The French corporate venture network and business survival : is there any relation ?

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Résumé

L'objectif de ce papier est d'analyser la relation entre le succès du projet entrepreneurial et la position du réseau des groupes (*corporate*) en France. En utilisant l'analyse de réseau, nous trouvons que les grands groupes représentent l'acteur central de ces réseaux. Les résultats mettent en valeur la relation négative entre les mesures de centralités et le taux d'échec (qui mesure la proportion d'échec des investissements). Le fait d'avoir plusieurs liens peut compromettre l'attention des grandes entreprises vis-à-vis des jeunes entreprises. Les résultats suggèrent que les entreprises bien établies financent de nombreuses jeunes entreprises, elles peuvent de ce fait devenir trop occupées pour participer efficacement aux projets innovants.

Keywords: Centralié; Corporate venturing

Abstract

The goal of this paper is to investigate the relationship between the survival of the venture and the corporations' network position in the French corporate venturing network. Using network analysis, we find that big corporations are the central actor in these networks. The findings highlight a negative relation between centrality metrics and the failure rate (which measures the proportion of failed investments). Having many ties can compromise the attention of large corporations on the focal young company. The results suggest that when established companies finance many young companies, they may become too busy to participate effectively to innovative projects.

Keywords: Centrality; Corporate venturing
JEL Classification: G24, O3; L26

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Introduction

Within networks, firms can learn from one another and benefit from new knowledge developed by other organizations. Powell and Smith-Doerr (1994) and Galaskiewicz (1996) consider that networks facilitate the organizational learning process that emerges from collaboration. Knowledge transfer among organizations provides opportunities for collaboration that stimulates the creation of new knowledge and access to R&D projects. Established firms operating in competitive markets are willing to obtain innovative capabilities in order to maintain profitability (Shumpeter, 1942). Several studies have stressed the organizational limits of large firms to generate creative capabilities internally (Tushman and Anderson, 1986; Henderson, 1993). In fact, a company's innovation capacity depends on its ability to integrate diverse skill set, i.e. ability to acquire and implement external knowledge (Teece et al., 1997; Cohen and Levinthal, 1990; Arrow, 1974). Consequently, a growing number of firms have begun innovating and developing strategies in order to secure technologies existing outside their boundaries (Chesbrough, 2002; Van de Vrande et al., 2011). This situation has motivated multiple scholars to focus on the ways large firms' source, value and assimilate external capabilities (Dushnitsky and Lenox, 2006). It includes mergers and acquisitions (Ahuja and Katila, 2001), strategic alliances (Ahuja, 2000), etc. More recently, established companies invested in entrepreneurial ventures, such investment–often referred to as Corporate Venturing (Dushnitsky and Lenox, 2006). Corporate venture capital is "corporate capital invested for the establishment of an investment in entrepreneurial ventures" (Schildt, Maula, and Keil 2005).

Research about Corporate Venturing focus on understanding motives for established companies to engage in corporate venturing, and factors contributing to the successes and failure of CV. Corporate venturing, as a strategic option, enables large companies to revitalize and improve their strategic and financial performance by exploring new opportunities in entrepreneurial firms – external corporate venturing (e.g., Benson and Ziedonis 2009; Covin and Miles 2007; Garrett and Neubaum 2013; Wadhwa and Basu 2013) or by exploiting existing assets – internal corporate venturing (Dushnitsky and Lenox 2006; Hill and Birkinshaw 2008). According to Leten and Van Dyck (2012), corporate venturing is a practice whereby a company sets up a separate organizational unit to invest in new technological and business opportunities arising within or outside the boundaries of the firm, for long-term strategic and/or short-term financial purposes. Corporations may prefer joining forces with other established companies over being the sole investor in order to promote the development of young and innovative companies. In the venture capital industry, venture capitalists tend to syndicate their investments with other VCs, rather than investing alone (Lerner, 1994). While the literature documents the prevalence of networks in many financial markets, the performance consequences of this organizational structure remain largely unknown. Considering a social network

perspective, in this paper, we address the following question: Does a corporate network position affect the survival likelihood of investments? More generally, we consider that an examination of social context constitute a gap in the corporate venturing research. Noyes et al. (2014) examined the relation between the number of investments a corporate venture capital does and its network position. They argue that a firm's network position and its proximity to firms with information about corporate venture capital investment experience should facilitate corporate venture capital investments. But, the opposite could be true: network distance from other corporations should constrain a corporation's implication in the corporate venture, and therefore on the success of a corporation's investments. In the interlocking directorates' literature, multiple directorships can have a negative impact on the firm's performance for companies operating in highly regulated sectors (Kaczmarez et al., 2012). This concern is commonly based on the busyness hypothesis, which proposes that many external board appointments are likely to compromise the quality of work of the focal company board. The idea that interlocking directorships may be 'a double-edged' sword, i.e. apparently beneficial, yet having negative implications when used excessively, is reflected in the mixed findings in research on the long debated interlocking-firm performance relationship: positive, negative or no association between the two variables (e.g., Geletkanycz and Boyd 2011; Kiel and Nicholson 2006; Loderer and Peyer 2002 ; Yeo et al. 2003). Similarly, we assume that multi-corporate venture may affect negatively the success likelihood of the young company when used excessively.

The paper is organized as follows. Section 1 presents the literature review. The methodology is presented in section 2. Results are presented and discussed in section 3. Section 4 concludes the paper.

1. Literature review

In the corporate venturing literature, we find several motives that may explain the practice of multi-corporate venturing between large firms. On the one hand, benefits that could explain why corporations syndicate their investments are strategic (Anokhin et al., 2011). Winters and Murfin (1988) list a number of benefits and argue that "acquisition is the most perceived benefit". Another benefit of contacts to highly innovative startups is to acquire licenses of promising technology in exchange for venture capital. This can help corporations that are struggling to bring out new and innovative products to compete in their market. Even if the venture is not willing to license (and maybe lose) its technology it can sell the marketing rights to the corporation. The venture benefits from the much greater marketing experience and contacts of the corporation, and the corporation can offer new products to its customers.

Especially in technology-oriented markets, it makes sense to use corporate venturing as a window on technology (Lantz and Sahut, 2010). Winters and Murfin (1988)

mention several examples where the detailed knowledge of venture company activities obtained by involvement in venture capital has influenced the strategic planning of major corporations. Moreover, by supporting many new ventures, large companies can screen and access many promising technologies, with a view to possibly internalizing them subsequently (Chesbrough and Tucci, 2004). Most importantly, the strategic benefits of networking include opportunities to observe and learn about fellow investors' operational processes, know-how and capabilities (Heimeriks and Duysters, 2007), how they conduct their corporate venture investments and how they internalize innovative ideas championed by syndicate partners and their investees (Gulati, 1999).

Another possibility for corporate venturing is to support the funding of ventures from within the corporation, known as internal (corporate) venturing or intrapreneurship. There may be people within the corporation that have significant entrepreneurial skills, but have doubts to leave the company and found the venture on their own. In addition, due to the mere activity in corporate venturing, the company will get contacts to "technology-based investment bankers, entrepreneurs, scientists, deal finders and makers, consultants and the whole network of people who drive the venture capital process" (Winters and Murfin, 1988). The corporation gets in touch with the people during their usual operation, and these contacts may result in business opportunities, which would probably not have emerged in any other way (Sykes, 1990). In addition, identification of new business opportunities and development of business relationships are on top of the corporate venture manager's list of strategic objectives. In his study, Dushnitsky (2004) argues that corporate venture capital is a paradox: "The actions which aid a firm to assess and benefit from corporate venturing inhibit an investment relationship with an innovative venture." His reasoning is that, e.g., corporations that use corporate venturing as a window on novel and disrupting technology will unlikely get their hands on this technology because entrepreneurs often dislike disclosing their intellectual property early on. Without being able to correctly evaluate the technology, corporations will not invest in the venture. He concludes that mostly complementary technologies will be acquired through corporate venturing. Further, Chesbrough and Tucci (2004) show that, corporate venture capital is positively related to corporate innovation and, is an important tool for sourcing external ideas.

Above all, the strategic benefits of multi-corporate venturing include opportunities to observe and learn about other investors: operational process, know-how and capabilities, how they conduct their corporate venturing investments, how they internalize innovative ideas (Anokhin et al, 2011). They argue that investing in a venture fund or Venture Company may help to identify better suiting acquisition targets. The corporation simply examines the ventures during their start-up process and invests only in ventures promising a synergistic fit.

Through its network of partners in the corporate venturing network, corporations have the opportunity to observe and learn from other investors. Joining forces, the partners will promote the development of young innovative companies.

According to van Wijk et al. (2008) "the closer they are to those who control the relevant sources of information, the more corporate investors can benefit from the experience of other syndicate members and the more access to knowledge and opportunities they can gain".

Based on network analysis, Hochberg et al. (2007) examine the performance consequence of relationships and networks in the context of relationships established when VCs syndicate portfolio company investment. Their findings indicate that better-networked VC firms experience better fund performance. Existing literature demonstrates at least two reasons to expect that syndicated networks improve the quality of deal flow causing better fund performance. On the one hand, VCs invite other to co-invest in their promising deals in the expectation of future reciprocity (Lerner, 1994). On the other hand, by checking each other's willingness to invest in potentially promising deals, VCs can pool correlated signals and thereby select better investments in situations of often extreme uncertainty about the viability and return potential of investment proposals (Wilson, 1968; Sah and Stiglitz, 1986). Moreover, syndication helps diffuse information across sector boundaries allowing VCs to diversify their portfolios (Stuart and Sorensen, 2001). According to Hochberg et al. (2007), centrality of corporations matter in the performance of young firms.

H_1: It is expected to find a positive relationship between CV centrality and the business survival.

However, and according to the busyness hypothesis of interlocking directorates, when used in excess (when too many ventures are supported at the same time), interlocking is likely to compromise the attention of directors on the focal company board. Similarly, in the corporate venturing context, large companies may not to be able to devote sufficient time and energy to contribute in the corporate venture with the entrepreneurial company. In other words, when corporations finance many young companies, they may become too busy to conduct effective innovative projects.

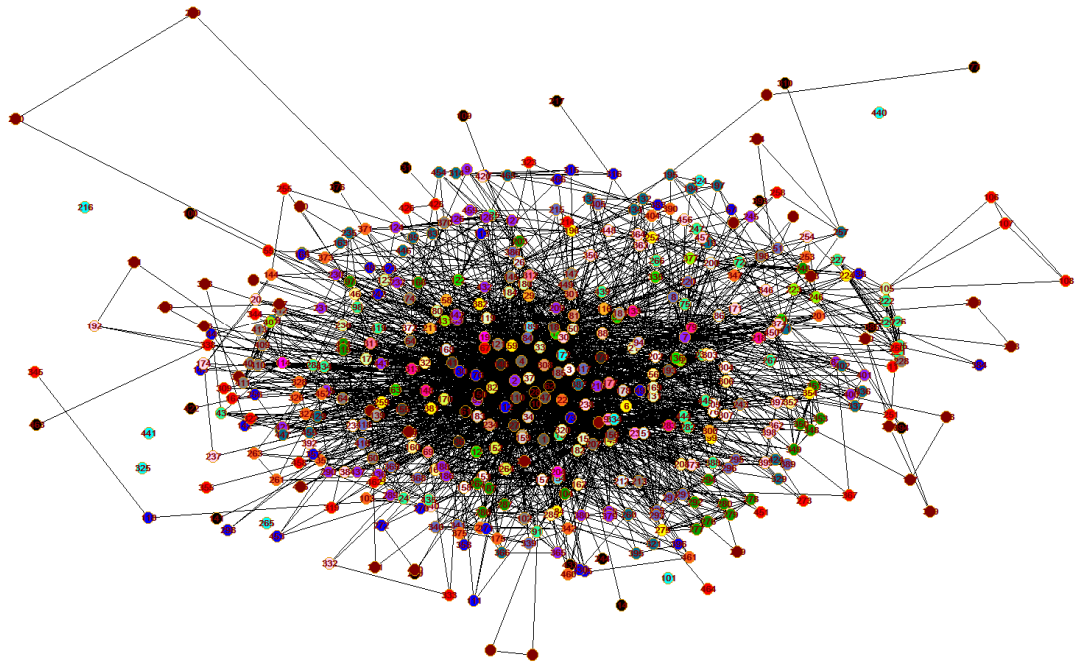
A firm's network centrality refers to the degree to which the firm has a strategically important position in the network (Freeman, 1979). In fact, the empirical evidence on the linkage between degree centrality and firm performance is very limited and mixed. On the one hand, being central in a network provides a focal firm various information advantages (in the form of access), control benefits (i.e. power) and learning (Gulati, 1999). For example, Shan et al. (1994) found that the number of ties between start-up firms and established firms is positively related to innovative output in biotechnology industry. Gulati (1999) found that the number of alliances formed by the focal firm affects its capability to form new alliances in the future. On the other hand, having many links may constrain the activity of the company. Fligstein and Brantly (1992) find a negative association between networks of

directors and profitability for a large sample of US companies. Loderer and Peyer (2002) generate a similar finding for Swiss listed companies.
Stuart (2000) found that a simple count of the number of alliances does not affect firm performance as measured by rate of innovation and rate of sales growth.
H_2: It is expected to find a negative relationship between CV centrality and the business survival.

2. Network Analysis Methodology

Network analysis aims to describe the structure of networks by focusing on the relationships that exist among a set of economic actors. A key aim is to identify influential actors. Influence is measured by how "central" an actor's network position is, based on the extent of his involvement in relationships with others. Network analysis uses graph theory to make the concept of centrality more defined.
Consider the network illustrated in Figure 1, which graphs the multicorporates venturing among French corporation over the period 1995 through 2015.

Figure 1: Corporate Venturing Network over the period 1995-2015



Corporations are represented as nodes and links represent the ties among them. In this network, it appears that two firms—2 and 37—are the most "central" in this

network, in the sense that they are connected to the most corporations, and that firm 2 is invited to co invest most often.
In graph theory, a network such as the one illustrated in Figure 1 is represented by a square "adjacency" matrix, the cells of which reflect the ties among the actors in the network. In our setting, we code two corporations coinvesting in the same entrepreneurial company as having a tie.
Adjacency matrices can be "symmetric" or "asymmetric." Only asymmetric matrices differentiate between the originator and the receiver of a tie. In our setting, a symmetric adjacency matrix records as a tie any participation by both corporation *i* and corporation *j* in a multicorporate venture.
We therefore construct our adjacency matrix and calculate centrality measures based on three popular concepts of centrality, specifically, degree, closeness, and betweenness. Here, we focus on how each measure captures to some extent different aspect of the role of corporations in the corporate venturing network.

2.1. Degree Centrality

Degree centrality measures the number of relationships an actor in the network has. Corporations that have ties to many other corporations may not be able to contribute effectively to projects. Since they have many ties, they become too busy and have to control a wider range of expertise, contacts, and pools of capital. It may also be a resource allocation problem. Formally, degree counts the number of unique ties each corporation has, that is, the number of unique corporations with which a corporation has co invested. Let $a_{ij} = 1$ if at least one common corporate venture exists between corporation *i* and *j*, and zero otherwise. Corporation *i*'s degree then equals $\sum_j a_{ij}$.

2.2. Closeness

While degree counts the number of relationships an actor has, closeness takes into account their "quality" (Hochberg et al., 2007). Closeness centrality is defined as the total graph theoretic distance to all other nodes in the network. Closeness centrality thus characterizes the reach of the ego to all other nodes of the network. A node with a high central closeness score (which mean highly central), means that partners are very close which can impact negatively the performance of corporations. However, if they are very close, the venture could ask for more funds and hope get a favorable management compared to other elements or nodes that are not as close.

2.3. Betweenness

Betweenness attributes influence to actors on whom many others must rely to make connections within the network. In our setting, betweenness proxies for the extent to which a corporation may act as an intermediary by bringing together corporations with complementary skills or investment opportunities that lack a direct relationship between them. Formally, let b_{jk} be the proportion of all paths linking actors *j* and *k* that pass through actor *i*.
Actor *i*'s betweenness is defined as $\sum b_{jk} \forall i \neq j \neq k$. Again, we normalize by dividing by the maximum betweenness in an *n*-actor network.

3. Sample and Data

To explore corporate venture network, we use data from France. We use the ThomsonOne database to select French companies that receive funding from at least one CVC. As signaled by Lee and Kang (2015), this database is frequently used in the VC literature. It enables us to collect information about each deal, especially on syndication, the round-by-round VC investments and the stage level of the funded venture. We then extract the number of investments and the number of VC firms at each round for each backed company. This allow us to get information about all VC funders, including the firm type (CVC, bank affiliated, Government Affiliated VC, etc.), the company and firm address and zip code, The CVC founded year, the number of funds managed by the CVC, the total number of deals and the total number of companies invested in by the CVC. Using ThomsonOne database enables us to observe the failure of the funded companies (if the company is defunct or bankrupt)The initial data set for this study consisted of all the investment decisions made by 476 corporations over the years from 1989 to 2016 giving a total of 3304 investment decisions.
In this data set, there is a high degree of variation in the way the name of an organization (Corporate venture, target companies and Funds) is recorded for different investment projects it is involved in. The use of data in this form, hence, results in treating the same organization as several different organizations depending on the number of different names under which it is recorded.
We eliminate this ambiguity in organizations' name before running the analysis.

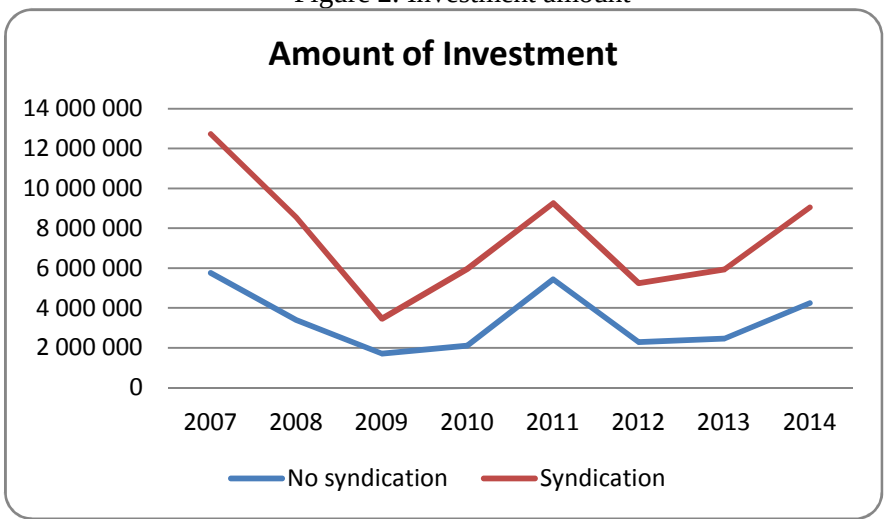
As a result we end up with a sample of 453 corporations and 406 target firm involved in 2729 investment decisions including 392 non syndicated investments and 2337 syndicated investments.
To explore the relation between the probability of failure of the investment and the network position, we consider three key variables: degree centrality, betweenness and closeness.

Type	Concept	Variables
Dependent	Successes or Failures of the investment	Failure rate which is equal to the number of failed and bankrupted investments by the total number of investments of a company.
Independent	Corporations centrality metrics	Degree centrality
		Betweenness centrality
		Closeness centrality
Control	Investments portfolio of the corporate	The whole number of investments financed by the corporation.

3.1. The French Corporate Venturing Network

3.1.1. The Network's characteristics

Figure 2: Investment amount



Variables	Mean	Variance	Std. Dev.	Min	Max
Ratio H/I	0,0584	0,0384	0,1959	0	1
degree	14,1218	303,5893	17,4238	0	131
normalized degree	0,0297	0,0013	0,0367	0	0,2758
weighted degree	73,1576	28986,0783	170,2530	0	1346

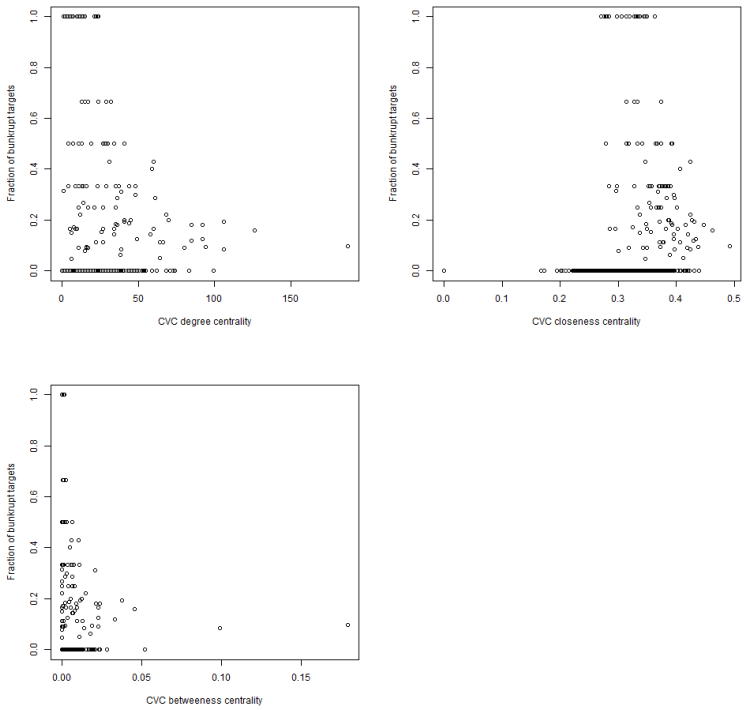
eccentricity	5,3592	1,5738	1,2545	0	8
closness_centrality	0,3863	0,0170	0,1302	0	1
harmonicclosnesscentrality	0,4119	0,0175	0,1323	0	1
betweeness_centrality	0,0033	0,0001	0,0116	0	0,1289
modularity_class	4,8109	18,0694	4,2508	0	21
clustering	0,7037	0,1068	0,3268	0	1
triangles	71,5756	17655,8785	132,8754	0	978

4. Results and discussion

Before we start with the regression analysis, let us examine a few bivariate plots that might provide the first insight into the relationship between the network position of a CV and the probability of failure of the target firm in which the CV has invested.

In Figure 2, we plot the fraction of CV fund's investments in the target firms, which later became defunct due to bankruptcy, against the three centrality measures (degree, closeness and betweenness). Although these plots cannot fully capture the true relationship, inspecting the graphs we notice several features. First, in case of degree and closeness centralities, the relationship between the fraction of failed target firms and the centralities of the CVs is non-monotonic: funds with few connections and/or being distant from the centre of the network tend to have low fractions of their target firms that ultimately failed. As the centrality is increasing that fraction start to rise, however after certain threshold it starts decreasing again and firms with many connections and/or being at the centre of the entire network also have lower fraction of failed target firms.

Figure 2: Share of failed targets as the function of CV's centrality (degree, closeness, and betweenness)



Interestingly, when we turn to betweenness centrality (Figure 2, right-most panel) we find that the fraction of failed investments seems to be monotonically decreasing with the centrality score

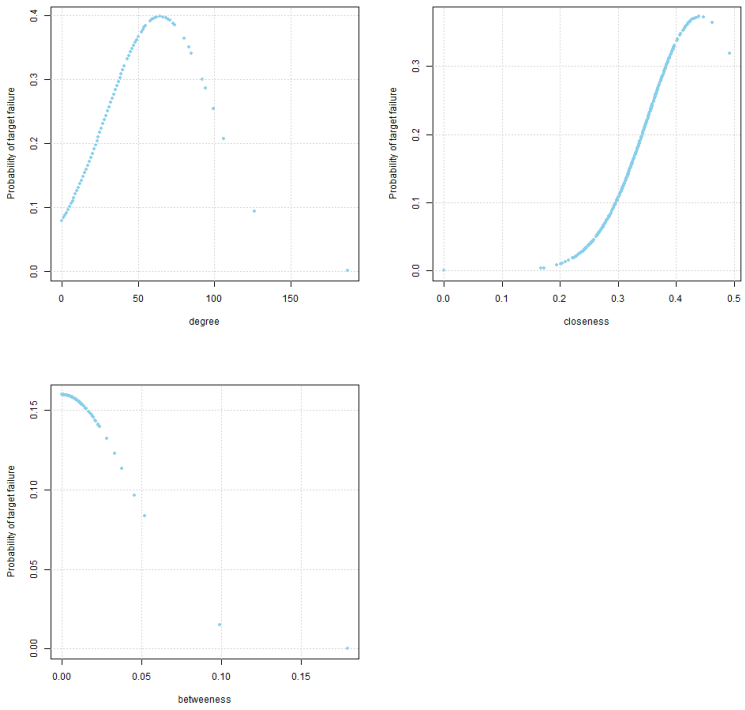
5. Regression analysis

For each of the three centrality measures we have estimated two specifications of negative binomial regression: a linear model and a model with a quadratic term to account for possible non-monotonic relationship between centrality and probability of targets' failures. The results of estimation are reported in Table 1 (see the Annex).

The results of the regression, indeed, confirm what we have noticed when inspecting Figure 2. Statistical significance of the coefficients of the quadratic terms of the degree centrality in model 2 suggests that the relationship between centrality and the probability of successful investment is, indeed, non-monotonic. The probability of investing in a target that will become defunct is relatively low when firm has few connections or have many connections with other CV funds. As the number of connections increases, the probability of making a 'wrong' investment is steadily increasing, until it reaches maximum and starts decreasing. We illustrate this pattern with the predicted probability (for the total number of investments set at its mean) plotted against degree in the right panel of Figure 3.

We find similar pattern in the estimated regression for closeness centrality: the significance of the regression coefficient at the square of closeness centrality suggests that, as in case of the degree centrality, the relationship between closeness and probability of investing in a target that will fail is first increasing with the closeness, but then the effect of the closeness levels up and further increase in closeness results in better performance.

Figure 3: Predicted probability of targets' bankruptcy as the function of CV's centrality



We have drastically different picture for the betweenness centrality. In both linear and quadratic models we found that the linear term is not significant (Table 1, model 6). Excluding statistically non-significant term from the regression we obtain model 7. The predicted probability of failed investment plotted against betweenness centrality is shown at Figure 2 (most-right panel). As one can see the probability to invest in a target firm that would fail is monotonically decreasing with betweenness centrality of CV fund. This result suggests that a target that receives investment from CV funds with higher betweenness centralities (i.e. located in strategically important positions in-between many other investors) is less likely to fail.

6. Conclusion

Corporations and politicians consider corporate venturing as an important tool for innovation (Dauderstädt, 2013).
Corporate Venturing supports firm innovation, drives up firm value, and provides management with tools to identify emerging trends in advanced technology. More precisely, corporate venturing is established corporations invest in and partner with entrepreneurial companies. By doing so, established companies are able to identify and source new emerging technologies from entrepreneurial companies. Corporate Venturing approaches have as their commonality the addition or the development of new business via equity investments within the corporation (Zhou, 2015). This can be accomplished through three implementation modes: internal corporate venturing, cooperative venturing and external corporate venturing. To achieve fast growth opportunities with different level of uncertainty, the investing corporation has to allocate resources strategically to finance the most promising projects that maximize the whole growth value of the investment portfolio (Lin and Lee, 2011). Uncertainty and risk associated with the investment are the main drivers of syndication (Ozdemir, 2006). Our study focuses on the network of corporation engaged in the corporate venturing network on the French market.
The goal of this paper is to explore whether a corporate position in the network is associated with the failure rate. In other words, is there any relationship between corporations' centrality and its failure rate?

The results generate U-shaped relation between centrality metrics and the failure rate (which measures the proportion of failed investments). Having many ties can compromise the attention of large corporations on the focal young company. The results suggest that when established companies finance many young companies, they may become too busy to participate effectively to innovative projects.

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ANNEX

Table 1: Results of the regression analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Degree	0.0181***	0.0498***					
Degree^2		-0.0004***					
Closeness			12.4450***	55.107**			
Closeness^2				-62.334*			
Betweennness					-9.100	25.046	
Betweennness^2						-370.54***	-242.77***
Intercept	-2.6217***	-3.0010***	-6.3762***	-13.592***	-2.417***	-2.455***	-2.451***
Total number of investments	0.1303***	0.1348***	0.1179***	0.123***	0.173***	0.163***	0.177***
Null deviance / df	588.14 / 916	628.96 / 916	620.70 / 916	625.70 / 916	574.37 / 916	600.48 / 916	592.72 / 916
Residual deviance / df	398.97 / 914	410.78 / 913	397.75 / 914	398.04 / 913	401.08 / 914	410.28 / 913	407.56 / 914
AIC	932.52	921.44	911.33	910.64	943.38	938.15	938.24