

WORKING
PAPERS IN
RESPONSIBLE
BANKING &
FINANCE

**Entrepreneurial Uncertainty
during the Covid-19 Crisis:
Mapping the Temporal Dynamics
of Entrepreneurial Finance**

By Ross Brown and Augusto Rocha

Abstract: This paper illustrates the crucial role real time data (RTD) analytics can play in tracking entrepreneurial uncertainty caused by profound shocks such as the Covid-19 pandemic. RTD sources afford policy makers the opportunity to proactively monitor the effects of a crisis in real-time. To explore this line of argument, this paper examines Crunchbase data examining entrepreneurial finance investments in China during the Covid-19 crisis. We show that equity investments slumped dramatically in the immediate aftermath of the Covid-19 virus, resulting in a year on year decrease of 60% in the total volume of investment raised between quarter 1 in 2019 and quarter 1 in 2020. Importantly, the data shows early-stage seed investments falling the most, suggesting the most nascent start-ups are those most heavily affected. While the global financial crisis heavily hit debt markets, the relational nature of equity investments may mean entrepreneurial finance is even more susceptible to the upheaval caused by the Covid-19 crisis. Overall, enterprise policy makers need to become better attuned at monitoring real-time data if chronic levels of entrepreneurial uncertainty are to be mitigated via strategic policy interventions.

WP N° 20-008

2nd Quarter 2020



Entrepreneurial Uncertainty during the Covid-19 Crisis: Mapping the Temporal Dynamics of Entrepreneurial Finance

Ross Brown, Centre for Responsible Banking & Finance, School of Management, University of St
Andrews: Ross.Brown@st-andrews.ac.uk

&

Augusto Rocha, School of Management, University of St Andrews: a.rocha@st-andrews.ac.uk

Abstract

This paper illustrates the crucial role real time data (RTD) analytics can play in tracking entrepreneurial uncertainty caused by profound shocks such as the Covid-19 pandemic. RTD sources afford policy makers the opportunity to proactively monitor the effects of a crisis in real-time. To explore this line of argument, this paper examines Crunchbase data examining entrepreneurial finance investments in China during the Covid-19 crisis. We show that equity investments slumped dramatically in the immediate aftermath of the Covid-19 virus, resulting in a year on year decrease of 60% in the total volume of investment raised between quarter 1 in 2019 and quarter 1 in 2020. Importantly, the data shows early-stage seed investments falling the most, suggesting the most nascent start-ups are those most heavily affected. While the global financial crisis heavily hit debt markets, the relational nature of equity investments may mean entrepreneurial finance is even more susceptible to the upheaval caused by the Covid-19 crisis. Overall, enterprise policy makers need to become better attuned at monitoring real-time data if chronic levels of entrepreneurial uncertainty are to be mitigated via strategic policy interventions.

Key Words: **Equity Investments** **Crisis** **Covid-19** **China**

Real-time Data **Public Policy**

1. Introduction

This paper aims to illustrate the crucial role real time data (RTD) can play in better comprehending how extreme uncertainty caused by crisis events affects start-ups and small and medium-sized enterprises (SMEs). For over a century, uncertainty has long been recognised as a central pillar influencing entrepreneurial decision making (Knight, 1921). Uncertainty is defined as the “*perceived [in]ability to predict outcomes in the general business environment accurately because of insufficient information or the inability to discriminate between relevant and irrelevant data*” (Milliken, 1987, p. 136). During shocks and crisis events, levels of uncertainty escalate at such *velocity* their impacts become highly debilitating for entrepreneurs and entrepreneurial actors such as banks and investors (McMullen and Shepherd, 2006; Block and Sandner, 2009; Packard et al, 2018). Therefore, deciphering uncertainty is an “integral part” of ascertaining how firms strategically respond to a crisis (Wenzel et al, 2020).

In recent years, levels of uncertainty have heightened considerably due to shocks such as, *inter alia*, major terrorist attacks (e.g. 9/11), the Gulf Wars, the global financial crisis (GFC), Brexit and, most recently, the Covid-19 pandemic currently engulfing the global economy (Buchan and Denyer, 2013; Wenzel et al, 2020). Globalisation means the world is now much more inter-dependent and susceptible to systemic shocks such as the Covid-19 pandemic (Goldin and Mariathan, 2015)¹. While the GFC was transmitted worldwide instantaneously via financial markets, the Covid-19 pandemic was propagated virally via global pipelines of people travelling across the world. Judging by its economic impact in

¹ In a play on the “butterfly effect” metaphor from chaos theory, Goldin and Mariathan (2015) refer to this as the “butterfly defect”.

areas initially affected², it seems that this crisis is likely to at least equal, if not surpass, the economic and societal dislocation caused by the GFC due to the hyper-uncertainty and devastation it has transmitted globally.

RTD is information captured and delivered immediately upon collection and falls under the wider rubric of “big data” which denotes the pervasive growth of data underpinned by advances in digital technology (Kitchin, 2014). While economists, finance and marketing scholars were quick to embrace “big data” as part of their methodological armoury (Varian, 2014; Cimadomo, 2016; Erevelles et al, 2016), entrepreneurs scholars have been slower to grasp this opportunity. It is now becoming increasingly recognised however that these novel and instantaneous data sources enable “*substantial contributions to entrepreneurship research*” (Obschonka and Audretsch, 2019; Schwab and Zhang, 2019, p. 843). These sources of information also have the added advantage of detecting emergent trends within society thereby making “*it possible to ask and answer questions in new ways*” (Kitchin, 2014, p. 10).

We wish to argue in this paper that RTD offers a crucial mechanism for policy makers to better comprehend the impact of shocks, such as Covid-19 crisis, have for entrepreneurial activity. Real-time big data sources enable immediate insights into how economies are actually functioning during crisis “periods”. This is important because shocks normally entail extended dynamic processes after the initial crisis episode (Doern et al, 2019). Since the onset of the GFC, central banks are now pro-actively exploring how real-time data can help augment traditional data sources to help “nowcast” how economies are performing over

² Industrial output in China fell by 13.5% in the first two months of 2020, representing the single largest contraction ever recorded (Financial Times, 2020a).

time (Bholat 2015; Aastveit et al, 2018)³. In the context of the current Covid-19 shock, sources of RTD can also inform policy makers which types of firms are recovering (and those that are not) from the crisis. For example, a start-up that collects GPS data from China's cargo vehicles, has been releasing a daily tally showing a rapid recovery in full-truck deliveries which are usually made by major companies, but only a gradual uplift for shared consignment shipments, which tend to be used by smaller businesses (Financial Times, 2020b). This shows that smaller firms are often those most affected by the Covid-19 crisis and its associated uncertainty may need specific forms of assistance.

Given the need for more rapid insights into how shocks translate into entrepreneurial uncertainty, this paper examines the Covid-19 pandemic and how the uncertainty induced by this shock has affected entrepreneurial activity in China. Whilst measurement of uncertainty admittedly poses formidable challenges (Packard et al, 2017), we wish to assess how entrepreneurial finance has been impacted since the outbreak of the virus. While some proxies used for measuring uncertainty are "far from perfect" (Bloom, 2014, p. 172), the crucial importance of entrepreneurial finance for start-ups and innovative SMEs (Hall and Lerner, 2010) makes this a powerful barometer of how uncertainty has affected entrepreneurial activity. To the best of our knowledge this is the first paper to examine the impact of the Covid-19 pandemic on entrepreneurial sources of finance, thereby making a valuable contribution to the growing volume of literature on crisis events and entrepreneurial uncertainty.

³ Nowcasting entails the exploitation of information that is published early and possibly at higher frequencies to obtain an "early estimate" before the official number becomes available (Bell et al, 2014).

The empirical setting for this study is China which was the first country to encounter a major outbreak of the Covid-19 virus. The source of RTD explored within the current paper is Crunchbase data, which collated 13,729 funding transactions in China between 1994 and quarter 1 in 2020. Through a mix of artificial intelligence, machine learning, data analysts, community contributors and an investor network with more than 3,700 global investment firms⁴, Crunchbase broadcasts practically in real-time information about funding rounds undertaken by companies around the world. Herein, our unit of analysis is the funding round, i.e. the financing round where start-ups and established SMEs raise money to finance their operations and growth-related activities. In recent years, a number of studies have utilised this comprehensive and real-time sources of data to examine emerging trends within entrepreneurial finance (Cumming et al, 2019), including how VC levels were affected by shocks such as the GFC (see Block and Sandner, 2009). While generally viewed as comprehensive, the data may be subject to some omissions, especially as seed stage deals by business angels can sometimes remain “hidden” (Freear et al, 1995).

The remainder of the paper is structured as follows. First, we undertake a brief literature review of entrepreneurial uncertainty. Second, we outline the findings from our RTD analysis. Finally, the conclusion outlines areas for further RTD research.

2. Literature Review

Uncertainty is a highly “amorphous” concept shaping entrepreneurial decision making (Bloom, 2014). These complex decision making activities can be conceptualised as a continuous and dynamic process (McMullen and Dimov 2013; Shepherd et al, 2015),

⁴ “The Crunchbase Data Difference” Crunchbase, April 3,2020, <https://about.crunchbase.com/products/the-crunchbase-difference/>

representing not a rational or binary set of choices (i.e. “forks in the road”), but rather an instinctual “dance” with uncertainty during which judgments are constantly “revisited, renewed, and revised” (Packard et al, 2018, p. 840). There is no singular type of uncertainty but an important distinction separates “risk” (with known probabilities which are potentially measurable) and true Knightian uncertainty (which cannot be measured) which is often addressed by the “gut feel” (Knight, 1921). Importantly, Packard et al (2017) distinguish between different analytical types of uncertainty (risk and ambiguity, environmental uncertainty, creative uncertainty and absolute uncertainty). While economics and the behavioural sciences focus primarily on risky and ambiguous scenarios, entrepreneurship scholars have become more interested in environmental uncertainty given its role in moulding business decision making (McMullen and Shepherd, 2006; Bylund and McCaffrey, 2017).

There is now a growing body of work examining how uncertainty and unforeseen shocks impact the entrepreneurial resilience within SMEs (Korber and McNaughton, 2018; Doern et al, 2019). It appears that many SMEs respond to extreme environmental uncertainty via entrepreneurial “inaction” (Packard et al, 2017) sometimes referred to as “wait and see” (Clarke and Liesch, 2017) or “business as usual” mentality (Doern et al, 2019). SMEs find it difficult to access appropriate market information which can disrupt and impede their decision making processes (Gaur et al, 2011). While there is some tentative evidence some entrepreneurs can overcome these challenges (Doern, 2016; Muñoz et al, 2019), this “wait and see” mindset can often result in delays to growth-oriented activities such as capital investment, innovative activities, new recruitment and exporting (Ghosal and Ye, 2015; Morikawa, 2016; Doshi et al, 2018). Another clear trend noted by the literature is that certain types of SMEs seem more detrimentally affected by environmental uncertainty.

Indeed, a raft of studies show that the most innovative and dynamic SMEs are often those most acutely affected by environmental uncertainty caused by shocks and market upheavals, such as the GFC and Brexit (Freel, 2005; Lee et al, 2015; Cumming and Zahra, 2016; Cowling et al, 2018; Brown et al, 2019).

Over the last decade there has been a proliferation of empirical studies examining the impact of major crisis events (and Denyer, 2013; Doern et al, 2019). A key factor explored by the burgeoning literature examines how certain shocks have influenced the ability of innovative SMEs to obtain external finance. In order to grow, external finance is crucial for start-ups and SMEs (Cassar, 2004; Cole and Sokolyk, 2018). For example, some of these studies have carefully explored how bank lending to SMEs was affected by the GFC using traditional methods such as government surveys, business databases and official GDP data (Lee et al, 2015; Cowling et al, 2018; Brown and Lee, 2019; Demirgüç-Kunt et al, 2020).

While there is a need for these robust studies to properly decipher the impact of the GFC *ex post*, these backward looking studies fail to yield much in the way of explanatory insights how policy could proactively deal with and mitigate the impact of these crisis periods as they actually unfolded. Ultimately, using retrospective research designs, means it is often difficult for researchers in this field “to engage in real time with the flow of events” (Buchanan and Denyer, 2013, p.215).

Another limitation with these studies is their strong orientation towards bank lending. To date, there has been substantially less evidence on the role that shocks play on the supply of entrepreneurial finance such as business angel investments and venture capital (VC) and how this has impacts SMEs. While some studies found substantially reduced levels of VC (Block and Sandner, 2009) other studies found sources of business angel finance to be

quite resilient post-GFC (Mason and Harrison, 2015). While this evidence is thin and patchy, there are compelling reasons for examining how equity investments are affected by shocks. In the main, these investments are often allocated to the most growth-oriented and innovative start-ups making them vital for long-term economic growth (Hall and Lerner, 2010).

Equity investments are also undertaken differently to bank lending practices. Indeed, a large body of work indicates that equity investors require close relational interactions and proximity (often face-to-face interactions) with their recipient firms (De Clercq and Sapienza, 2006). Indeed, the relationally based nature of these investments is one of the key reasons why many of these investments are spatially localised so that investors can use their personal networks to elicit deals and then oversee their investee firms by staying “close to their money” (Shane and Cable, 2002; Cumming and Dai, 2010; Colombo et al, 2019). Therefore, given the innately relational nature of entrepreneurial finance, there are strong, *a priori*, theoretical reasons for expecting sources of equity finance to be hit hard by shocks such as pandemics given the need for face-to-face contact.

3. Summary of Results

From our analysis of the RTD it is quite evident that the Covid-19 crisis is having a discernible and substantive impact on the marketplace for equity finance within the Chinese economy. Overall, between the first quarter of 2019 and the first quarter of 2020, China saw a reduction in the value of entrepreneurial finance investment raised fall by a full 60% (see Table 1). Below we outline the impact of the crisis on the various stages of funding rounds. The data source enables us to break the different equity funding rounds into three main stages: seed funding (angels, pre-seed and seed), early stage funding (series A and B

VC) and late-stage funding (series C-G funds)⁵. Given the nature of the data we are able to see how these funding stages have altered over the last five years right up until the first quarter of 2020 which ended at the end of March 2020. It also enables us to detect the spatial areas in China most heavily impacted.

Table 1: Number of transactions and volume of investment raised (in USD) plus their respective differences compared with similar previous period (Year – Year; Quarter – Quarter)

	# of Transactions	% Difference (Transactions)	Investment Raised (in USD)	% Difference (Investment Raised)
2015	1014		\$25,096,015,694	
Qtr1	253		\$6,551,083,885	
Seed	87		\$80,735,878	
Early Stage Venture	138		\$2,420,348,007	
Late Stage Venture	28		\$4,050,000,000	
Qtr2	250		\$5,665,836,141	
Seed	80		\$123,797,301	
Early Stage Venture	146		\$3,617,367,245	
Late Stage Venture	24		\$1,924,671,595	
Qtr3	263		\$7,724,333,925	
Seed	68		\$253,613,171	
Early Stage Venture	158		\$4,269,641,189	
Late Stage Venture	37		\$3,201,079,565	
Qtr4	248		\$5,154,761,743	
Seed	68		\$55,232,105	
Early Stage Venture	147		\$1,863,567,848	
Late Stage Venture	33		\$3,235,961,790	
2016	1000	-1.38%	\$38,569,642,056	53.69%
Qtr1	286	13.04%	\$12,419,645,674	89.58%
Seed	68	-21.84%	\$87,930,836	8.91%
Early Stage Venture	195	41.30%	\$10,723,385,982	343.05%
Late Stage Venture	23	-17.86%	\$1,608,328,856	-60.29%
Qtr2	226	-9.60%	\$11,917,640,348	110.34%
Seed	59	-26.25%	\$32,499,317	-73.75%
Early Stage Venture	129	-11.64%	\$8,177,222,019	126.05%
Late Stage Venture	38	58.33%	\$3,707,919,012	92.65%
Qtr3	255	-3.04%	\$7,837,687,433	1.47%
Seed	78	14.71%	\$44,942,015	-82.28%
Early Stage Venture	145	-8.23%	\$4,925,432,192	15.36%
Late Stage Venture	32	-13.51%	\$2,867,313,226	-10.43%
Qtr4	233	-6.05%	\$6,394,668,601	24.05%
Seed	53	-22.06%	\$79,374,901	43.71%
Early Stage Venture	136	-7.48%	\$2,501,871,590	34.25%
Late Stage Venture	44	33.33%	\$3,813,422,110	17.85%
2017	1192	19.20%	\$48,063,037,387	24.61%
Qtr1	271	-5.24%	\$10,276,713,824	-17.25%
Seed	63	-7.35%	\$69,525,852	-20.93%
Early Stage Venture	164	-15.90%	\$4,233,334,089	-60.52%
Late Stage Venture	44	91.30%	\$5,973,853,883	271.43%
Qtr2	248	9.73%	\$7,433,796,810	-37.62%
Seed	40	-32.20%	\$72,377,486	122.70%

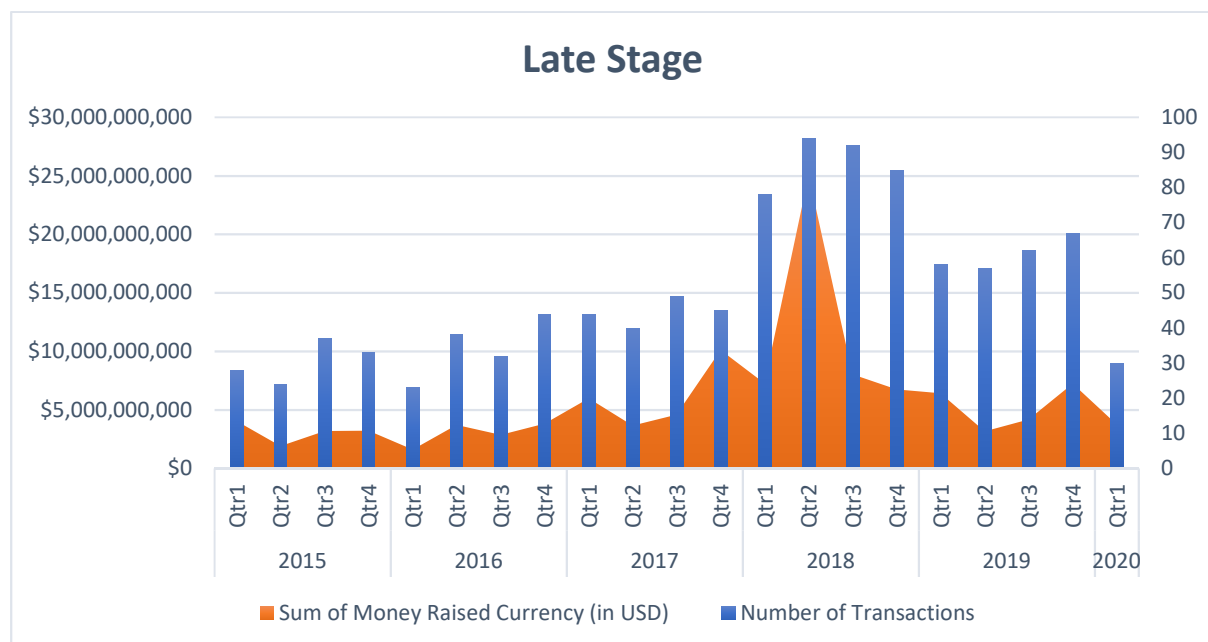
⁵ “Glossary of Funding Types”, Crunchbase, April 3, 2020, <https://support.crunchbase.com/hc/en-us/articles/115010458467-Glossary-of-Funding-Types>

Early Stage Venture	168	30.23%	\$3,712,384,957	-54.60%
Late Stage Venture	40	5.26%	\$3,649,034,367	-1.59%
Qtr3	276	8.24%	\$11,767,256,644	50.14%
Seed	51	-34.62%	\$143,068,141	218.34%
Early Stage Venture	176	21.38%	\$7,027,266,421	42.67%
Late Stage Venture	49	53.13%	\$4,596,922,082	60.32%
Qtr4	397	70.39%	\$18,585,270,109	190.64%
Seed	90	69.81%	\$406,132,764	411.66%
Early Stage Venture	262	92.65%	\$8,053,241,243	221.89%
Late Stage Venture	45	2.27%	\$10,125,896,102	165.53%
2018	3034	154.53%	\$83,663,861,916	74.07%
Qtr1	539	98.89%	\$15,620,388,103	52.00%
Seed	110	74.60%	\$255,042,806	266.83%
Early Stage Venture	351	114.02%	\$8,096,785,390	91.26%
Late Stage Venture	78	77.27%	\$7,268,559,907	21.67%
Qtr2	841	239.11%	\$32,200,299,200	333.16%
Seed	286	615.00%	\$285,436,252	294.37%
Early Stage Venture	461	174.40%	\$6,866,295,177	84.96%
Late Stage Venture	94	135.00%	\$25,048,567,771	586.44%
Qtr3	973	252.54%	\$22,349,964,781	89.93%
Seed	412	707.84%	\$1,145,661,240	700.78%
Early Stage Venture	469	166.48%	\$13,171,403,764	87.43%
Late Stage Venture	92	87.76%	\$8,032,899,777	74.75%
Qtr4	681	71.54%	\$13,493,209,832	-27.40%
Seed	268	197.78%	\$548,967,181	35.17%
Early Stage Venture	328	25.19%	\$6,188,491,212	-23.16%
Late Stage Venture	85	88.89%	\$6,755,751,439	-33.28%
2019	2215	-26.99%	\$45,171,011,298	-46.01%
Qtr1	596	10.58%	\$12,798,913,826	-18.06%
Seed	226	105.45%	\$383,948,117	50.54%
Early Stage Venture	312	-11.11%	\$6,001,429,324	-25.88%
Late Stage Venture	58	-25.64%	\$6,413,536,385	-11.76%
Qtr2	638	-24.14%	\$9,044,625,128	-71.91%
Seed	248	-13.29%	\$354,248,769	24.11%
Early Stage Venture	333	-27.77%	\$5,523,489,192	-19.56%
Late Stage Venture	57	-39.36%	\$3,166,887,167	-87.36%
Qtr3	619	-36.38%	\$9,458,381,477	-57.68%
Seed	242	-41.26%	\$385,387,146	-66.36%
Early Stage Venture	315	-32.84%	\$4,897,520,846	-62.82%
Late Stage Venture	62	-32.61%	\$4,175,473,485	-48.02%
Qtr4	362	-46.84%	\$13,869,090,867	2.79%
Seed	71	-73.51%	\$125,067,518	-77.22%
Early Stage Venture	224	-31.71%	\$6,503,830,482	5.10%
Late Stage Venture	67	-21.18%	\$7,240,192,867	7.17%
2020	142	-93.59%	\$5,129,576,312	-88.64%
Qtr1	142	-76.17%	\$5,129,576,312	-59.92%
Seed	18	-92.04%	\$52,298,483	-86.38%
Early Stage Venture	94	-69.87%	\$1,345,535,850	-77.58%
Late Stage Venture	30	-48.28%	\$3,731,741,979	-41.81%
Total	8597		\$245,693,144,663	

We can see from Figure 1, that the largest late-stage VC deals have been heavily impacted by the crisis. These late stage deals often involve considerable prior due diligence and may be slightly more resilient to temporary shocks than earlier stage deals. While these

type of deals had been steadily increasing throughout the period 2015-2019, between the final quarter of 2019 and the first quarter of 2020 these deals fell dramatically. As shown in Table 1, investment levels shrunk by 42% between the first quarter of 2019 and the first quarter of 2020. Plus, deal flow almost decreased in half (48%) in the final quarter of 2019 compared to quarter 1 in 2020, with the deal flow and overall value returning to levels last seen in the first quarter of 2015.

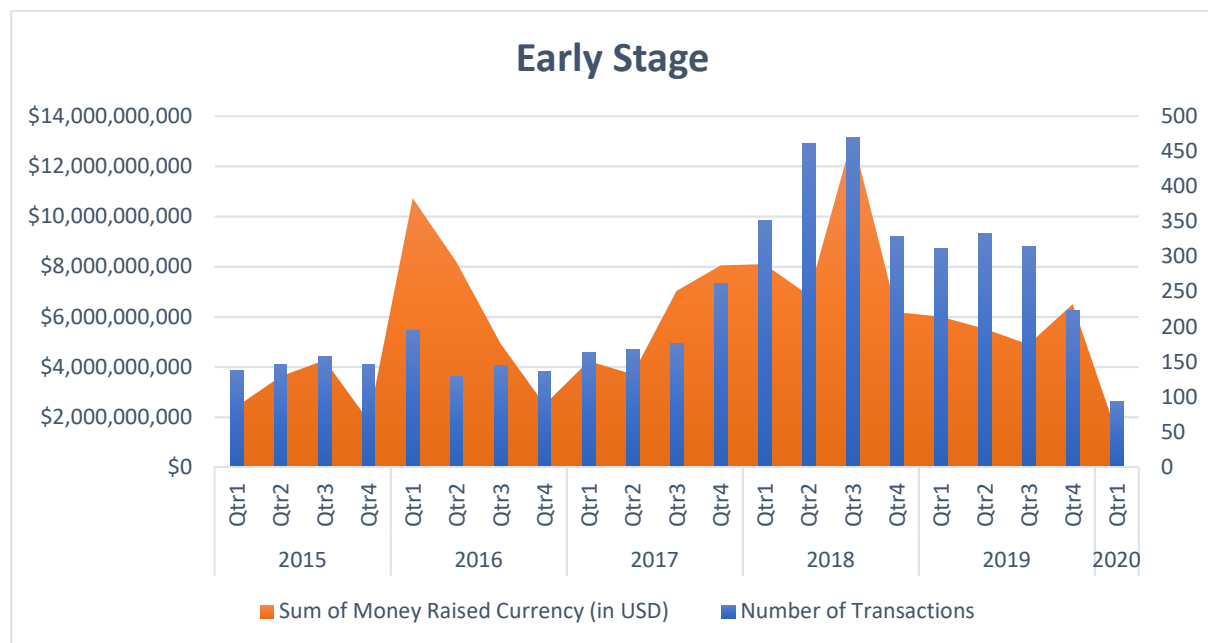
Figure 1: Late Stage Equity Deals in China, Quarter 1 2015- Quarter 1 2020



Turning our attention to early stage deals, we can see a similar pattern emerging as with the above later stage deals (see Figure 2 below). These early stage deals had increased markedly over the last five years, albeit in a rather lumpy fashion, peaking in the third quarter of 2018 (see Table 1). The deal flow of these investments remained quite steady during 2019 until the final quarter when it dropped markedly. Strikingly, between the final quarter of 2019 and the first quarter of 2020, the deal flow fell by two-thirds from 224 to less than 100 deals. As shown in Table 1, investment levels shrunk by 77% between the first

quarter of 2019 and the first quarter of 2020. This was also matched by a major reduction in the value of these deals, with investors potentially reducing their level of investments or re-writing the agreed terms between VCs and entrepreneurs. Indeed, there appears some tentative evidence that VCs are using the Covid-19 crisis to undertake this type of opportunistic behaviour⁶.

Figure 2: Early Stage Equity Deals in China, Quarter 1 2015- Quarter 1 2020

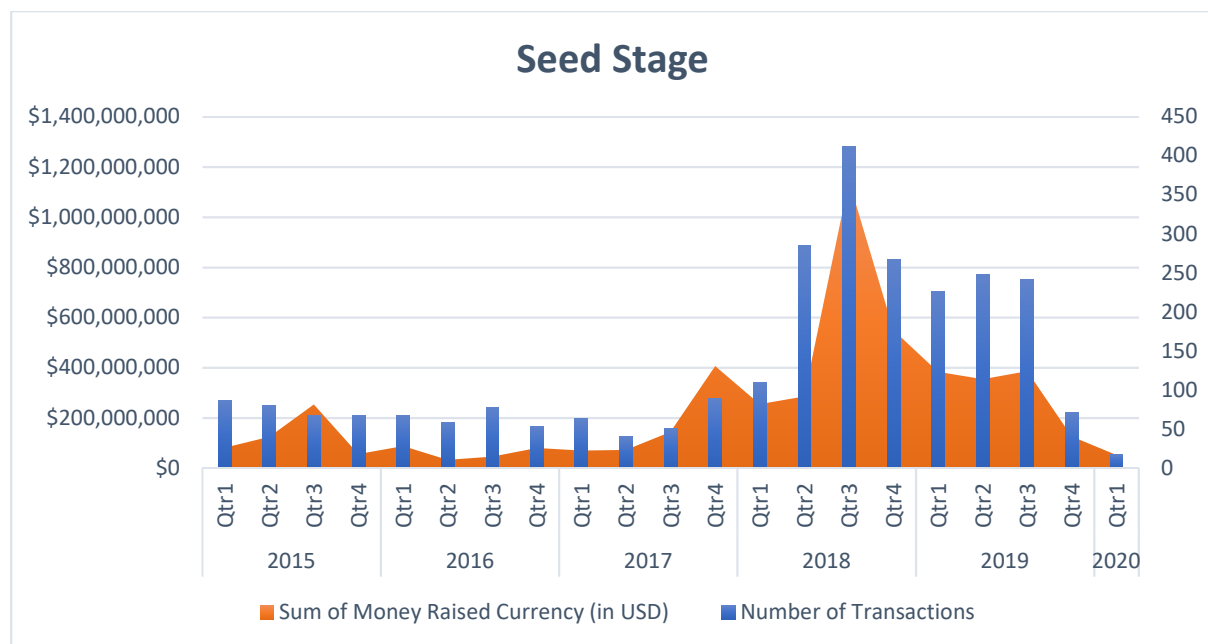


In contrast to the larger deals outlined in Figures 1 and 2, the growth of seed stage investments in China over the last five years has been less spectacular (see Figure 3 below). Innovative start-ups typically receive this form of finance to help them grow. These transactions grew dramatically during 2018 when they almost quadrupled (from just over a 100 to over 400 deals) between the first quarter of 2018 and the third quarter of the same year. Between quarters 1 and 4 of 2019, deal flow fell by two-thirds from 226 to 71. This declining trend became further magnified between the final quarter of 2019 and the first

⁶ “Coronavirus will show VCs’ true colours”, Sifted, April 3 2020, <https://sifted.eu/articles/vc-coronavirus-bad-behaviour/>

quarter of 2020 at the height of the crisis. Indeed, seed stage deals almost disappeared during the first quarter of 2020 to less than 20 deals in total, representing an 86% year on year reduction, suggesting start-ups could be starved of finance during the crisis.

Figure 3: Seed Stage Equity Deals in China, Quarter 1 2015- Quarter 1 2020



Given seed stage finance is mainly allocated to the most nascent and informationally opaque types of start-ups/SMEs we would probably have expected to see these types of transactions to be those most heavily impacted by the crisis. Anecdotal evidence suggests that many VCs simply stopped bringing these types of deals to their investment committees in China⁷. Given some of these deals may necessitate close relational interaction between the investors and the entrepreneurs, anxiety about contracting the virus may explain the dramatic decrease in this category of investment deal during the crisis period. Future work

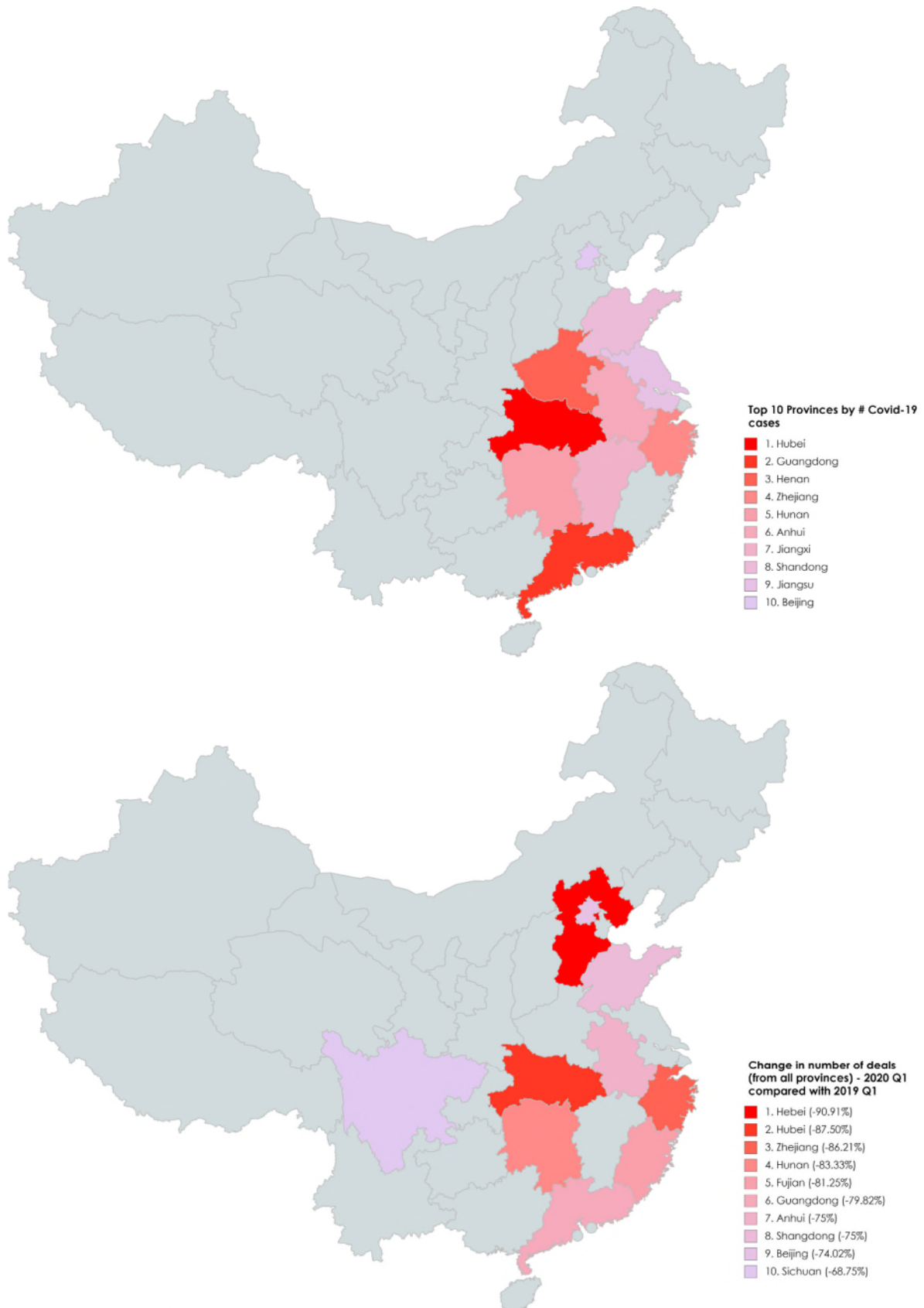
⁷ “China’s start-ups struggle as coronavirus fear hits funding”, Financial Times, April 3, 2020 <https://www.ft.com/content/85b95870-591c-11ea-a528-dd0f971febbc>

is needed to examine whether this is a short-term impact or a more enduring feature of the risk capital market in China.

Finally, we were also able to examine the spatial impact of the crisis by examining the geographical areas most acutely impacted. Traditionally, entrepreneurial finance is heavily dominated by a few key urban agglomerations in China, especially Beijing, Shanghai and Shenzhen (Pan and Yang, 2019). However, in recent years our data reveals that other Chinese provinces have been able to attract these forms of finance.

The data in Figure 4 shows that the province suffering the starkest decrease was the Hebei province, demonstrating that the crisis negatively impacted investment levels across the whole of the country and not just the areas most associated with the outbreak of the virus. However, Figure 4 also clearly shows that several of the provinces the virus most adversely affected also suffered the heaviest decreases of entrepreneurial finance (i.e. Hubei, Zhejiang and Hunan). The spatial data also shows that the funding stage most deeply affected in these areas was the seed funding round, which reduced by over 90% in many of the top ten provinces for entrepreneurial finance transactions such as Hebei and Beijing (see Table 2).

Figure 4: Top 10 Chinese Provinces by number of Covid-19 cases (April 3, 2020) and Provinces with highest drops in number of investments received (between 2019 Q1 and 2020 Q1)



Data source: China National Health Commission, April 3, 2020 and Crunchbase, April 1, 2020

Table 2: Number of funding transactions in the first quarter of 2020 compared with 2019

Province/Funding Stage	2019 Q1 transactions	2020 Q1 transactions	% Difference
Anhui	8	2	-75.00%
Seed	4	-	-100.00%
Early Stage Venture	2	1	-50.00%
Late Stage Venture	1	1	0.00%
Venture - Series Unknown	1	-	-100.00%
Beijing	204	53	-74.02%
Seed	73	5	-93.15%
Early Stage Venture	99	33	-66.67%
Late Stage Venture	20	9	-55.00%
Venture - Series Unknown	12	6	-50.00%
Fujian	16	3	-81.25%
Seed	11	1	-90.91%
Early Stage Venture	4	2	-50.00%
Late Stage Venture	1	-	-100.00%
Guangdong	109	22	-79.82%
Seed	40	5	-87.50%
Early Stage Venture	57	12	-78.95%
Late Stage Venture	9	4	-55.56%
Venture - Series Unknown	3	1	-66.67%
Hebei	11	1	-90.91%
Seed	7	-	-100.00%
Early Stage Venture	3	-	-100.00%
Late Stage Venture	1	-	-100.00%
Venture - Series Unknown	-	1	-
Hubei	8	1	-87.50%
Early Stage Venture	8	-	-100.00%
Venture - Series Unknown	-	1	-
Hunan	6	1	-83.33%
Seed	2	-	-100.00%
Early Stage Venture	3	1	-66.67%
Late Stage Venture	1	-	-100.00%
Shandong	8	2	-75.00%
Seed	5	-	-100.00%
Early Stage Venture	3	1	-66.67%
Venture - Series Unknown	-	1	-
Sichuan	16	5	-68.75%
Seed	6	-	-100.00%
Early Stage Venture	8	3	-62.50%
Venture - Series Unknown	2	2	0.00%
Zhejiang	58	8	-86.21%
Seed	18	-	-100.00%
Early Stage Venture	35	5	-85.71%
Late Stage Venture	4	3	-25.00%
Venture - Series Unknown	1	-	-100.00%

4. Conclusion

The primary aim of this paper is to demonstrate the valuable insights to be gained from utilising RTD sources to illustrate how uncertainty has impacted entrepreneurial activity during a crisis. Since the outbreak of the Covid-19 virus in China there has been a stark and dramatic decrease in aggregate levels of equity investments (i.e. a 60% year on year decrease between quarter 1 in 2019 and quarter 1 in 2020) in China across all stages of the investment process. This is three times the size of decrease in detected in the US by scholars following the financial crisis (Block and Sandner, 2009), suggesting that the uncertainty cause by the Covid-19 crisis is likely to surpass the GFC. Indeed, some estimate that if a drop like that happens globally, even for just two months, approximately \$28 billion in start-up investment could go awry⁸. This impact has been most pronounced for the most nascent entrepreneurial firms (i.e. the most opaque and most in need of close investor-entrepreneur interaction). These findings corroborate a large body of literature inferring that uncertainty has deeply damaging consequences for the most innovative and informationally opaque start-ups and SMEs.

Turning to the wider theoretical implications of the study, these data sources also offer scholars opportunities to inform their longer-term research and theoretical development. If entrepreneurs and investors cannot physically meet, interact and converse these deeply network-based, relational and spatially mediated investment processes underpinning entrepreneurial sources of finance may cease to function adequately during a crisis such as a pandemic? It also begs key questions concerning the types of

⁸ https://venturebeat.com/2020/04/01/startup-genome-the-coronavirus-is-hurting-global-startup-investments/?mc_cid=91ef797a9c&mc_eid=ea0e001cad

entrepreneurial behaviour deployed by start-ups during a crisis. Entrepreneurial behavioural theories such as bricolage seem obvious candidates to explore entrepreneurial responses to resource parsimony induced by crisis situations (Baker and Nelson, 2005).

We urge scholars to explore other sources of RTD to help provide policy makers with insights into the impact uncertainty can have during unforeseen shocks. While this study used entrepreneurial finance as an indicator to measure the impact of uncertainty, other proxies could be used by scholars to examine this construct using RTD. This can potentially yield invaluable insights to aid rapid policy responses to tackle these types of quickly unfolding crisis periods with strategically targeted policy interventions. While central banks have eagerly embraced these types of novel data sources to help inform their decision making, this empirical evidence suggests they also offer strong resonance for enterprise policy makers⁹. Added to this, these types of live data sources can enable policy makers to track how entrepreneurial phenomenon (such as entrepreneurial finance) responds during recovery periods following shock events. Therefore, it can enable *real-time policy evaluation* to ascertain how effectively entrepreneurial actors respond to policy measures implemented to address crisis situations.

Given the magnitude of the uncertainty sweeping the global economy, further scholarly work is urgently needed to examine how entrepreneurship is being impacted by the Covid-19 pandemic in other spatial contexts. We hope this paper stimulates others to seek out the growing array of RTD sources to help illuminate key public policy issues in times of crisis.

⁹ For example, Chinese policy makers could perhaps offer time-bound investment incentives to help address the huge decreases in entrepreneurial finance detected, especially for the seed stage investments in the provinces most acutely impacted.

References

- Aastveit, K. A., Ravazzolo, F., & Van Dijk, H. K. (2018). Combined density nowcasting in an uncertain economic environment. *Journal of Business & Economic Statistics*, *36*(1), 131-145.
- Baker, T., & Nelson, R. E. (2005). Creating something from nothing: Resource construction through entrepreneurial bricolage. *Administrative science quarterly*, *50*(3), 329-366.
- Bell, V. Wah Co L, Stone S, et al. (2014) Nowcasting UK GDP growth. Bank of England Quarterly Bulletin 54(1): 58–68.
- Bholat, D. (2015). Big data and central banks. *Big Data & Society*, *2* (1), 1-6.
- Block, J., & Sandner, P. (2009). What is the effect of the financial crisis on venture capital financing? Empirical evidence from US Internet start-ups. *Venture Capital*, *11*(4), 295-309.
- Bloom, N. (2014). Fluctuations in uncertainty. *Journal of Economic Perspectives*, *28*(2), 153-76.
- Brown, R., & Lee, N. (2019). Strapped for cash? Funding for UK high growth SMEs since the global financial crisis. *Journal of Business Research*, *99*, 37-45.
- Brown, R., Liñares-Zegarra, J., & Wilson, J. O. (2019). The (potential) impact of Brexit on UK SMEs: regional evidence and public policy implications. *Regional Studies*, *53*(5), 761-770.
- Bylund, P. L., & McCaffrey, M. (2017). A theory of entrepreneurship and institutional uncertainty. *Journal of Business Venturing*, *32*(5), 461-475.
- Buchanan, D. A., & Denyer, D. (2013). Researching tomorrow's crisis: methodological innovations and wider implications. *International Journal of Management Reviews*, *15*(2), 205-224.

- Cassar, G. (2004). The financing of business start-ups. *Journal of Business Venturing*, 19(2), 261-283.
- Cimadomo, J. (2016). Real-time data and fiscal policy analysis: A survey of the literature. *Journal of Economic Surveys*, 30(2), 302-326.
- Clarke, J. E., & Liesch, P. W. (2017). Wait-and-see strategy: Risk management in the internationalization process model. *Journal of International Business Studies*, 48(8), 923-940.
- Cole, R. A., & Sokolyk, T. (2018). Debt financing, survival, and growth of start-up firms. *Journal of Corporate Finance*, 50, 609-625.
- Colombo, M. G., D'Adda, D., & Quas, A. (2019). The geography of venture capital and entrepreneurial ventures' demand for external equity. *Research Policy*, 48(5), 1150-1170.
- Cowling, M., Liu, W., & Zhang, N. (2018). Did firm age, experience, and access to finance count? SME performance after the global financial crisis. *Journal of Evolutionary Economics*, 28(1), 77-100.
- Cumming, D., & Dai, N. (2010). Local bias in venture capital investments. *Journal of Empirical Finance*, 17(3), 362-380.
- Cumming, D. J., & Zahra, S. A. (2016). International business and entrepreneurship implications of Brexit. *British Journal of Management*, 27(4), 687-692.
- Cumming, D., Werth, J. C., & Zhang, Y. (2019). Governance in entrepreneurial ecosystems: venture capitalists vs. technology parks. *Small Business Economics*, 52(2), 455-484.

De Clercq, D., & Sapienza, H. J. (2006). Effects of relational capital and commitment on venture capitalists' perception of portfolio company performance. *Journal of Business Venturing*, 21(3), 326-347.

Demirgüç-Kunt, A., Peria, M. S. M., & Tressel, T. (2020). The global financial crisis and the capital structure of firms: Was the impact more severe among SMEs and non-listed firms?. *Journal of Corporate Finance*, 60, 101514.

Doern, R. (2016). Entrepreneurship and Crisis Management: The Experiences of Small Businesses during the London 2011 Riots. *International Small Business Journal* 34 (3): 276–302.

Doern, R., Williams, N., & Vorley, T. (2019). Special issue on entrepreneurship and crises: business as usual? An introduction and review of the literature. *Entrepreneurship & Regional Development*, 31(5-6), 400-412.

Doshi, H., Kumar, P., & Yerramilli, V. (2018). Uncertainty, capital investment, and risk management. *Management Science*, 64(12), 5769-5786.

Erevelles, S., Fukawa, N., & Swayne, L. (2016). Big Data consumer analytics and the transformation of marketing. *Journal of Business Research*, 69(2), 897-904.

Financial Times (2020a) Chinese economy suffers record blow from coronavirus, 16/3/20.

Financial Times (2020b) Coronavirus: China's risky plan to revive the economy, 10/3/20.

Freear, J., Sohl, J. E., & Wetzel Jr, W. E. (1995). Angels: personal investors in the venture capital market. *Entrepreneurship & Regional Development*, 7(1), 85-94.

- Freel, M. S. (2005). Perceived environmental uncertainty and innovation in small firms. *Small Business Economics*, 25(1), 49-64.
- Ghosal, V., & Ye, Y. (2015). Uncertainty and the employment dynamics of small and large businesses. *Small Business Economics*, 44(3), 529-558.
- Goldin, I., & Mariathan, M. (2015). *The butterfly defect: How globalization creates systemic risks, and what to do about it*. Princeton University Press.
- Gaur, A. S., Mukherjee, D., Gaur, S. S., & Schmid, F. (2011). Environmental and firm level influences on inter-organizational trust and SME performance. *Journal of Management Studies*, 48(8), 1752-1781.
- Hall, B. H., & Lerner, J. (2010). The financing of R&D and innovation. In *Handbook of the Economics of Innovation* (Vol. 1, pp. 609-639). North-Holland.
- Kitchin, R. (2014). Big Data, new epistemologies and paradigm shifts. *Big data & society*, 1(1), 1-12.
- Korber, S., & McNaughton, R. B. (2018). Resilience and entrepreneurship: a systematic literature review. *International Journal of Entrepreneurial Behavior & Research*.
- Lee, N., Sameen, H., & Cowling, M. (2015). Access to finance for innovative SMEs since the financial crisis. *Research Policy*, 44(2), 370-380.
- Mason, C. M., & Harrison, R. T. (2015). Business angel investment activity in the financial crisis: UK evidence and policy implications. *Environment and Planning C: Government and Policy*, 33(1), 43-60.

McMullen, J. S., & Shepherd, D. A. (2006). Entrepreneurial action and the role of uncertainty in the theory of the entrepreneur. *Academy of Management Review*, 31(1), 132-152.

McMullen, J. S., & Dimov, D. (2013). Time and the entrepreneurial journey: The problems and promise of studying entrepreneurship as a process. *Journal of Management Studies*, 50(8), 1481-1512.

Milliken, F. J. (1987). Three types of perceived uncertainty about the environment: State, effect, and response uncertainty. *Academy of Management Review*, 12(1), 133-143.

Morikawa, M. (2016). Business uncertainty and investment: Evidence from Japanese companies. *Journal of Macroeconomics*, 49, 224-236.

Muñoz, P., Kimmitt, J., Kibler, E., & Farny, S. (2019). Living on the slopes: entrepreneurial preparedness in a context under continuous threat. *Entrepreneurship & Regional Development*, 31(5-6), 413-434.

Obschonka, M., & Audretsch, D. B. (2019). Artificial intelligence and big data in entrepreneurship: a new era has begun. *Small Business Economics*, 1-11.

Pan, F., & Yang, B. (2019). Financial development and the geographies of startup cities: evidence from China. *Small Business Economics*, 52(3), 743-758.

Schwab, A., & Zhang, Z. (2019). A new methodological frontier in entrepreneurship research: Big data studies, *Entrepreneurship, Theory and Practice*, 43(5), 843-854.

Shane, S., & Cable, D. (2002). Network ties, reputation, and the financing of new ventures. *Management Science*, 48(3), 364-381.

Shepherd, D. A., Williams, T. A., & Patzelt, H. (2015). Thinking about entrepreneurial decision making: Review and research agenda. *Journal of Management*, 41(1), 11-46.

Varian, H. R. (2014). Big data: New tricks for econometrics. *Journal of Economic Perspectives*, 28(2), 3-28.

Wenzel, M., Stanske, S., and Lieberman, M. (2020). Strategic Responses to Crisis, *Strategic Management Journal*, doi/epdf/10.1002/smj.3161.



**The Centre for Responsible Banking & Finance
CRBF Working Paper Series**

School of Management, University of St Andrews
The Gateway, North Haugh,
St Andrews, Fife,
KY16 9RJ.

Scotland, United Kingdom

<http://www.st-andrews.ac.uk/business/rbf/>



Recent CRBF Working papers published in this Series

Second Quarter | 2020

20-007 **Foly Ananou, Amine Tarazi, John O.S. Wilson:** Liquidity Regulation and Bank Lending.

20-006 **Marc Cowling, Ross Brown, Neil Lee:** The Geography of Business Angel Investments in the UK: Does Local Bias (Still) Matter?

First Quarter | 2020

20-005 **Donal McKillop, Declan French, Barry Quinn, Anna L. Sobiech, John O.S. Wilson:** Cooperative Financial Institutions: A Review of the Literature.

20-004 **Dimitris K. Chronopoulos, Anna L. Sobiech, John O.S. Wilson:** Social Capital and the Business Models of Financial Cooperatives: Evidence from Japanese Shinkin Banks.

20-003 **Ross Brown, Augusto Rocha, Suzanne Mawson:** Capturing Conversations in Entrepreneurial Ecosystems.

20-002 **Georgios A. Panos and Tatja Karkkainen:** Financial Literacy and Attitudes to Cryptocurrencies.

20-001 **Mais Sha'ban, Claudia Girardone, Anna Sarkisyan:** Cross-Country Variation in Financial Inclusion: A Global Perspective.

Fourth Quarter | 2019

19-020 **Ross Brown:** Mission-Oriented or Mission Adrift? A Critique of Plans for a Mission-Oriented Scottish National Investment Bank.

19-019 **Dimitris K. Chronopoulos, George Dotsis, Nikolaos T. Milonas:** International Evidence on the Determinants of Banks' Home Sovereign Bond Holdings.



University of St Andrews
Scotland's first university

600 YEARS
1413 – 2013