, where Y Combinator acted less often as a first investor), are too young to evaluate their performance in terms of operating. In the cohorts from summer 2011 onwards, from which onwards one can observe an increase in the amount of startups that already attracted investors before joining Y Combinator, the operating rate is 100% (except for summer 2014 cohort). This is higher than the operating rate of startups in which Y Combinator was the first investor, except of the years 2014 and 2015 (see Figure 7). Before 2011 there are no clear differences in the operating rates due to the fact that Y Combinator mainly invested as a first investor. It remains to be proven, if Y Combinator's new selection

⁷ Cohort of the years 2013, 2014, and 2015

approach increases the operating rate, as they choose “better” performing startups that have raised funds before joining the accelerator.

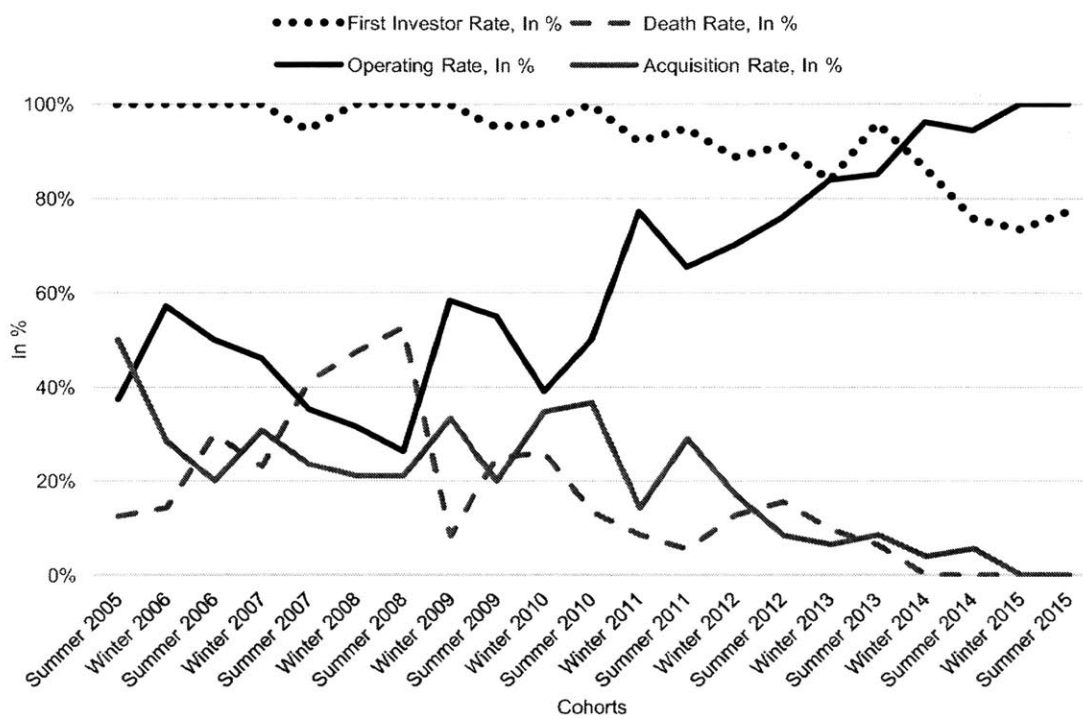
Looking at the development over time (see Figure 6), Y Combinator has accepted more and more startups that have raised capital before. This can have three different reasons. First, Y Combinator has changed its selection process and criteria. Second, Y Combinator has become more popular and startups that have raised money before determine a value in joining the accelerator. Thus, Y Combinator gets access to “better” startups and some of those accept a lower valuation in order to be able to join Y Combinator. Third, it has become easier to raise capital and startups tend to raise money earlier. All three reason seem to be plausible and even a combination of all three might explain this development.

Figure 6: Y Combinator, Cohort Analysis by Accelerator acted as First Investor



Notes: Author’s calculation; Source: Crunchbase (2016), ylist.com (2016); Total # Firms variable shows the total number of firms in a cohort in which the accelerator acted as a first investor; First Investor Rate variable is the ratio of number of firms in a cohort in which the accelerator acted as first investor and the total number of firms in a cohort

Figure 7: Y Combinator, Cohort Analysis by Accelerator acted as First Investor and Status



Notes: Author’s calculation; Source: Crunchbase (2016), ylist.com (2016); First Investor Rate variable is the ratio of number of firms in a cohort in which the accelerator acted as first investor and the total number of firms in a cohort; Operating Rate variable is the ratio of number of firms in a cohort in which the accelerator acted as first investor that are still alive and the total number of firms in a cohort in which the accelerator acted as first investor.

4.2 Quantitative Findings for Techstars

4.2.1 Profile

In 2007, Techstars was founded in Boulder, Colorado by the entrepreneur David Cohen and the investor Brad Feld (Miller & Bound, 2011). Techstars has accepted more than 30 cohorts since its start, each cohort consisting of around 12 startups. Unlike Y Combinator it operates not only out of one city, but multiple ones. Until today Techstars ran accelerator programs in 14 different cities. Also, they do not strictly separate between a winter and summer cohort. In some location they accept winter and summer cohort (e.g. Boston and Seattle) and in others they only accept

one cohort per year (e.g. Kansas City and Los Angeles). The number of startups accelerated during one year increased between 2007 and 2015 (which is the last recorded year in the data) from 10 a year to 124 nowadays. During this time period Crunchbase recorded 507 equity investments by Techstars. Techstars does not have a specific industry focus and creates specialized accelerator programs for certain industries, such as the Barclays Accelerator for Fintech, the Disney Accelerator for entertainment startups, or the Mobility Accelerator in Detroit. For these specialized programs they either cooperate with one major player from the industry or with an industry association. The most famous alumni of the program are DigitalOcean, ClassPass, PillPack, Graphicly, SendGrid, and Vanilla Forums. Together with Y Combinator, Techstars has established itself as a leading accelerator in the technology space due to its success in accelerating some very successful technology companies. Techstars core services offered to startups are workshops, coaching, networking, legal and banking support, hosting services, co-working space, and Demo day (NESTA, 2014).

Unlike Y Combinator, Techstars offers office space to the accepted startups during the acceleration period to entirely focus on the projects. This creates a strong tie between the different teams, as one celebrates and struggles together over the entire time.

Mentoring is one of the core elements at Techstars and in the first month the main focus is put on meeting experienced entrepreneurs, investors, and mentors in order to receive valuable feedback for their business. This can lead to receiving important contacts, meeting potential clients, but also to brutal feedback that leads to pivoting of the idea. If a team cannot convince at least five mentors to support them, Techstars encourages them to pivot. Thus, mentoring is the core of Techstars' accelerator program and is based on strong community of startups, alumni, experienced entrepreneurs, and investors.

Techstars' growth happened mainly on a geographical level by expanding to new locations. This is different to Y Combinator's approach that grew its cohort size at one location. The expansion happened organically as the two founders were

approached by local investors trying to convince them to open a branch in their city. When they decide to expand to a new location, they hire “one operator and one networker to connect the programme to the local investment community” (Miller & Bound, 2011) (p.10). This approach is basically a replica of how Cohen and Feld started the first Techstars accelerator back in 2007.

Lastly, the Techstars program lasts for three months and upon acceptance Techstars takes 6% of common stake in exchange for a \$ 100,000 convertible note.

4.2.2 Descriptive Analysis

The following analysis focuses on determining the performance of Techstars of the last nine years. As explained above, I crossed the Crunchbase data with my online research and therefore I was able to allocate each startup to the location, cohort, and year it was accelerated. As not every location was hosting a program each year and the cohort size is comparatively small, I decided to perform the analysis on a location and yearly basis. The analysis is four folded and based on four key performance indicators: startup status (dead, acquired, or operating), number of funding rounds, total funding amount, and if the Techstars acted as the first investor into the startup or not.

4.2.2.1 Startup Status: Dead, Acquired or Operating

As one can see in Exhibit 14 in the Appendix the number of startups accelerated increased over the nine years and has now reached a high of 124 startups per year. Overall the accelerator hosted 507 companies according to Crunchbase. The cities that has accelerated the most startups for Techstars since its existence are Boston (97 startups), Boulder (91 startups), and New York City (81 startups). Across the entire period and across all cities the operating rate is at 78%, which is slightly higher than for Y Combinator with 76%. The breakdown is as follows, 10% of the startups were closed, 12% were acquired, and 78% are still operating (see Figure 8). Considering that the startups from the years 2014 and 2015 just recently graduated

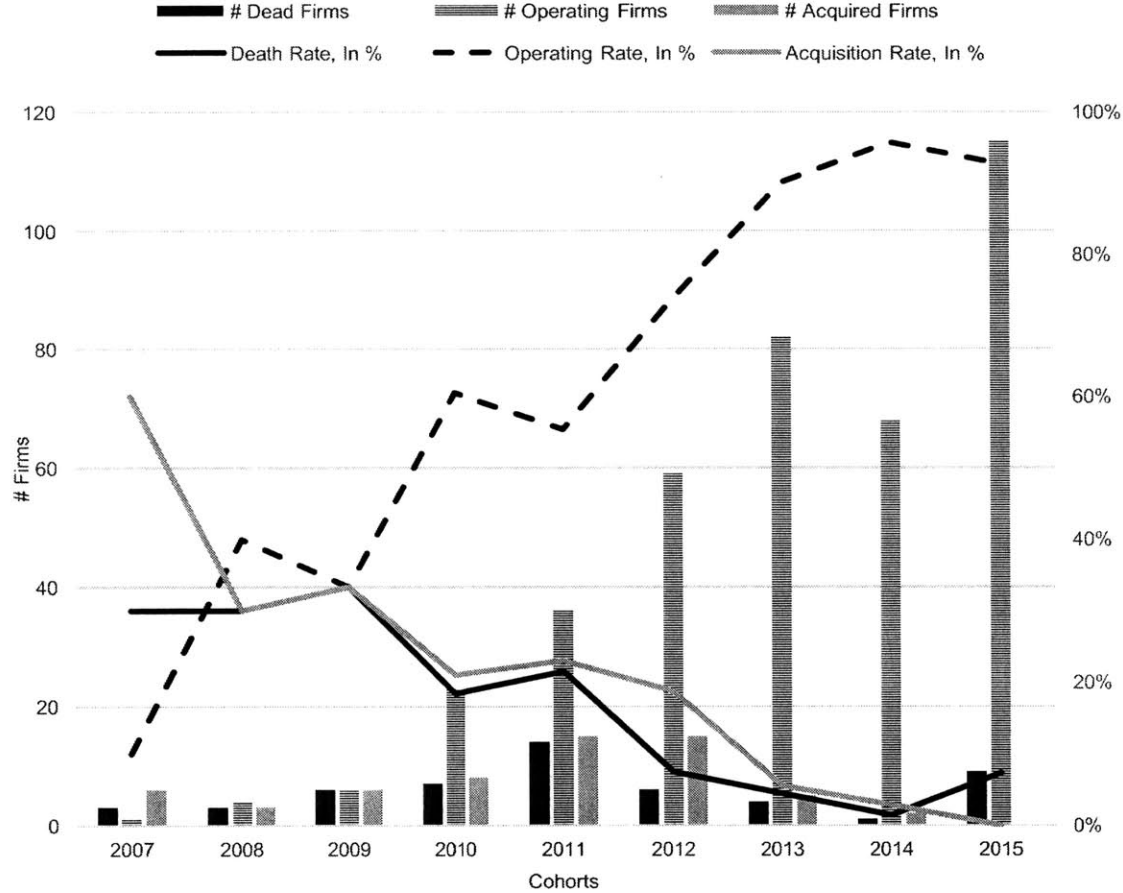
from the program, their operating rate is not very meaningful – however, from 2015's startups 7% are already closed. Before 2014, 312 startups were accelerated of which 14% were closed, 19% were acquired, and 67% are still operating. Thus, 86% of these startups were either acquired or are still operating. The three cities that hosted most of the startups, achieve an operating rate of 72% on average. Interestingly, Boulder has the highest number of acquisitions and only 63% of the accelerated companies in Boulder are still operating, which is the lowest operating rate among all cities (see Figure 9).

Before 2014, the operating rates of each year reaches its peak in 2013 with 90%, but this number might still drop in the future, as it represents comparatively young companies. In the overall development one can observe that operating rates were increasing over time. The lowest operating rate is recorded for the year 2007 with only 10%. This is below the lowest operating rates of Y Combinator (26%) and was also recorded during the economic crisis in 2008. The locations with the highest operating rates are Berlin, Kansas City, Los Angeles, Portland, and San Diego with 100% of operating companies. None of the startups from these cities was closed or acquired. However, the dataset only records one startup for the Portland accelerator program and three for the Kansas City accelerator, thus, the numbers are not representative of the whole program as too few startups are listed. For the other three locations Berlin (9 startups), Los Angeles (6 startups), and San Diego (10 startups) the 100% operating rate is more meaningful (see Exhibit 14). However, they also need to be interpreted carefully, because all locations hosted only a few cohorts (maximum of two cohorts), not all startups are recorded by the dataset, and all cohorts took place in either 2014 or 2015. With this information one can see that the high operating rate also depends on the young age of the startups in these locations. Besides these five cities, which data is difficult to interpret due to imperfect information, San Antonio has an operating rate of 93% and has accelerated 29 startups since 2012.

The slow start of Techstars' operating rates can have two reasons, either Techstars improved their program, became better over time and achieved therefore higher

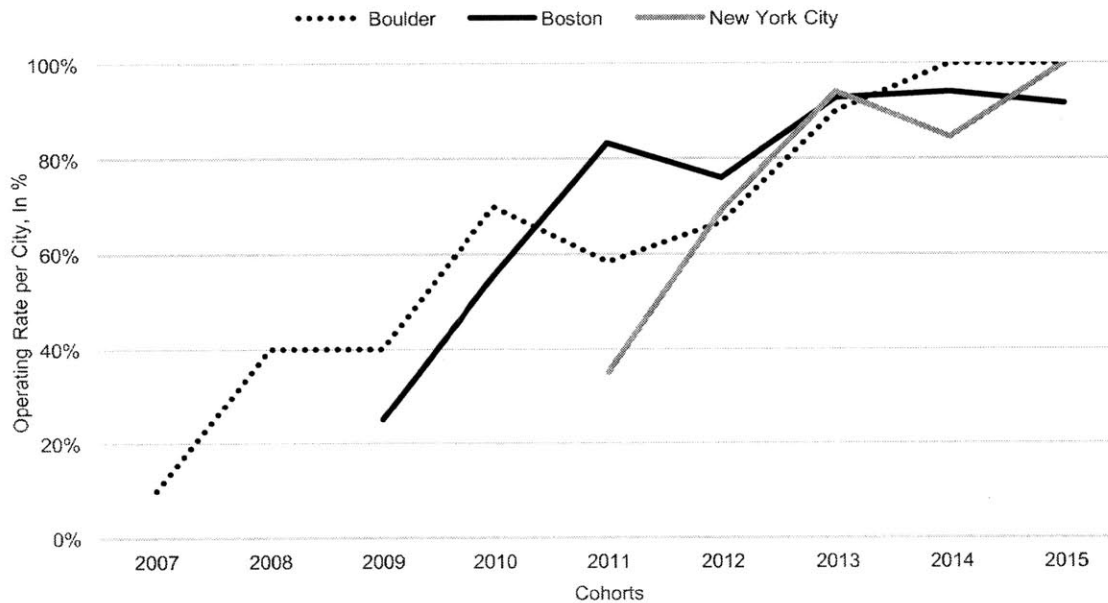
operating rates, or the external economic environment improved after the crisis and it became easier for startups to survive. However, it remains difficult to identify the exact reason or reasons for this development.

Figure 8: Techstars, Cohort Analysis by Startup Status as of 2016



Notes: Author’s calculation; Source: Crunchbase (2016), techstars.com (2016); Operating Firms variable means firm is alive (=1, if alive and =0, if acquired or dead) as of 2016; Operating Rate variable is the ratio of the number of operating firms in a cohort and the total number of firms in a cohort.

Figure 9: Techstars, Selected City Analysis by Operating Rate of the Companies as of 2016



Notes: Author's calculation; Source: Crunchbase (2016), techstars.com (2016); Operating Rate variable is the ratio of the number of operating firms accelerated in a city during a certain year and the total number of firms accelerated in a city during a certain year.

4.2.2.2 Rounds of Investment

Taking a look at Exhibit 16 in the Appendix one can observe that the 507 startups accelerated by Techstars raised a total of 1302 investment rounds. On average each startup raised 2.6 rounds (median is 2.0 rounds), which is higher than the average Y Combinator achieves. The maximum amount of investment rounds raised by one startup is 12, but most of the startups only raised one round and the standard deviation amounts 1.7 across all startups. In Exhibit 17 in the Appendix the histogram shows that the distribution of investment rounds is right skewed. Thus, most of the companies receive one or two investments, but then they do not secure any further funding, either because they are not of interest to investors or because they do not need to raise more funds. There are very few companies raise 5 rounds or more, a similar distribution was observed for Y Combinator. First, I will analyze Techstars'

performance in terms of number of investment rounds across cities and, then, over time based on the year the startups were accelerated.

The highest average of investment rounds was reached by startups from Boston, New York City, and San Antonio with 3.1, 2.9, and 2.9 rounds respectively. Their standard deviation amounts 1.8 for Boston, 1.7 for New York City, and 1.9 for San Antonio, which are also among the highest degree of standard deviation across all cities. This indicates that they had a few top performers that raised an over proportional amount of funding rounds. This is different for the startups from San Diego⁸, where startups raised 1.5 rounds on average and the standard deviation is much lower with 1.0. Thus, in terms of number of rounds raised the startups from San Diego are more similar and the distribution is less right skewed. Going into more detail and analyzing the companies from locations where the maximum amount of investment rounds is above equal or above nine (Locations: Boston, Boulder, Chicago, and San Antonio), one can conclude that these cities had a few very well performing startups among them that raised a high amount of rounds. These observations include successful startups, such as Meal Ticket (Boulder, 12 rounds), DigitalOcean (Boulder, six rounds), Graphicly (Boulder, seven rounds), SendGrid (Boulder, five rounds), Localytics (Boston, seven rounds), Placester (Boston, six rounds), Zagster (Boston, nine rounds), Marginize (Boston, seven rounds), Ginger.io (Boston, five rounds), FanGo Software (Chicago, nine rounds), SpotHero (Chicago, five rounds), Distil Networks (San Antonio, 10 rounds), and Keen.io (San Antonio, five rounds). This shows that very successful companies, such as DigitalOcean or Distil Networks raised more than four rounds until today. Does this mean that raising more than four rounds could be used as a success indicator? However, companies like Meal Ticket have raised 12 rounds, but are by far not as successful as other companies named above. This makes sense, as some companies might have troubles raising one larger round, instead they raise several smaller rounds over time or they need to raise several bridge rounds until they are able to raise a larger round.

⁸ I am ignoring Portland as a location in this analysis, as the dataset only records one observation, which is too low in order to make a good judgment on performance.

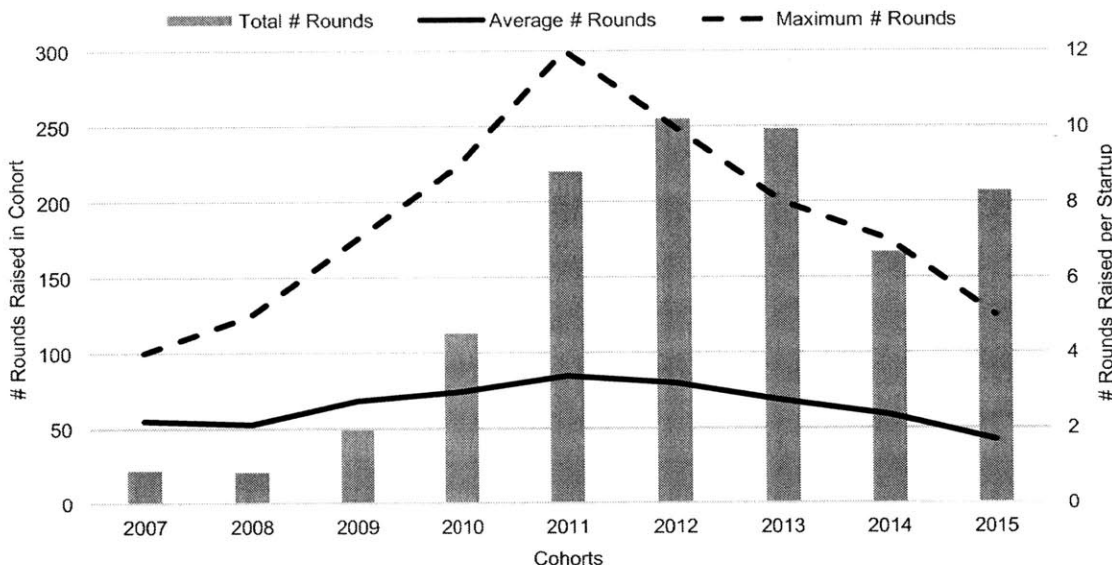
Thus, one cannot generalize success based on raising four financing rounds or more.

Now, the highest average amount of investment rounds was reached by startups accelerated in the years 2011 (3.4 rounds per startup) and 2012 (3.2 rounds per startup). Their standard deviation amounts 2.1 and 1.8 respectively, which is the second and fourth highest standard deviation across all cohorts. Also, these two years achieve the highest maximum with 12 rounds in 2011 and 10 rounds in 2012. This indicates that they had a few companies that raised an over proportional amount of funding rounds. This is different for startups accelerated in 2008⁹, where startups raised 2.1 rounds on average and the standard deviation is lower with 1.4. Taking a closer look at the startups with a very high number of rounds raised, one makes the same observation, as for the analysis across cities. This means that successful companies raise four rounds or more, but the extreme outliers such as Meal Ticket with 12 rounds are not as known and as successful in terms of total funding. This is analyzed in more detail in the next Section.

Observing the overall development one can see that the average amount of investment rounds is lower during the economic crisis, but the difference is not as recognizable as for the operating rates (see Figure 10). Naturally, the average number of rounds decreases in more recent years, since these startups do not have the need of raising multiple rounds yet. In general, one cannot verify that the amount of investment rounds is an indicator for success, because some startups might only need two or three financing rounds to become profitable, whereas others need seven or eight. Furthermore, there is no indication of the size of the financing round, which is a better indicator for success.

⁹ I am ignoring the 2015 in this analysis, as these startups are too young and therefore have raised less rounds.

Figure 10: Techstars, Cohort Analysis by Rounds of Investment as of 2016



Notes: Author’s calculation; Source: Crunchbase (2016), techstars.com (2016); Total # Rounds variable shows the total number of rounds raised by a cohort as of 2016; Average # Rounds variable indicates the average number of rounds raised in a cohort as of 2016; Maximum # Rounds variable indicates the maximum number of rounds raised by a startup in a cohort as of 2016.

4.2.2.3 Total Funding

As mentioned above, the size of total funding might be a more meaningful indicator how well startups from one year and one location performed. The dataset does not record information on total funding for 38 startups, thus, this analysis only represents 469 instead of 507 startups. In Exhibit 18 in the Appendix one can see that the 469 startups accelerated by Techstars have raised a total amount of \$ 1,807 million and \$ 3.9 million on average. The maximum amount raised is \$ 175 million by DigitalOcean accelerated in Boulder in the year 2012. The distribution of all recorded startups in terms of total funding is highly right skewed and has a standard deviation of \$ 11.6 million. As for Y Combinator, these numbers make sense regarding the investment economics of an accelerator, because most of the investments will be written off or just pay back the capital invested and only a few top performers reach high valuations and good exit scenarios such as an IPO or a meaningful exit. Overall

the startups from the more recent years 2014 and 2015 have raised less total funding on average, which makes sense since they have not been existing for a long time yet.

The startups from New York City (\$ 6.1 million), Boston (\$ 5.24 million), Boulder (\$ 5.26 million), and San Antonio (\$ 4.7 million) have raised the most total funding on average. Furthermore, the standard deviation of all startups accelerated in each location are high and indicate that the distribution per location are highly right skewed – New York City (\$ 13.0 million), Boston (\$ 11.4 million), Boulder (\$ 20.1 million), San Antonio (\$ 8.8 million). This leads to a similar finding as for the analysis of total number of investment rounds raised scilicet that there are a few top performers that have raised an over proportional high amount of total funding. The same can be observed with locations that raised a lower amount of total funding per startup, of course the discrepancy between the different quartiles are not as high, but the distributions are still quite right skewed. Only for Detroit one can observe a left-skewed distribution. As the well performing locations in terms of total funding are the same as for the analysis of the number of funding rounds the well performing startups are assumingly almost the same as before. For Boston¹⁰ the startups PillPack (\$ 62.8 million), Synack (\$ 34.0 million), Placester (\$ 50.9 million), Ginger.io (\$ 28.2 million), and Localytics (\$ 59.8 million) raised more than \$20 million in total funding. For Boulder¹¹ DigitalOcean (\$ 175.2 million), SendGrid (\$ 47.4 million), and Occipital (\$ 21.0 million) raised above \$ 20 million. There are four startups from the New York City¹² accelerator program that raised more than \$ 20 million in total funding – Grockit (\$ 44.7 million), Bluecore (\$ 28.2 million), Plated (\$ 56.4 million),

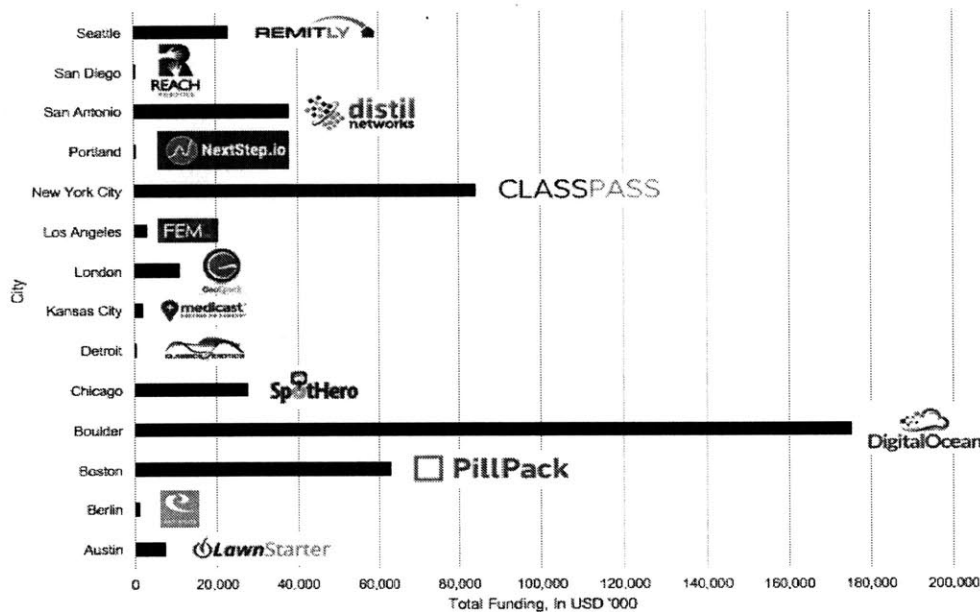
¹⁰ Observations include 91 startups; five startups have raised more than \$ 20 million; five startups have raised between \$ 10 million and \$ 20 million; 10 startups have raised between \$ 5 million and \$ 10 million; 71 startups have raised less than \$ 5 million in total funding.

¹¹ Observations include 82 startups; three startups have raised more than \$ 20 million; four startups have raised between \$ 10 million and \$ 20 million; eight startups have raised between \$ 5 million and \$ 10 million; 67 startups have raised less than \$ 5 million in total funding.

¹² Observations include 73 startups; four startups have raised more than \$ 20 million; six startups have raised between \$ 10 million and \$ 20 million; nine startups have raised between \$ 5 million and \$ 10 million; 54 startups have raised less than \$ 5 million in total funding.

and ClassPass (\$ 84.0 million). From the San Antonio¹³ accelerator startups were able to raise more than \$ 20 million of total funding. This includes the startups Data Robot (\$ 24.4 million) and Distil Networks (\$ 38.0 million) (see Figure 11). When looking at these 14 startups that have raised more \$ 20 million funding until today and cross checks the number of rounds they have raised, one can observe that only few of them raised more than four or five rounds of funding. This proves the assumption from the section before that number of rounds raised might not be the best success indicator. Looking at Detroit, the only location with a left-skewed distribution, one can see that none of the startups raised more than \$ 0.5 million, however, Detroit only hosted one cohort with nine startups in 2015. Thus, the startups have a natural age disadvantage in terms of total funding.

Figure 11: Techstars, Startups with Maximum Funding per City as of 2016



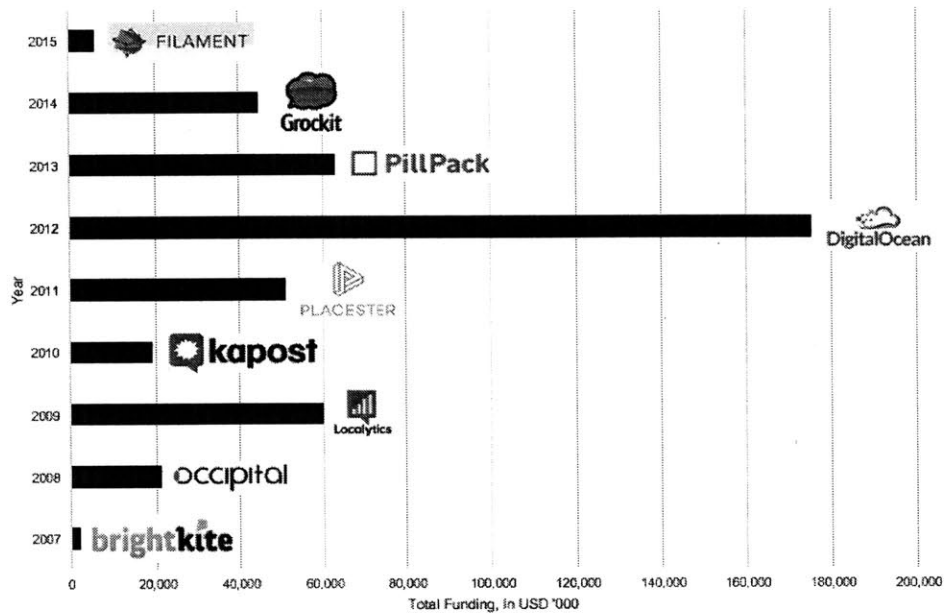
Notes: Author's calculation. Source: Crunchbase (2016), ylist.com (2016); Graph shows the accelerated startups that raised the maximum of total funding within the accelerator's city as of 2016; Maximum Funding variable indicates the maximum funding raised by a startup in the accelerator's city as of 2016.

¹³ Observations include 28 startups; two startups have raised more than \$ 20 million; three startups have raised between \$ 10 million and \$ 20 million; one startup has raised between \$ 5 million and \$ 10 million; 22 startups have raised less than \$ 5 million in total funding.

Now, analyzing the year-by-year performance¹⁴ of Techstars one can observe that the years 2007, 2008, and 2010 are performing worse than the other years in terms of average total funding per startup. Interesting to observe is that the accelerated startups in the recent economic crisis seem to perform worse in terms of total funding than startups from accelerated in other years. However, this excludes startups accelerated in 2009 that raised \$ 7.3 million on average per startup – the Y Combinator cohorts from 2009 were also performing better than its surrounding cohorts. The years 2012 and 2009 perform the best with raising \$ 7.4 million and \$ 7.3 million on average per startup. Their standard deviation indicates that the distribution of both years a quite right skewed – standard deviation amounts \$ 17.2 million in 2009 and \$ 22.5 million in 2012. The maximum amount raised by one startup was raised in 2012 by DigitalOcean and the fourth highest amount was raised in 2009 by Localytics (see Figure 12). The well performing years in terms of total funding have one or two top performers that have raised more than \$ 50 million in funding (see Figure 13). In the case of the year 2009 the startups Localytics and SendGrid raised more than \$ 47 million each. For the year 2012, ClassPass and DigitalOcean have each raised more than \$ 80 million. The bottom 75% of companies accelerated in 2009 raised only \$ 2 million and in 2012 \$ 5.9 million. For the cohort of 2009 only six companies raised more than \$ 1.0 million.

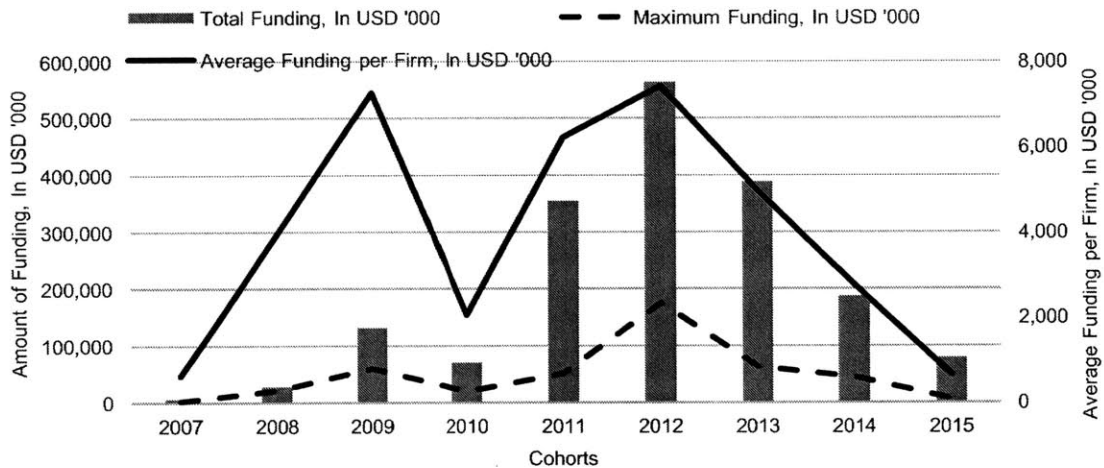
¹⁴ Excluding the years 2014 and 2015, as the startups observed are too young to be compared to the other cohorts.

Figure 12: Techstars, Startups with Maximum Funding per Year as of 2016



Notes: Author's calculation; Source: Crunchbase (2016), ylist.com (2016); Graph shows the accelerated startups that raised the maximum of total funding within their cohort year as of 2016; Maximum Funding variable indicates the maximum funding raised by a startup in their cohort year as of 2016.

Figure 13: Techstars, Cohort Analysis by Total Funding as of 2016



Notes: Author's calculation; Source: Crunchbase (2016), techstars.com (2016); Total Funding variable shows total amount of funding raised by a cohort as of 2016; Average Funding per Firm variable indicates average number of funding raised per startup in a cohort as of 2016; Maximum Funding variable indicates the maximum funding raised by a startup in a cohort as of 2016.

Thus, one can observe that well performing years and locations in terms of total funding have at least one company among them that raised more than \$ 40 million in funding. However, almost every year, but not location, has at least one startup that raised more than \$ 20 million, except the companies from the years 2007 and 2015. Overall there is a pattern of lower total funding during the crisis year 2008 and 2010, but not for the year of 2009. The years 2008 and 2010 perform worse than the average in terms of total funding per startup. And both years do not have one startup that raised more than \$ 40 million (maximum at around \$ 20 million for both years). A similar pattern can be observed for the performance of locations. Thus, the performance in terms of total funding is highly driven by the top performers in the cohort or location that raise more than \$ 40 million. However, the performance is not driven as much by the top performers as it is the case at Y Combinator. Accordingly, the average of total funding per startup seems to be a good indicator of success of a cohort and a location.

4.2.2.4 Accelerator Acts as First Investor

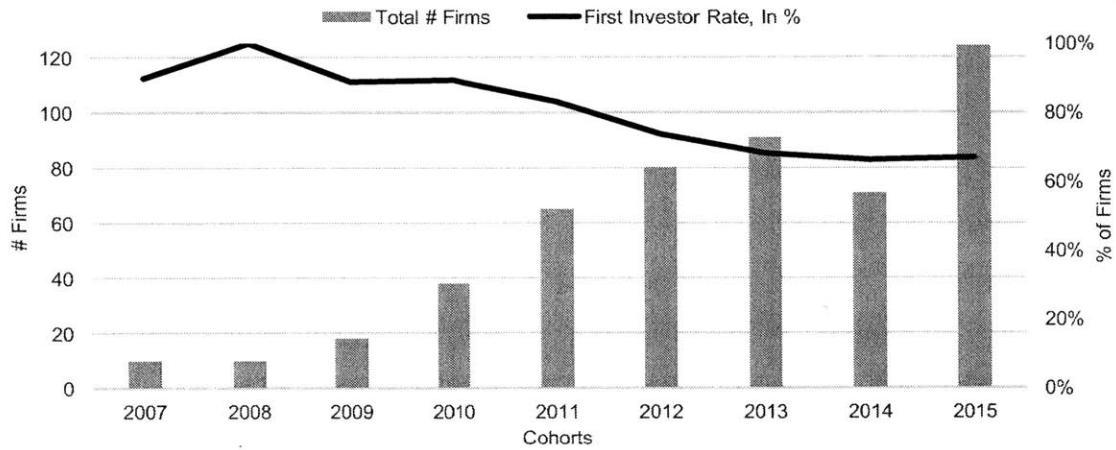
As one can see in Exhibit 19 there are 374 startups (74%) in which case Techstars acted as a first equity investor and 133 startups (26%) in which a different investor took the first investment. It displays the same phenomenon for Techstars, as Exhibit 11 in the Appendix does for Y Combinator, meaning that selection of both accelerators has changed over the past decade, as the percentage of startups in which they were the first investor has decreased over time and they seem to favor startups that have already attracted some funding. There is no clear pattern across the 14 different locations of Techstars. As this analysis is sensitive more to time than location, the following analysis is focused rather on the development over time than across locations.

Of the companies where Techstars acted as the first investor 12% are closed, 13% were acquired, and 75% are still operating. The overall operating rate of 75% (see Exhibit 20 in the Appendix) is lower than for startups that received an investment

prior to joining the accelerator with 85% (see Exhibit 21 in the Appendix). Also, the operating rate goes up over time for the startups in which Techstars invested as first investor (see Figure 15). However, this can either be a natural development, as startups from recent years are still young and, thus, the operating rate will converge to the average over time. Or startups are actually performing better in terms of survival, either because of a better selection by Techstars, Techstars is adding more value and helps them to survive or a better external economic environment. The same is the case for the operating rate. The operating rates are higher for startups in which Techstars was not the first investor. Thus, it remains to be proven, if Techstars changing selection approach increases the operating rate, as they choose “better” performing startups that have raised funds before joining the accelerator.

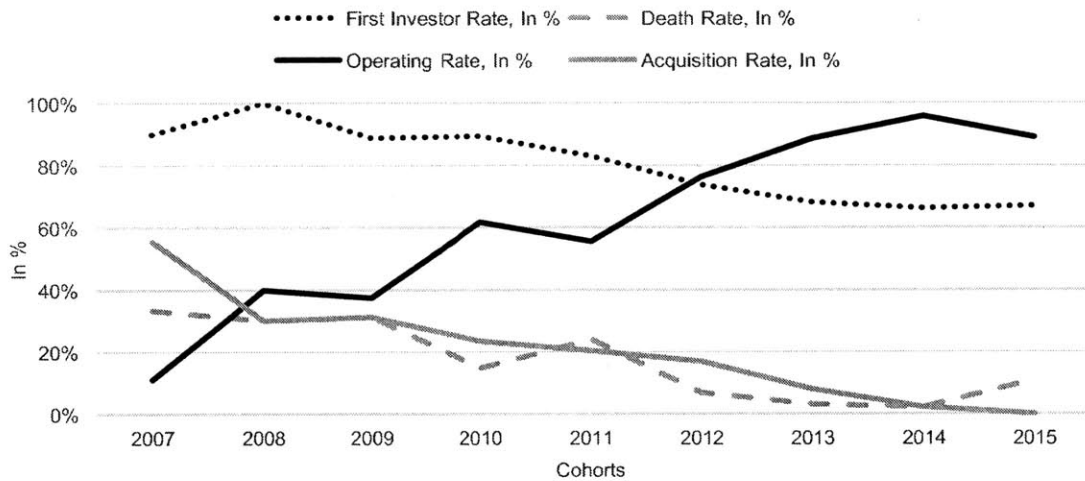
Like Y Combinator, Techstars has accepted more and more startups that have raised capital before (see Figure 14). This development can have three different reasons. First, Techstars has changed its selection process and criteria. Second, Techstars has become more popular and startups that have raised money before determine a value in joining the accelerator. Thus, Techstars has access to “better” startups. Third, it has become easier to raise capital and startups tend to raise money earlier. All three reason seem to be plausible and even a combination of all three might explain this development. However, this opens opportunities to some further research that is not covered in this thesis.

Figure 14: Techstars, Cohort Analysis by Accelerator did act as a First Investor



Notes: Author's calculation; Source: Crunchbase (2016), techstars.com (2016); Total # Firms variable shows the total number of firms in a cohort in which the accelerator acted as a first investor; First Investor Rate variable is the ratio of number of firms in a cohort in which the accelerator acted as first investor and the total number of firms in a cohort.

Figure 15: Techstars, Cohort Analysis by Accelerator did act as First Investor and Status as of 2016



Notes: Author's calculation; Source: Crunchbase (2016), techstars.com (2016); First Investor Rate variable is the ratio of number of firms in a cohort in which the accelerator acted as first investor and the total number of firms in a cohort as of 2016; Operating Rate variable is the ratio of number of firms in a cohort in which the accelerator acted as first investor that are still alive and the total number of firms in a cohort in which the accelerator acted as first investor.

4.3 Links between Techstars and the Regional Clusters

To better understand the performance of Techstars, in this section I explore if startups are preferably joining accelerators located in a cluster with strong specialization in the startup's field. For example, a medical devices startup may prefer to participate in an accelerator program in Boston than in New York City because Boston has a stronger Medical Devices cluster (geographic concentration of related firms and industries and supporting institutions). The preliminary analysis focuses on Techstars' accelerators based in New York City and Boston, since both regions have different cluster composition and have accelerated more than 80 startups. In order to construct a sound analysis on this topic, I cross-checked Crunchbase's industry data on each startup with the startup's website to get a better understanding to which industry each startup belongs. Then, I matched this information with the different industrial clusters definitions described by Delgado, Porter, and Stern (2016b). This identified cluster affiliation of each startup was then complemented with the cluster specializations¹⁵ of the respective city in order to analyze if the startups' industry background overlap with the city's cluster specialization. The cluster data was sourced from the US Cluster Mapping Project.

Exhibit 22 in the Appendix shows that Boston MSA has a strong specialization in Education and Knowledge Creation, Financial Services, IT, Biopharma, and Footwear compared.¹⁶ Most of the startups accelerated by Techstars Boston are in the Education and Knowledge creation (8% of the startups), Marketing, Design, and Publishing (10%), Financial Services (12%), or Information Technology and Analytical Instruments (34%). Also, 30 startups¹⁷ (31%) are active in industries that Boston does not have cluster specialization.

¹⁵ Cluster specialization is measured with the Location Quotient which is the ratio of a cluster's (set of related industries) share of total regional employment in a location relative to its share of total national employment. The LQ measures the specialization of a cluster in a particular region. An LQ > 1 indicates a higher than average cluster concentration in a location.¹⁶ LQ above 1.8

¹⁶ LQ above 1.8

¹⁷ 14 startups are in the business services and seven in the distribution and eCommerce industry, which have a LQ < 1 for Boston.

Exhibit 23 in the Appendix shows a similar table for New York City indicating that it has a strong specialization¹⁸ in Music and Sound Recording, Jewelry, Marketing, Design, and Publishing, Performing Arts, Financial services, and Apparel. Most of the startups accelerated by Techstars in New York City are active in Video Production (6%), Distribution and eCommerce (9%), Financial Services (10%), Marketing, Design, and Publishing (12%), or Education (21%). 31 startups from Techstars New York City are from industries in which New York City does not have a cluster specialization¹⁹.

For both cities some of the strong regional clusters have a strong overlap with the industry background of Techstars startups. In Boston, 69% of the Techstars startups are operating in an industry Boston has a cluster specialization. In New York City, 62% of the Techstars startups are operating in an industry New York City has a cluster specialization.

In sum, there is a recognizable overlap between the industries in which Techstars startups operate in and strong cluster specializations of the respective locations. This can be partly explained by the fact that Techstars has a strong technology focus. This is consistent with more startups being born in strong clusters (Delgado, Porter, and Stern, 2010) increasing the pool of accelerator startup candidates or with startups choosing accelerators in locations with a comparative advantage in their field. Relatedly, the strong positive correlation between the employment within clusters and the number of accelerated startups in the cluster suggests that startups choose a location where there is a lot of industry talent and knowledge in order to profit from the local innovation ecosystem.

Finally, the accelerator concept does not work for startups from all industries. For example, a biopharma startup probably prefers the incubator model, as it has a longer product development cycle, meaning that a three-month acceleration period

¹⁸ LQ above 1.8

¹⁹ 21 startups are in the IT and seven in the business services industry, which have a LQ < 1 for New York City.

is too short to have a real impact. Also, biopharma incubators often offer rentable lab space, which otherwise would be difficult to finance for early stage startups.

5. Regression Model: Startup Survival

Throughout the descriptive analysis of both accelerators I recognized that the economic crisis, during the years 2008 and 2009, has a negative impact on the performance of accelerated startups. The operating status of startups is a good indicator to measure the performance of accelerators and especially this KPI is low during crisis years. I expect that is not a coincidence, but that crisis effects decrease the odds of operating for startups. These crisis effects include general vulnerability of small companies due to a high dependency on investors, lower consumer purchasing power, lower corporate purchasing power, lower consumer investments, and lower corporate investments. Consequently, my research question is how economic crisis impact the survival of startups accelerated by Y Combinator and Techstars during a crisis period.

To examine this question I use a logistic regression equation with startup *Operating Status* as the dependent variable. The regression model is run separately for each accelerator:

$$Operating\ Status_i = 1 / (1 + e^{-(\beta_0 + \sum_k \beta_k x_k)}) \quad (1)$$

Based on the data available I use *Operating Status* as the dependent variable. This dummy variable equals one if a startup *i* is still operating as of 2016 and zero if the startup was acquired or closed.²⁰

The independent variables are *Cohort Age*, *Crisis Period*, *Ln VC Money Region*, and *Accelerator City*. The definitions of these variables are listed in Table 3 below.

²⁰ I do not observe when the firm exits or the type of exit (i.e. death or acquisition).

Table 3: Definition of Regression Variables

	Variable Name	Variable Definition
Dependent Variable	<i>Operating Status</i>	If startup is operating or not as of 2016; operating = 1; dead or acquired = 0
Explanatory Variables	<i>Cohort Age</i>	Age in years of the startup's cohort as of 2016
	<i>Crisis Period</i>	If a startup's cohort was accelerated during a crisis year (2008 and 2009)
	<i>VC Money Region</i>	Amount of venture capital invested in seed and early stage startups in the year the startup's cohort was accelerated and the region where the startup was accelerated
	<i>Ln VC Money Region</i>	Logarithmic scale of amount of venture capital invested in seed and early stage startups in the year the startup's cohort was accelerated and the region where the startup was accelerated
	<i>Accelerator City</i>	City in which the accelerator program takes place. This only applies to echstars, as Y Combinator is located in only one city.

Notes: Source: Crunchbase Database (2016); yclist.com (2016); techstars.com (2016)

Now, I explain the intuitions and definitions behind each independent variable as well as its expected effect on the dependent variable. I control for the age of the cohort in which the startup was accelerated. Startups of younger cohorts left the accelerator more recently and simply did not have time yet to die or to be acquired and are more likely to be still operating. Consequently, I expect a negative relationship between the age of the cohort and the operating status of startups. Also, I control for the crisis period (2008 and 2009), which is a binary variable explaining if a startup was accelerated during a crisis (*Crisis Period* = 1) or not (*Crisis Period* = 0). I expect that startups accelerated during a crisis will have lower likelihood of survival due to the above explained crisis effects (e.g., credit constraints and lower demand). Then, I control for the venture capital money invested in the region of the accelerator on a

seed and early stage level during the year the startup was accelerated, because I want to try to separate the funding environment effects from other crisis effects. It seems likely that operating status and amount of VC capital invested have a positive relationship with each other, as more money invested facilitates the access to capital that is needed to operate for startups. Furthermore, I control for the accelerators location in order to understand the region's impact on the operating status of the accelerated startups. I expect that for accelerators located in strong industrial clusters, the region might have a significant impact on the operating status of startups (Delgado et al., 2010, 2016a).

In sum, I expect that an economic crisis will have a significant negative impact on the operating status of accelerated startups. This could create a discussion around the added value of attending an accelerator program, as it might not protect startups from economic shocks. Also, when funding is scarce their network to the investing community might be less helpful than startups expected. This could motivate a debate on how accelerators could potentially protect startups from economic shocks and what are the best policies to do so. Additionally, I do not anticipate significant differences in terms of operating status between the two accelerators. However, it will be interesting to observe, which accelerator has a more positive impact on the operating status of its startups. Based on the descriptive analysis I expect a similar outcome in terms of the significance and magnitude of the estimated coefficients for both accelerators.

5.1 Regression Findings: Y Combinator

Looking at the correlation between the dependent variable and the three independent variables (see Table 4), one can observe that startups' operating status is negatively correlated to its cohort age. This is expected as younger startups do not exist for long enough to fail. Startup survival is also negatively correlated to being accelerated during the crisis period. This is consistent with the prior descriptive analysis, and suggests that startups are more vulnerable during an economic crisis. The VC money invested in the region during the year of acceleration is positively

related to the operating status, which is also expected, since more invested VC money facilitates the access to the capital needed in the early stage of company that is essential for survival.

Cohort Age and Crisis Period are positively correlated, as the crisis took place in 2008 and 2009 during the early stages of Y Combinator. Thus, only older companies were affected by the crisis. Cohort Age and Ln VC Money Region have a high negative correlation to each other which can be explained by the fact that the amount of capital invested in Silicon Valley has increased since 2005 (see Exhibit 3 and 4 in the Appendix). Lastly, Crisis Period and Ln VC Money Region have a negative correlation with each other implying there was less money invested during the crisis. This observation is reasonable, because the VC market tends to follow the public market (see Exhibit 3 in the Appendix and Section 3 for more information).

Table 4: Y Combinator, Variable Correlation Matrix (N = 743)

	<i>Operating Status</i>	<i>Cohort Age</i>	<i>Crisis Period</i>	<i>Ln VC Money Region</i>
<i>Operating Status</i>	1.00			
<i>Cohort Age</i>	-0.47	1.00		
<i>Crisis Period</i>	-0.26	0.45	1.00	
<i>Ln VC Money Region</i>	0.40	-0.80	-0.32	1.00

Notes: Author's calculation; Source: Crunchbase Database (2016); yclist.com (2016); Operating Status variable indicates whether startup is operating or not (operating = 1; not = 0); Cohort Age gives the age in years of the startup's cohort as of 2016; Crisis Period indicates whether or not a startup's cohort was accelerated during a crisis year (2008 and 2009); Ln VC Money Region is the logarithmic scale of the amount of venture capital invested in seed and early stage startups in the year and region the startup's cohort was accelerated.

The regression analysis confirms the correlation findings. Exhibit 24 in the Appendix shows that the three independent variables are statistically significant at 1% level in each of the separated models (see models (1), (2), and (3)). *Cohort Age* and *Crisis Period* have both a negative coefficient and, thus, a negative relationship to the

dependent variable *Operating Status*, whereas *Ln VC Money Region* has a positive coefficient. This means the older the *Cohort Age*, the less likely it is that the startup is still operating. Younger startups simply did not have the time to fail or to be acquired yet, as they only recently left the accelerator. For *Crisis Period*, if a startup was accelerated by Y Combinator during the economic crisis, it is more likely that it is no longer operating. This can be explained by the external funding environment, but also by other economic shocks during crisis, such as greater uncertainty, excess capacity, lower customer²¹ purchasing power and a higher general vulnerability of small companies during a crisis. For *Ln VC Money Region*, if more money is invested by VCs in the region of the accelerator during the acceleration year of the startup, there is more capital available and startups are more likely to still operate, as they have easier access to capital.

Using odds ratios for the all three independent variables in the separated models one notices the following:

- If the startup's cohort is one year older the odds the startup is still operating decreases by 37%.
- If the startup was accelerated during the crisis the probability that the startup is still operating decreases by 82%.
- If VCs invest one more unit of *Ln VC Money Region* it will increase the probability of operating, which is multiplied by 32.

Model (4) of Exhibit 24 shows the most comprehensive model with all three independent variables. Because of the correlation among the explanatory variables, we need to be cautious about the interpretation of the findings. I find that *Ln VC Money Region* and *Cohort Age* remain highly significant, whereas *Crisis Period* is no longer significant. The signs of the coefficient of each variable do not change and, thus, there is the same relationship, as in the separated models. The odds ratios

²¹ This includes business and consumer customers.

change. For example, one year older regarding *Cohort Age*, while all other variables stay constant, decreases the odds of operating by 24.7%.

The fact that *Crisis Period* is insignificant in model (4) suggests that other crisis effects, except the decrease in VC capital invested, do not have a significant impact on the startups' operating status. As I do not control for all other potential crisis influences on the operating status (such as uncertainty and decline in demand), I cannot identify the crisis factors that influence the operating status. One plausible interpretation is that Y Combinator is able to "protect" the startups from external economic shocks, excluding the availability of VC funding that the accelerator does not control. This would make it attractive for startups to join Y Combinator during a crisis or just before a crisis. Nevertheless, the model does not compare Y Combinator's startups to non-accelerated startups or other accelerators. Hence I cannot properly assess if there is an advantage for startups accelerated by YC Combinator during a crisis period.

In sum, model (4) has the highest relative quality of the four logistic regression models after comparing the different Akaike information criterion (AIC) and log-likelihood scores. *Cohort Age* and *Ln VC Money Region* are significant and *Crisis Period* becomes insignificant, with an area under the curve (AUC) of 0.81, which means that the model is able to explain 81% of the variability of the dependent variable. Based on the model above I predicted the operating status for all startups. Predicting on the entire dataset²² gives a good indication of how much of the variability in the dataset can be explained by the built logistic regression model. As one can see the model performs a lot better than a naïve baseline model²³. The AUC measures the model's discriminative ability. The interpretation is that given a random positive observation and negative observation, the AUC gives the proportion of the time our model predicts correctly, if a startup is operating or not. In this case the

²² This procedure can be described as predictions on the training set.

²³ The naïve baseline model is a model that randomly decides, if a startup is still operating or not. Thus, it would be able to explain 50% of the dataset's variability.

likelihood of our model to differentiate a startup that is still operating from one that is not operating anymore is 81%.

5.2 Regression Findings: Techstars

It is important to note that Techstars had only one program operating during the whole crisis period (2008, 2009). Another program started during the crisis (2009) in Boston. For Techstars (see Table 5a), one can observe that startups' operating status is negatively correlated to its cohort age and if the startups were accelerated during the crisis. These findings are the same than for the case of Y Combinator (Table 4). The VC money invested in the region during the year of acceleration is positively related to the operating status (0.15). However, this correlation is lower than the one observed for Y Combinator (0.40). One explanation is that there was less money invested and the fluctuations seem to be weaker in the different cities of Techstars compared to the VC money invested in Silicon Valley.

Cohort Age and *Crisis Period* are positively correlated, at this time Techstars only had only its Boulder program and the crisis started directly after Techstars set up its operations. Thus, only older companies were affected by the crisis. *Cohort Age* and *Ln VC Money Region* have a less strong negative correlation than it was the case for Y Combinator. This is intuitive, as the increase in VC money invested was stronger in Silicon Valley (see Exhibit 4 and 5 in the Appendix). Lastly, *Crisis Period* and *Ln VC Money Region* have a negative correlation with each other which indicates that there was less money invested during the crisis in Boulder.

Analyzing the correlations between the variables for the startups accelerated in Boulder (see Table 5b), one can see there is no significant difference compared to the correlations in Table 5a. The correlation between *Crisis Period* and *Ln VC Money Region* changes from slightly negative to slightly positive. This seems less intuitive at first, but there was an increase in VC money invested in Colorado from 2007 to 2008, which explains this change.

Table 5a: Techstars, Variable Correlation Matrix (N = 507)

	<i>Operating Status</i>	<i>Cohort Age</i>	<i>Crisis Period</i>	<i>Ln VC Money Region</i>	<i>Accelerator City</i>
<i>Operating Status</i>	1.00				
<i>Cohort Age</i>	-0.45	1.00			
<i>Crisis Period</i>	-0.24	0.48	1.00		
<i>Ln VC Money Region</i>	0.15	-0.38	-0.19	1.00	
<i>Accelerator City</i>	0.04	-0.16	-0.19	-0.06	1.00

Notes: Author's calculation; Source: Crunchbase Database (2016); techstars.com (2016); Operating Status variable indicates whether startup is operating or not (operating = 1; not = 0); Cohort Age gives the age in years of the startup's cohort as of 2016; Crisis Period indicates whether or not a startup's cohort was accelerated during a crisis year (2008 and 2009); Ln VC Money Region is the logarithmic scale of the amount of venture capital invested in seed and early stage startups in the year and region the startup's cohort was accelerated; Accelerator City indicates in which city the accelerator is located.

Table 5b: Techstars Boulder, Variable Correlation Matrix (N = 91)

	<i>Operating Status</i>	<i>Cohort Age</i>	<i>Crisis Period</i>	<i>Ln VC Money Region</i>
<i>Operating Status</i>	1.00			
<i>Cohort Age</i>	-0.55	1.00		
<i>Crisis Period</i>	-0.25	0.51	1.00	
<i>Ln VC Money Region</i>	-0.01	-0.07	0.05	1.00

Notes: Author's calculation; Source: Crunchbase Database (2016); techstars.com (2016); Operating Status variable indicates whether startup is operating or not (operating = 1; not = 0); Cohort Age gives the age in years of the startup's cohort as of 2016; Crisis Period indicates whether or not a startup's cohort was accelerated during a crisis year (2008 and 2009); Ln VC Money Region is the logarithmic scale of the amount of venture capital invested in seed and early stage startups in the year and region the startup's cohort was accelerated; Accelerator City indicates in which city the accelerator is located.

The regression analysis confirms the findings in the pairwise correlation analysis. Exhibit 25 in the Appendix shows that all three independent variables are highly significant in each of the separated models (Models (1), (2), and (3)). As in the Y Combinator case, *Cohort Age* and *Crisis Period* have a negative relationship to the dependent variable, but *Ln VC Money Region* has a positive relationship.

Regarding the magnitude of the estimated effects, using odds ratios for each of the three independent variables in the separate models one can conclude the following:

- If the startup's cohort is one year older the probability of startup survival declines by 44%.
- If the startup was accelerated during the crisis the probability that the startup is still operating decreases by 86% (i.e., the probability of operating would be multiplied by 0.14).
- If VCs invest one unit more in Ln VC Money Region it will increase the probability of operating, which is multiplied by 1.64.

Model (4) includes all three independent variables, only *Cohort Age* is significant. Also, the signs of the coefficients change for *Crisis Period* from negative to positive and for *Ln VC Money Region* from positive to negative. When adding *Accelerator City* as control variable in model (5), *Cohort Age* is still the only variable being significant. As shown in Table 5 above, *Cohort Age* and *Ln VC Money Region* are highly negatively correlated (-0.38) and *Cohort Age* and *Crisis Period* are highly positively correlated (0.48). Those relationships might cause multicollinearity and, for this reason, the outcome of the model is confusing and not robust.

Thus, none of the models (4) or (5) provide useful information on the main factors influencing operating status. I run additional logistic regression models including a mix of combination with two out of the three independent variables excluding *Accelerator City*. The model with *Crisis Period* and *Ln VC Money Region* shows the expected results: the estimated coefficient of *Ln VC Money Region* is positive and statistically significant, and that of *Crisis Period* is significant and negative. This result would indicate that crisis effects do have a negative impact on the operating status of startups accelerated during the crisis. However, in this model I do not control for *Cohort Age*, which is a powerful indicator regarding operating status.

In sum, I do not recommend using a multivariate logistic regression model to separate the main factors influencing the operating status of Techstars' startups. One observation is that, unlike Y Combinator, Techstars only started its operations in 2007 just before the crisis and was probably not able to build enough learning and value added for startups during this short time period before the crisis. This is

underpinned by the low operating rate during the first three to four years of operations (see Exhibit 14).

5.3 Reliability and Model Robustness

In my descriptive and statistical analysis, I had to trust on the information accuracy of the database and websites I used to build my dataset. Crossing data from two sources helped to cross-reference some information. The private nature of the investor and startup industry can potentially generate a survivor bias for successful events, as announcing negative events such as bad exits or closures might be neglected. Also, ignoring all acquisitions in terms of success creates another similar bias. In order to eliminate these two biases one needs to collect information from each startup to understand the current status of the startup and if the exit was successful or if the company is still operating independently after the acquisition. This approach would be beyond the scope of this proposal, but might be useful for future research.

Considering the high correlation between the independent variables and the caused multicollinearity in some models leaves plenty opportunity for explanation. Also, the few independent variables used in the regression models opens chances to include deeper and more sophisticated variables explaining the variability in the dependent variable. Thus, the issue of omitted variable bias is certainly present in this case and demands further research. Nonetheless, I believe the conducted descriptive analysis and the regression models provide valuable findings.

6. Conclusion

This study analyzes the accelerator concept and offers important insights on the performance of accelerators. After establishing a common ground for accelerators in the context of its historical evolution, differentiating the concept of an accelerator from related institutions, and outlining the different kind of accelerators types, I

explained in a deep dive the business model and economics of an investor accelerator. Then, I focused on analyzing the performance of two popular accelerators and understanding the impact of crisis effects on the performance of accelerated startups. Based on the analysis, I have identified six key findings.

First, the survival rate of accelerated startups from both accelerators increased over time and both accelerators have very similar average operating rates across all years of operation. One can observe a clear increase in death rates during the recent economic crisis (especially in 2008). However, it remains difficult to identify the exact reasons for the increase of death rates during the crisis period. There was significantly less funding available, which negatively correlates with survival (this was proven for Y Combinator and Techstars). However, some of the most successful companies in the recent history such as Airbnb were founded during a crisis period and were not significantly affected by the funding scarcity. There are different hypotheses that would need to be tested. Did death rates increase, because accelerators selected worse startups during the crisis? How did the weak funding environment during the crisis impact Y Combinator startups? Did the crisis increase the dispersion in startup funding and reduced the average survival rate? Could startups not survive due to lower demand and increased uncertainty in their particular industries? Were the accelerators able to improve the value added of their programs and became better over time and achieved therefore higher operating rates? Or was it a combination of all these factors?

Second, the analysis of number of funding rounds led to three main conclusions that hold for both accelerators. First, the average operating rate is higher among startups that raised more funding rounds. This suggests that more funding rounds are increasing the odds of survival. Indeed, funding is needed to build and grow a startup to eventually become profitable. Second, there is a clear decrease in the average number of funding rounds during the crisis period. Both accelerators raise the least of amount of rounds per startup during the peak of the crisis in 2008.²⁴

²⁴ Not counting the cohorts in 2015.

Third, I offered two key findings related to the level of total funding and the amount of funding during the crisis. First, I could observe relevant differences between the two accelerators. Successful cohorts (with high average total funding per startup) at Y Combinator have at least one company that raised more than \$100 million in funding and almost every cohort has at least one company that raised more than \$30 million, ignoring more recent cohorts that naturally did not reach these funding levels yet. At Techstars, however, well performing cohorts and locations had at least one company that raised more than \$40 million in total funding and almost every location and year has at least one startup that raised more than \$20 million. Thus, the top performing startups from Y Combinator raise more funds than at Techstars and on average Y Combinator startups raised \$12.9 million more per startup. This difference can be explained by a few top performers within the Y Combinator cohorts such as Airbnb (\$2.4 billion) and Dropbox (\$1.1 billion). In sum, the average of total funding per startup seems to be a good indicator of success of a cohort and a location across both accelerators. Second, although one cannot observe a clear decrease in total funding during the crisis period, as top-performers such as Airbnb distort this development, there is a decrease observable at the core of the crisis in 2008. This is aligned with the observed decrease in venture capital invested during the crisis period.

Fourth, Y Combinator and Techstars have accepted more and more startups that have raised capital before joining the accelerators. There are several plausible explanations. The accelerator has changed its selection process and criteria to now accelerate companies at a later stage of the life cycle. Or, the accelerator has become more popular and even startups that have raised money believe that there is value in joining the accelerator. Thus, the accelerators get access to higher potential startups. Lastly, it has become easier to raise capital and startups tend to raise money earlier. All three potential reasons are related to the rising popularity of startup accelerators and therefore open opportunities to further research that is not covered in this thesis. For both accelerators the operating rates are higher on average for startups that have attracted capital before joining an accelerator. Nevertheless, this does not mean they are performing better, since this is only a

recent development there is a natural age bias present. Thus, one needs to keep this development in mind and continuously analyze it over the next few years in order to make a sound judgment.

Fifth, there is an overlap between the industries in which Techstars' startups operate and the presence of industrial clusters in the respective locations. Also, there is a strong positive correlation between employment within the cluster and the number of accelerated firms in the cluster suggesting that startups are born or choose a location where there is a lot of industry talent and knowledge in order to benefit from the local innovation ecosystem.

Finally, the empirical findings offer a great insight into the performance of the two accelerators and how the crisis affected the survival of their startups. The death rate of startups accelerated during the recession is significantly greater than that of startups accelerated before or after the recession. The scarce VC funding in a location during the crisis seems to be driving this increased death rates.

My analysis also offers implications for future research. The focus of this study was to offer a qualitative overview of accelerator types and a descriptive and regressive analysis of two popular accelerators. This can be extended to other investor accelerator programs, but also to matchmaker and ecosystem builder accelerators. The regression built in this research can be seen as a first attempt to understand the influence of economic shocks on accelerated startups. Future research should focus on comparing the impact of crisis on startups from different accelerators, and comparing accelerated startups versus not accelerated startups in the same location. Also, it would be important to understand what types of startups are more resilient to economic shocks, as my analysis did not control for startup attributes. This would provide a great insight into the real value-added of accelerator programs, especially during crisis periods.

Lastly, I focused on operating status as a success indicator, but this variable does not capture the quality of startups (Guzman & Stern, 2015). To better assess the performance of accelerated startups we need to take into account other success indicators, such as the number of jobs created, total funding raised by the startup or

IPOs. This would lead to a sounder performance analysis and could prove particularly helpful to assess the resilience of accelerated startups.

7. Bibliography

- Altman, S. (2014). Y Combinator - The New Deal. Retrieved from <https://blog.ycombinator.com/the-new-deal>
- Caley, E., & Kula, H. (2013). *Seeding Success: Canadian Startup Accelerators - MaRS Data Catalyst*.
- Christiansen, J. D. (2016). Seed-DB.com.
- Clarysse, B., Wright, M., & Hove, J. Van. (2015). *A Look Inside Accelerators - Building Businesses*. NESTA.
- Cochrane, J. H. (2005). The risk and return of venture capital. *Journal of Financial Economics*, 75, 3–52.
- Cohen, S. (2013). What Do Accelerators Do? Insights from Incubators and Angels. *Innovations: Technology, Governance, Globalization*, 8(3), 19.
- Cohen, S., & Hochberg, Y. V. (2014). Accelerating Startups: The Seed Accelerator Phenomenon. *SSRN Electronic Journal*, 1 – 16.
- Cohen, S., Hochberg, Y. V., & Fehder, D. C. (2015). Seed Accelerator Rankings Project.
- Crunchbase. (2016). Crunchbase.com.
- Delgado, M., Porter, M. E., & Stern, S. (2010). Clusters and Entrepreneurship. *Journal of Economic Geography*, 10(4), 495–518.
- Delgado, M., Porter, M. E., & Stern, S. (2016a). *Clusters and the Great Recession* (Vol. 53).
- Delgado, M., Porter, M. E., & Stern, S. (2016b). Defining Clusters of Related Industries. *Journal of Economic Geography*, 16(1), 1–38.
- Delgado, M., & Zeuli, K. (2016). Clusters and Regional Performance: Implications for Inner Cities. *Economic Development Quarterly*.
- EForAll. (2016). Entrepreneurship For All.

- Fehder, D. C., & Hochberg, Y. V. (2015). Accelerators and the Regional Supply of Venture Capital Investment. *SSRN Electronic Journal*, 1–40.
- Feld, B., & Mendelson, J. (2013). *Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist*.
- Financial Times. (2016). Financial Times Lexikon. Retrieved from www.lexicon.ft.com
- Gompers, P., Kovner, A., Lerner, J., & Scharfstein, D. (2008). Venture capital investment cycles: The impact of public markets. *Journal of Financial Economics*, 87(1), 1–23.
- Gompers, P., & Lerner, J. (1998). What drives venture capital fundraising? *Brookings Papers on Economic Activity Microeconomics*, 149–204.
- Gompers, P., & Lerner, J. (2001). The Venture Capital Revolution. *Journal of Economic Perspectives*, 15(2), 145–168.
- Grimaldi, R., & Grandi, A. (2005). Business incubators and new venture creation: An assessment of incubating models. *Technovation*, 25(2), 111–121.
- Guzman, J., & Stern, S. (2015). Where is Silicon Valley. *Science*, 347(6222), 606–609.
- Hallen, B. L., Bingham, C. B., & Cohen, S. L. (2016). Do Accelerators Accelerate? The Role of Indirect Learning in New Venture Development. *SSRN Electronic Journal*.
- Hathaway, I. (2016). *Accelerating growth: Startup accelerator programs in the United States*.
- Isabelle, D. A. (2013). Key Factors Affecting a Technology Entrepreneur's Choice of Incubator or Accelerator. *Technology Innovation Management Review*, (February), 16–22.
- Jeng, L. a., & Wells, P. C. (2000). The determinants of venture capital funding: evidence across countries. *Journal of Corporate Finance*, 6(3), 241–289.
- Kaplan, S. N., & Schoar, A. (2005). Private Equity Performance: Returns, Persistence and Capital Flows. *The Journal of Finance*, 1791–1824.
- Ljungqvist, A., & Richardson, M. (2003). The Cash Flow, Return and Risk Characteristics

of Private Equity. *NBER Working Paper*.

Miller, P., & Bound, K. (2011). *The startup factories: The rise of accelerator programmes to support new technology ventures*. NESTA. Retrieved from <http://www.nesta.org.uk/library/documents/StartupFactories.pdf>

Mulcahy, D. (2014). Venture Capitalists Get Paid Well to Lose Money. *Harvard Business Review*. Retrieved from <https://hbr.org/2014/08/venture-capitalists-get-paid-well-to-lose-money>

NESTA. (2014). *Startup Accelerator Programmes: A Practical Guide*.

NVCA, & Ernst & Young. (2015). *Venture Capital Review*.

Preqin. (2012). *Preqin Special Report: US Private Equity*.

Preqin. (2014). *Preqin Special Report: Venture Capital*.

Quora. (2016a). Quora. Retrieved from www.quora.com/Are-the-funds-raised-by-YC-and-500-Startups-from-their-LPs-structured-with-the-2-20-formula-or-are-they-structured-differently

Quora. (2016b). Quora. Retrieved from www.quora.com/How-financially-does-Techstars-or-other-startup-accelerators-run-their-accelerator-program-and-pay-their-staff

Rao, L. (2014). YC Ends YCVC In Favor Of Raising From LPs. *Techcrunch*. Retrieved from <http://techcrunch.com/2014/04/22/yc-ends-venture-partnership-ycvc-in-favor-of-raising-from-lps-will-now-invest-120k-for-seven-percent-of-startup-equity/>

Rothaermel, F. T., & Thursby, M. (2005). University-Incubator Firm Knowledge Flows: Assessing Their Impact on Incubator Firm Performance. *Research Policy*, 34(3), 305–320.

Samila, S., & Sorenson, O. (2010). Venture Capital as a Catalyst to Commercialization. *Research Policy*, 39(10), 1348–1360.

Samila, S., & Sorenson, O. (2011). Venture Capital, Entrepreneurship, And Economic

Growth. *The Review of Economics and Statistics*, 93(1), 338–349.

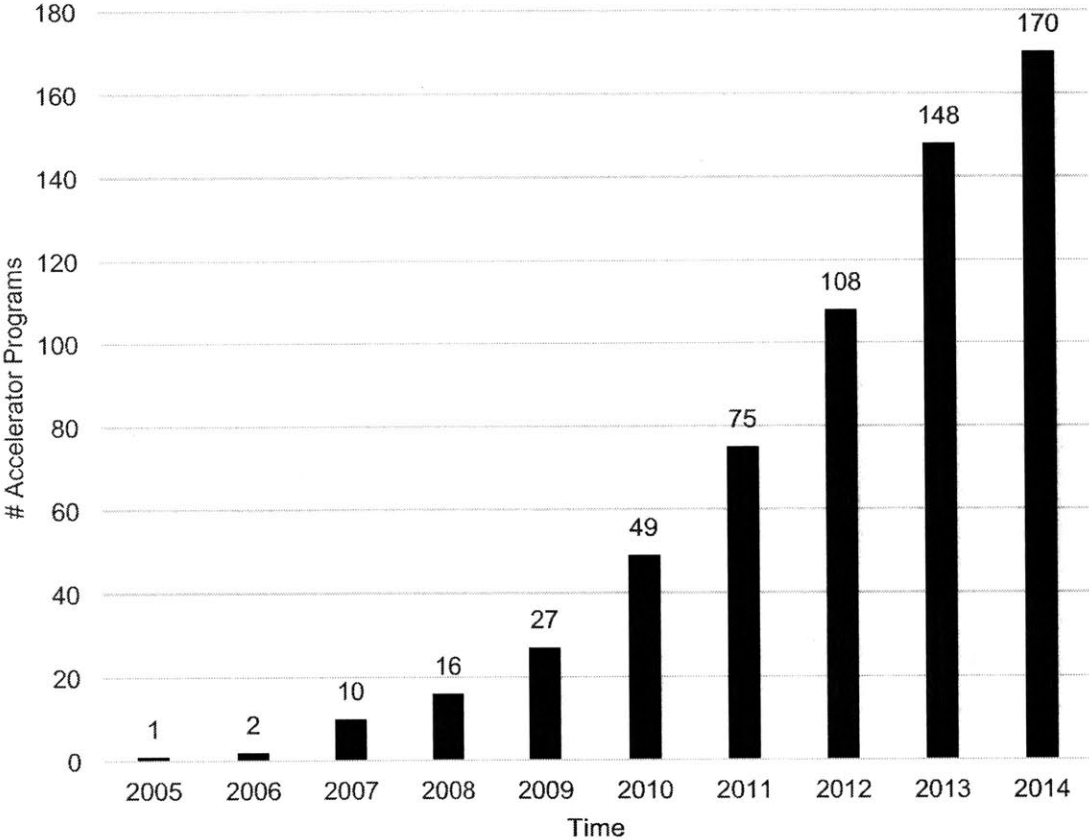
Techstars. (2016). Techstars Mobility Program. Retrieved from <http://www.techstars.com/programs/mobility-program>

U.S. Cluster Mapping Project. (2016). Retrieved from www.clustermapping.us

Zott, C. (2007). How Entrepreneurs use Symbolic Management to Acquire Resources? *Administrative Science Quarterly*, 52, 70–105.

Appendix

Exhibit 1: Number of Accelerator Programs in the United States, 2005 - 2014



Notes: Author's calculation; Source: Hathaway (2016); # Accelerator Programs variable shows how many accelerator programs were active in the United States during a year

Exhibit 2: Interview Guide Instrument - Innovation Warehouse

Interviewee: Adam Shpiro, International Business Development

Accelerator Profile

Accelerator: Innovation Warehouse

Founder/ CEO: Ami Shpiro

Founding year: 2010

Location: London

Employees: 10

Business Model

Vision

- What is the motivation behind Innovation Warehouse?
- How do you differentiate yourself from other accelerators?
- What is the vision/plan for the future?

Revenue Model

- What is your revenue model? And what are the main revenue streams?
 - Are you taking equity investments in startups?
 - What are the services that you offer to startups?
 - Do start-ups purchase these services?
- Do you receive public funding or some type of grants?
- If you take equity investments, whose capital are you investing?
- If you have a fund, what type of investors (Business Angels, VC, PE etc.) are investing in the fund?
 - What are the agreements in terms of management fee and carried interest?
- If you offer other services in exchange for payment, what services are the main revenue driver?

Partnerships

- Do you have partnerships that are essential to your business model?
- How do you attract mentors to your accelerator program (experienced entrepreneurs, venture capitalists, industry specialists etc.)?
- What are the perks of being mentor?

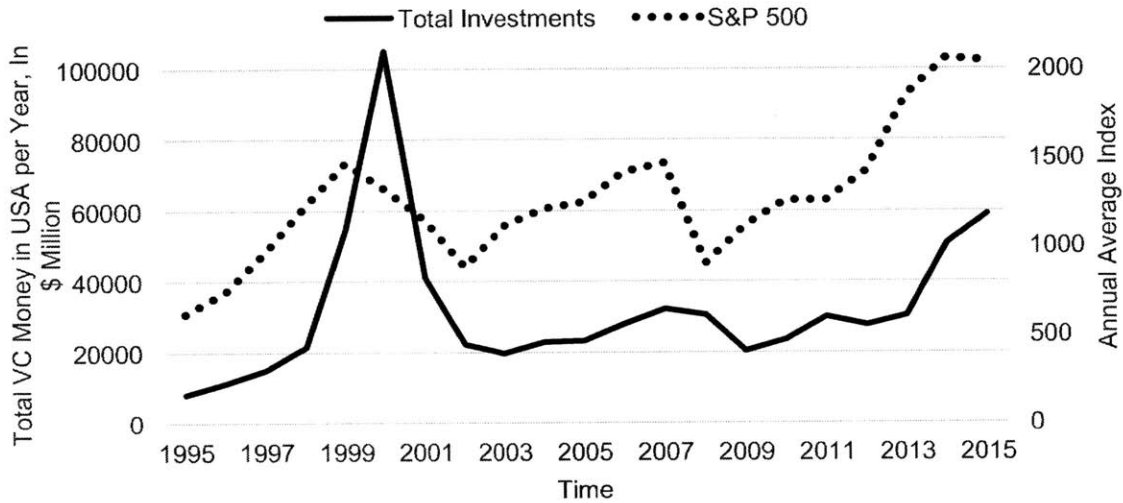
Selection Process

- How does the startup selection process look like?
- What is the preferred profile of startups you accept to the program?
- What are the most important decision making criteria to accept a startup?
- How do you attract your described profile of startups to apply?

Performance Metrics

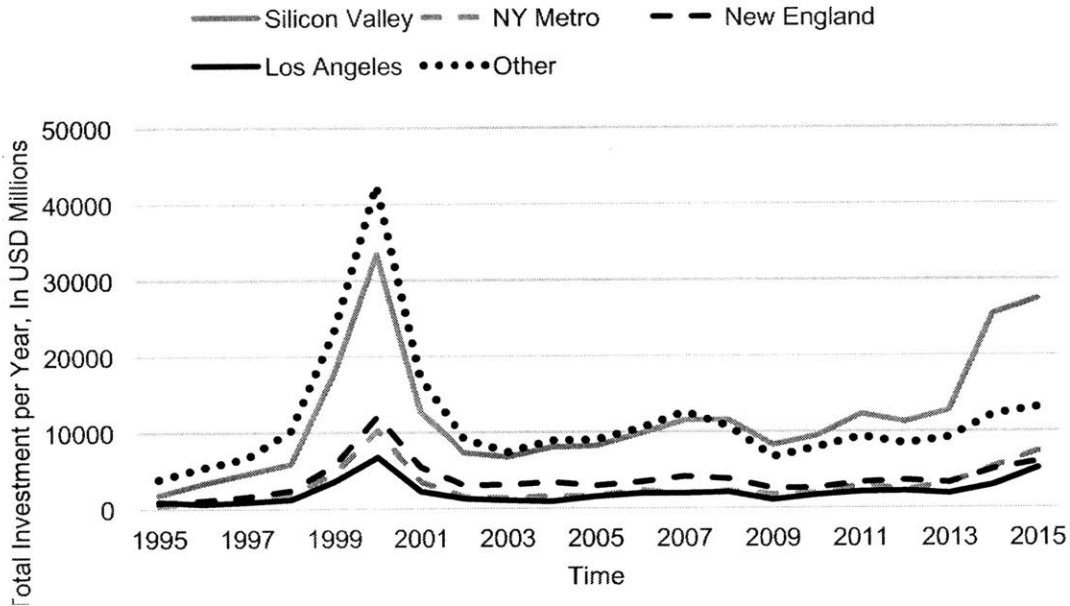
- Do you measure Innovation Warehouse's performance?
- If yes, what are the KPIs you are focusing on?
- If no, why aren't you measuring performance?

Exhibit 3: Annual Venture Capital Investments in the United States and S&P 500 Annual Average Closing points, 1995 – 2015



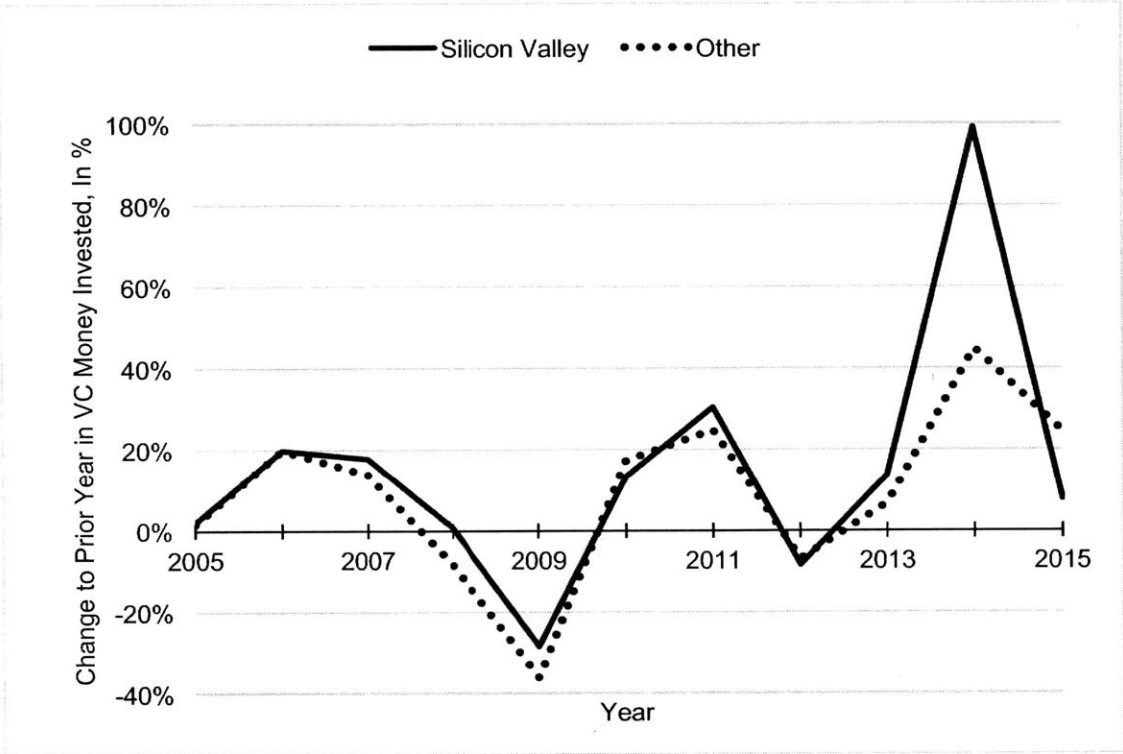
Note: Author's calculation; Source: NVCA & Ernst & Young (2015); Total Investments variable shows the total capital in USD millions invested into the VC market on a seed and early stage stage; S&P 500 variable is the index' annual average closing

Exhibit 4: Annual Venture Capital Investments by Region, 1995 – 2015



Note: Author's calculation; Source: NVCA & Ernst & Young (2015); NY Metro variable stands for New York City Metropolitan Area; Other variable includes US areas: Southeast, Midwest, Northwest, Washington DC, San Diego, Texas, Southwest, Colorado, Philadelphia, North Central, Upstate New York, South Central, Sacramento

Exhibit 5: Yearly Change in Venture Capital Investments, 1995 – 2015



Note: Author's calculation; Source: NVCA & Ernst & Young (2015); Other variable includes US areas: Southeast, Midwest, Northwest, Washington DC, San Diego, Texas, Southwest, Colorado, Philadelphia, North Central, Upstate New York, South Central, Sacramento, NYC Metro, New England, Los Angeles.

Exhibit 6: Variable Definitions

Variable Name	Variable Definition
<i>Accelerator First Investor</i>	Accelerator acted as the first investor in the startup: 1 = yes; 0 = no
<i>Cohort</i>	Cohort in which the startup was accelerated
<i>Company Category</i>	Category/Industry the startup belongs to
<i>Company Region</i>	Original region of the accelerated startup
<i>Company City</i>	Original city of the accelerated startup
<i>Total Funding</i>	Total amount of funding the accelerated startup received in USD
<i>Funding Rounds</i>	Total number of funding rounds the startup raised
<i>Death.Status</i>	If startup is dead or not; dead = 1; no = 0
<i>Acquired.Status</i>	If startup is acquired or not; acquired = 1; no = 0
<i>Operating Status</i>	If startup is operating or not; operating = 1; no = 0
<i>Cohort Year</i>	Year in which the startup's cohort was accelerated
<i>First Investor Rate</i>	Number of startups in a cohort in which the accelerator acted as a first investor divided by the total number startups in the cohort
<i>Not First Investor Rate</i>	Number of startups in a cohort in which the accelerator did not act as a first investor divided by the total number startups in the cohort
<i>Death Rate</i>	Number of startups in a cohort that are dead divided by the total number startups in the cohort
<i>Operating Rate</i>	Number of startups in a cohort that are still operating divided by the total number startups in the cohort
<i>Acquisition Rate</i>	Number of startups in a cohort that were acquired divided by the total number startups in the cohort
<i>Cluster Location Quotient</i>	The Location Quotient (LQ) measures the specialization of a cluster in a particular location relative to the national average. An LQ > 1 indicates the region is specialized in the cluster.

Note: Descriptive variables are used in the descriptive analysis; Source: Crunchbase Database (2016); yclist.com (2016); techstars.com (2016); clustermapping.us (2016)

Exhibit 7: Y Combinator, Cohort Analysis by Startup Status as of 2016

Cohort*	Total # Firms	Firms in % of Total	# Dead Firms	Death Rate, In %	# Operating Firms	Operating Rate, In %	# Acquired Firms	Acquisition Rate, In %
Summer 2005	8	1%	1	13%	3	38%	4	50%
Winter 2006	7	1%	1	14%	4	57%	2	29%
Summer 2006	10	1%	3	30%	5	50%	2	20%
Winter 2007	13	2%	3	23%	6	46%	4	31%
Summer 2007	18	2%	7	39%	7	39%	4	22%
Winter 2008	19	3%	9	47%	6	32%	4	21%
Summer 2008	19	3%	10	53%	5	26%	4	21%
Winter 2009	12	2%	1	8%	7	58%	4	33%
Summer 2009	21	3%	6	29%	11	52%	4	19%
Winter 2010	24	3%	6	25%	10	42%	8	33%
Summer 2010	30	4%	4	13%	15	50%	11	37%
Winter 2011	38	5%	4	11%	29	76%	5	13%
Summer 2011	58	8%	3	5%	38	66%	17	29%
Winter 2012	53	7%	6	11%	38	72%	9	17%
Summer 2012	78	10%	11	14%	61	78%	6	8%
Winter 2013	37	5%	3	8%	32	86%	2	5%
Summer 2013	49	7%	3	6%	42	86%	4	8%
Winter 2014	59	8%	0	0%	57	97%	2	3%
Summer 2014	70	9%	0	0%	66	94%	4	6%
Winter 2015	98	13%	0	0%	98	100%	0	0%
Summer 2015	22	3%	0	0%	22	100%	0	0%
NA	10	1%	0	0%	10	100%	0	0%
All Firms	753	100%	81	11%	572	76%	100	13%

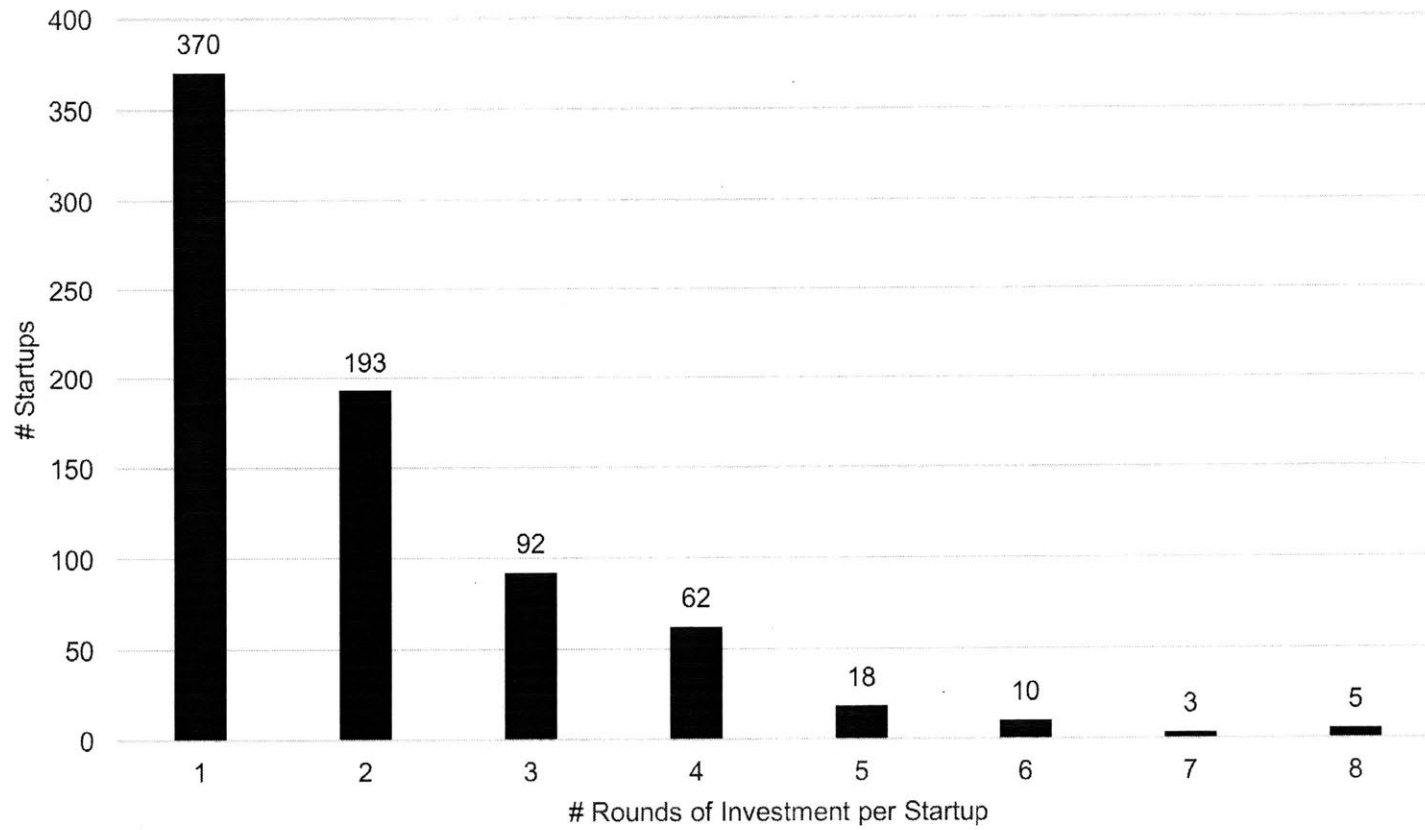
Note: Author's calculations; Source: Crunchbase Database (2016), ylist.com (2016); *Y Combinator is located in the Silicon Valley; Total # Firms variable counts all firms available in a certain cohort; Firms in % of Total variable is the ratio of Total # Firms and All Firms accelerated by Y Combinator; # Operating Firms variable counts how many firms are alive (=1, if alive and =0, if acquired or dead) as of 2016; Operating Rate variable is the ratio of the number of operating firms in a cohort and the total number of firms in a cohort.

Exhibit 8: Y Combinator, Cohort Analysis by Rounds of Investment as of 2016

Cohort*	Total # Firms	Total # Rounds	Average # Rounds	Standard deviation	Skew	Minimum # Rounds	25th percentile	Median	75th percentile	Maximum # Rounds
Summer 2005	8	15	1.9	1.5	1.8	1.0	1.0	1.0	2.3	5.0
Winter 2006	7	17	2.4	2.5	2.4	1.0	1.0	2.0	2.0	8.0
Summer 2006	10	26	2.6	2.7	1.3	1.0	1.0	1.0	4.0	8.0
Winter 2007	13	22	1.7	0.9	1.4	1.0	1.0	1.0	2.0	4.0
Summer 2007	18	43	2.4	2.1	1.6	1.0	1.0	1.0	3.0	8.0
Winter 2008	19	33	1.7	1.1	1.8	1.0	1.0	1.0	2.0	5.0
Summer 2008	19	28	1.5	1.1	2.6	1.0	1.0	1.0	1.0	5.0
Winter 2009	12	26	2.2	2.2	2.1	1.0	1.0	1.0	2.3	8.0
Summer 2009	21	52	2.5	1.5	0.7	1.0	1.0	2.0	3.0	6.0
Winter 2010	24	49	2.0	1.7	1.5	1.0	1.0	1.0	2.0	6.0
Summer 2010	30	72	2.4	1.6	1.0	1.0	1.0	2.0	3.8	7.0
Winter 2011	38	78	2.1	1.5	2.0	1.0	1.0	1.0	3.0	8.0
Summer 2011	58	103	1.8	1.0	1.0	1.0	1.0	1.0	2.0	4.0
Winter 2012	53	116	2.2	1.3	0.7	1.0	1.0	2.0	3.0	5.0
Summer 2012	78	140	1.8	1.1	1.5	1.0	1.0	1.0	2.0	6.0
Winter 2013	37	87	2.4	1.5	1.0	1.0	1.0	2.0	3.0	6.0
Summer 2013	49	117	2.4	1.2	0.6	1.0	1.0	2.0	3.0	6.0
Winter 2014	59	101	1.7	0.8	1.2	1.0	1.0	2.0	2.0	4.0
Summer 2014	70	134	1.9	1.0	2.0	1.0	1.0	2.0	2.0	7.0
Winter 2015	98	180	1.8	1.1	2.0	1.0	1.0	2.0	2.0	7.0
Summer 2015	22	34	1.5	0.7	0.9	1.0	1.0	1.0	2.0	3.0
NA	10	18	1.8	1.2	1.4	1.0	1.0	1.0	2.0	4.0
All Firms	753	1491	2.0	1.3	1.7	1.0	1.0	2.0	3.0	8.0

Note: Author's calculations; Source: Crunchbase Database (2016), ylist.com (2016); *Y Combinator is located in the Silicon Valley; Total # Firms variable counts all firms accelerated in a certain cohort; Total # Rounds variable counts all rounds raised in a certain cohort as of 2016; Average # Rounds variable is the average number of rounds raised by startups in a certain cohort; Skew variable indicates the skew of the distribution of a cohort (left skewed < 0, right skewed > 0); Minimum # Rounds variable describes the minimum number of rounds raised in a certain cohort; Maximum # Rounds variable describes the maximum number of rounds raised in a certain cohort.

Exhibit 9: Y Combinator, Rounds of Investment Histogram as of 2016



Note: Author's calculations; Source: Crunchbase Database (2016); ylist.com (2016); Explanation: # Startups variable counts the number of startups that raise a certain amount of funding rounds across all cohorts.

Exhibit 10: Y Combinator, Cohort Analysis by Total Funding as of 2016

Cohort*	Total # Firms	# Firms with Missing Data	Total Funding, In USD '000	Average** Funding per Firm, In USD '000	Standard deviation, In USD '000	Skew Factor	Minimum Funding, In USD '000	25th percentile, In USD '000	Median, In USD '000	75th percentile, In USD '000	Maximum Funding, In USD '000
Summer 2005	8	4	90,104	22,526	25,887	0.15	50	648	19,977	41,854	50,100
Winter 2006	7	4	57,388	19,129	33,014	1.73	20	69	118	28,684	57,250
Summer 2006	10	7	106,114	35,371	16,532	-1.48	16,600	29,176	41,752	44,757	47,762
Winter 2007	13	7	37,650	6,275	14,403	2.45	15	330	387	756	35,670
Summer 2007	18	5	1,181,310	90,870	305,527	3.60	10	15	1,250	10,500	1,107,215
Winter 2008	19	12	105,319	15,046	32,625	2.54	225	585	1,000	7,312	88,300
Summer 2008	19	11	13,305	1,663	3,465	2.70	15	15	393	1,094	10,140
Winter 2009	12	6	2,405,945	400,991	976,778	2.45	10	100	1,553	6,684	2,394,820
Summer 2009	21	7	218,875	15,634	26,106	2.06	15	344	5,008	11,941	77,015
Winter 2010	24	14	213,507	21,351	45,483	2.80	500	1,090	2,150	11,387	146,200
Summer 2010	30	13	505,184	29,717	66,623	3.71	217	1,015	6,770	28,679	280,000
Winter 2011	38	13	223,404	8,936	14,790	1.94	50	1,150	1,800	6,725	46,014
Summer 2011	58	26	260,992	8,156	9,306	1.34	168	1,575	5,182	11,975	31,200
Winter 2012	53	22	517,630	16,698	23,468	1.81	106	1,735	6,400	16,200	86,100
Summer 2012	78	40	575,540	15,146	47,048	4.99	88	1,225	2,300	6,590	274,800
Winter 2013	37	11	810,010	31,154	113,600	4.97	97	1,298	3,000	8,694	583,600
Summer 2013	49	18	237,739	7,669	12,150	2.99	97	1,375	2,700	9,100	59,700
Winter 2014	59	25	216,371	6,364	8,758	1.63	40	1,059	2,450	7,306	30,720
Summer 2014	70	2	358,839	5,277	18,737	6.21	25	120	763	2,044	141,000
Winter 2015	98	2	164,732	1,716	3,361	3.02	100	120	120	2,078	18,120
Summer 2015	22	2	33,912	1,696	2,331	3.19	100	455	1,000	2,153	10,600
NA	10	5	5,127	1,025	1,037	1.67	250	420	507	1,180	2,770
All Firms	753	256	8,338,996	16,779	122,788	16.37	10	201	1,600	6,570	2,394,820

Note: Author's calculations; Source: Crunchbase Database (2016), ylist.com (2016); *Y Combinator is located in the Silicon Valley; **Average out of the firms with available data; Total # Firms variable counts all firms accelerated in a certain cohort; # Firms with Missing Data variable counts the firms for which there is no funding data available; Total Funding variable counts all funding raised in a certain cohort as of 2016; Average Funding per Firm variable is the average funding raised by startups in a certain cohort; Skew variable indicates the skew of the distribution of a cohort (left skewed < 0, right skewed > 0); Minimum Funding variable describes the minimum funding raised in a certain cohort by a startup; Maximum Funding variable describes the maximum funding raised in a certain cohort by a startup.

Exhibit 11: Y Combinator, Cohort Analysis by First Investor

Cohort*	Total # Firms	# Firms in Which Accelerator Acted as First Investor	First Investor Rate, In %	# Firms Accelerator Did Not Act as First Investor	Not First Investor Rate, In %
Summer 2005	8	8	100%	0	0%
Winter 2006	7	7	100%	0	0%
Summer 2006	10	10	100%	0	0%
Winter 2007	13	13	100%	0	0%
Summer 2007	18	17	94%	1	6%
Winter 2008	19	19	100%	0	0%
Summer 2008	19	19	100%	0	0%
Winter 2009	12	12	100%	0	0%
Summer 2009	21	20	95%	1	5%
Winter 2010	24	23	96%	1	4%
Summer 2010	30	30	100%	0	0%
Winter 2011	38	35	92%	3	8%
Summer 2011	58	55	95%	3	5%
Winter 2012	53	47	89%	6	11%
Summer 2012	78	71	91%	7	9%
Winter 2013	37	31	84%	6	16%
Summer 2013	49	47	96%	2	4%
Winter 2014	59	51	86%	8	14%
Summer 2014	70	53	76%	17	24%
Winter 2015	98	72	73%	26	27%
Summer 2015	22	17	77%	5	23%
NA	10	7	70%	3	30%
All Firms	753	664	88%	89	12%

Note: Author's calculation; Source: Crunchbase (2016), ylist.com (2016); Total # Firms variable shows the total number of firms in a cohort in which the accelerator acted as a first investor; # Firms in Which Accelerator Acted as First Investor variable counts all startups that did not receive funding before joining the accelerator; First Investor Rate variable is the ratio of number of firms in a cohort in which the accelerator acted as first investor and the total number of firms in a cohort; # Firms in Which Accelerator Did Not Act as First Investor variable counts all startups that did receive funding before joining the accelerator; Not First Investor Rate variable is the ratio of number of firms in a cohort in which the accelerator did not act as first investor and the total number of firms in a cohort.

Exhibit 12: Y Combinator, Cohort Analysis by Accelerator Acted as First Investor and Status as of 2016

Cohort*	Total # Firms	Firms in % of Total	# Firms in which Accelerator Acted as First	First Investor Rate, In %	# Dead Firms	Death Rate, In %	# Operating Firms	Operating Rate, In %	# Acquired Firms	Acquisition Rate, In %
Summer 2005	8	1%	8	100%	1	13%	3	38%	4	50%
Winter 2006	7	1%	7	100%	1	14%	4	57%	2	29%
Summer 2006	10	1%	10	100%	3	30%	5	50%	2	20%
Winter 2007	13	2%	13	100%	3	23%	6	46%	4	31%
Summer 2007	18	2%	17	94%	7	41%	6	35%	4	24%
Winter 2008	19	3%	19	100%	9	47%	6	32%	4	21%
Summer 2008	19	3%	19	100%	10	53%	5	26%	4	21%
Winter 2009	12	2%	12	100%	1	8%	7	58%	4	33%
Summer 2009	21	3%	20	95%	5	25%	11	55%	4	20%
Winter 2010	24	3%	23	96%	6	26%	9	39%	8	35%
Summer 2010	30	4%	30	100%	4	13%	15	50%	11	37%
Winter 2011	38	5%	35	92%	3	9%	27	77%	5	14%
Summer 2011	58	8%	55	95%	3	5%	36	65%	16	29%
Winter 2012	53	7%	47	89%	6	13%	33	70%	8	17%
Summer 2012	78	10%	71	91%	11	15%	54	76%	6	8%
Winter 2013	37	5%	31	84%	3	10%	26	84%	2	6%
Summer 2013	49	7%	47	96%	3	6%	40	85%	4	9%
Winter 2014	59	8%	51	86%	0	0%	49	96%	2	4%
Summer 2014	70	9%	53	76%	0	0%	50	94%	3	6%
Winter 2015	98	13%	72	73%	0	0%	72	100%	0	0%
Summer 2015	22	3%	17	77%	0	0%	17	100%	0	0%
NA	10	1%	7	70%	0	0%	7	100%	0	0%
All Firms	753	100%	664	88%	79	12%	488	73%	97	15%

Note: Author's calculation; Source: Crunchbase (2016), ylist.com (2016); # Firms in Which Accelerator Acted as First Investor variable counts all startups that did not receive funding before joining the accelerator; First Investor Rate variable is the ratio of number of firms in a cohort in which the accelerator acted as first investor and the total number of firms in a cohort; Operating Rate variable is the ratio of number of firms in a cohort in which the accelerator acted as first investor that are still alive as of 2016 and the total number of firms in a cohort in which the accelerator acted as first investor.

Exhibit 13: Y Combinator, Cohort Analysis by Accelerator did not act as First Investor and Status as of 2016

Cohort*	Total # Firms	Firms in % of Total	# Firms in Which Accelerator did not act as First	Not First Investor Rate, In %	# Dead Firms	Death Rate, In %	# Operating Firms	Operating Rate, In %	# Acquired Firms	Acquisition Rate, In %
Summer 2005	8	1%	0	0%	0	N.C.	0	N.C.	0	N.C.
Winter 2006	7	1%	0	0%	0	N.C.	0	N.C.	0	N.C.
Summer 2006	10	1%	0	0%	0	N.C.	0	N.C.	0	N.C.
Winter 2007	13	2%	0	0%	0	N.C.	0	N.C.	0	N.C.
Summer 2007	18	2%	1	6%	0	0%	1	100%	0	0%
Winter 2008	19	3%	0	0%	0	N.C.	0	N.C.	0	N.C.
Summer 2008	19	3%	0	0%	0	N.C.	0	N.C.	0	N.C.
Winter 2009	12	2%	0	0%	0	N.C.	0	N.C.	0	N.C.
Summer 2009	21	3%	1	5%	1	100%	0	0%	0	0%
Winter 2010	24	3%	1	4%	0	0%	1	100%	0	0%
Summer 2010	30	4%	0	0%	0	N.C.	0	N.C.	0	N.C.
Winter 2011	38	5%	3	8%	1	33%	2	67%	0	0%
Summer 2011	58	8%	3	5%	0	0%	2	67%	1	33%
Winter 2012	53	7%	6	11%	0	0%	5	83%	1	17%
Summer 2012	78	10%	7	9%	0	0%	7	100%	0	0%
Winter 2013	37	5%	6	16%	0	0%	6	100%	0	0%
Summer 2013	49	7%	2	4%	0	0%	2	100%	0	0%
Winter 2014	59	8%	8	14%	0	0%	8	100%	0	0%
Summer 2014	70	9%	17	24%	0	0%	16	94%	1	6%
Winter 2015	98	13%	26	27%	0	0%	26	100%	0	0%
Summer 2015	22	3%	5	23%	0	0%	5	100%	0	0%
NA	10	1%	3	30%	0	0%	3	100%	0	0%
All Firms	753	100%	89	12%	2	2%	84	94%	3	3%

Note: Author's calculation; Source: Crunchbase (2016), ylist.com (2016); N.C. stands for Not Computable; # Firms in Which Accelerator did not act as First Investor variable counts all startups that did receive funding before joining the accelerator; Not First Investor Rate variable is the ratio of number of firms in a cohort in which the accelerator did not act as first investor and the total number of firms in a cohort as of 2016; Operating Rate variable is the ratio of number of firms in a cohort in which the accelerator did not act as first investor that are still alive as of 2016 and the total number of firms in a cohort in which the accelerator acted as first investor.

Exhibit 14: Techstars, Cohort Analysis by Startup Status, For City and Cohort Year as of 2016

City (Start Year)	Total # Firms	Firms in % of Total	# Dead Firms	Death Rate, In %	# Operating Firms	Operating Rate, In %	# Acquired Firms	Acquisition Rate, In %
Austin (2013)	23	5%	1	4%	21	91%	1	4%
Berlin (2015)	9	2%	0	0%	9	100%	0	0%
Boston (2009)	97	19%	12	12%	76	78%	9	9%
Boulder (2007)	91	18%	13	14%	57	63%	21	23%
Chicago (2010)	48	9%	6	13%	36	75%	6	13%
Detroit (2015)	9	2%	1	11%	8	89%	0	0%
Kansas City (2014)	3	1%	0	0%	3	100%	0	0%
London (2013)	37	7%	5	14%	32	88%	0	0%
Los Angeles (2014)	6	1%	0	0%	6	100%	0	0%
New York City (2011)	81	16%	7	9%	61	75%	13	16%
Portland (2013)	1	0%	0	0%	1	100%	0	0%
San Antonio (2012)	29	6%	1	3%	27	93%	1	3%
San Diego (2015)	10	2%	0	0%	10	100%	0	0%
Seattle (2010)	63	12%	7	11%	47	75%	9	14%
All Firms	507	100%	53	10%	394	78%	60	12%

Year*	Total # Firms	Firms in % of Total	# Dead Firms	Death Rate, In %	# Operating Firms	Operating Rate, In %	# Acquired Firms	Acquisition Rate, In %
2007	10	2%	3	30%	1	10%	6	60%
2008	10	2%	3	30%	4	40%	3	30%
2009	18	4%	6	33%	6	33%	6	33%
2010	38	7%	7	18%	23	61%	8	21%
2011	65	13%	14	22%	36	55%	15	23%
2012	80	16%	6	8%	59	74%	15	19%
2013	91	18%	4	4%	82	90%	5	5%
2014	71	14%	1	1%	68	96%	2	3%
2015	124	24%	9	7%	115	93%	0	0%
All Firms	507	100%	53	10%	394	78%	60	12%

Note: Author's calculations; Source: Crunchbase Database (2016), techstars.com (2016); *One year includes several cohorts from different cities, until 2009 (during the crisis period) Techstars is only active in Boulder; Portland was only active in 2013; Total # Firms variable counts all firms available in a certain cohort or city; Firms in % of Total variable is the ratio of Total # Firms and All Firms accelerated by Y Combinator; # Operating Firms variable counts how many firms are alive (=1, if alive and =0, if acquired or dead) as of 2016; Operating Rate variable is the ratio of the number of operating firms in a cohort or city and the total number of firms in a cohort or city.

Exhibit 15: Techstars, Operating Rate Matrix by City and Cohort Year as of 2016

	2007	2008	2009	2010	2011	2012	2013	2014	2015	Firms per city
Austin	NA	NA	NA	NA	NA	NA	90%	100%	100%	23
Berlin	NA	NA	NA	NA	NA	NA	NA	NA	100%	9
Boston	NA	NA	50%	56%	100%	96%	93%	94%	92%	97
Boulder	70%	70%	80%	90%	83%	100%	100%	100%	100%	91
Chicago	NA	NA	NA	90%	60%	89%	100%	NA	100%	48
Detroit	NA	NA	NA	NA	NA	NA	NA	NA	89%	9
Kansas City	NA	NA	NA	NA	NA	NA	NA	100%	100%	3
London	NA	NA	NA	NA	NA	NA	80%	100%	75%	37
Los Angeles	NA	NA	NA	NA	NA	NA	NA	100%	100%	6
New York City	NA	NA	NA	NA	70%	92%	100%	100%	100%	81
Portland	NA	NA	NA	NA	NA	NA	100%	NA	NA	1
San Antonio	NA	NA	NA	NA	NA	90%	100%	NA	100%	29
San Diego	NA	NA	NA	NA	NA	NA	NA	NA	100%	10
Seattle	NA	NA	NA	89%	82%	100%	100%	100%	64%	63
Firms per year	10	10	18	38	65	80	91	71	124	507

Note: Author's calculations; Source: Crunchbase Database (2016), techstars.com (2016); Firms per city variable counts all firms accelerated in a certain city; Firms per year variable counts all firms accelerated during a certain year; Operating Rate variable is the ratio of the number of operating firms in a cohort and the total number of firms in a cohort in a certain location.

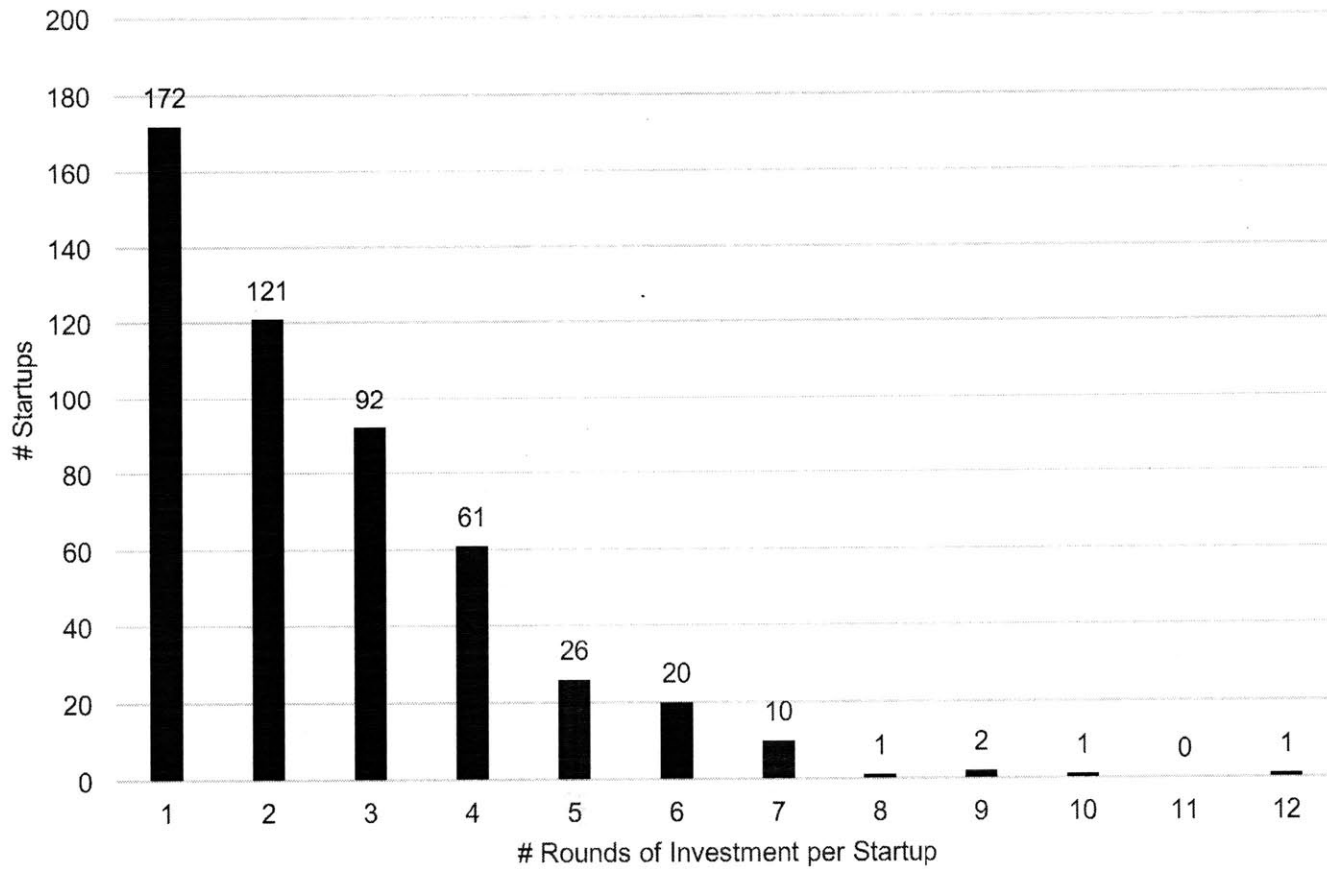
Exhibit 16: Techstars, Cohort Analysis by Rounds of Investment, For Location and Cohort Year as of 2016

City (Start Year)	Total # Firms	Total # Rounds	Average # Rounds	Standard deviation	Skew	Minimum	25th percentile	Median	75th percentile	Maximum
Austin (2013)	23	58	2.52	1.75	1.20	1.0	1.0	2.0	4.0	7.0
Berlin (2015)	9	17	1.89	0.93	0.26	1.0	1.0	2.0	3.0	3.0
Boston (2009)	97	297	3.06	1.78	0.72	1.0	1.0	3.0	4.0	9.0
Boulder (2007)	91	233	2.56	1.90	1.95	1.0	1.0	2.0	3.0	12.0
Chicago (2010)	48	103	2.15	1.57	2.09	1.0	1.0	1.5	3.0	9.0
Detroit (2015)	9	15	1.67	0.87	0.82	1.0	1.0	1.0	2.0	3.0
Kansas City (2014)	3	6	2.00	1.00	0.00	1.0	1.5	2.0	2.5	3.0
London (2013)	37	77	2.08	1.26	1.71	1.0	1.0	2.0	3.0	6.0
Los Angeles (2014)	6	10	1.67	0.82	0.86	1.0	1.0	1.5	2.0	3.0
New York City (2011)	81	237	2.93	1.73	0.89	1.0	2.0	3.0	4.0	8.0
Portland (2013)	1	1	1.00	0.00	0.00	1.0	1.0	1.0	1.0	1.0
San Antonio (2012)	29	85	2.93	1.89	2.29	1.0	2.0	3.0	3.0	10.0
San Diego (2015)	10	15	1.50	0.97	2.27	1.0	1.0	1.0	1.8	4.0
Seattle (2010)	63	148	2.35	1.40	0.90	1.0	1.0	2.0	3.0	6.0
All Firms	507	1302	2.57	1.69	1.44	1.0	1.0	2.0	3.0	12.0

Year*	Total # Firms	Total # Rounds	Average # Rounds	Standard deviation	Skew	Minimum	25th percentile	Median	75th percentile	Maximum
2007	10	22	2.20	0.92	0.60	1.0	2.0	2.0	2.8	4.0
2008	10	21	2.10	1.37	1.40	1.0	1.0	2.0	2.0	5.0
2009	18	49	2.72	2.22	0.98	1.0	1.0	1.5	4.0	7.0
2010	38	113	2.97	1.97	1.14	1.0	1.3	2.0	4.0	9.0
2011	65	220	3.38	2.09	1.15	1.0	2.0	3.0	5.0	12.0
2012	80	255	3.19	1.75	1.24	1.0	2.0	3.0	4.0	10.0
2013	91	248	2.73	1.58	0.95	1.0	1.0	2.0	4.0	8.0
2014	71	167	2.35	1.51	1.64	1.0	1.0	2.0	3.0	7.0
2015	124	207	1.67	0.90	1.18	1.0	1.0	1.0	2.0	5.0
All Firms	507	1302	2.57	1.69	1.44	1.0	1.0	2.0	3.0	12.0

Note: Author's calculations; Source: Crunchbase Database (2016), techstars.com (2016); *One year includes several cohorts from different cities, until 2009 (during the crisis period) Techstars is only active in Boulder; Portland was only active in 2013; Total # Firms variable counts all firms accelerated in a certain cohort or city; Total # Rounds variable counts all rounds raised in a certain cohort or city as of 2016; Average # Rounds variable is the average number of rounds raised by startups in a certain cohort or city; Skew variable indicates the skew of the distribution of a cohort or city (left skewed < 0, right skewed > 0); Minimum # Rounds variable describes the minimum number of rounds raised in a certain cohort or city; Maximum # Rounds variable describes the maximum number of rounds raised in a certain cohort or city.

Exhibit 17: Techstars, Rounds of Investment Histogram as of 2016



Note: Author's calculations; Source: Crunchbase Database (2016); techstars.com (2016); Explanation: # Startups variable counts the number of startups that raise a certain amount of funding rounds across all cohorts.

Exhibit 18: Techstars, Cohort Analysis by Total Funding as of 2016, For City and Cohort Year

City (Start Year)	Total # Firms	# Firms with Missing Data	Total Funding, In USD '000	Average** Funding per Firm, In USD '000	Standard deviation, In USD '000	Skew Factor	Minimum, In USD '000	25th percentile, In USD '000	Median, In USD '000	75th percentile, In USD '000	Maximum, In USD '000
Austin (2013)	23	2	30,669	1,460	2,158	2.0	118	118	350	1,418	7,226
Berlin (2015)	9	0	2,619	291	320	2.7	118	118	200	288	1,118
Boston (2009)	97	6	477,248	5,244	11,365	3.8	12	450	1,370	4,050	62,800
Boulder (2007)	91	9	431,041	5,257	20,087	7.8	12	126	925	3,118	175,206
Chicago (2010)	48	2	74,702	1,624	4,122	5.8	15	75	355	1,770	27,510
Detroit (2015)	9	0	1,208	134	44	-0.6	45	120	140	145	205
Kansas City (2014)	3	0	2,635	878	945	1.3	130	348	565	1,253	1,940
London (2013)	37	2	60,610	1,732	2,630	2.4	118	130	969	1,918	10,860
Los Angeles (2014)	6	1	4,800	960	1,315	1.5	120	120	120	1,320	3,120
New York City (2011)	81	8	447,692	6,133	13,012	4.3	20	1,000	1,630	6,155	84,000
Portland (2013)	1	0	150	150	N.C.	N.C.	150	150	150	150	150
San Antonio (2012)	29	1	131,521	4,697	8,847	2.7	110	247	606	3,668	38,048
San Diego (2015)	10	0	1,355	136	41	3.0	120	120	120	120	250
Seattle (2010)	63	7	140,481	2,509	4,651	2.8	12	118	524	2,155	23,000
All Firms	507	38	1,806,730	3,852	11,575	9.0	12	120	980	2,741	175,206

Year*	Total # Firms	# Firms with Missing Data	Total Funding, In USD '000	Average** Funding per Firm, In USD '000	Standard deviation, In USD '000	Skew Factor	Minimum, In USD '000	25th percentile, In USD '000	Median, In USD '000	75th percentile, In USD '000	Maximum, In USD '000
2007	10	0	6,215	621	749	1.6	15	224	365	500	2,095
2008	10	3	27,715	3,959	7,593	2.5	18	528	1,015	2,306	21,015
2009	18	0	130,771	7,265	17,210	2.7	12	18	238	2,009	59,750
2010	38	4	69,621	2,048	3,500	3.7	12	94	772	2,449	18,950
2011	65	8	354,370	6,217	8,917	2.8	12	1,000	2,570	8,748	50,926
2012	80	4	563,629	7,416	22,492	6.3	18	447	1,514	5,919	175,206
2013	91	13	388,143	4,976	10,691	4.0	70	589	1,498	4,213	62,800
2014	71	3	187,401	2,756	6,051	5.4	18	414	1,108	2,234	44,720
2015	124	3	78,864	652	1,080	2.7	18	118	120	618	6,155
All Firms	507	38	1,806,730	3,852	11,575	9.0	12	120	980	2,741	175,206

Note: Author's calculations; Source: Crunchbase Database (2016), techstars.com (2016); N.C. stands for Not Computable; *One year includes several cohorts from different cities, until 2009 (during the crisis period) Techstars is only active in Boulder; Portland was only active in 2013; **Average out of the firms with available data; Total # Firms variable counts all firms accelerated in a certain cohort or city; # Firms with Missing Data variable counts the firms for which there is no funding data available; Total Funding variable counts all funding raised in a certain cohort or city as of 2016; Average Funding per Firm variable is the average funding raised by startups in a certain cohort or city; Skew variable indicates the skew of the distribution of a cohort or city (left skewed < 0, right skewed > 0); Minimum Funding variable describes the minimum funding raised in a certain cohort or city by a startup; Maximum Funding variable describes the maximum funding raised in a certain cohort or city by a startup.

Exhibit 19: Techstars, Cohort Analysis by First Investor, For City and Cohort Year

City (Start Year)	Total # Firms	# Firms in Which Accelerator Acted as First Investor	First Investor Rate, In %	# Firms Accelerator Did Not Act as First Investor	Not First Investor Rate, In %
Austin (2013)	23	16	70%	7	30%
Berlin (2015)	9	5	56%	4	44%
Boston (2009)	97	62	64%	35	36%
Boulder (2007)	91	79	87%	12	13%
Chicago (2010)	48	41	85%	7	15%
Detroit (2015)	9	5	56%	4	44%
Kansas City (2014)	3	3	100%	0	0%
London (2013)	37	26	70%	11	30%
Los Angeles (2014)	6	3	50%	3	50%
New York City (2011)	81	56	69%	25	31%
Portland (2013)	1	1	100%	0	0%
San Antonio (2012)	29	20	69%	9	31%
San Diego (2015)	10	7	70%	3	30%
Seattle (2010)	63	50	79%	13	21%
All Firms	507	374	74%	133	26%

Year*	Total # Firms	# Firms in Which Accelerator Acted as First Investor	First Investor Rate, In %	# Firms Accelerator Did Not Act as First Investor	Not First Investor Rate, In %
2007	10	9	90%	1	10%
2008	10	10	100%	0	0%
2009	18	16	89%	2	11%
2010	38	34	89%	4	11%
2011	65	54	83%	11	17%
2012	80	59	74%	21	26%
2013	91	62	68%	29	32%
2014	71	47	66%	24	34%
2015	124	83	67%	41	33%
All Firms	507	374	74%	133	26%

Note: Author's calculation; Source: Crunchbase (2016), techstars.com (2016); *One year includes several cohorts from different cities, until 2009 (during the crisis period) Techstars is only active in Boulder; Portland was only active in 2013; Total # Firms variable shows the total number of firms in a cohort or city in which the accelerator acted as a first investor; # Firms in Which Accelerator Acted as First Investor variable counts all startups that did not receive funding before joining the accelerator; First Investor Rate variable is the ratio of number of firms in a cohort or city in which the accelerator acted as first investor and the total number of firms in a cohort or city; # Firms in Which Accelerator Did Not Act as First Investor variable counts all startups that did receive funding before joining the accelerator; Not First Investor Rate variable is the ratio of number of firms in a cohort or city in which the accelerator did not act as first investor and the total number of firms in a cohort or city.

**Exhibit 20: Techstars, Cohort Analysis by Accelerator acted as First Investor and Status, For City and Cohort
Year as of 2016**

City (Start Year)	Total # Firms	Firms in % of Total	# Firms in which Accelerator Acted as First Investor	First Investor Rate, In %	# Dead Firms	Death Rate, In %	# Operating Firms	Operating Rate, In %	# Acquired Firms	Acquisition Rate, In %
Austin (2013)	23	5%	16	70%	0	0%	15	94%	1	6%
Berlin (2015)	9	2%	5	56%	0	0%	5	100%	0	0%
Boston (2009)	97	19%	62	64%	7	11%	50	81%	5	8%
Boulder (2007)	91	18%	79	87%	12	15%	47	59%	20	25%
Chicago (2010)	48	9%	41	85%	6	15%	30	73%	5	12%
Detroit (2015)	9	2%	5	56%	1	20%	4	80%	0	0%
Kansas City (2014)	3	1%	3	100%	0	0%	3	100%	0	0%
London (2013)	37	7%	26	70%	5	19%	21	81%	0	0%
Los Angeles (2014)	6	1%	3	50%	0	0%	3	100%	0	0%
New York City (2011)	81	16%	56	69%	6	11%	38	68%	12	21%
Portland (2013)	1	0%	1	100%	0	0%	1	100%	0	0%
San Antonio (2012)	29	6%	20	69%	1	5%	18	90%	1	5%
San Diego (2015)	10	2%	7	70%	0	0%	7	100%	0	0%
Seattle (2010)	63	12%	50	79%	7	14%	39	78%	4	8%
All Firms	507	100%	374	74%	45	12%	281	75%	48	13%

Year*	Total # Firms	Firms in % of Total	# Firms in which Accelerator Acted as First Investor	First Investor Rate, In %	# Dead Firms	Death Rate, In %	# Operating Firms	Operating Rate, In %	# Acquired Firms	Acquisition Rate, In %
2007	10	2%	9	90%	3	33%	1	11%	5	56%
2008	10	2%	10	100%	3	30%	4	40%	3	30%
2009	18	4%	16	89%	5	31%	6	38%	5	31%
2010	38	7%	34	89%	5	15%	21	62%	8	24%
2011	65	13%	54	83%	13	24%	30	56%	11	20%
2012	80	16%	59	74%	4	7%	45	76%	10	17%
2013	91	18%	62	68%	2	3%	55	89%	5	8%
2014	71	14%	47	66%	1	2%	45	96%	1	2%
2015	124	24%	83	67%	9	11%	74	89%	0	0%
All Firms	507	100%	374	74%	45	12%	281	75%	48	13%

Note: Author's calculation; Source: Crunchbase (2016), techstars.com (2016); *One year includes several cohorts from different cities, until 2009 (during the crisis period) Techstars is only active in Boulder; Portland was only active in 2013; # Firms in Which Accelerator Acted as First Investor variable counts all startups that did not receive funding before joining the accelerator; First Investor Rate variable is the ratio of number of firms in a cohort or city in which the accelerator acted as first investor and the total number of firms in a cohort or city; Operating Rate variable is the ratio of number of firms in a cohort or city in which the accelerator acted as first investor that are still alive as of 2016 and the total number of firms in a cohort or city in which the accelerator acted as first investor.

Exhibit 21: Techstars, Cohort Analysis by Accelerator did not act as First Investor and Status, For City and Cohort Year as of 2016

City (Start Year)	Total # Firms	Firms in % of Total	# Firms in Which Accelerator did not act as First Investor	Not First Investor Rate, In %	# Dead Firms	Death Rate, In %	# Operating Firms	Operating Rate, In %	# Acquired Firms	Acquisition Rate, In %
Austin (2013)	23	5%	7	30%	1	14%	6	86%	0	0%
Berlin (2015)	9	2%	4	44%	0	0%	4	100%	0	0%
Boston (2009)	97	19%	35	36%	5	14%	26	74%	4	11%
Boulder (2007)	91	18%	12	13%	1	8%	10	83%	1	8%
Chicago (2010)	48	9%	7	15%	0	0%	6	86%	1	14%
Detroit (2015)	9	2%	4	44%	0	0%	4	100%	0	0%
Kansas City (2014)	3	1%	0	0%	0	N.C.	0	N.C.	0	N.C.
London (2013)	37	7%	11	30%	0	0%	11	100%	0	0%
Los Angeles (2014)	6	1%	3	50%	0	0%	3	100%	0	0%
New York City (2011)	81	16%	25	31%	1	4%	23	92%	1	4%
Portland (2013)	1	0%	0	0%	0	N.C.	0	N.C.	0	N.C.
San Antonio (2012)	29	6%	9	31%	0	0%	9	100%	0	0%
San Diego (2015)	10	2%	3	30%	0	0%	3	100%	0	0%
Seattle (2010)	63	12%	13	21%	0	0%	8	62%	5	38%
All Firms	507	100%	133	26%	8	6%	113	85%	12	9%

Year*	Total # Firms	Firms in % of Total	# Firms in Which Accelerator did not act as First Investor	Not First Investor Rate, In %	# Dead Firms	Death Rate, In %	# Operating Firms	Operating Rate, In %	# Acquired Firms	Acquisition Rate, In %
2007	10	2%	1	10%	0	0%	0	0%	1	100%
2008	10	2%	0	0%	0	N.C.	0	N.C.	0	N.C.
2009	18	4%	2	11%	1	50%	0	0%	1	50%
2010	38	7%	4	11%	2	50%	2	50%	0	0%
2011	65	13%	11	17%	1	9%	6	55%	4	36%
2012	80	16%	21	26%	2	10%	14	67%	5	24%
2013	91	18%	29	32%	2	7%	27	93%	0	0%
2014	71	14%	24	34%	0	0%	23	96%	1	4%
2015	124	24%	41	33%	0	0%	41	100%	0	0%
All Firms	507	100%	133	26%	8	6%	113	85%	12	9%

Note: Author's calculation; Source: Crunchbase (2016), techstars.com (2016); N.C. stands for Not Computable; *One year includes several cohorts from different cities, until 2009 (during the crisis period) Techstars is only active in Boulder; Portland was only active in 2013; # Firms in Which Accelerator did not act as First Investor variable counts all startups that did receive funding before joining the accelerator; Not First Investor Rate variable is the ratio of number of firms in a cohort or city in which the accelerator did not act as first investor and the total number of firms in a cohort or city; Operating Rate variable is the ratio of number of firms in a cohort city in which the accelerator did not act as first investor that are still alive as of 2016 and the total number of firms in a cohort or city in which the accelerator acted as first investor.

Exhibit 22: Strong Industrial Clusters in Boston MSA, Techstars Cohorts Boston 2009-2015

Cluster Name	Cluster Specialization (LQ), 2013	Employment Within Cluster, 2013	# Accelerated Startups in the Cluster, 2009-2015	Accelerated Startups in the Cluster, In %
IT	2.74	62,031	33	34%
Education and Knowledge Creation	2.68	170,429	8	8%
Footwear	2.30	752	0	0%
Financial Services	2.04	82,468	12	12%
Biopharma	1.81	8,971	0	0%
Fishing	1.55	1,238	0	0%
Marketing, Design, and Publishing	1.48	40,038	10	10%
Insurance Services	1.28	41,202	0	0%
Medical Devices	1.27	7,018	1	1%
Aerospace Vehicles and Defense	1.07	12,128	0	0%
Performing Arts	1.04	7,322	3	3%
Other Clusters	-	-	30	31%
All Startups	-	-	97	100%
% of Startups in Strong Clusters	-	-	-	69%

Notes: Author's calculation. Sources: Crunchbase (2016), techstars.com (2016), and U.S. Cluster Mapping Project (2016), naics.com (2016); N.C. stands for Not Computable; Cluster specialization is based on an employment Location Quotient (LQ). An LQ > 1 indicates a higher than average cluster specialization in a location; Employment Within Cluster variable is the number of people working within the cluster.

Exhibit 23: Strong Industrial Clusters in New York City MSA, Techstars Cohorts New York City 2011-2015

Cluster Name	Cluster Specialization (LQ), 2013	Employment Within Cluster, 2013	# Accelerated Startups in the Cluster, 2011-2015	Accelerated Startups in the Cluster, in %
Music and Sound Recording	4.2	6,028	0	0%
Jewelry	3.79	5,932	0	0%
Marketing, Design, and Publishing	2.54	201,292	10	12%
Performing Arts	2.41	49,252	1	1%
Financial Services	2.39	283,085	8	10%
Apparel	1.88	15,713	0	0%
Biopharma	1.73	24,985	0	0%
Video Production	1.63	19,847	5	6%
Communications Equipment and Services	1.50	43,739	2	2%
Education and Knowledge Creation	1.42	263,866	17	21%
Distribution and eCommerce	1.26	435,635	7	9%
Downstream Chemicals	1.21	18,014	0	0%
Insurance Services	1.17	109,723	0	0%
Other Clusters	-	-	31	38%
All Startups	-	-	81	100%
% of Startups in Strong Clusters	-	-	-	62%

Notes: Author's calculation. Sources: Crunchbase (2016), techstars.com (2016), and U.S. Cluster Mapping Project (2016), naics.com (2016); N.C. stands for Not Computable; Cluster specialization is based on an employment Location Quotient (LQ). An LQ > 1 indicates a higher than average cluster specialization in a location; Employment Within Cluster variable is the number of people working within the cluster.

Exhibit 24: Survival of Startups Accelerated by Y Combinator – Logit Estimates

	Dependent variable: Operating.Status											
	(1)			(2)			(3)			(4)		
	β	<i>p-value</i>	<i>Odds Ratio</i>	β	<i>p-value</i>	<i>Odds Ratio</i>	β	<i>p-value</i>	<i>Odds Ratio</i>	β	<i>p-value</i>	<i>Odds Ratio</i>
Cohort Age	-0.461	0.000	0.631							-0.284	0.000	0.753
Crisis Period				-1.714	0.000	0.180				-0.276	0.345	0.758
Ln VC Money Region							3.478	0.000	32	1.815	0.000	6.141
Constant	3.285	0.000		1.344	0.000		-31.787	0.000		-14.660	0.001	
N			743			743			743			743
Area under the curve			0.813			0.590			0.76131			0.809
AIC			668.280			785.130			683.460			654.550
Log-likelihood			-332.142			-390.566			-339.732			-323.274

Note: Author's calculation; Source: Crunchbase Database (2016); yclist.com (2016); Operating Status variable indicates whether startup is operating or not (operating = 1; not = 0); Cohort Age gives the age in years of the startup's cohort as of 2016; Crisis Period indicates whether or not a startup's cohort was accelerated during a crisis year (2008 and 2009); Ln VC Money Region is the logarithmic.

Exhibit 25: Survival of Startups Accelerated by Techstars – Logit Estimates

Dependent variable: Operating Status

	(1)			(2)			(3)			(4)			(5)		
	β	<i>p</i> -value	Odds Ratio	β	<i>p</i> -value	Odds Ratio	β	<i>p</i> -value	Odds Ratio	β	<i>p</i> -value	Odds Ratio	β	<i>p</i> -value	Odds Ratio
Cohort Age	-0.578	0.000	0.561							-0.614	0.000	0.541	-0.656	0.000	0.519
Crisis Period				-1.985	0.000	0.137				0.209	0.669	1.233	0.115	0.827	1.122
Ln VC Money Region							0.494	0.001	1.638	-0.133	0.456	0.876	-0.395	0.479	0.674
Accelerator City (14 Cities)	No			No			No			No			Yes		
Constant	3.506	0.000		1.397	0.000		-2.386	0.030		4.614	0.002		6.647	0.116	
N			507			507			507			507			507
Area under the curve			0.790			0.567			0.601			0.790			0.805
AIC			438.260			517.660			530.740			441.500			456.940
Log-likelihood			-217.130			-256.829			-263.371			-216.754			-211.471

Note: Author's calculation; Source: Crunchbase Database (2016); techstars.com (2016); Operating Status variable indicates whether startup is operating or not (operating = 1; not = 0); Cohort Age gives the age in years of the startup's cohort as of 2016; Crisis Period indicates whether or not a startup's cohort was accelerated during a crisis year (2008 and 2009); Ln VC Money Region is the logarithmic scale of the amount of venture capital invested in seed and early stage startups in the year and region the startup's cohort was accelerated; Accelerator City indicates in which city the accelerator is located.