

Theory and Evidence.....

**Corporate Venture Capital and
Digital Disruption**

by

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Abstract

Developments in digital technologies is disrupting many physical-world companies, affecting not just the type of products provided by the incumbents but the business models themselves. This paper examines how investment choices by the corporate venture capital (CVC) arm of corporations reflects their response to such disruptions. This focuses on the investments of 103 select CVCs and examines their investments. It shows that CVCs whose parents are in the technology industry are more likely to make within-industry investments while CVCs whose parent companies are not related to technology are more likely to make outside-industry investments. Additionally, CVCs whose parents are healthcare or pharmaceutical companies demonstrate a different investment profile, investing almost exclusively within the same industry as the parent company. However, startups which receive funding from a CVC outside of their industry are more likely to be startups which are not in the technology industry.

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1. Introduction to Digital Disruption

Recent developments in digital technology have redefined the way that business function – both in technology-related industries as well as physical-world industries. Such disruption often challenges the existence of firms that have previously dominated their industry. Broadly speaking, digital disruption refers to the process where digital innovations fundamentally changes previous foundations in the value creation and capture process¹. Such disruption have rapid and systematic impacts, eroding the competitive positions of incumbent firms.² With companies such as Uber, Airbnb, and Ant Financial bringing digital innovations and generating huge valuations along the way, digital disruption has gained substantial attention and established firms find themselves increasingly needing to respond to the challenge.

However, digital developments were not always so prominent. When computing technologies were still in its infancy, it was largely limited to military applications with prohibitively expensive machines that weighing tons occupying entire rooms. In the 1960s, things started to change as firms began to use mainframes in their business operations. In the 1980s, digital technologies really started to take off as personal computing devices became increasingly affordable and found their way into individual households.

During this first wave of development, the disruption was largely in digital related industries, such as in music, publishing, and video entertainment. Physical media such as vinyl records, audio cassette tapes, and cassette-like videotapes were replaced by CDs

¹ Skog, Daniel A., Henrik Wimelius, and Johan Sandberg. 2018. “Digital Disruption.” *Business & Information Systems Engineering* 60 (5): 431–37. <https://doi.org/10.1007/s12599-018-0550-4>.

² Ibid.

and DVDs, which were much more reliable and compact at transmitting information³. This was followed by the increasing use of the internet and mobile phones and saw the birth of some of the largest technology companies of today including Amazon and Google.

Whilst the disruption in this first wave was more related to digital technologies, the disruption that is happening today covers a much broader set of companies which extend beyond technology industry. In the automotive arena, Waymo and Uber are fundamentally changing the way people think about purchasing a vehicle. A joint analysis by the World Economic Forum and Accenture suggests that digital transformation in the automotive industry has the opportunity to create \$700 billion in value⁴. McKinsey also reports that on-demand mobility services and data-driven services could create up to \$1.5 trillion in revenue by 2030⁵. In addition to the automotive industry, digital disruption may play a central role in transforming the healthcare industry as biotechnology companies are increasingly challenging the business model of big pharmaceutical companies. A report by HBM Partners, a healthcare investment firm, estimates that as much as 64% of recently approved drugs have been developed by start-ups or small academic- and biotech-driven ventures⁶. The financial services industry is also undergoing transformation which digital technologies changing everything from investment management to transactions and the development of digital wallets is one

³ Tardieu, Hubert, David Daly, José Esteban-Lauzán, John Hall, and George Miller. 2020. *Deliberately Digital: Rewriting Enterprise DNA for Enduring Success*. Future of Business and Finance. Cham: Springer International Publishing. <https://doi.org/10.1007/978-3-030-37955-1>.

⁴ World Economic Forum. "Identifying Value at Stake for Society and Industry." World Economic Forum. Accessed May 14, 2020. http://reports.weforum.org/digital-transformation/identifying-value-at-stake-for-society-and-industry/?doing_wp_cron=1589449569.9630808830261230468750.

⁵ Gao, Paul, Hans-Werner Kaas, Detlev Mohr, and Dominik Wee. "Disruptive Trends That Will Transform the Auto Industry." McKinsey & Company, January 1, 2016. <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/disruptive-trends-that-will-transform-the-auto-industry>.

⁶ "Biotechs Investments Disrupt Big Pharma Business Model." BNP Paribas, November 12, 2019. <https://group.bnpparibas/en/news/biotechs-investments-disrupt-big-pharma-business-model>.

such example. Whilst companies such as Visa and Mastercard are still market leaders, many non-financial companies, such as Apple and Google have entered the area of digital payments. Apart from technology firms, there are also newly entrants emerging in the area of financial technology, such as Revolut and TransferWise, who are attracting consumers by providing services such as cross-border payment innovations⁷. There has been especially rapid growth in Asian countries, where payment apps are integrated with e-commerce, chat, and other services. Changes are also taking place in African countries where only one quarter of the population have access to a bank account but many more have access to a mobile phone⁸. In the hospitality industry, Airbnb has driven down hotel revenues and a study has even quantified the impact, citing a 13% loss of room revenue and a 0.35% decrease in monthly hotel room revenue for every 10% increase in Airbnb listings in Texas.⁹ The retail industry has also been greatly affected by the growth of e-commerce. In 2017, 64% of American households were subscribed to Amazon Prime, a paid subscription service by the e-commerce giant¹⁰ and there is even the term “Amazon effect” to describe the firm’s influence on consumer shopping patterns and the downward pressure it has put on prices¹¹. Even the manufacturing industry, which has been viewed as more resilient to digital disruption is experiencing a “fourth industrial revolution” which McKinsey describes as the next phase in the digitization of the manufacturing

⁷ “Digital Disruption in Banking and its Impact on Competition.” OECD, February 26, 2019. <http://www.oecd.org/daf/competition/digital-disruption-in-banking-and-its-impact-on-competition-2020.pdf>

⁸ Ibid.

⁹ Thomas, David R. “A General Inductive Approach for Analyzing Qualitative Evaluation Data.” *American Journal of Evaluation* 27, no. 2 (June 2006): 237–46. doi:10.1177/1098214005283748.

¹⁰ Shep Hyken, “Sixty-Four Percent Of U.S. Households Have Amazon Prime,” *Forbes*, <https://www.forbes.com/sites/shephyken/2017/06/17/sixty-four-percent-of-u-s-households-have-amazon-prime/#639dc5694586>.

¹¹ Holland, Roberta. “The ‘Amazon Effect’ Is Changing Online Price Competition-and the Fed Needs to Pay Attention.” HBS Working Knowledge, April 24, 2019. <https://hbswk.hbs.edu/item/the-amazon-effect-is-changing-online-price-competition-and-the-fed-needs-to-pay-attention>.

sector¹². Finally, the emergence of new technologies is constantly creating disruption, even within the technological industry.

Digital disruption is closely related to disruptive innovation theory, where Clayton Christensen defines disruption as “a process whereby a smaller company with fewer resources is able to successfully challenge established incumbent businesses”.¹³ This happens when incumbents, who focus on improving the products and services for the most demanding, and typically the most profitable consumers, ignore the needs of other customers. Entrants focus on the segments which have not received the same attention and deliver a product with suitable functionality, and usually at lower price. One characteristic of these disruptive innovators is that they originate in either low-end footholds or new-market footholds. Low-end footholds are the consumer segments that the incumbent usually pays less attention to, as they are focused on satisfying the needs of more demanding customers. New-market footholds are consumers who did not consume the product before. One example of this was when the introduction of personal copiers led individuals and small organizations to use photocopy machines.

There are several characteristics of disruptive innovation. First, “disruptive innovation” is a constantly evolving process, rather than a static, fixed target or goal.¹⁴ Disruptors typically start on a small scale and focus on getting both the business model and the product correctly. During this stage of constant exploration, the incumbents gain increasing market share until they are able to reach profitability, with both the business model and product continually evolving during this process. Second, the business models

¹² Baur, Cornelius, and Dominik Wee. “Manufacturing's next Act.” McKinsey & Company, June 1, 2015. <https://www.mckinsey.com/business-functions/operations/our-insights/manufacturing-next-act>.

¹³ Christensen, Clayton M, Michael Raynor, and Rory McDonald. “What Is Disruptive Innovation?” *Harvard Business Review*, December 2015. <https://pedrotrillo.com/wp-content/uploads/2016/01/Whatisdisruptiveinnovation.pdf>.

¹⁴ Ibid.

of disruptors are seem different from those of incumbents, making it hard at early stages to distinguish whether disruptors and incumbents are in the same industry. Specifically, incumbents often use the “solution shop” business model while entrants use the “process” business model, which takes a more disruptive path. Finally, not all disruptive innovations will succeed. Being disruptive is not sufficient for being successful and not all successful firms take the disruptive path. Whilst disruption theory can be applied to companies, it does not tell the companies what exactly they need to do in order to win the low-end foothold or the new-market footholds and successfully grow.

As a result of digital disruption that is taking place, incumbent firms must be constantly aware of impending technological changes. As many of the examples have shown, impending technological developments could seriously threaten the business models of firms both in the technology industry and beyond.

2. Background to Corporate Venture Capital

2.1 What is Corporate Venture Capital?

CVC (corporate venture capital) is a minority equity investment in a privately-held entrepreneurial venture by an established corporation¹⁵. In recent years, global CVC has seen significant growth, increasing from \$17.9 billion in 2014 to \$57.1 billion in 2019¹⁶. In addition, corporates are also playing an increasingly important role in the

¹⁵ Dushnitsky, Gary, and Michael J. Lenox. 2006. “When Does Corporate Venture Capital Investment Create Firm Value?” *Journal of Business Venturing* 21 (6): 753–72.
<https://doi.org/10.1016/j.jbusvent.2005.04.012>.

¹⁶ CB Insights. 2019. “The Global CVC Report.”

overall venture capital ecosystem with rounds including a CVC investor accounting for 50.9% of total capital invested.¹⁷

CVC differs from independent venture capital (IVC) investments in a key way: with CVC, both strategic and financial considerations are important¹⁸. Specifically, CVCs provide a window on technology for investing corporations by giving them an opportunity to take stock of the environment for new technologies¹⁹. Existing research has also established relationships between CVC and corporate innovation. For example, firms have used CVC investments in small startup companies to explore innovative business models²⁰. Additionally, CVC investments help corporations build knowledge and learning, which then enhance the innovative performance of companies²¹.

With the rapid development in technologies, firms may choose to consider investing in CVC as a means to adapt to the increasingly technologized world. According to a Deloitte report, 94% of firms consider digital transformation a top strategic priority. For such firms, CVCs can provide access to needed technology, helping them innovate and protect their offerings.

2.2 Objectives of CVC

Firms can have a wide range of objectives on that they want to achieve when setting up a CVC arm. Most research has largely grouped the objectives of CVCs into either strategic goals or financial goals. This thesis will put aside the financial objectives,

¹⁷ PitchBook. "18 Charts to Illustrate US VC in 2018." PitchBook, January 28, 2019. <https://pitchbook.com/news/articles/18-charts-to-illustrate-us-vc-in-2018>.

¹⁸ Dushnitsky, Gary. 2009. *Corporate Venture Capital: Past Evidence and Future Directions*. Edited by Anuradha Basu, Mark Casson, Nigel Wadson, and Bernard Yeung. Vol. 1. Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780199546992.003.0015>.

¹⁹ Dushnitsky, Gary, and Michael J. Lenox. 2005. "When Do Incumbents Learn from Entrepreneurial Ventures?" *Research Policy* 34 (5): 615–39. <https://doi.org/10.1016/j.respol.2005.01.017>.

²⁰ Chesbrough, Henry. 2007. "Business Model Innovation: It's Not Just about Technology Anymore." *Strategy & Leadership* 35 (6): 12–17. <https://doi.org/10.1108/10878570710833714>.

²¹ Yang, Yi, V.K. Narayanan, and Shaker Zahra. 2009. "Developing the Selection and Valuation Capabilities through Learning: The Case of Corporate Venture Capital." *Journal of Business Venturing* 24 (3): 261–73. <https://doi.org/10.1016/j.jbusvent.2008.05.001>.

as the data for this is less robust. Moreover, strategic objectives is one of the distinguishing features of CVCs which differentiate it from other venture capital investments.

The most commonly cited and well-documented objective for CVCs is to provide a “window on technology”. Window on technology refers to scanning the environment for novel technologies that either threaten or complement core businesses. This scanning can provide useful information about potential competitors and help identify future alliance partners²². Studies have found that CVC which provide a window on technology usually create more value²³, develop more innovative insights²⁴, and improve firm performance²⁵.

Additional studies have been done on the strategic objectives of CVCs more broadly. In the first comprehensive study on the investment objectives of CVC, which consisted of 7 interviews and an extensive questionnaire which was answered by 52 companies, “Exposure to New Technologies and Markets” was found to be the most important strategic benefit for CVCs. Other important objectives, ranked in order of decreasing importance were “Potential to manufacture or market new products”, “Potential to improve manufacturing processes”, and “Potential to acquire companies”²⁶.

²² Dushnitsky, Gary, and Michael J. Lenox. 2006. “When Does Corporate Venture Capital Investment Create Firm Value?” *Journal of Business Venturing* 21 (6): 753–72. <https://doi.org/10.1016/j.jbusvent.2005.04.012>.

²³ Ibid.

²⁴ Smith, Sheryl Winston, and Sonali K. Shah. 2013. “Do Innovative Users Generate More Useful Insights? An Analysis of Corporate Venture Capital Investments in the Medical Device Industry: Do Innovative Users Generate More Useful Insights?” *Strategic Entrepreneurship Journal* 7 (2): 151–67. <https://doi.org/10.1002/sej.1152>.

²⁵ Benson, David, and Rosemarie H. Ziedonis. 2009. “Corporate Venture Capital as a Window on New Technologies: Implications for the Performance of Corporate Investors When Acquiring Startups.” *Organization Science* 20 (2): 329–51. <https://doi.org/10.1287/orsc.1080.0386>.

²⁶ Siegel, Robin, Eric Siegel, and Ian C. MacMillan. 1988. “Corporate Venture Capitalists: Autonomy, Obstacles, and Performance.” *Journal of Business Venturing* 3 (3): 233–47. [https://doi.org/10.1016/0883-9026\(88\)90017-1](https://doi.org/10.1016/0883-9026(88)90017-1).

In a 1990 study of the success of CVC, another survey was conducted to 31 major corporations through questionnaires. This was followed by follow-up interviews. For strategic objectives, this study found that “Identify new opportunities” was the most popular objective. This was followed by “Develop Business Relationships” (Skye, 1990).

In a 2002 survey of 95 CVC programs, ‘Learning and Developing Strategic Relationships’ and ‘Increasing Demand for our Products and Services’ were found to be the top goals for CVCs. Other capabilities that CVCs hope to develop include ‘an entrepreneurial mindset among employees’, ‘commercial capabilities throughout the company’, ‘networking inside and outside the company’, ‘market sensing’, and ‘the discipline of funding and killing projects’.

Dushnitsky summarizes “In the same way, spotting potential acquisition candidates is an oft-cited objective. Another common CVC objective is the development of strategic relationships, most often with the intent of learning or engaging new markets. Recent surveys indicate that investment in ventures with the intent to create demand for corporate products or services is an alternative role of CVC. Less common is the view of CVC investment as an opportunity to enter foreign markets (e.g. ‘International Business Opportunities,’ or ‘Tapping into Foreign Markets’). Similarly, a few firms point at ‘Exposure to Entrepreneurial Spirit’ and an effort to ‘Change Corporate Culture’ as an important, yet not primary, objective.”

(Dushnitsky, 2018, page 22)

Identify novel sources: ‘Exposure to New Technologies’ (McNally, 1997), ‘External R&D’, ‘Accelerated Market Access’ (Kann, 2000), and potentially ‘Identification of Acquisition Candidates’ (Siegel et al., 1988).

Complement corporate business: ‘increase the value of existing corporate businesses (Brandenburger and Nalebuff, 1996). The two may complement each other along different dimensions: technologically (e.g. ‘Develop Business Relationships’, Birkinshaw et al., 2002), in the product market (e.g. ‘Demand Enhancement’, Kann, 2000), as well as geographically (e.g. ‘Tapping into Foreign Market’, Ernst & Young, 2002).

More literature sources:

A recent survey of global CVC programs finds that 67% of firms invest in new ventures for strategic reasons (Ernst and Young, 2002). Additional survey results (Siegel et al., 1988; Block and MacMillan, 1993; Yost and Devlin, 1993), case studies (Chesbrough, 2000; Henderson and Leleux, 2002) and practitioner accounts (Sykes, 1986; Winters and Murfin, 1988) support the claim that firms often pursue CVC as much for indirect strategic benefits as for direct financial return on investment.

More typologies

http://facultyresearch.london.edu/docs/Birkinshaw_Journal_of_Business_Venturing_forthcoming_2008.pdf

Some companies utilize corporate venture capital as a means to explore alternative business models in small startup companies (Chesborough 07)

For a typography, see Chesborough 02

2.3 Thesis question

This thesis will examine when the actual investments made by the top-100 CVCs are consistent with the objective of wanting to hedge against digital disruption (which is one kind of “business model innovation” objective), or when they are better explained wanting to strengthen existing competitive position/innovation (or make synergistic investments).

- i. Any CVC would fulfil the talent management objectives.*
- ii. The data isn't good enough to look at financial objectives.*

3. Data

3.1 VentureXpert

VentureXpert, owned by Thomson Reuters, is a database containing venture capital information about firms, funds, and portfolio companies. This database has been widely used in academic research on CVC. Working on this data helped me develop a better understanding of the literature and replicating results of prior studies to better understand the data that was available on the database.

3.2 Crunchbase

VentureXpert data can only be downloaded in large amounts from SDC Platinum, an online historical financial transactions database. Similar to a Bloomberg terminal, SDC Platinum can only be accessed through certain terminals. There is only one terminal on-campus which is located on the sixth floor of Tisch hall.

Due to the impact of COVID-19, however, NYU shut down and I lost access to the data. Remote access options to SDC Platinum is extremely limited. Taking a leaf out

of the startup playbook, “pivoted” to analyzing CrunchBase data. Whilst it was disappointing not to have VentureXpert as a source of data, it was also exciting since little research has been done yet on the data from CrunchBase and the dataset has not been used to study CVC before.

The CrunchBase data contains four main sets of data. There is a special data associated with each entity in CrunchBase, called UUID. The documentation explains that “A UUID in the CrunchBase API is a globally-unique identifier of an Entity across the entire CrunchBase graph, independent of Entity type” (CrunchBase N.D.).

The first set of data is a list of 104 select CVCs. These CVCs are an exogenously specified set of the 104 top CVCs my advisor provided. This dataset includes both the industry name as well as the UUID. I further used both Google and CrunchBase to isolate the parent companies of the CVCs to categorize the CVCs. This is because most CVCs are financial companies, but that label does not give insight into the type of investment the parent company may make.

The second set of data is a list the information of all investors in the CrunchBase universe. This contains a set of 4,896 investors with information across 459 different **classifications** of information. However, not all of them provide unique information. One **entity** usually has four classifications: an entity definition, the variable, a permanent link, and a uuid. Furthermore, not all classifications are made equal. Apart from the UUID, there is at least one data that is not present in each classification. Some classification has as few as just 2 points of data. One reason for this might be that the data is missing. However, the bigger reason is that the investor does not need or have the information for all the categories. For example, CrunchBase allows the user to enter up to 15 founders.

However, some investors may have just one founder. Thus, the other categories may simply be unnecessary.

The third set of data is a list the information of all companies that have been invested in. This contains a set of 6,648 investors with information across 387 classifications of information. Similar to the investor data, entities that are used frequently has four classifications, an entity definition, the variable, a permanent link, and a UUID. In addition, there are also many classifications for which data is missing. Similarly, the main issue is that companies do not need or have the information for all the categories, which is described above.

The last set of data is a list of a funding rounds that have occurred on CrunchBase. This dataset has a list of 35,727 funding rounds. Each funding round has an investor, an investor, a company, as well as the category that the company belongs to. Table 1 contains the 646 CrunchBase-defined industry/business categories that have been used to label each startup.

This dataset is extremely rich and comprehensive. One drawback compared to the VentureXpert data, however, is that it does not provide investment amount or robust information about financial details of exits.

3.3 Terms

Each of the 103 CVCs have a parent company. This paper will use “CVC” to refer to the corporate investment arm of the parent company and the term “company” to refer to the parent company. Additionally, it will use “startup” to refer to the company that is receiving investment from the CVC.

4. Analysis

4.1 Inductive Analysis

4.2 Hypothesis 1

4.3 Hypothesis 2

5. Results

6. Conclusion

6.1 Limits and future research

7. Appendix

Exhibit 1: 646 Categories of companies

3d-printing	3d-technology	ab-testing
accounting	ad-exchange	ad-network
ad-retargeting	ad-server	ad-targeting
advanced-materials	advertising-6cb6	advertising-platforms
advice	aerospace-8a20	affiliate-marketing
agriculture	agtech	air-transportation
alternative-medicine	american-football	amusement-park-and-arcade
analytics	android-3f49	angel-investment
animation	app-discovery	app-marketing
application-performance-management	application-specific-integrated-circuit-asic	apps
architecture	archiving-service	art
artificial-intelligence	asset-management	assistive-technology
association	auctions	audio
augmented-reality	auto-insurance	automotive
autonomous-vehicles	b2b	b2c
baby	banking	basketball
battery	beauty	big-data
billing	biofuel	bioinformatics
biomass-energy	biometrics	biopharma
biotechnology	bitcoin-1c16	blockchain
blogging-platforms	boating	brand-marketing
brewing	broadcasting	browser-extensions
building-material	business-development	business-information-systems
business-intelligence	business-travel	cad-3cfd
call-center	car-sharing	career-planning
casino	casual-games	catering
cause-marketing	celebrity	charity
chemical	chemical-engineering	child-care
children	civitech	classifieds
clean-energy	cleantech	clinical-trials
cloud-computing	cloud-data-services	cloud-infrastructure
cloud-management	cloud-security-db34	cloud-storage
cms	coffee-bad7	collaboration
collaborative-consumption-22fc	collectibles	college-recruiting

comics	commercial	commercial-insurance
commercial-lending	commercial-real-estate	communication-hardware
communications-infrastructure	communities	compliance-da6d
computer	computer-vision	concerts
console-games	construction	consulting
consumer	consumer-applications	consumer-electronics
consumer-goods	consumer-lending	consumer-research
consumer-reviews	consumer-software	contact-management
content	content-creators	content-delivery-network
content-discovery	content-marketing	content-syndication
cooking	corporate-training	cosmetic-surgery
cosmetics	coupons	courier-service
coworking	creative-agency	credit
credit-bureau	credit-cards	crm
crowdfunding	crowdsourcing	cryptocurrency
customer-service	cyber-security	cycling
data-center	data-center-automation	data-integration-0c4a
data-mining	data-storage	data-visualization
database	dating	debit-cards
debt-collections	delivery	delivery-service-758d
dental	desktop-apps	developer-apis
developer-platform	developer-tools	diabetes
dietary-supplements	digital-entertainment	digital-marketing-9bff
digital-media-2f47	digital-signage	direct-marketing
direct-sales	diy-4b6c	document-management
document-preparation	drone-management	drones
dsp-0be5	e-commerce-275d	e-commerce-platforms
e-learning	e-signature	ebooks
ediscoversy	edtech	education
edutainment	elder-care	elderly
electric-vehicle	electrical-distribution	electronic-design-automation-eda
electronic-health-record-ehr	electronics	email
email-marketing	embedded-software	embedded-systems
emergency-medicine	emerging-markets	employee-benefits
employment	energy-0ff0	energy-efficiency
energy-management	energy-storage	enterprise
enterprise-applications	enterprise-resource-planning-erp	enterprise-software

environmental-consulting	environmental-engineering-5941	esports
ethereum-3e04	event-management	event-promotion
events	eyewear-dc77	facebook-59d1
facial-recognition	facilities-support-services	facility-management
family	fantasy-sports	farming
fashion	fast-moving-consumer-goods	fertility
field-programmable-gate-array-fpga	field-support	file-sharing
film-c333	film-distribution	film-production
finance	financial-exchanges	financial-services
fintech-e067	fitness	flash-storage
fleet-management	food-and-beverage	food-delivery
food-processing	fossil-fuels	franchise
fraud-detection	freelance	freemium
freight-service	fruit-21b2	fuel
fuel-cell	funding-platform	furniture
gambling	gamification-af92	gaming
genetics	geospatial-aac4	gift
gift-card	gift-exchange	google-3cb6
google-glass	government	govtech-b9c9
gps	gpu	graphic-design-e362
green-building	green-consumer-goods	greentech
grocery	group-buying	guides
handmade-9af4	hardware	health-care
health-diagnostics	health-insurance	hedge-funds
higher-education	home-decor-c954	home-health-care
home-improvement	home-renovation	home-services
homeland-security	hospital-650c	hospitality
hotel	housekeeping-service	human-computer-interaction
human-resources	hunting-a46c	iaas
identity-management	image-recognition	impact-investing
incubators	independent-music	indoor-positioning
industrial	industrial-automation	industrial-design
industrial-engineering	industrial-manufacturing	information-communications-technology-ict
information-services-f579	information-technology-dbca	infrastructure
innovation-management	insurance	insurtech

intellectual-property	intelligent-systems	interior-design
internet	internet-of-things-ed3a	internet-radio
intrusion-detection	ios-6e02	isp
it-infrastructure	it-management	janitorial-service
jewelry	journalism	knowledge-management
landscaping	language-learning	laser
last-mile-transportation	laundry-and-dry-cleaning	law-enforcement
lead-generation	lead-management	leasing
legal	legal-tech	leisure
lending	lgbt	life-insurance
life-science	lifestyle	lighting
lingerie	linux	livestock
local-8ebe	local-advertising	local-business
local-shopping	location-based-services	logistics
loyalty-programs	machine-learning	machinery-manufacturing
made-to-order-56eb	management-consulting	management-information-systems
manufacturing	mapping-services	marine-transportation
market-research	marketing-2795	marketing-automation
marketplace-772d	mechanical-design	mechanical-engineering
media-and-entertainment	medical	medical-device
meeting-software	mens	messaging-8c62
mhealth	micro-lending	millennials
mineral	mining-4ce2	mining-technology
mmo-games-a4ef	mobile	mobile-advertising
mobile-apps	mobile-devices	mobile-payments
mooc	motion-capture	music
music-education	music-label	music-streaming
music-venues	musical-instruments	nanotechnology
national-security	natural-language-processing	natural-resources
navigation	network-hardware	network-security
neuroscience-e37a	news	nfc
nightclubs	nightlife-68e7	non-profit
nutraceutical	nutrition-654b	office-administration
oil-and-gas	online-auctions	online-forums
online-games	online-portals	open-source
operating-systems	optical-communication	organic-be0f
organic-food	outdoor-advertising	outdoors
outsourcing-59ca	paas	packaging-services

parenting	parking	payments
pc-games	peer-to-peer	penetration-testing
performing-arts	personal-branding	personal-development
personal-finance	personal-health	personalization
pet	pharmaceutical	photo-editing
photo-sharing	photography	physical-security
podcast	point-of-sale-37d6	politics
pollution-control	power-grid	precious-metals
prediction-markets	predictive-analytics-ca83	presentation-software
presentations	price-comparison	primary-education
printing	privacy-e1a4	private-cloud
private-social-networking	procurement	product-design
product-management	product-research	product-search
productivity-tools	professional-networking	professional-services
project-management-db17	property-development	property-insurance
property-management	psychology	public-relations
public-safety	public-transportation	publishing
qa	quality-assurance	quantified-self-4b52
quantum-computing-2	racine	railroad
reading-apps	real-estate	real-estate-investment
real-time	recipes	recreation
recreational-vehicles	recruiting	recycling
religion	renewable-energy	rental
rental-property	reputation	reservations
residential	resorts	restaurants
retail	retail-technology	rfid
ride-sharing	risk-management	robotics
saas-5c4e	sailing	sales
sales-automation	same-day-delivery	satellite-communication
scheduling	search-engine-0d39	secondary-education
security-4c60	sem-3277	semantic-search
semantic-web	semiconductor	sensor
seo	serious-games	service-industry
sharing-economy	shipping	shipping-broker
shoes	shopping	shopping-mall
simulation	skiing	skill-assessment
small-and-medium-businesses	smart-building	smart-cities
smart-home-8900	sms	snack-food

sns	soccer	social
social-bookmarking	social-crm	social-entrepreneurship
social-impact-bf5c	social-media	social-media-advertising
social-media-management	social-media-marketing	social-network-714d
social-news	social-recruiting-b53b	social-shopping
software	software-engineering	solar-c3d5
space-travel-b590	spam-filtering	speech-recognition
sponsorship	sporting-goods	sports
staffing-agency	stem-education	stock-exchanges
subscription-service	supply-chain-management	sustainability-e391
task-management	taxi-service	technical-support
telecommunications	tennis	test-and-measurement
text-analytics	textiles	theatre
therapeutics	ticketing	tourism
toys	trading-platform	training
transaction-processing	translation-service	transportation
travel	travel-accommodations	travel-agency
tutoring	tv	tv-production
unified-communications-76fb	universities	usability-testing
ux-design	vacation-rental	venture-capital-b37d
veterinary	video	video-advertising
video-chat	video-conferencing	video-editing
video-games	video-on-demand-e544	video-streaming
virtual-assistant	virtual-currency	virtual-desktop
virtual-goods	virtual-reality	virtual-workforce
virtual-world-2d1a	virtualization	visual-search
voip-487d	warehousing	waste-management-ea5b
water	water-purification	wealth-management
wearables	web-apps	web-browsers
web-design	web-development	web-hosting
wedding	wellness	wholesale
wind-energy	windows-phone-9f50	wine-and-spirits
wired-telecommunications	wireless	womens
young-adults		

Exhibit 2: 152 Categories of parent of investors

advertising	advertising-platforms	analytics
android	animation	apps
artificial-intelligence	asset-management	association
auctions	automotive	b2b
banking	biotechnology	blockchain
blogging-platforms	brand-marketing	broadcasting
business-development	business-information-systems	business-intelligence
charity	chemical	cloud-computing
collaboration	commercial-real-estate	communications-infrastructure
communities	consulting	consumer
consumer-electronics	consumer-goods	content
content-creators	content-delivery-network	corporate-training
credit	credit-cards	crm
crowdsourcing	cyber-security	delivery
delivery-service	developer-tools	digital-entertainment
digital-marketing	digital-media	e-commerce
e-commerce-platforms	education	electronics
email	emergency-medicine	energy
energy-management	enterprise-applications	enterprise-software
fashion	fast-moving-consumer-goods	film
finance	financial-services	fintech
food-and-beverage	gaming	hardware
health-care	health-diagnostics	home-services
hospital	human-resources	industrial
industrial-engineering	industrial-manufacturing	information-services
information-technology	infrastructure	innovation-management
insurance	internet	internet-of-things
ios	language-learning	legal
lending	life-science	logistics
manufacturing	marketing	mechanical-engineering
media-and-entertainment	medical	medical-device
messaging	mhealth	mobile
mobile-devices	mobile-payments	natural-resources
news	non-profit	oil-and-gas
online-games	online-portals	operating-systems

payments	pharmaceutical	product-design
public-relations	publishing	real-estate
real-time	renewable-energy	retail
risk-management	robotics	saas
sales	search-engine	security
semiconductor	sensor	seo
service-industry	shipping	shopping
social-impact	social-media-marketing	social-network
software	solar	sports
telecommunications	therapeutics	tourism
transaction-processing	translation	translation-service
transportation	travel	tv
tv-production	venture-capital	video
video-on-demand	video-streaming	wealth-management
web-development	web-hosting	wholesale
windows-phone	wireless	

Exhibit 3: Distribution of industry categories for parent of investors

Bucket	Frequency	Percentage
Technology	36	36.4%
Services	20	20.2%
Finance	16	16.2%
Auto	1	1.0%
Manufacturing	5	5.1%
Health	13	13.1%
Energy	6	6.1%
Technology/Service	2	2.0%
Total	99	100%

Exhibit 4: Breakdown of funding rounds by round type

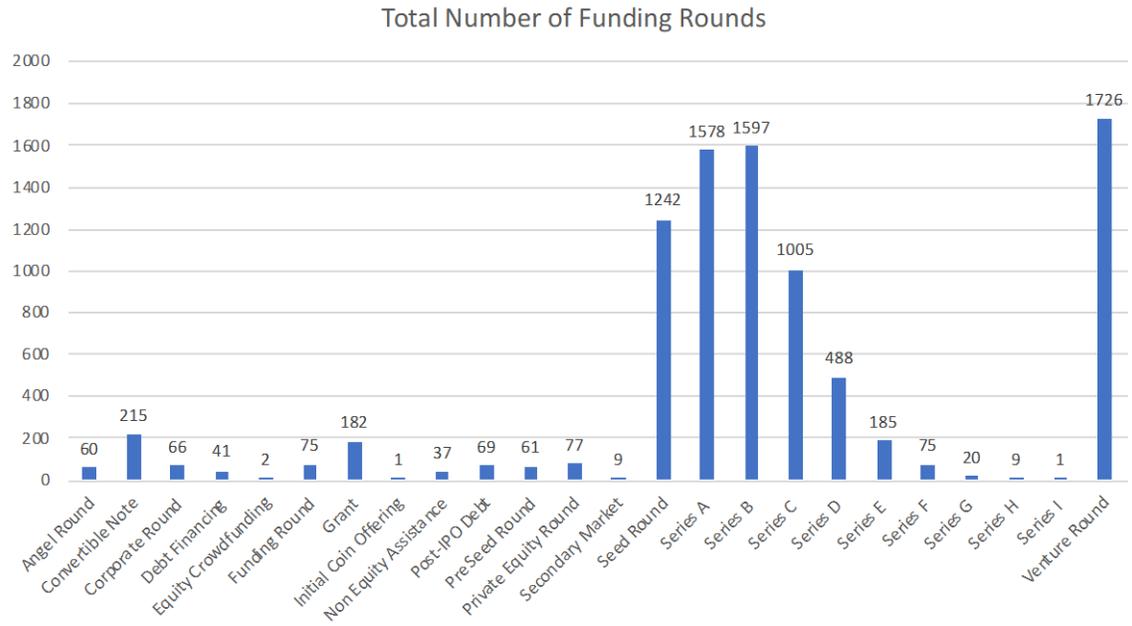


Exhibit 5: Pre-clustering (left) and post-clustering (right)

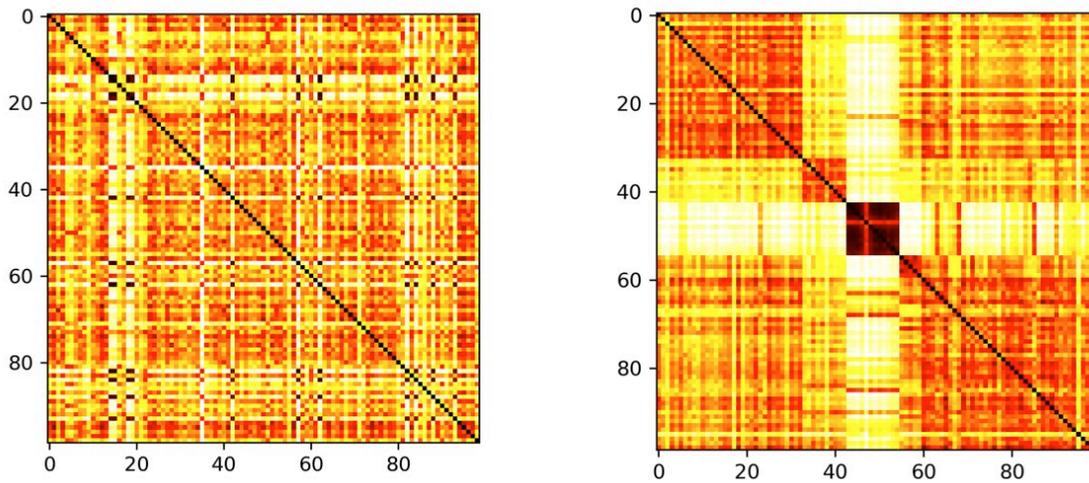


Exhibit 6: Distribution of technology CVCs and non-technology CVCs

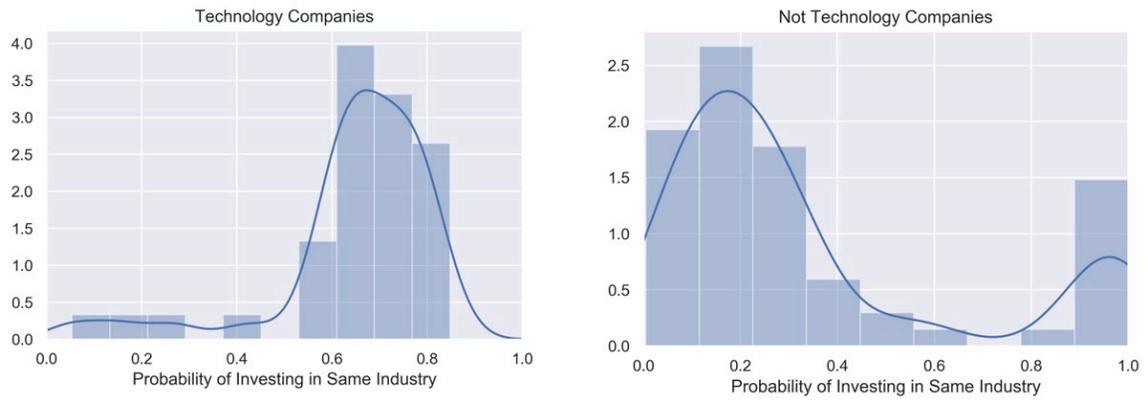


Exhibit 7: Distribution of technology CVCs and non-technology CVCs excluding cluster

