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Entrepreneurship, Innovation and the Past Economic Crisis

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Abstract

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Keywords: creative destruction, economic crisis, entrepreneurship, innovation, recession

1. Introduction

The past financial crisis has severely impacted European economies. Besides the negative ramifications for financial markets, also other areas of the economy have been dragged into a race to the bottom. As a consequence, the GDP of all European economies plummeted (OECD, 2012a). Additionally, economic activities with a long run focus such as innovation and startup activities decreased sharply at the peak of the economic crisis in 2009 in most European economies (OECD 2012a, 2012b).

Notwithstanding the negative effects of the past crisis, an economic downturn changes the economic environment for innovation and entrepreneurship and can epitomize an opportunity for some actors in the economy and therewith a trigger for technological change (Schumpeter, 1942). In upswing and boom periods, innovation tends to be cumulative and is largely conducted by incumbent companies which innovate along established technology trajectories pre-empting market entry by challengers. An economic downturn can force inefficient industry incumbents to exit the market or to shrink their business, leading to a reallocation of resources thereby creating opportunities for newcomers (Hall, 1995; Caballero and Hammour, 1994, 1999; Gomes et al., 1997).¹ New ventures, which are eager to exploit emerging technological opportunities, can take their chance to challenge the status quo starting a process of “creative destruction” (Schumpeter, 1942). As advocated by Schumpeter (1942), creative destruction becomes noticeable when technological progress results from the competition among entrepreneurs and emerges as the dominant driver of economic growth (Aghion and Howitt, 1990). The process of creative destruction can yield an opportunity for innovation leading the economy to a new growth path (Foster, Haltiwanger and Krizan, 2001; Hall, 1991). Some of the most radically innovative and successful companies in their field

¹ There is weak empirical evidence supporting an increase in allocative efficiency during economic downturns (Bailey et al., 1992; Griliches and Regev, 1995)

such as Disney, Microsoft, Oracle, Cisco and Hewlett Packard have been founded during economic downturns (OECD, 2012a). According to Stangler (2009), the majority of Fortune 500 firms has been founded during recessions or bear markets.

A positive response in terms of startup activities and their innovation activities in recessions can however not be taken for granted (Shane, 2011). During periods of economic downturn, entrepreneurs face significant financial constraints, which can hinder the foundation of new companies as well as the new ventures' business activities and their innovation efforts in particular (Aghion et al., 2012, Himmelberg and Petersen, 1994). Ventures with higher financing requirements can be affected disproportionately strong during economic downturns so that an economic crisis rather than supporting hampers the process of creative destruction through exacerbated credit market imperfections (Barlevy, 2002, 2003). This is why recessions typically evoke a majority of so called necessity entrepreneurs that chose entrepreneurship as a reaction to layoffs and decreased labor market opportunities (Thompson, 2011; Blau, 1987; Evans and Leighton, 1990). Necessity entrepreneurs are less likely to have business ideas with significant growth prospects (Shane, 2009) and are less likely to start a business around a substantial innovation contributing to the process of technological change (Hessels, Van Gelderen and Thurik, 2008).

The arguments above render the impact of an economic crisis on entrepreneurship as a vehicle for innovation and technological change an empirical one. The impact of the business cycle on entrepreneurial efforts and in particular on innovation behavior of startups during economic downturns is a largely uncharted field of economic research (Koellinger and Thurik, 2012). This paper responds to this gap in the literature by exploring the innovativeness of startups founded during the last economic crisis. Focusing on a sample of startup companies in high tech sectors in Germany that have been founded before and during the most recent economic crisis, descriptive statistics show that crisis foundations are more

likely to be established in order to implement a specific business idea than pre-crisis foundations and that they are not more likely to be set up in response to missing job opportunities. This suggests that crisis foundations in Germany do not predominantly represent necessity entrepreneurship. Multivariate regression analysis further shows that crisis foundations in Germany are not more or less likely to introduce a new product or service into the market in their first years as compared to ventures founded before the crisis.

Digging deeper into the type of innovations that crisis foundations supply, we investigate whether their products and services are based on new in-house developed technologies or whether they rather represent combinations and applications of existing technologies. An interesting difference appears. Conditional on having introduced a new product or service, crisis foundations are more likely to launch products or services that are based on in-house developed technologies than ventures started before the past economic crisis, rather than introducing products that combine existing technologies or apply technologies developed by third parties. This suggests that there is a promising group of innovative ventures among the crisis foundations that is likely to contribute to technological change. These firm level findings for Germany are in line with the notion that an economic downturn creates opportunities for some entrepreneurs, which contribute to the process of creative destruction. The results are also in line with Koellinger's and Thurik's (2012) conclusion from a country and global level analysis that entrepreneurship can be seen as an early indicator of the recovery from economic recessions.

The remainder of this paper is structured as follows. First, the literature review will survey the most important contributions regarding innovation, entrepreneurship and the business cycle. Subsequently, the dataset, sample and descriptive statistics are presented followed by an outline of the estimation strategy and empirical analysis. The final section discusses the underlying results and ends with some concluding remarks.

2. Literature Review and Hypotheses Development

2.1. Entrepreneurship and the business cycle

Despite the importance of entrepreneurship and innovation for the advancement of economies, there is little research on the influence of the business cycle on entrepreneurship and vice versa (Koellinger and Thurik, 2012).

The classical model of individual's decision to choose entrepreneurship over wage employment by Evans and Jovanovic (1989) helps to shed light on the effects of an economic downturn on entrepreneurial activity. In their model, the individual's choice to become self-employed centers on the comparison of the expected earnings from self-employment versus expected earnings from salary work. The expected wage income is modeled as a function of the individual's wage and the interest gains from the assets that she owns. The expected income from self-employment is a function of the entrepreneurial ability and the interest gains from the individual's assets diminished by the capital needed to start a business. The individual chooses the option with the higher expected income.

This simple model helps illustrating the effects of recessions on the decision to become self-employed: In recessions, demand for products and services is low and the personal wealth of individuals is reduced. For instance, through declining home values the expected income from self-employment decreases as compared to boom periods. In addition, the acquisition of external finance for entrepreneurship is more difficult during recessions which reduces the personal wealth of the individual when she has to deduct the starting budget from her own assets. Accordingly, the expected income from self-employment is lower in recessions.

However, recessions also decrease the expected wage decreases and opportunity costs of capital rendering wage employment less attractive than in boom periods as well. Yet, at the same time the costs of production are also lower during an economic downturn (especially rent and labor) increasing the expected income from self-employment.

The mechanisms at work render the effect of the business cycle on the entrepreneurial decision ambiguous. With focus on the Great Recession, Fairlie (2013) investigates the relationship between the entrepreneurial decision and the business cycle empirically for the U.S. He finds that the labor market conditions – increased layoffs and fewer opportunities on the labor market – have been the main drivers of the decision to become self-employed.

Bernanke and Gertler (1989) and Carlstrom and Fuerst (1997) emphasize the financing of entrepreneurship over the business cycle. They model entrepreneurship and the business cycle using a costly-state-verification framework. In these models, investments are optimally financed by debt contracts because a debt contract minimizes the verification costs since it incurs only in case the entrepreneur defaults. Bernanke and Gertler (1989) analyze entrepreneurial financing over the business cycle from a principal (entrepreneur) – agent (lender) perspective. The entrepreneur can observe the returns to her venturing project without incurring costs, while the investor faces fixed costs when she wants to observe the entrepreneurial success. The model shows that entrepreneurial output is pro-cyclical due to fact that entrepreneurs will be more financially solvent during boom times resulting in lower agency cost. In contrast, during economic downturns entrepreneurs face tighter financial burdens, accordingly increasing countercyclical agency costs thus reinforce the business cycle. Build on Bernanke and Gertler (1989), Carlstrom and Fuerst (1997) predict that entrepreneurial solvency is countercyclical due to higher bankruptcy rates and risk premiums caused by higher capital cost and technology shocks during boom times. Both studies assume the rate of entrepreneurs in the business cycle as constant. Leaving the dynamically developing number of entrepreneurs influenced by the business cycle out of consideration, the focus of both models is not on entrepreneurship itself but on agency costs' influence on business cycle dynamics.

Relaxing the assumption of a constant rate of entrepreneurship, Rampini (2004) furthers the result of Bernanke and Gertler (1989). He builds on the result by Kihlstrom and Laffont (1979) that the entrepreneurial decision is determined by the individual's risk attitude with the less risk-averse individuals choosing self-employment over wage employment. Rampini's model allows wealth and risk aversion to vary with the business cycle making entrepreneurial activities dependent upon it. The model shows a pro-cyclical pattern of entrepreneurship, which is explained by the risk associated with self-employment rather than by the constraints to external funding as in Bernanke and Gertler (1989).

In a recent empirical paper, Koellinger and Thurik (2012) test whether entrepreneurship is pro-cyclical or countercyclical for a panel of 22 OECD countries from 1972-2007. Their analysis focuses on the national as well as on the aggregate level. Employing fixed-effect (country data) as well as autoregressive models (aggregate data), the authors find for the global business cycle that the entrepreneurship cycle granger-causes the business cycle in terms of GDP development. Koellinger and Thurik (2012) conclude that this finding suggests entrepreneurial activities as an early indicator of the economy's recovery from a recession. In contrast, GDP as well as the unemployment cycle do not predict the entrepreneurship cycle. On the national level, the ascendancy of the entrepreneurship cycle on the GDP is weaker than on the aggregate level.²

Regarding the past economic crisis, a short decline of startup activities was observed at the peak of the economic crisis in most OECD countries followed by an upswing in the subsequent quarters towards the pre-crisis level (OECD, 2012b). For Germany, OECD data show a spike in entrepreneurial activity in the year 2009 (OECD, 2012b). While the implications of the crisis for entrepreneurship in Germany and other European countries are

² Germany has been excluded from the analysis since the unification effects could not be corrected for regarding the time series nature of the data.

not (yet) extensively discussed in the literature there is a fierce debate ongoing in the U.S. Some scholars argue that the year 2009 shows the highest entry into entrepreneurial activity in the U.S. for one and a half decade (Fairlie, 2010). Others take a more nuanced stance. Shane (2011) argues that the economically more substantial firm foundations such as employer firm foundations and foundations of incorporated firms decreased during the past recession. For instance, he reports a decrease of employer firm foundations by 17.3% in 2009 as compared to 2007 (Shane, 2011). OECD data (2012b) seem to confirm the skeptics reporting no increase in entrepreneurial activity in terms of business foundation with at least one employee during 2009.

2.2. Innovation and the business cycle

The relationship between innovation activities and the business cycle is not unambiguous either. Advocates of a pro-cyclical pattern argue that innovation strongly depends on demand so that incentives to innovate are lacking during a recession (Schmookler, 1966; Shleifer, 1986). Moreover, it is easier to finance innovation via internal and external funds during boom periods when financial constraints are lowest (Aghion et al., 2012; Hall, 1992; Himmelberg and Petersen, 1994).

Proponents of a countercyclical innovation behavior argue that the opportunity costs of allocating productive assets from manufacturing to innovation are lower in recessions than in boom periods (Aghion and Saint-Paul, 1998; Stieglitz, 1993). Furthermore, profitability declines during recessions encourage companies to seek for measures to improve productivity, creating room for innovation (Aghion and Saint-Paul, 1998). Financial constraints play a crucial role here as well. Recent evidence shows that only financially constrained companies behave pro-cyclical while unconstrained companies show a counter-cyclical innovation behavior (Aghion et al., 2010; Aghion et al., 2012).

With regards to the past economic crisis, innovation expenses decreased in most European countries (OECD, 2012). In Germany, private sector R&D expenses decreased by 2.9%, while this effect was even stronger in other European countries such as the UK and Italy (OECD, 2012a). At the firm level, prior studies show mixed results. While the majority of companies decreased their innovation expenses during the past crisis in Germany (Kulicke et al., 2010), Europe (Archibugi, Filippetti and Frenz, 2013) and Latin America (Paunov, 2012), a few small companies and new entrants bucked the trend and expended their innovation expenses (Antonioli et al., 2011, for Italy; Archibugi, Filippetti and Frenz, 2013, for Europe). In contrast, Kanerva and Hollanders (2009) find no association between firm size and innovation declines during the past crisis for European companies using the Innobarometer 2009. However, highly innovative firms and companies in innovation leader countries such as Germany are found to be least likely to have decreased innovation investment during the past crisis (Kanerva and Hollanders, 2009).

With regards to Germany, companies in manufacturing reduced their innovation expenditure by 9.5%-16.7%, whereby especially small and medium-sized companies were affected (Rammer, 2011). Service companies were less affected (Rammer, 2011). A counter-cyclical innovation policy in Germany helped R&D expenses to increase again shortly after the crisis peaked (Hud and Hussinger, 2015).

2.3. Entrepreneurship, innovation and the business cycle

While the overall effect of the crisis on innovation is negative, some entrepreneurs seem to be able to seize emerging opportunities (Antonioli et al., 2011, Archibugi, Filippetti and Frenz, 2013). The central role of entrepreneurship for innovation and technological change has long been acknowledged (Drucker, 2014; Kortum and Lerner, 2000; Schumpeter, 1942; Shane and Venkataraman, 2000). The entrepreneur is often regarded as an “agent of progress” who founds new entities and introduces new technologies, products and services

and thus leads the economy to a new growth path (Audretsch, 2007; Schumpeter, 1934; Wennekers and Thurik, 1999).³ An economic downturn can foster this process of creative destruction by facilitating the reallocation of assets from unproductive industry incumbents that exit the market or shrink their business to new ventures (Caballero and Hammour, 1994 and 1999; Gomes et al., 1997; Hall, 1995). Some entrepreneurs are able to exploit the emerging opportunities and benefit from easier access to assets that are reallocated.

The question is to which extent new ventures established during recessions are willing and able to introduce new products and services to the market. Crisis foundations resemble at least partly necessity entrepreneurship⁴ in response to an increased number of layoffs.

Necessity entrepreneurs are those that start new ventures due to a lack of job market opportunities (Blau, 1987; Block and Koellinger, 2009; Evans and Leighton, 1990). They typically have less human capital and financial resources than opportunity entrepreneurs that start a business in response to an upcoming opportunity (Block et al., 2015; Caliendo and Kritikos, 2009). As compared to opportunity entrepreneurs, necessity entrepreneurs are less likely to have business ideas with significant growth prospects (Shane, 2009). In response, they invest less in their business (Evans and Jovanovic, 1989, Santarelli and Vivarelli, 2007), are less likely to incorporate (Bruhn, 2008), show lower survival rates (Block and Wagner, 2010), lower earnings and growth rates (Bates, 1990; Preisendörfer and Voss, 1990).

Analyzing the composition of entrepreneurs over the business cycle in a theoretical model, Thompson (2011) shows that during recessions the share of necessity entrepreneurs increases while the share of opportunity entrepreneurs decreases. High ability entrepreneurs chose self-

³ Entrepreneurship thereby is not limited to the foundation of new firms but can also comprise entrepreneurial activity in or by existing firms (Wennekers and Thurik, 1999; Czarnitzki, Dick and Hussinger, 2010).

⁴ The terms necessity and opportunity entrepreneur have been introduced along with the Global Entrepreneurship Monitor (GEM) (cf. Bosma and Harding, 2006; Reynolds et al., 2005).

employment independent of their occupational situation while low ability entrepreneurs are more inclined to starting a business when job markets are weak in recessions.

The arguments above render the question to whether the entrepreneurial activities observed in recessions is more likely to lead to innovation (in case the recession ventures grasp new opportunities) or less (in case most of the new ventures reflect necessity entrepreneurship) an empirical one. Accordingly, we formulate a null hypothesis and alternative hypothesis.

H_{1a}: Startups are more likely to market an innovative product or service when founded during the crises compared to non-crises foundations.

H_{1b}: Startups are less likely to market an innovative product or service when founded during the crises compared to non-crises foundations.

The Schumpeterian notion that entrepreneurs are “agents of progress” is not satisfied with the introduction of new products and services by founders. It requires that these innovations are substantial so that they have the power to contribute to or start a process of creative destruction. Such innovative projects are often ambitious and expensive. During recessions, startup companies, however, face significant financial constraints, which can hinder the business activities of founders and their innovation activities in particular (Aghion et al., 2012; Himmelberg and Petersen, 1994). Ventures with high financing needs can be affected disproportionately strong during economic downturns so that especially founders with an ambitious business idea can be struggling (Barlevy 2002; 2003). Complex innovation projects that are planned to be realized by the startup itself definitely belong to the type of activities that should be most seriously affected by financial constraints. Czarnitzki and Hottenrott (2011) show that firms focused on launching product novelties are disproportionally more affected by financial constraints than firms aiming at product improvements or the adaption of already existing technologies. In a recent paper, Giebel and Kraft (2015) find that financial

constraints impact innovative firms stronger than non-innovative firms in terms of diminished investment growth, as a direct result of the crisis. Against this evidence, it is likely that the innovative products and services taken out by ventures established during the crisis are less complex and demand less research and development than the products or services taken out by ventures established in non-crisis years due to financial constraints.

Taking a behavioral perspective, one could, however, argue that especially the crisis foundations develop more challenging innovations. Prospect theory suggests that the risk attitude of individuals depends on their reference point, which is defined by the situation that an individual aspires (Kahneman and Tversky, 1979). A high level of risk aversion is typically observed among individuals that operate in a so-called gain position in which any change would most likely lead to a deterioration of the status quo. Individuals in gain frames, hence, strive for sustaining the status quo and avoid risky actions. Individuals in loss frames, in contrast, have a lot to gain and little to lose so that they behave risk seeking in order to improve their status quo. A recession can cause an individual's income to fall below the reference point, e.g. in case of salary cuts or job loss, and, hence, triggers risk seeking behavior, putting her into a loss frame and increasing her risk tolerance. This is in line with Koellinger's (2008) finding that very innovative business ideas associated with high risk and uncertainty are likely to be pursued by individuals who have "nothing to lose". The lower opportunity costs during a crisis thereby plays a pivotal role since the propensity to engage in risk seeking behavior increases as other alternatives become increasingly unattractive (Venkataraman, 1997).

The arguments above do not provide a clear-cut answer to the question whether innovations taken out by businesses founded during a crisis should be expected to be more or less novel and technologically advanced. On the one hand, financial constraints can hamper ambitious innovation projects; on the other hand, the risk attitude of entrepreneurs can have changed so

that more risky and challenging innovative projects are pursued. Accordingly, we formulate a second null hypothesis and alternative hypothesis:

H_{2a}: Crises startup foundations are more successful launching products with new technologies developed in-house than with technologies based on third party innovations.

H_{2b}: Crises startup foundations are less successful launching products with new technologies developed in-house than with technologies based on third party innovations.

3. Data, Variables and Descriptive Statistics

3.1. Data

The empirical analysis is based on the KfW/ZEW Startup Panel (SuP), a large sample of startups located in Germany.⁵ Started in 2008, the SuP is a joint project of the Centre for European Economic Research (ZEW) in Mannheim, the “Kreditanstalt für Wiederaufbau“ (KfW) Bankengruppe, Germany’s largest state-owned promotional bank, and “Creditreform”, the largest credit rating agency in Germany. The SuP aims at providing a complete track record for entrepreneurial startups with respect to specific firm characteristics (e.g. sales, number of employees), strategic decisions (e.g. composition of the management team, product market entry strategy) and financial sources. The survey targets ventures that have been founded in the past three years. Firms drop out of the sample if they reach an age of eight years. The SuP is a stratified random sample covering most manufacturing and service industries with a focus on high tech manufacturing.⁶ For a more detailed description of the survey and its sample design we refer to Fryges, Gottschalk and Kohn (2009).

⁵ The SuP focuses on legally independent firms excluding de-mergers and subsidiaries.

⁶ The industry sectors agriculture, mining and quarrying, electricity, gas and water supply, health care, and the public sector are excluded from the sample.

For our analysis we use the sample years 2007 - 2009 which includes startups that have been founded in the period 2005 - 2009. We are restricted to these three waves because the previous survey questionnaires do not include the variable that we use as dependent variable in our regression models. In total, our sample comprises 7,291 venture year observations. Since most of our startup companies are only observed once, this figure corresponds to 4,175 ventures.

3.2. Variables

We use the information whether ventures have introduced a product or service into the market in the first years after their foundation as a first dependent variable in order to test whether crisis foundations are more likely to introduce innovations than non-crisis foundations. The second dependent variable captures the degree of novelty of the product or service that the new ventures provide. Ventures were asked to rank their new product or service with regards to the novelty of the underlying technologies.⁷ Rather than relying on the subjective judgment of the survey respondents about the degree of novelty of their product or service, respondents were given four specific options that relate to the origin of the technology on which the new product or service is based:

- Tested technologies and common combination of existing technologies
- New combinations of existing technologies
- New technologies developed by third parties
- New in-house developed technologies

The most challenging and ambitious type of innovation for the venture is the latter, which is based on in-house developed technologies. Ventures providing this type of innovation carry

⁷ In case the company had more than one new product the response refers to the new product or process that generates the highest returns.

the full technology risk in addition to the market risk. The least challenging and least risky type of innovation is the first that relies on tested and common combinations of existing technologies.

Table 1 shows the number of ventures in the different categories. In addition to the four categories that depict the degree of novelty of the introduced product or service, a fifth category is presented that captures the ventures that did not introduce any new products or processes. Table 1 shows that the distributions of new ventures founded before and during crisis across the different categories of product/service novelty are different from each other. Ventures founded during the crisis appear relatively more often in the most extreme categories. They are more likely to have not introduced a new product or service at all and they are also more likely to offer a product or service that is based on a technology developed in-house, the most innovative venture category. Crisis foundations are comparatively less often found in the category of ventures that launch products or services that are based on well tested and established technologies. A χ^2 -test rejects the null hypothesis that the differences are not statistically significant at the 1% level of statistical significance. The empirical section of this paper explores whether these descriptive pattern holds in a multivariate regression framework.

Table 1: Dependent variable

Innovativeness of new product or service	Founded before the crisis	Crisis-foundation	Total
No new products or services	3166 (50%)	593 (59%)	3759
Tested technologies and common combinations of existing technologies	1624 (26%)	181 (18%)	1805
New combinations of existing technologies	578 (9%)	76 (8%)	654
New technologies developed by third parties	423 (7%)	57 (6%)	480
New in-house developed technologies	497 (8%)	96 (10%)	593
Total	6288	1003	7291

We use a number of control variables. We control for firm size in terms of employment since firm size is likely to be correlated with the innovation capabilities of the venture. We use the logarithm of the number of employees in order to account for the skewness of the venture size distribution. Further variables that control for the innovation capacity are the share of R&D employees over total employment and a dummy variable that indicates whether the firm has applied for at least one patent since its foundation.⁸

We also control for the financial structure of the venture by including dummies that equal one if the firm is using internal and external funds. Internal sources of finance include the owner of the startup, family, friends, other supporters as well as mezzanine funding, which usually is a form of investment in between debt in equity in that it is senior to equity but junior to a bank loan (Sprink, 2003). External sources of finance include banks, the public funding institutions as well as overdrafts. Since not all firms answered the financing questions we also include a dummy for companies that did not answer both questions and set the dummies to

⁸ We use a dummy variable rather than a continuous variable because only 1.34% of the venture observations applied for patents.

zero. This is a common practice in order to not lose observations because of missing values for a control variable.

We further control for certain characteristics of the founder or the founding team. We use the number of founders as a measure for the size of the founder team. Larger founder teams are more likely to facilitate the progress and growth of the venture in the first years after firm foundation (Eisenhardt and Schoonhoven, 1990). Another control variable is employed to account for the experience of the founder(s). We include the industry experience of the founder, a dummy accounting for her leadership experience as well as a dummy that indicates whether the founder team includes re-starters. Re-starters can have advantages due to their past experience if they learned from their past endeavor(s).

The survey further allows us to control for the motivation of the founder to start the business.

Respondents were given six answers they could choose from:

- Desire to work independently
- Implementation of a specific business idea
- Lack of a suitable job
- Escaping unemployment
- Encouragement from the past employer
- Tax reasons

This information can provide some hints about the share of necessity entrepreneurs among the crisis foundations.

We also use information on the gender of the entrepreneur and on her nationality. We further utilize a set of industry dummies and dummies for the year of firm foundation. Finally, we include a dummy for the year of observation to control for possible differences in cyclical patterns. These variables are included in all regressions, but not reported.

3.3. Descriptive Statistics

Table 2 shows the descriptive statistics for our variables distinguishing between ventures founded during the crisis and before. The descriptive statistics show that ventures founded during the crisis are significantly smaller than earlier foundations hinting at larger financial constraints faced by crisis foundations. On the other hand, crisis foundations are slightly more likely to have a patent and access to internal and external funding hinting at a tough selection process for ventures started during the crisis. There are also more re-starters among the crisis-foundation and founders with less industry experience. Further, the number of founders of crisis foundations is significantly lower than the number of founders in the pre-crisis period.

Regarding the motive for starting a business Table 2 reveals that ventures founded during the crisis are more likely to start the business because they want to implement a specific business idea. Crisis foundations are not more likely to emerge because of a lack of employment opportunities or in order to escape unemployment. These findings do not suggest that necessity entrepreneurship was predominant during the past crisis in Germany.

Table 3 shows bivariate correlations.

Table 2: Descriptive statistics

	Founded before the crisis		Crisis foundation		mean difference	t- test
	mean	st.d ev.	mean	st.dev.		
Log(employment)	0.72	0.83	0.58	0.75	0.14	***
Share of R&D employees	0.06	0.17	0.06	0.17	0.00	
Patent dummy	0.01	0.09	0.02	0.14	-0.01	***
Internal finance dummy	0.43	0.50	0.67	0.47	-0.24	***
External finance dummy	0.22	0.42	0.38	0.49	-0.16	***
Years of industry experience	14.99	9.25	13.57	9.85	1.42	***
Restarter	0.27	0.45	0.31	0.46	-0.04	**
Leadership experience	0.57	0.49	0.60	0.49	-0.03	
Number of founders	1.04	0.39	1.00	0.00	0.04	***
Motive: desire to work independently	0.49	0.50	0.46	0.50	0.03	*
Motive: implementation of a specific business idea	0.27	0.45	0.36	0.48	-0.09	***
Motive: lack of suitable job	0.09	0.28	0.08	0.27	0.01	
Motive: escaping unemployment	0.11	0.31	0.09	0.29	0.02	
Motive: encouragement by past employer	0.03	0.16	0.00	0.00	0.03	***
Motive: tax reasons	0.01	0.12	0.00	0.00	0.01	***
Male founder	0.87	0.34	0.86	0.34	0.01	
Foreign founder	0.08	0.27	0.08	0.27	0.00	
Super high tech manufacturing	0.08	0.27	0.03	0.18	0.05	***
High tech manufacturing	0.04	0.20	0.02	0.14	0.02	***
Technology services	0.27	0.44	0.22	0.41	0.05	***
Software	0.10	0.29	0.06	0.24	0.04	***
Non tech manufacturing	0.16	0.37	0.11	0.31	0.05	***
Knowledge-intense services	0.09	0.28	0.05	0.22	0.04	***
Other services	0.07	0.25	0.06	0.23	0.01	
Consum-oriented services	0.18	0.38	0.12	0.33	0.06	***
Construction	0.01	0.11	0.13	0.34	-0.12	***
Commerce	0.01	0.08	0.20	0.40	-0.19	***

Table 3: Bivariate correlations

	No new products or services	Tested technologies and common combination of existing technologies	New combinations of existing technologies	New technologies developed by third parties	New in-house developed technologies	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1 Log(employment)	0.01	0.00	-0.01	-0.01	0.04																	
2 Share of R&D employees	0.19	-0.06	0.07	0.02	0.34	-0.01																
3 Patent dummy	0.06	-0.01	0.01	0.02	0.11	0.02	0.08															
4 Internal finance dummy	0.06	0.00	0.03	0.01	0.06	0.00	0.08	0.05														
5 External finance dummy	-0.03	-0.01	0.00	0.00	-0.03	0.14	-0.01	0.00	0.28													
6 Years of industry experience	-0.01	-0.01	-0.01	0.01	0.01	0.08	-0.01	0.00	-0.09	-0.04												
7 Restarter	0.07	-0.02	0.01	0.04	0.11	0.09	0.14	0.04	0.05	-0.05	0.09											
8 Leadership experience	0.07	-0.02	0.03	0.03	0.10	0.20	0.12	0.03	0.01	-0.01	0.22	0.53										
9 Number of founders	0.05	0.00	0.00	0.00	0.08	0.12	0.05	0.02	0.03	0.00	0.00	0.08	0.06									
10 Motive: desire to work independently	-0.03	0.02	-0.02	0.01	-0.07	-0.02	-0.07	-0.05	-0.06	-0.02	-0.03	-0.02	0.02	-0.03								
11 Motive: implementation of a specific business idea	0.07	-0.03	0.05	0.00	0.13	0.11	0.15	0.06	0.10	0.05	-0.05	0.10	0.08	0.07	-0.62							
12 Motive: lack of suitable job	-0.02	0.01	-0.02	-0.01	-0.02	-0.05	-0.03	0.00	-0.01	-0.03	0.05	-0.04	-0.04	-0.03	-0.30	-0.19						
13 Motive: escaping unemployment	-0.03	0.00	-0.01	0.00	-0.05	-0.09	-0.06	-0.01	-0.03	-0.01	0.05	-0.06	-0.12	-0.02	-0.33	-0.21	-0.10					
14 Motive: encouragement by past employer	-0.02	0.01	0.00	-0.01	-0.04	0.02	-0.03	0.00	-0.02	0.01	0.03	-0.04	-0.01	0.00	-0.15	-0.10	-0.05	-0.05				
15 Motive: tax reasons	0.00	0.00	-0.01	0.01	0.01	-0.02	0.00	-0.01	0.00	-0.03	-0.01	0.03	0.03	-0.01	-0.11	-0.07	-0.03	-0.04	-0.02			
16 Male founder	0.09	0.01	0.06	0.05	0.04	-0.01	0.07	0.01	-0.03	-0.03	0.09	0.07	0.10	0.00	0.04	0.00	-0.03	-0.03	0.00	0.02		
17 Foreign founder	-0.03	-0.01	-0.01	-0.01	-0.02	0.02	-0.02	0.00	0.03	-0.01	-0.07	0.02	-0.04	0.02	-0.06	0.04	-0.03	0.06	-0.02	0.01	0.00	

4. Estimation Strategy and Empirical Results

4.1. Main results

We are interested in analyzing whether crisis foundations are more likely to introduce new products and services than pre-crisis foundations (hypothesis 1) and whether the products and services that ventures founded during the crisis introduced are different in terms of their degree of novelty than the products and services of companies that have been founded in pre-crisis years (hypothesis 2). Our dependent variable for hypothesis 2 is an ordered variable that describes the degree of novelty of the ventures' product or service ranging from products and services is categorical so that we estimate ordered probit models. We estimate ordered probit models with selection (De Luca and Perotti, 2010) in order to answer the question whether crisis foundations are more likely to introduce new products or services (hypothesis 1) and in order to account for the fact that only ventures that already have products or service can answer the question about the degree of novelty of the product or service (hypothesis 2). The selection equation captures whether the firm has introduced a new product or service or not. The outcome equation measures the degree of novelty conditional on having introduced a new product or service and hence tests out first hypothesis.

In order to be identified the selection model requires an exclusion restriction, i.e. a variable that affects the selection equation, but has no impact on the outcome equation. For our application, this implies a need for variables that explain whether the venture has introduced a new product or service, but has no impact on the novelty of that product or service. We suggest two different variables that fulfill this requirement from a theoretical point of view. The first one is a dummy variable indicating whether the founder is a foreigner. Foreigners might find it more difficult to deal with the German administration when setting up a venture and before a new product or service launch as compared to natives. According to the World Bank studies on the ease of doing business, Germany only ranks 114 out of the 189

economies on the ease of starting a business with twice as many administrative procedures necessary and simultaneously incurring more than double the cost compared to the OECD average indicating significant bureaucratic burdens for founders in Germany (World Bank Group, 2015). Foreign entrepreneurs often lack country-specific human capital and a local business network, which can slow down their business development and makes them vulnerable to administrative burdens (Zacharakis, 1997). While administrative hurdles might be more difficult to handle by foreigners there is no reason to assume that the products and services that foreign entrepreneurs provide have a higher or lower degree of novelty.

As a second exclusion restriction we suggest employing the gender of the founder. Female entrepreneurs have been found to have a lesser interest in growth (Cliff, 1998) and superior difficulties to access external finance (Kwong, Jones-Evans and Thompson, 2012; Sexton and Bowman-Upton, 1990). These gender differences are likely to cause a difference between male and females to launch a product or service in the first venture years, but do not necessarily cause a difference in the degree of novelty of the product or service.

Our empirical estimation confirms that gender significantly impacts the likelihood of introducing a product or service in the first years after venture foundation. However, there is no impact in the degree of novelty on the product or service. Hence, this variable is a suitable exclusion restriction for our ordered probit selection model. The coefficient for the dummy whether the founder is a foreigner or not is not statistically different in the first stage of the model so that – although appealing from a theoretical point of view - it does not qualify as an exclusion restriction.

Table 4 shows the estimation results. The first two columns of Table 4 show the results of the ordered probit selection model. The first column depicts the coefficients of the selection equation for having introduced a product or service, the second column shows the result for

the ordered probit equation for the degree of novelty of the new product or service. The results of the selection equation reveal that crisis foundations are not more or less likely to introduce a new product or service to the market. This means that we do not find support for hypothesis 1 or the alternative hypothesis. This result might be explained by a great heterogeneity among the ventures that are founded during the crisis. Some reflect necessity entrepreneurship and might take longer to provide products and services, while others target a well-selected opportunity. On average, we, hence, do not find that the crisis foundations differ from ventures that have been founded in the pre-crisis period.

Before we move to the test for the degree of novelty of the products and services taken out by the crisis foundations a statistical finding deserves our attention. Table 4 illustrates that the selection and outcome equation are not correlated. ρ equals 0.01 and is not statistically significant from zero. This means that we can safely estimate the ordered probit equation for the degree of novelty without the selection equation. The third column of Table 4 displays the results of the ordinary ordered probit without selection. In order to test whether we can further simplify our regression model, we test whether the coefficients of the ordered model are identical across the response categories, but an LR-test rejects this null hypothesis on the 1% level of statistical significance. Additionally, we checked whether the cutoff points are the same. Also this null hypothesis was rejected for both neighboring cutoff points on the 1% level of statistical significance so that we cannot further simplify our model and proceed with the ordinary ordered probit model.

Table 4: Ordered probit models

Model	Ordered probit model with selection		Ordered probit model
Dependent variable	Introduction of new product or service	Degree of novelty	Degree of novelty
	Coef (s.e.)	Coef (s.e.)	Coef (s.e.)
Crisis foundation	-0.02 (0.06)	0.16** (0.07)	0.18*** (0.05)
Log(employment)	0.04* (0.02)	0.04 (0.03)	0.05** (0.02)
Share of R&D employees	0.91*** (0.10)	1.50*** (0.13)	1.53*** (0.08)
Patent dummy	0.59*** (0.19)	0.47*** (0.17)	0.43*** (0.11)
Internal finance dummy	0.27*** (0.04)	0.12** (0.05)	0.12*** (0.03)
External finance dummy	-0.09** (0.04)	-0.08 (0.05)	-0.09** (0.04)
Years of industry experience	-0.01*** (0.00)	-0.00 (0.00)	0.00 (0.00)
Restarter	0.06 (0.04)	0.11** (0.05)	0.03 (0.04)
Leadership experience	0.05 (0.04)	0.14*** (0.05)	0.16*** (0.04)
Number of founders	0.11** (0.05)	0.09** (0.05)	0.04** (0.02)
Motive: implementation of a specific business idea	0.13*** (0.04)	0.26*** (0.05)	0.24*** (0.04)
Motive: lack of suitable job	-0.02 (0.06)	-0.03 (0.08)	-0.01 (0.07)
Motive: escaping unemployment	0.02 (0.05)	0.03 (0.07)	-0.02 (0.07)
Motive: encouragement by past employer	-0.12 (0.11)	-0.26* (0.15)	-0.12 (0.12)
Motive: tax reasons	-0.02 (0.14)	0.15 (0.19)	0.16 (0.17)
Male founder	0.15*** (0.05)		
Foreign founder	-0.08 (0.06)		
Constant	-1.32*** (0.13)		
ρ	0.01		
cut off points	0.79*** 1.36*** 1.88***		0.66*** 1.28*** 1.74***
#	7,291		5,440
LL	-8,345.75		-6,108.66

*** (**, *) indicate a significance level of 1% (5%, 10%).

The regressions include a set of industry dummies, 2 foundation dummies and a dummy that picks up whether the finance information was not complete.

The results from the ordinary ordered probit model as presented in column 3 of Table 4 confirm a significant relationship between being a crisis foundation and the degree of novelty of the new product or service introduced. As the coefficients of an ordered probit model cannot be interpreted in terms of coefficient size or sign for the intermediary cells, Table 5 presents the marginal effects for the ordered probit model.

Table 5: Ordered probit model – marginal effects

Dependent variable Category	Degree of novelty			
	Tested and commonly used combinations of existing technologies	New combinations of existing technologies	New technologies developed by third parties	New in- house developed technologies
	Marginal effect (s.e.)	Marginal effect (s.e.)	Marginal effect (s.e.)	Marginal effect (s.e.)
Crisis foundation	-0.06*** (0.02)	0.01** (0.00)	0.01*** (0.00)	0.04*** (0.01)
Log(employment)	-0.02** (0.01)	0.00** (0.00)	0.00** (0.00)	0.01** (0.01)
Share of R&D employees	-0.51*** (0.03)	0.05*** (0.01)	0.10*** (0.01)	0.36*** (0.02)
Patent dummy	-0.14*** (0.04)	0.01*** (0.00)	0.03*** (0.01)	0.10*** (0.03)
Internal finance dummy	-0.04*** (0.01)	0.00** (0.00)	0.01*** (0.00)	0.03*** (0.01)
External finance dummy	0.03** (0.01)	-0.00 (0.00)	-0.01** (0.00)	-0.02** (0.01)
Years of industry experience	-0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Restarter	-0.01 (0.01)	0.00 (0.00)	0.00 (0.00)	0.01 (0.01)
Leadership experience	-0.05*** (0.01)	0.01*** (0.00)	0.01*** (0.00)	0.04*** (0.01)
Number of founders	-0.01** (0.05)	0.00** (0.00)	0.00** (0.00)	0.01** (0.00)
Motive: implementation of a specific business idea	-0.08*** (0.01)	0.01*** (0.00)	0.02*** (0.00)	0.06*** (0.01)
Motive: lack of suitable job	0.00 (0.02)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.02)
Motive: escaping unemployment	0.01 (0.02)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.02)
Motive: encouragement by past employer	0.04 (0.03)	-0.00 (0.00)	-0.00 (0.01)	-0.03 (0.03)
Motive: tax reasons	-0.05 (0.06)	0.01 (0.01)	0.01 (0.01)	0.04 (0.04)
#	5,440			

*** (**, *) indicate a significance level of 1% (5%, 10%).

It appears that the crisis foundation dummy has a negative sign on the likelihood of having the least novel type of new product or service and a positive one on the likelihood to have a product or service corresponding to the highest novelty category. The effect on the

intermediary novelty categories is positive and significant as well, yet the effect is smaller. The results demonstrate that crisis foundations tend to introduce more novel products and services than non-crisis foundations.

Marginal effects allow interpreting small changes in continuous variables on the likelihood of being in a specific category. For our application, the differences in probabilities for crisis foundations and non-crisis foundations for the different novelty degrees are more informative. Table 6 illustrates that the likelihood of launching a product or service of the least novel category is 5 percentage points lower for crisis foundations than for ventures that have been founded prior to the crisis. In contrast, the likelihood to be in the highest novelty category is 4 percentage points higher for crisis foundations. This pattern is in line with the arguments provided by prospect theory that entrepreneurs are risk seeking during crisis times when they have little to lose, but a lot to win, hence pursuing risky projects.

Table 6: Ordered probit model – probability of being in the different categories for crisis and non-crisis foundations

	Crisis foundation	Non-crisis foundation	Difference	95% confidence interval
Pr(y = Tested and commonly used combinations of existing technologies X)	0.3132	0.3681	-0.0549	[-0.1065, -0.0034]
Pr(y = New combinations of existing technologies X)	0.2842	0.2860	-0.0018	[-0.0032, -0.0004]
Pr(y = New technologies developed by third parties X)	0.1736	0.1597	0.0139	[0.0115, 0.0164]
Pr(y = New in-house developed technologies X)	0.2290	0.1862	0.0428	[0.0025, 0.0832]

With regard to the control variables, Table 5 shows that the probability of being in the lowest category decreases with firm size, the share of R&D employees and the patent variable and increases for all other categories. Leadership experience and the number of founders impact

the probability pattern in the same direction. This finding is in accordance with the notion that new ventures need a superior capacity and extraordinary capabilities to come up with a product or service of a high degree of novelty (Bhide, 2000; Kimberly, 1979).

Further, the likelihood to launch a novel product or service increases with internal finance and decreases with external finance. This is in line with the argument that riskier projects are often based on internal rather than external capital (Bhagat and Welch, 1995; Friend and Lang, 1988; Hall, 1992; Hall and Lerner, 2010).

Lastly, the motivation to start up a company is correlated with the degree of the venture's product or service. Ventures that are based on the realization of a specific business idea launch the more novel products and services, which are based on in-house developed technologies. The marginal effect in the category of the most novel products and services is highest for this variable.

4.2. Robustness check

Our results could be driven by the fact that ventures founded in the crisis might engage in different industries than ventures founded in the pre-crisis years and by the fact that the crisis foundations are on average younger than the pre-crisis foundations due to the structure of our dataset. In order to test whether our findings are the result of a change of the industry mix or of a different average age, we repeat the regressions for a matched sample of crisis and pre-crisis foundations. Matching criteria are the venture's age and industry affiliation. Marginal effects of the ordered probit regression for the matched sample are presented in Table 7.⁹

Table 8 reports the changes of the probabilities of belonging to either category for crisis and non-crisis foundations.

⁹ We tested whether the slopes across the categories are identical which an LR test rejects at the 5% level of statistical significance. T-tests reject the null hypothesis of equal neighbouring cutoff points at the 1% level of statistical significance.

Table 7: Ordered probit model for the matched sample – marginal effects

Dependent variable Category	Degree of novelty			
	Tested and commonly used combinations of existing technologies	New combinations of existing technologies	New technologies developed by third parties	New in-house developed technologies
	Marginal effect (s.e.)	Marginal effect (s.e.)	Marginal effect (s.e.)	Marginal effect (s.e.)
Crisis foundation	-0.05** (0.02)	0.00 (0.00)	0.01** (0.01)	0.04** (0.02)
Log(employment)	-0.04* (0.02)	0.00 (0.00)	0.01* (0.00)	0.03* (0.02)
Share of R&D employees	-0.72*** (0.06)	0.02 (0.02)	0.15*** (0.02)	0.12** (0.06)
Patent dummy	-0.16** (0.08)	0.01 (0.00)	0.03** (0.02)	0.10*** (0.03)
Internal finance dummy	0.01 (0.03)	-0.00 (0.00)	-0.00 (0.01)	-0.00 (0.02)
External finance dummy	0.01 (0.03)	-0.00 (0.00)	-0.00 (0.01)	-0.00 (0.02)
Years of industry experience	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.02)
Restarter	-0.03 (0.03)	0.00 (0.00)	0.01 (0.01)	0.02 (0.02)
Leadership experience	-0.05 (0.03)	0.00 (0.00)	0.01 (0.01)	0.04 (0.02)
Number of founders	-0.01 (0.02)	0.00 (0.00)	0.00 (0.00)	0.01 (0.01)
Motive: implementation of a specific business idea	-0.07*** (0.03)	0.00 (0.00)	0.02*** (0.01)	0.06*** (0.02)
Motive: lack of suitable job	0.06 (0.05)	-0.00 (0.00)	-0.01 (0.01)	-0.05 (0.04)
Motive: escaping unemployment	-0.00 (0.05)	-0.00 (0.00)	0.00 (0.00)	0.00 (0.04)
Motive: encouragement by past employer	0.05 (0.12)	-0.00 (0.00)	-0.01 (0.02)	-0.04 (0.09)
Motive: tax reasons	0.12 (0.12)	-0.00 (0.00)	-0.03 (0.02)	-0.09 (0.09)
#	1,106			

*** (**, *) indicate a significance level of 1% (5%, 10%).

Table 8: Ordered probit model for the matched sample – probability of being in the different categories for crisis and non-crisis foundations

	Crisis foundation	Non-crisis foundation	Difference	95% confidence interval
Pr(y = Tested and commonly used combinations of existing technologies X)	0.4066	0.4757	-0.0691	[-0.1104, -0.0278]
Pr(y = New combinations of existing technologies X)	0.2399	0.2336	0.0063	[0.0054, 0.0073]
Pr(y = New technologies developed by third parties X)	0.1547	0.1372	0.0175	[0.0162, 0.0189]
Pr(y = New in-house developed technologies X)	0.1988	0.1536	0.0452	[0.0161, 0.0743]

The results show that neither a potentially changed industry mix of ventures founded during and before the crisis nor a different age pattern cause our previous results. We still find that ventures founded during the crisis have a higher likelihood to be in the category with the most novel products and services of about 4 percentage points. The crisis foundations are also less likely to be in the category of ventures that introduce the least novel type of new product or service.

Most of the marginal effects for the control variables as presented in Table 7 are similar to the previous results. However, some variables such as the finance variables as well as leadership experience and the team size variable lose their significance.

5. Discussion

The past economic crisis has severely affected most economies in terms of GDP declines and reductions in long-term investments such as R&D expenses (OECD, 2012a). Nevertheless, recessions can bear opportunities for some entrepreneurs because an economic downturn can force inefficient industry incumbents to exit the market or shrink their business allowing for a reallocation of assets within the economy (Caballero and Hammour, 1994, 1999; Gomes et al., 1997; Hall, 1995). Eager to exploit the newly emerging opportunities, entrepreneurs can

act as “agents of progress” in times of crisis, taking their chance to challenge the status quo starting a process of “creative destruction” (Schumpeter, 1942). A counteracting force to such innovative entrepreneurship during recessions constitute alleviated financial constraints that hinder business activities and innovation in particular.

Despite the often-cited importance of entrepreneurship and innovation for the advancement of economies, there is little research on the influence of the business cycle on entrepreneurship and innovation (Koellinger and Thurik, 2012). This paper addresses this gap in the literature providing novel insights into the discussion about the role of entrepreneurship and innovation during the past economic crisis. With focus on new ventures founded in Germany before and during the past economic crisis, we present several interesting findings. First, we show that startups that are founded during a cyclical downswing are not more or less likely to introduce new products and services to the market than startups that were founded before the crisis. This finding does not support the argument that crisis foundations present mostly necessity entrepreneurship that occurs as a response to weak job market conditions with little prospect of significant innovation. The result that crisis foundations do not differ from pre-crisis foundations in terms of their likelihood to introduce new products or services is likely to be explained by a greater variety of crisis foundations. Some reflect necessity entrepreneurship, while others successfully explore emerged opportunities. A tougher competition for scarce funds might lead to a positive selection of successful ventures. Such a concentration at the extreme ends of the quality distribution of ventures can explain the non-significant result.

Second, conditionally on having succeeded at introducing a new product or service, the products and services of crisis foundations are more novel in the sense that they are more likely to be based on in-house developed technologies rather than on the applications or combinations of well-tested existing technologies. Ventures started during the crisis are even

less likely to introduce products that are based on commonly known and well-tested technologies. The strength of crisis foundations in introducing challenging innovations is remarkable given the financial constraints that new ventures, especially for innovative activities, face during a crisis (Czarnitzki and Hottenrott, 2011; Giebel and Kraft, 2015; Hall, 1992). The finding is in line with behavioral arguments derived from prospect theory that propose that entrepreneurs are more willing to undertake risky and challenging projects when she has nothing to lose (Koellinger, 2008; Kahneman and Tversky 1979). The finding is also in line with the Schumpeterian notion of creative destruction triggered by new ventures (Schumpeter, 1942).

The results have to be interpreted with care. They do not show that a crisis necessarily fosters substantial innovation through entrepreneurship. The results rather display that there is great heterogeneity among the crisis foundations which, on the one hand, are not more likely to introduce new products or service, but on the other hand, contain some important ventures that are able to commercialize new in-house developed technologies in economically difficult times. This finding is in line with Archibugi, Filippetti and Frenz (2013) who report that a few small companies and new entrants swam against the stream and expended their innovation expenses during the past economic crisis. The results are also in line with the notion of Koellinger and Thurik (2012) that entrepreneurship can be an early indicator of an economy's recovery after a recession.

There is an important takeaways for policy makers and investors that may support in ventures founded during recessions can be drawn. Not all of the ventures founded in economic downswings represent necessity entrepreneurship and some do well deserve funding or resemble promising investment opportunities. Due to the greater variety among the crisis foundations, crisis foundations have to be carefully screened. The most promising ones

should be funded in order to mitigate financial constraints that entrepreneurs face in general and especially during recessions.

Our study is not free of limitations and raises a couple of further research questions for future research. First of all, we do not address a potential survivor bias in our regressions. This means that our results have to be interpreted as conditional on venture survival. Given our sample of ventures that are maximum three years old, the concern is less strong since we only focus on very young companies. For future research, it would be very interesting to explore the effects of the crisis on venture survival and to investigate performance differences and innovation of ventures founded before and during the crisis in the longer term. Second, since the survey questions of interest are not available in all years of our database our sample is limited to three years. It would be very interesting to compare the effects of the recent financial crisis on the innovativeness of crisis foundations with the effects of earlier recessions. Third, this study does not investigate the financing structure of new ventures founded before and during the crisis and has to be seen as descriptive in this respect. Given the complexity of this topic, we leave it for future research.

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