



Università degli Studi di Cagliari

**PHD DEGREE**  
**Economics and Business**  
**Cycle XXXI**

**TITLE OF THE PHD THESIS**

**Networks in the early stage risk capital market**

Scientific Disciplinary Sector(s)

SECS-P07

PhD Student:	Giulia Boi
Coordinator of the PhD Programme	Andrea Melis
Supervisor	Alessandro Spano

Final exam. Academic Year 2017 – 2018  
Thesis defence: January-February 2019 Session



## **ABSTRACT**

Despite the wide interest in the role of social capital theory in entrepreneurship, there is scarce literature which uses this theoretical framework to study venture capital finance. Indeed, this literature, aiming at describing the investor's due diligence process, has used methodologies and theoretical framework which most of the times have not considered the sociological aspect. Therefore, the purpose of this study is to investigate how entrepreneurial network theory could be used in the field of entrepreneurial finance. To achieve this, this thesis is made up of three papers which investigate different research questions regarding venture capital finance literature by drawing on sociological theory and entrepreneurial network theory and by using statistical model (Exponential Random Graph Model) and software (R and UCINET). By using this integrated approach, this study explains the importance of network in the early stage equity market both for investors to reduce the uncertainty of the investment, and for the entrepreneurs to increase new venture's chance to get resources and to survive. This thesis provides practitioners with a meaningful pathway for future research and insights.

**Keywords:** social network analysis, entrepreneurial finance, business angels, exponential random graph model, entrepreneur's network, syndication.

## Table of contents

CHAPTER 1: Introduction.....	8
Background of the study and the rationale for the research.....	8
Research question .....	9
Empirical focus and data .....	10
Structure of the thesis.....	11
Bibliography.....	12
CHAPTER 2: Investigating the Role of Entrepreneur’s Social Network on Investor’s Decision Making .....	15
Abstract .....	15
Introduction.....	15
Literature review .....	16
The investment decision making process.....	16
The entrepreneurship network theory.....	18
Context and Methodology.....	23
Research Context.....	23
Research Methodology .....	24
Analysis of the results.....	25
Network relevance in investment decision making process .....	25
The case of valuation.....	27
Discussion and conclusion.....	36
References.....	37
Appendix.....	42
Table 1 Network as a source of resources.....	42
Table 2 Investors’ characteristics.....	44
CHAPTER 3: A social network analysis of the early stage risk capital market: the case of Scotland.....	46
Astract .....	46
Introduction.....	46
Literature review .....	48
Hypotheses development.....	49
The study setting .....	52
The Scottish investment sector.....	52
Data collection.....	52
Operationalisation of the variables: .....	53
Method.....	55

Results .....	56
Discussion and conclusions .....	59
References .....	62
Appendix.....	66
Table 1:Operationalization of variables .....	66
Figure 1: Visualization of the Scottish investment network.....	67
Figure 2: Visualization of network formed by business angels, business angel groups and VCS.....	68
Table 2: Results of ERGM estimation: Model for testing homophily in Co-investment Network.....	69
Figure 3: Robustness check Network 1 Final Model.....	71
Figure 4: Robustness check Network 2 Final Model.....	73
CHAPTER 4: How does a venture capital network position influence the new venture performance? .....	76
Abstract .....	76
Introduction.....	76
Literature.....	78
Theoretical Framework .....	79
Structural embeddedness .....	80
Relational embeddedness .....	80
Network content .....	82
Scottish context.....	82
Data .....	83
Methodology .....	83
Dependent- variable.....	83
Independent variables.....	84
Control Variables .....	84
Results .....	86
Discussion .....	87
Conclusion .....	88
Bibliography.....	89
Appendix.....	93
Table 1: Hypotheses .....	93
Table 3: Probit models predicting new venture survival based on venture capital network variables..	94
Table 4: Marginal effects of network variables on probability of new venture’s survival .....	95
CONCLUSION .....	97
Theoretical contribution.....	97
Methodological contribution.....	98
Implication for practice .....	98

Limitations and future research .....	99
References .....	100



# CHAPTER 1: Introduction

## Background of the study and the rationale for the research

Venture capital and in particular angel investment have been considered as strategic for the regional entrepreneurial development (Mason, Botelho, and Harrison 2013; Mason and Harrison 2002; Spigel 2017). Indeed, this source of capital, quite often referred to as ‘smart capital’, does not only provide the entrepreneur with money, but also with experience, network contacts and managerial skills which foster new venture’s activity (Mason and Harrison 1995). This is why, for over two decades, the European Union has issued different policies with the aim of supporting risk capital market, such as tax incentives or the development of co-investment funds (EBAN 2015; Harrison 2018). In particular, in the business angel context, at European level, the formation of business angels’ groups, which in turn creates a network, has been acknowledged as a good strategy to boost the birth of investors and improve their activity (Mason, Botelho, and Harrison 2013). This because through networks investors can help each other in the due diligence process and in knowledge exchange (EBAN 2015) which in turn reduces the asymmetry of information of the investment.

The importance of networks has been always more acknowledged also at a theoretical level. In fact, during the last decades, the concept of social capital, defined as the resources coming from a network (Adler and Kwon 2002), has emerged as a fundamental tool to investigate different phenomena from biology to entrepreneurship.

In particular, based on the most important sociological works (Burt 2001; Coleman 1988; Granovetter 1973; Uzzi 1999) social capital theory has been used as a theoretical framework to enlarge our understanding of entrepreneurial phenomena. Through this approach, it has been possible to address research questions attaining why certain new entrepreneurs with certain network configuration tend not to fail (Davidsson and Honig 2003; Stam, Arzlanian, and Elfring 2014) and how do new entrepreneurs create their network (Boschma 2005).

However, despite the already seen practical and theoretical importance of network in the early stage equity market, the social capital theory has been little used as a framework to investigate venture capital phenomena during the early stage of the entrepreneurial process. In fact, venture capital finance literature, devoted to investigate how do investors evaluate new ventures (Bruno and Tyebjee 1984; Franke et al. 2008; Silva 2004) and the impact of investment syndications (Brander, Amit, and Antweiler 2002; Lerner 1994), has been considered apart from sociological theory. However, given the recognized importance of the soft factors for



investors (Paul et al. 2007), the social capital theory could be useful implemented to investigate some aspects which are under-researched in this field, such as the ones relating to how investors manage the risk (Söderblom, Samuelsson, and Mårtensson 2016).

### Research question

Therefore, this thesis represents an exploratory study which replies to the need of growing demand for sociological theory on finance (Uzzi 1999) and it aims at addressing the following main research question:

*To what extent does social capital theory explain entrepreneurial financial phenomena?*

In addressing this research question, this thesis positions itself among two main research streams: venture capital finance and entrepreneurship network theory, with the willing to set a bridge among them.

Few studies have already combined these two main research fields. In detail, it has been already discovered that investment decision making process is driven other than by some specific criteria such as entrepreneur's skills and business proposition potential (Bruno and Tyebjee 1984; Mason and Harrison 1996), also by entrepreneur's number of alliances (Baum and Silverman 2004; Miloud, Aspelund, and Cabrol 2012). Though, it is still under-researched whether the entrepreneur's network in terms of content and structure could justify why entrepreneurs are not funded. Moreover, literature has already explained the impact of investment syndications (Lerner 1994) and the importance of homophily in choosing a co-investment partner (Gompers, Mukharlyamov, and Xuan 2016), but it does not explain the origins of co-investment network at the regional level and how this network influences entrepreneur's performance.

By integrating these streams of research, this thesis contributes to entrepreneurship network literature by showing the impact of networks in the early stage equity market for entrepreneurs and investors. In particular, the thesis informs us about how entrepreneur's network influences the investment decision making process and thus the entrepreneur's financial resources-acquisition, and which are the main dynamics which lead investors to syndicate and consequently how the early stage risk capital network emerges as an element which can influence new venture's survival. Moreover, this thesis wants also to offer practical insights both to entrepreneurs who are looking for financial resources and to new investors who are looking for best practice. In addition, it provides a further comprehension of the regional context dynamics which can help policy makers to better fit their policies.

The main research question is investigated through three sub-research questions in three empirical papers which disentangle the influence of networks in a different aspect of early stage risk capital market. Before moving to better explain the content of the three chapters, the reasons why Scotland has been chosen as the landscape of this study are provided.

### **Empirical focus and data**

Studies on the entrepreneurial ecosystem have acknowledged the need to study the entrepreneurs' success as a result of interactions among resources, institutions and policy available at a regional level (Spigel and Harrison 2018). Therefore, an analysis of entrepreneurial finance and network without a specific link to a regional context is not complete. This thesis is set in a specific regional context: Scotland.

Scotland has been chosen several times as a landscape for research in venture capital finance and overall in entrepreneurship literature, which are the main research streams used as a theoretical framework by this thesis. On the one side, with regard of venture capital finance literature, several studies used the Scottish landscape to investigate the early stage equity market and in particular for describing the business angel role in this context and their investment decision making process (Mason and Harrison 1996; Paul et al. 2007). This is because Scotland has experienced a faster development of business angel market than any other country in Europe (Mason, Botelho, and Harrison 2013). Moreover, here there are Europe's long-lasting business angels groups and one of the most well developed business angel market organizations (Harrison 2018). On the other side, Scotland has been used also as a scenery where to study the impact of the network on entrepreneurship. In particular, Jack 2005 showed that entrepreneurs used differently strong and weak ties for their new ventures, whereas Moyes et al. 2015 investigated how entrepreneurs' network helps new venture in acquiring resources in a Scottish rural context.

In addition, the attention to these topics is paid also by public policies issued by the Scottish government which aims to create the best conditions to improve the risk capital market, such as the Scottish Co-investment Fund (SCF) and tax- incentives (Harrison 2018). This attention is reflected also by the number of reports and data set which are used to monitor this ecosystem. Among this data-set, Young company finance Scotland ([www.ycfscotland.co.uk](http://www.ycfscotland.co.uk)) assumes a relevant role. Their data set, other than in this thesis, is used by the

government to elaborate the main reports about equity investments and start-up in Scotland (Young Company Finance 2012, 2016).

### Structure of the thesis.

Having already discussed the main research question and the study setting, an overview of the chapters of the thesis and the relative research questions are presented. The need to provide a clear overview of the impact of networks both for investors and entrepreneurs required the thesis to be split up in three studies, hereinafter referred to as paper 1, paper 2 and paper 3. The content and outcomes of each chapter are summarized below.

The first chapter, titled: “Investigating the role of entrepreneur’s social network on investment decision making process”, examines whether and how entrepreneur’s network impacts on the new venture’s financial resource access by influencing the investment decision making process. To accomplish this, ten business angels and four main informants based in Scotland were interviewed. The results show that an entrepreneur’s strong and weak ties influence the investment decision-making process in different ways, leading investors to be more or less willing to finance. This result is moderated by an investor’s experience.

The second chapter, titled “A social network analysis of the early stage risk capital market: the case of Scotland” focuses on the main drivers that lead investors to choose their co-investment partners and thus to explain the structure of the early stage risk capital network. To do this, the network formed by 72 Scottish investors through syndications set up in Scotland during 2006-2017 was analyzed. By using the Boschma 2005 theoretical framework, social network analysis tools and in particular the *Exponential random graph model* was used to test several hypotheses. Overall, after controlling for endogenous effects and node attribute variables, the statistical results show that cognitive, geographical, organizational and institutional proximity among investors explains investment tie formation.

The third chapter, titled “How does a venture capital network position influence the new venture performance?” explores how the start-up’s network position in the venture capital network impacts on its survival. To achieve this, through the social network analysis software UCINET, we first built the venture capital network made by all the investors and Scottish startups involved in investments during the 2009-2013. Subsequently, we tested, by using probit regressions, the importance of new venture’s network position in terms of size, strong and weak ties, and heterophily in influencing the survival of 49 Scottish companies, which

were born in 2009-2010. We found that weak ties with other companies as well as heterophily influence new venture performance.

The three papers together deepen our understanding of the importance of networks in the early stage equity market for new ventures' access to finance and survival, and of the main dynamics which lead investors to syndicate and thus to consequently create venture capital network. In doing so, these results reinforce the need to draw from sociology to understand finance and thus they invite researchers to adopt a sociological approach when studying financial phenomena. This is especially true in an uncertain context such as the early stage of the entrepreneurial process where networks might play as a central tool to reduce uncertainty and the risk of investment.

## Bibliography

- Adler, Paul S, and Seok-woo Kwon. 2002. "Social Capital : Prospects for a New Concept." *The Academy of Management Review* 27(1): 17–40.
- Baum, Joel A C, and Brian S. Silverman. 2004. "Picking Winners or Building Them? Alliance, Intellectual, and Human Capital as Selection Criteria in Venture Financing and Performance of Biotechnology Startups." *Journal of Business Venturing* 19(3): 411–36.
- Boschma, Ron. 2005. "Proximity and Innovation: A Critical Assessment." *Regional Studies* 39(1): 61–74.
- Brander, James A., Raphael Amit, and Werner Antweiler. 2002. "Venture-Capital Syndication: Improved Venture Selection vs. the Value-Added Hypothesis." *Journal of Economics & Management Strategy* 11(3): 422–51.
- Bruno, Albert V ., and Tyzoon T . Tyebjee. 1984. "A Model of Venture Capitalist Investment Activity." *Management Science* 30(9): 1051–66.
- Burt, Ronald S. 2001. "Structural Holes versus Network Structure as Social Capital." *Social Capital: Theory and Research*: 31–56.
- Coleman, James S. 1988. "Social Capital in the Creation of Human Capital." *American Journal of Sociology* 94: S95–120.
- Davidsson, Per, and Benson Honig. 2003. "The Role of Social and Human Capital among Nascent Entrepreneurs." *Journal of Business Venturing* 18(3): 301–31.
- EBAN. 2015. *European Early Stage Market Statistics*. Brussel: Eban.
- Franke, Nikolaus, Mark Gruber, Harhoff Dietmar, and Joachim Henkel. 2008. "Venture Capitalists' Evaluations of Start-Up Teams: Trade-Offs, Knock-Out Criteria, and the Impact of VC Experience." *Entrepreneurship: Theory and Practice*: 459–83.
- Gompers, Paul A., Vladimir Mukharlyamov, and Yuhai Xuan. 2016. "The Cost of Friendship." *Journal of Financial Economics* 119(3): 626–44.
- Granovetter, Mark. 1973. "The Strength of Weak Ties." *The American Journal of Sociology* 78(6): 1360–80.

- Harrison, Richard T. 2018. "Crossing the Chasm : The Role of Co-Investment Funds in Strengthening the Regional Business Angel Ecosystem." *Small Enterprise Research* 0(0): 1–20.
- Jack, Sarah L. 2005. "The Role , Use and Activation of Strong and Weak Network Ties : A Qualitative Analysis." *Journal of Management Studies* 42(6).
- Lerner, J. 1994. "The Syndication of Venture Capital Investments." *Financial Management* 23(3): 16.
- Mason, Colin, Tiago Botelho, and Richard Harrison. 2013. "The Transformation of the Business Angel Market: Evidence from Scotland." *Working Paper, Adam Smith Business School, University of Glasgow and University of Edinburgh Business School.*
- Mason, Colin, and Richard T Harrison. 1995. "Closing the Regional Equity Capital Gap: The Role of Informal Venture Capital." *Small Business Economics* 7(2): 153–72.
- Mason, Colin M, and Richard Harrison. 1996. "Why 'Business Angels' Say No: A Case Study of Opportunities Rejected by an Informal Investor Syndicate." *International Small Business Journal* 14(2): 35–51.
- Mason, Colin M, and Richard T Harrison. 2002. "The Geography of Venture Capital Investments in the UK." *Transactions, Institute of British Geographers* 27: 427–51.
- Miloud, Tarek, Arild Aspelund, and Mathieu Cabrol. 2012. "Startup Valuation by Venture Capitalists: An Empirical Study." *Venture Capital* 14(2–3): 151–74.
- Moyes, David, Paul Ferri, Fiona Henderson, and Geoffrey Whittam. 2015. "The Stairway to Heaven? The Effective Use of Social Capital in New Venture Creation for a Rural Business." *Journal of Rural Studies* 39: 11–21.
- Paul, Stuart et al. 2007. "Towards a Model of the Business Angel Investment Process Towards a Model of the Business Angel Investment Process." *Venture Capital An International Journal of Entrepreneurial Finance.*
- Silva, Jorge. 2004. "Venture Capitalists' Decision-Making in Small Equity Markets: A Case Study Using Participant Observation." *Venture Capital An International Journal of Entrepreneurial Finance* 6(2–3): 125–45.
- Söderblom, Anna, Mikael Samuelsson, and Pär Mårtensson. 2016. "Opening the Black Box : Triggers for Shifts in Business Angels ' Risk Mitigation Strategies within Investments." *Venture Capital An International Journal of Entrepreneurial Finance* 1066: 1–26.
- Spigel, Ben. 2017. "The Relational Organization of Entrepreneurial Ecosystems." *Entrepreneurship Theory and Practice.*
- Spigel, Ben, and Richard Harrison. 2018. "Toward a Process Theory of Entrepreneurial Ecosystems." *Strategic Entrepreneurship Journal* 12: 151–68.
- Stam, Wouter, Souren Arzlanian, and Tom Elfring. 2014. "Social Capital of Entrepreneurs and Small Firm Performance : A Meta-Analysis of Contextual and Methodological Moderators." *Journal of Business Venturing* 29(1): 152–73.
- Uzzi, Brian. 1999. "Embeddedness in the Making of Financial Capital : How Social Relations and Networks Benefit Firms." *American Sociological Review* 64(4): 481–505.
- Young Company Finance. 2012. *The Risk Capital Market in Scotland 2009-2011.* Glasgow.
- . 2016. *The Risk Capital Market in Scotland: Annual Report 2016.* Glasgow.



## **CHAPTER 2: Investigating the Role of Entrepreneur's Social Network on Investor's Decision Making**

### **Abstract**

This paper explores whether investors conduct an entrepreneur's social network analysis before financing and if so, why and what are the most valuable characteristics of entrepreneur's connections for them. Prior literature has identified the main criteria driving the investment decision making process. However, despite the wider interest in the role of networks in entrepreneurship literature, evidence on the impact of the entrepreneur's social network on investment decisions is scarce. Ten Scottish investors and four main informants who operate in the early-stage equity market were interviewed. The findings show that investors duly conduct an analysis of the entrepreneur's social network. This analysis reduces the asymmetry of information about crucial resources available to new ventures, and highlights an entrepreneur's key managerial and leadership skills, which, in turn, affects investors' decision. This research contributes to the entrepreneurship network theory and investment decision-making process literature, acknowledging an important role of entrepreneurs' network for the risk assessment of new projects.

**Keywords:** business angels, investment decision, social network, new ventures, entrepreneur

### **Introduction**

Business angels, namely private investors who actively invest their money in a new venture to obtain a financial gain (Mason and Harrison 1995), represents the greatest source of finance for the early stage market (Mason, 2006). Given the relevance of this form of entrepreneurial finance, academics have studied the antecedents of the investment decision-making process (Mason and Harrison 1996; Harrison et al. 2010; Maxwell et al. 2011), finding that investors' decision is not only influenced by hard factors, such as product and business potential (Bruno and Tyebjee 1984; Franke et al. 2008; Muzyka, Birley, and Leleux 1996), but also by soft factors, such as formal and informal networks (Paul et al. 2007). In fact, entrepreneur's network can not only be a source of crucial financial funds, emotional support, and knowledge for entrepreneurs (Brüderl and Preisendörfer 1998; Huggins 2000; Jack and Anderson 2002) but also a source of information for investors about entrepreneur's abilities and resources. Nevertheless, there are few studies that describe the impact of the entrepreneur's network on investment decision (Baum and Silverman, 2004; Miloud et al., 2012). These studies are mainly based on the perspective that the higher the number of ties, the better for the

organization (Steier and Greenwood 2000) and as such this approach is irrespective of the type of exchanged resources. Therefore, we would like to investigate whether the quality of the entrepreneurs' network can have an impact on the investor's decision to fund the new venture. Thus, this article addresses these questions: *Are investors influenced by the entrepreneur's social network? If so, why are they influenced? What are the characteristics of an entrepreneur's network which influence an investor's decision?*

The findings from fourteen semi structured interviews with Scottish investors and informants enhance the investment decision-making process literature (Bruno and Tyebjee 1984; Mason and Stark 2004). Specifically, we improve our understanding of how business angels evaluate deals by adding evidence about the importance of soft factors. Further, we also contributed to the entrepreneurship network theory (Heuven and Groen 2012; Hoang and Antoncic 2003) by acknowledging a new role to the entrepreneur's network as a source of information for investors useful to contrast the agency risk related to the investment. Moreover, we provide evidence to the under-investigated stream of research which links network quality, resources and entrepreneur's performance (Semrau 2014).

This study has also the practical implication to help investors to increase their acknowledgement of their investment process and to align entrepreneurs' business proposition with investor's preferences.

The article is organized as follows. In the first section, the literature relating to the investor's decision-making process and entrepreneurship network theory is considered. Thereafter, we present the methodology and data. Finally, the results of the analysis and their discussion with future research implications are provided.

## Literature review

### The investment decision making process

The literature on investment decision-making process broadens our understanding of this process to help investors to reduce potential inefficiencies and help start-ups to better fit investor's criteria (Mason and Harrison 2002; Maxwell, Jeffrey, and Lévesque 2011). Two main streams of this literature are identified. The first one focuses on classifying and describing the main stages of the investment decision-making process (Bruno and Tyebjee 1984; Fried and Hisrich 1994) whereas the second one recognizes the criteria used by investors to assess business opportunities (Muzyka, et al., 1996). These criteria mainly include: product, team's (personal and human capital) characteristics (Franke et al. 2008; Silva 2004), and market potential (Dean a



Shepherd 1999; Silva 2004). Overall, investors pay more attention to evaluate the entrepreneur and management team rather than other elements (Nunes et al. 2014; Bruno and Tyebjee 1984; MacMillan et al. 1985; Silva 2004). This because one of the main risks related to the investment is the agency risk, that is the uncertainty that the entrepreneur will not make decisions in the best interests of the investors (Fiet 1995; Söderblom, Samuelsson, and Mårtensson 2016). In particular, business angels are more sensitive to the agency risk than market risk during the evaluation process (Fiet 1995; Mason and Stark 2004) because they lack competences to manage the market risk and so they rely on the entrepreneur to control it (Fiet 1995). Hence, for these investors trust toward the entrepreneur results fundamental in speeding up the negotiation process (Harrison et al., 1997) and the entrepreneur becomes the prime driver to refuse business proposal (Mason and Harrison 1996). This is also why they prefer to invest locally to increase the chance to know better the entrepreneurs and monitor them (Harrison, Mason, and Robson 2010) and they adopt a hands on approach in post investment activities (Landstrom 1992).

Literature showed that entrepreneur's network plays an important role in order to reduce this uncertainty of the investment (Heuven and Groen 2012; Shane et al. 2002) because it contributes to decrease the asymmetry of information among investors and entrepreneurs. Indeed, from one side, entrepreneur's network contacts might act as a referral for new ventures making investors more willing to fund (Heuven and Groen 2012; Shane et al. 2002; Sørheim 2003). On the other side, entrepreneurs' ties with prominent actors can increase new venture's legitimacy and reassure investors about them (Baum and Oliver 1991; Stuart and Hybels 2016). This is especially true for new ventures because they suffer from liability of newness and smallness (Stinchcombe 1965; Witt 2004; Aldrich and Fiol 1994). In this regard, literature has also started to investigate how the entrepreneur's network characteristics can be included in the investor's evaluation analysis as a signal of the quality of the entrepreneur. In particular, Baum and Silverman (2004) suggested that the number of upstream and horizontal alliances have a positive impact on the venture capitalist valuation. Miloud et al. (2012) found that entrepreneurs are more likely to be financed by investors as the number of alliances increases. Nevertheless, these quantitative papers do not provide a deeper understanding of the reasons why investors are more likely to fund when entrepreneurs have these ties. Therefore, despite this evidence, this analysis is often taken for granted and no prior literature clearly states, as far as we know, if investors judge the entrepreneur's network in terms of type of connections and exchanged resources before financing the new venture and if yes,

why. This represents an important gap in literature especially considering that entrepreneur develops their business through their social networks (Birley 1985; Jones and Jayawarna 2010) and therefore network could be an important source of information in terms of entrepreneur's resources and his/her leadership and managerial skills.

### **The entrepreneurship network theory**

In order to study the investor's point of view about the entrepreneur's network, it is essential to identify which are the main entrepreneur's contacts and which resources are exchanged among them. According to Dubini and Aldrich (1991), the entrepreneur's personal network is made up of people with whom entrepreneurs have direct dealings and from whom they receive resources, such as services, advice, and moral support. Ties can be strong or weak. Strong ties are those with whom the entrepreneur interacts frequently, such as family and friends, whereas weak ties are in general represented by acquaintances, with whom the individual entrepreneur has less frequent contact (Granovetter 1973) such as suppliers, banks, institutional organisations, incubator, customers, university, and government regulators. Research has shown that in the early stage of the entrepreneurial process, entrepreneurs' networks play an important role in obtaining fundamental resources, such as emotional support, information and financial funds in addition to reputation and endorsement (Uzzi 1996; Brüderl and Preisendörfer, 1998; Adams et al. 2014; Pirolo and Presutti, 2010). As the entrepreneurial process enters the next stage, these resources (entrepreneur's social capital) initially help entrepreneurs in transforming a business idea into a new venture (Renzulli et al., 2000) and later on, also help them in improving the business performance (Baum et al., 2000; Baum and Silverman, 2004; Adams et al., 2014; Stam et al., 2014). Finally, Davidsson and Honig, 2003 claimed that these resources positively affect the sales and profitability of the business. Below, we provide a literature analysis of the main connections.

#### *Family and friends*

Family and friends are long-lasting connections characterised by low asymmetric information and trust as a mechanism of governance (Arregle et al. 2015; Uzzi 1996). Trust facilitates the exchange of resources at more convenient conditions in comparison to the market, such as a loan at low or zero interests and better repayment condition (Brüderl and Preisendörfer 1998; Arregle et al. 2015). This why it is often called the 'love money'

(Deffains-Crapsky and Klein 2016). Similarly, family members help entrepreneurs in some aspects of the firm's activities, offering emotional support and encouragement, unpaid work, and business experience, especially, in the mainstream sectors. Strong ties are more willing to exploit their own connections to provide contacts or information to the familiar entrepreneur (Davidsson and Honig 2003).

In terms of impact, on the one hand, family connections provide support to entrepreneurs. Davidsson and Honig (2003) showed that involving parents or friends in business or receiving their encouragement, increases the probability of being a nascent entrepreneur. Additionally, Brüderl and Preisendörfer (1998) argued that support from the life partner provides emotional stability to the entrepreneur. On the other hand, these connections supply redundant information which might isolate new entrepreneurs, and therefore create difficulties for discovering new opportunities (Burt 2001; Granovetter 1973). This is the main reason why Renzulli et al. (2000) suggested that a network made up mainly of kinship relations is disadvantageous for entrepreneurs. Further, Arregle et al. (2015) also found that advice and emotional support provided by family can have a positive impact on new venture growth to a certain extent, whereas business resources provided only by family ties are mainly associated with a reduction in new venture's performance.

### *Suppliers*

Established relations with suppliers might provide new ventures with strategic information about technology, innovation opportunities and costs reduction (Bennett and Robson 1999). Hormiga et al. 2011 suggested that suppliers can deliver raw material for the productive process at a lower cost or with favorable terms of payment. Suppliers may even be involved in a financial bootstrapping strategy (Harrison et al., 2004), in which entrepreneurs take advantage of the delay in payments to suppliers, or by special deals for hardware access (Freear et al., 1995).

Baum and Silverman (2004) found that downstream alliances in the biotechnology sector that offer access to distribution channels, marketing and expertise, increase the probability to receive financing from an investor and improve start-up's performance and its survival chances. However, this connection is based mainly on the exercise of coercive market power rather than trust (Bennett and Robson 1999). Consequently, sharing knowledge with these suppliers can arise intellectual property (IP) protection issues. Moreover, start-ups with

these types of connections signal that they are closer to commerciality and thus far from producing an innovative product (Baum and Silverman 2004).

### *Customers*

There are various resources coming from connections with customers, such as financial resources, endorsement and advice in product development. Harrison, Mason and Girling 2004 revealed that small firms in Northern and South-East England tend to involve customers in implementing financial bootstrapping through the negotiation of special terms or discounted advance payment. This technique has great importance not only for the product development, but even and mostly for business development. In relation to advice, the presence of customers appears to be the best market feedback for the success of new products (Bennett and Robson 1999).

Pirola and Presutti (2010) argued that trust and long-lasting relationships with customers allow a higher number of interactions and transactions of resources among actors. However, these strong ties increase redundant information (Granovetter 1973), and thus contribute to the isolation of the entrepreneur, which, in turn, negatively affects a firm's innovative performance. Moreover, relying on a few trusted customers can cause serious damage to business, especially in the case of unexpected loss of them (Pirola and Presutti 2010).

### *Other businesses*

Entrepreneurs' connections with other similar entrepreneurs who operate at the same stage, or with experienced firms, help them to solve shared problems in terms of strategy, bureaucracy, and marketing. Freear et al. (1995) showed that the three most important reasons behind a business alliance for a start-up operating in the software sector were: market penetration, sales/marketing channels and the lack of adequate resources. Furthermore, being embedded to another firm is a source of competitive advantage because firm might benefit from transferred reciprocal trustworthiness and hence support coming from third parties (Uzzi 1996). This, in turn, can allow new ventures to obtain strategical information or important contacts.

Baum and Silverman (2004) found that start-ups with higher horizontal alliances are more likely to be funded by venture capitalist than those with a less number, even if these can lead to a negative impact on firm's

performance caused by learning races. However, Uzzi (1996) argued that embedded ties with other businesses might insulate firms from new partners.

### *Universities*

Universities are considered important to develop the entrepreneurial ecosystem (Smith 2007; Harrison and Leitch 2010). They can act as a good source of legitimacy for entrepreneurs (Ensley and Hmieleski 2005; Mian 1996), human capital through student employees and faculty consultants (Mian 1996) and they can offer networking opportunities (Colombo and Delmastro 2002). Additionally, they offer programs aiming to transfer technology and stimulate the birth of new firms under the form of spin-out (Wright et al. 2006). However, obtaining these resources means dealing with the technology transfer office (TTO) of the university, in charge of disciplining the licensing deals among the institute and the company. Through this complex and time-consuming agreement, the university asks royalties or decides to have an equity position in the start-up (Powers and McDougall 2005). Harrison and Leitch (2010) showed that the university's involvement in new venture's equity may have a counterproductive effect. Baum and Silverman (2004) found that in biotechnology sector upstream alliances with universities do not have an impact on venture capital financing because they signal that the company is stuck in a development phase yet, and therefore far from commercial viability. In terms of new venture's performance, authors showed that these alliances have a weaker or even detrimental effect (Baum and Silverman 2004).

### *Other connections*

Early stage entrepreneurs before pitching to an investor might be connected with consultants, particular institutions, government agencies, incubator, and other investors.

Professional advisors, like lawyers and accountants, help entrepreneurs in choosing the venture capitalist that best fit the investment opportunity, in preparing the business plan and the pitch to investors, moreover they provide the entrepreneur with assistance about venture capitalists investment procedures (Lehtonen and Lahti 2009). Furthermore they support the entrepreneur with contracting and legal issues such as IP (Kenney and Patton 2005). In Silicon Valley these actors also bridge the structural hole among their clients and potential investors (Suchman 2000). However, according to Robson and Bennett (2001) only lawyers are associated

with better firm performance, whereas the presence of other advisors like accountants does not show any association with growth. Kirby and King (1997) claimed that the accountant's positive effect is limited by the lack of accountant's training on management issues and marketing of the provided services. Additionally, it could take time to find the most appropriate advisor and sometimes they should be paid although the new ventures do not obtain financial funds (Lehtonen and Lahti 2009).

Ties with institutions play an important role in reducing the rates of mortality of an organisation (Baum and Oliver 1991). This type of entities, like non-profit organisations, related to the new venture's sector may provide entrepreneurs with potential customers and give them external legitimacy.

Government agencies help inexperienced entrepreneurs to set up their businesses providing numerous resources, such as financial resources in the form of grants, advice for developing and improving the product, and collaborators through a program of readiness (Bennett and Robson 1999). Receiving a grant from a government agency signals that the new venture is worth consideration (Baum and Oliver 1991). However, Davidsson and Honig (2003) showed that ties with these agencies increase the probability of having a business plan, but they do not increase the pace of gestation activity and no significance is observed in terms of a more likely new venture's success.

Incubators provide start-ups with legal support, marketing and networking assistance (Davidsson and Honig 2003; Aernoudt 2004; Al-mubaraki and Schrödl 2011) in addition to space where entrepreneurs can work on their projects and remain in touch with other entrepreneurs instead of working in an isolated fashion (Buss 2016). Working together represents the premise of an exchange of strategic information and expertise. Furthermore, incubators organize seminars and workshops about developing a good business model and preparing it to pitch to the investors. Nevertheless, there is no common measure in literature to evaluate the effectiveness of incubator in promoting the start-up's survival and growth (Al-mubaraki and Schrödl 2011).

Banks do not tend to finance start-ups because they are considered too risky, given the lack of track records and negative cash flows (Mason and Harrison 1995; Harrison and Mason 2000). Therefore, private investors involved in this phase of the entrepreneurial process are mainly business angels and venture capitalists. Venture capital is considered smart money (Mason and Harrison 1995) because informal investors have a double role in start-ups growth. They do not only provide financial resources, contacts and expertise to entrepreneurs, but also coach them to develop the business through all stages (Harrison and Mason, 2000; Alperovych et al.,

2015). However, entrepreneurs should exercise their activity under a strict day to day control of the investors, who can decide to change the management team if it is considered not appropriate (Bruno and Tyebjee 1984). Table 1 ‘Network as a source of resources’ summarises the main resources coming from these connections that can negatively or positively influence the investment decision-making process.

-----  
Insert Table 1 about here.  
-----

In light of this part of the literature and so given the role played by entrepreneur’s network in new venture’s survival, it is expected that investors and in particular business angels collect information also in relation to people surrounding the entrepreneur for several reasons. Firstly, they need to know what kind of resources the entrepreneur has access and at which costs, and what are instead the resources that the business angels should bring in. Secondly, as the entrepreneur’s network has been reckoned as a source of positive influence, it could be also a source of problems that the investor should face during the post investment activities. Furthermore, the investor could use the past performance of the entrepreneur in accumulating resources through the network to predict his future performance.

In this paper, we address the following research questions *Are investors influenced by the entrepreneur’s social network? If so, why are they influenced? What are the characteristics of an entrepreneur’s network which influence an investor’s decision?*

## Context and Methodology

### Research Context.

This qualitative study was undertaken in Scotland. Although, there can be several reasons for selecting Scotland as a research setting for this study, three main reasons are mentioned below. First of all, Scotland has one of the most developed business angels market organization. Here, it has been experienced the fastest growth in number of angel groups outside the USA (Mason et al., 2013). Second, Scotland showed to be an interesting context for new ventures, in fact two famous unicorns were born here. Third, a very diversified sample of investors in terms of experience and organization operates in Scotland. This allows us to observe

differences among investors' attitude towards this analysis and hence to contribute to the literature concerning different approaches of due diligence (Alperovych et al., 2015; Brander et al., 2015).

### Research Methodology

Previous works on the valuation of the entrepreneur's network used quantitative analysis (Baum et al., 2000; Baum and Silverman, 2004; Miloud et al., 2012). However, a qualitative analysis is more suitable when we want to address "how" and "why" research questions (Söderblom, Samuelsson, and Mårtensson 2016; Sørheim 2003; Yin 1984).

This research is based on fourteen semi structured interviews with two main informants of an important business angels' association and ten Scottish business angels. Further interviews were conducted with two public sector venture capitalists, who are often involved in the co-investment model with business angels (C. Mason, Botelho, and Harrison 2013). They could provide additional information about business angels practices. Furthermore, all the interviewed investors conducted more than two investments, and they still operate in different industries, from food and drink sector to high-tech and life science. This allows us to capture the variability related to the different sectors. Information about investors is showed in table 2.

-----  
Insert Table 2 about here.  
-----

The interviews were conducted from November 2016 to June 2017 and lasted between 30 and 90 minutes. They were recorded and transcribed. Subsequently, data were analysed through a directed content analysis, which is the most appropriate technique when a theoretical framework needs to be expanded (Hsieh and Shannon 2005). Transcripts were loaded into Nvivo 11 programme and they were broke in small parts to observe similar patterns and points of difference among investors' answers. The final coding scheme is an output of an iterative procedure that considers the theory, emerging patterns and the data. We found the main themes, that reflect the main research questions, include categories, which in turn grouped together several codes. The relationship among codes was studied through a process of axial coding (Strauss and Corbin 1990). Previous studies on the investment decision-making process have used different methodologies. Several scholars criticise post hoc methodologies, such as surveys or other self-reported data, in favour of real-time



experiments, such as verbal protocol analysis and conjoint analysis, because of the conscious and unconscious errors associated with post hoc rationalisation (Shepherd and Zacharakis 1999; Harrison et al. 2015; Mason and Stark 2004). However, in this case, the use of real time experiments was difficult because the terminology was not shared among the researcher and investors, even ‘the social network analysis’ needed to be explained before.

### **Analysis of the results.**

This section of the paper summarizes and analyses the empirical findings. It begins by considering the importance acknowledged by business angels of the entrepreneur’s network for new business development. Thereafter, we explain if an entrepreneur’s network information is processed by investors and how this influences the investment decision-making process. In order to preserve the anonymity, investors and government venture capitalist are numbered.

#### **Network relevance in investment decision making process**

What was particularly interesting with this sample of investors was that they know how much the network is important for the daily tasks of an entrepreneur. Investors, indeed, reckoned that entrepreneurs use their network as an important tool for new business development. The start-up journey is seen as a network journey because engaging with their networks, entrepreneurs develop the ability to stand in the market and also to understand the environment. Especially during the start-up phase, they expect the new entrepreneur to be unable to run the business alone because he or she needs some important resources that can obtain through their networks, such as information, support, expertise and stimuli.

‘The initial social capital is actually very important and quite often is what put them forward’ (Investor 5)

‘Certainly, it is very important to know people who can do a variety of things to help you and so introducing to a new market or investors, solving some technological problems or introducing someone who can solve technology problems’ (Investor 4)

‘We do not believe that the entrepreneur knows everything is going to do, I mean, he has to be able to debate on board and have other people around making sure that he is doing the right thing at the right time’ (Investor 8)

From the interviews, it emerges that the entrepreneur’s network information results as influential information during the pre-investment phase. Investors ask questions about entrepreneur’s network not only to verify possible problems related to these interactions, i.e cost of exchanged resources, but also to observe how entrepreneurs build and leverage their network and how they are reluctant to change them. These last managerial, leadership and dynamic capabilities connected to the network help them to delineate the entrepreneur’s profile.

‘If the wrong people are involved, I tend to walk away because the individuals who selected them in the first place...probably it means that I do not trust the judgement of the entrepreneur. At the end of the day, the questions you have to ask yourself is: do you trust that man with your money? and if you cannot answer that positively, then you should not mess’ (Investor 2);

‘I am assessing whether he is assessing what his network is telling him and coming to his own conclusions from it or whether he is representing what the network is giving him and so...we want to be able to see if he is going to run the business and so I want to see if he is using his network to find out the information. I want to see that he chases this information critically and then he is able to make a sort of decision, that makes sense’ (Investor 8);

‘A number of times I come across people who have a control perspective, the entrepreneur tries to undermine the control by using the lawyer that he has always used.. I will give you an example of an entrepreneur who developed a new allarm product, and he was looking to the world sales, to America... he decided that the one man from the family was the perfect corporate lawyer. I asked: What experiences did he get in new york or in China? none... now, how on earth can you say that you want him? well that causes the problem and basically, as investors we actually had invested in this company and the second round we refused cause no sense’ (Investor 9)

## The case of valuation

Per each formal and informal tie, investors show a particular preference about how the entrepreneur should interact with their connections and in particular which are the possible benefits and threats related to the exchange of resources with these ties. These preferences arise from their past experiences as they recall numerous examples to demonstrate their judgement.

### *Family and friends*

The family is one of the most controversial connection because investors have a different point of view about their role in new business development. If family provides the entrepreneur with financial resources, two of them are less willing to finance because family invest for other emotional reasons and they do not have the knowledge to make an investment, becoming only a source of tension and conflicts.

‘They do not understand that they have founded a start-up, with only an idea and value of 5 millions of euros, and the professional investors come along and say it is not worth 5 millions of euro even now. We are going to invest half of that. We have created a family that is not happy that see these outsiders who come along and cross the business’ (Investor 1)

On the contrary, other investors expect the family to be the first port of call for the entrepreneurs, representing a signal of a ‘skin in the game’ that can increase entrepreneur’s commitment and responsibility in the eyes of the investors. The family does not represent a problem, provided that the given amount of money is proportional to the family’s capacity, and they do not receive back many shares, especially when the family is not experienced and there is not good human chemistry with investors. In any case, investors are aware that the family can bring personal and family related issues that are difficult for investors to deal with, thus affecting the daily business activity.

The unpaid work is fine. Only two investors are against that for two reasons. Firstly, a proper business requires people with a certain level of skills to perform work activities for the company and hence these people should be paid on an arm's length basis. Secondly, it creates an obligation between the company and the family members in a way that if the company is solved for a large amount of money and there is no track record that can justify benefits for the unpaid work, then it can create tensions.

Business experience is positive if the person, providing this resource, is not effectively managing the business because investors are looking for entrepreneurs who may listen to suggestions, but able to make their own decisions.

As for financial resources, investors expect the family to be a source of emotional support. The lack of this emotional support could be of concern because starting a business is a hard job and there are always times when the entrepreneur feels lonely or needs to be able to speak to others.

Only one investor claims that the family is more a source of negativity and tension than constructive feelings. The entrepreneur should then be able to keep going without this support.

‘You do not get emotional support and sometimes you get the opposite. If the entrepreneur by nature tends to ignore people who are negative anyway... If they are delusional, we will say then actually we probably agree with your family, do not do that’ (Investor 6)

Special attention is reserved for the role of the life-partner. Investors collect information about the opinion of the life-partner on the project to discover whether the partner is supportive or a source of personal pressure. Having a supportive life partner is essential because it helps to build the entrepreneur’s business stamina and to lead an entrepreneur to be focused on the hard job of creating a new venture. In particular, one investor prefers to meet the life partner before investing.

‘A life partner is essential because otherwise as entrepreneurs start working crazy hours, cannot take holidays, cannot buy nice things for their children because the company has going to need money, that causes tension’ (Investor 1)

On the contrary, three investors consider the emotional support coming from a partner as not important and not expected because life partner is always negative. Therefore, the entrepreneur should not rely on that.

The business angels’ attention reserved to this contact is confirmed by public venture capitalists involved in the co-investment model. Indeed, they observe that resources coming from the family are negative only when they co-invest with business angels, who can disapprove the involvement of the family into the business.

## *Suppliers*

Business angels critically evaluate financial resources exchanged with suppliers. They want to understand who is providing what and why. If the entrepreneur is not able to give an answer to these questions, the investor will not finance.

‘I want to see an agreement that says all the product development that comes out from that relationship belongs to the company [..]. I want to understand who is giving what and why that. I am not interested in investing in somebody who has a secret deal going on around suppliers funding for some reasons’ (Investor 8)

The exchange of financial resources impacts negatively if the supplier is not considered the best in terms of price and quality because the investor could think that the supplier is taking out more than bringing in, funding the entrepreneur to secure his or her own customers. Ultimately, this negatively contributes to investors’ judgement about the ability of an entrepreneur to involve the right people in the company. Furthermore, two investors are really against the financial resources provided by suppliers because this can disincentive potential buyers.

‘It is very difficult to sell that business if people who are buying the business know that you have got somebody who owns the 20% of your stock and does not know what the terms are and they are not able to change them’ (Investor 3)

The exchange of technological expertise creates some concerns regarding the intellectual property of the products. An agreement is expected to exist to discipline this aspect and protect the start-up from eventual conflicts. If the suppliers are a key to the business, then they should be locked in an agreement. If their connection is based only on trust, instead, they should have shares of the business ventures so that there is evidence that the relationship will continue in the future. The endorsement is always positive, especially when it comes from an independent supplier that has no financial connection with the entrepreneur. Furthermore,

one investor claims that entrepreneurs should have more connections with suppliers instead of depending on just a few strong ties to diversify the risk.

### *Customers*

Financial resources and external endorsement coming from customers attract investors because they signal that the product could have a growth perspective and entrepreneur's commercial intelligence. The lack of this connection and of the idea where to get these customers or buyers is perceived by the investor as a low ability to understand the marketplace and it can lead to the deal killer. Feedback for product improvement is especially important to understand whether the product meets the expectations and the value for money, or not. In relation to how many customers should be present, there is no one defined rule and of course it depends on the sector. However, it emerges that having more weak ties with customers is better than just a few in terms of product improvement, because the entrepreneur learns more from a crowd. Furthermore, potential acquirers of the business think that stronger relationship with a prominent customer is not good to reduce the business risk and the isolation.

‘Alternative acquirers of the business think that a too strong relationship with suppliers and customers is not good. It would make them nervous’ (Investor 3)

### *Other firms*

For most of the investors, support coming from entrepreneurs operating at the same stage is considered very positive because they can learn from each other on how to face the same problems, and there is room for positive externalities. Consequently, they organize meetings among their start-ups.

Only two investors consider less helpful when entrepreneurs at the same level of activity, particularly start-ups, meet each other to moan about the fact that investors do not understand them and talk about how to operate rather than actually operate. This influences very negatively the investor's judgement.

‘It is better if they talk to people that are in a higher level ahead [...]. What we do not want is an entrepreneur to get involved in what is called a “pity party”. You know, when they sympathise to

each other. You want somebody who is able to say not thanks to step up and gets at the next level'

(Investor 6)

### *University*

Investors are critical about the connection between entrepreneur and university. If the resource exchanged is the endorsement, they think that having this approbation from the university can positively influence the investment decision-making process only until a certain point. Professors are considered better at giving a valid opinion regarding the technological aspect than a judgement on the business potential.

Furthermore, the endorsement tends to be without value if the start-up is a university spin-off because in that case the university endorsement is considered too biased for being considered.

In terms of business advice, in general, investors think that university can give some advice on how to set up the business or other factual staff whereas entrepreneurs cannot learn from them the entrepreneurial spirit. One investor said that entrepreneurs get better advice from people who run their own business and by nature are risk takers, unlike professors. Professors from universities are considered too much academic and risk adverse for giving such entrepreneurial advice.

Moreover, another investor claims that entrepreneurs should go to university consultancy services only providing that they consider it the best option and not because they are offered for free to the entrepreneurs.

'Just because the university wants to give you support does not mean that you should take that support. You should always go to the most appropriate source of support. So, I will be concerned if the company was locked into only taking a narrow vision about where they got the support from' (Investor 1)

The exchange of technological expertise should be disciplined by a clear collaboration agreement. The main issues about these agreements regard: the intellectual property (IP) and the number of shares or royalties reserved to the university. In relation to the IP, investors want the university to give the entrepreneur the exclusive use of the intellectual property as a condition of financing.

When the university asks for a lot of shares and royalties, dealing with University is considered difficult for some investors whereas for some others is a deal killer. From the interviews, it emerges that dealing with some

specific Scottish universities with the low experienced commercial department is hard, so that although the business idea and the entrepreneur are valid, the investors will not finance.

### *Consultant*

All the resources coming from the consultants are seen either negatively or positively in relation to who the consultant is. Business angels are more willing to finance if consultants come from their same network and if they are experienced in business valuation.

‘I will ask him if he has a legal advisor and if he says: yes, I’m talking to XXX. Well, that will assure me because I know the fame of XXX. If they gave me the name of a lawyer that I never heard of, that it would be a warning flag that must be an argue to do, because they are not taking good legal advisors’ (Investor 1)

A consultant with a bad reputation impacts negatively on the investment decision for several reasons. Firstly, it means that investors should spend the time to re-educate the entrepreneurs. Secondly, consultants could cost in terms of money and time wasted, because they are not used to the standardised terms of the agreement. Thirdly, the presence of bad advisors is a worrying signal for investors in terms of the ability of the entrepreneur to choose good people. This is a deal killer for some investors, who oblige the entrepreneurs to change them. By refusing to substitute these bad consultants, entrepreneurs signal their willing to maintain control over the new venture and a lack of trust toward the investor, especially when advisors are the lawyers or the accountants of the family.

For only one investor, consultants cannot influence the investment decision because they do not add any value to the company. However, if the consultant is considered as a key figure in the project, s/he should be locked in an agreement otherwise this negatively impacts the investment decision.

### *Incubators*

The period spent in an incubator is considered positively if the investors’ judgement is positive about the incubator. Overall in Scotland, each investor has an opinion about each incubator and certain incubators are considered better than others in giving to start-ups a better chance to succeed. The investor’s judgement is



based on the quality of the consultants and on the quality of the qualification process that the start-up should go through to get in. If an investor does not know the specific incubator, s/he will expect to see the specific mentor to understand their experience.

For some investors, going to a bad incubator is worse than not going at all for several reasons. Firstly, entrepreneurs are wasting their time. Secondly, a bad incubator could lead the investor to wonder about the entrepreneurs' ability to be surrounded by quality connections that can challenge them. Therefore, this is perceived as a handicap in a race and it signals that they should pay more attention during the due diligence process. Investors will test entrepreneur's personal business knowledge deeper than for a person that comes from a better incubator.

'It's better not to go in a bad incubator rather than to go because you are wasting your time. If an entrepreneur comes to me and says that he was in that bad incubator, I would reply to him: why did you spend your time going to that incubator? You want you to be surrounded by quality, you want to go where you are challenged, you want to be proud of where you went' (Investor 1)

In any case, investors expect entrepreneurs not to depend on incubator's help. For one investor, incubators are completely useless and contribute to create an unrealistic representation of the valuation. The person setting up the incubator is represented as a property owner and landlord that is more interested in filling spaces than providing quality advice. There is no screening of the start-up and of the services provided to the occupants.

### *Investors*

The presence of another investor shifts the relationship with the entrepreneur from a straight line to a triangle, where two investors and the entrepreneur should interact. Therefore, it is very important that investors have a shared view on the investment, especially when the entrepreneur is taking the business down the wrong track.

'If you have investors who are not aligned with you, who do not have the same attitude to risk or the same patience to grow up the business, who do not have money to follow up to fund, then that can make the investors' relationship very difficult' (Investor 1)

The lack of a shared view represents a deal killer. For almost all the investors, it is more important who the other investors are than the characteristics of the entrepreneur, because they can get rid of the CEO or the founder, whereas it is very difficult to get rid of other investors.

Only one investor said that he tends not to care about that because he said to be determined and that he looks for them not liking them.

One public venture capitalist represents this business angels view. This defines the Scottish ecosystem as a competitive and cooperative ecosystem because all investors recognize that no single group is strong enough to be able to do on their own. However, there are some investors who have some practices which cause other investors not to deal with them.

‘There is somebody who has sharp practices and that they do not do what we think is the right way of investing. We do not want to deal with them. Do you really want to take that money? the money is important from the person is coming from. It is very important. More important than the entrepreneur sometimes’(Government Venture Capital 1)

### *Association*

Association ties help to increase the entrepreneur’s legitimacy in the eyes of investors, especially if the contact inside the entity is a prominent figure. For instance, the possibility to use the national association budget could help entrepreneurs to attract customers and to better endorse the product. Consequently, the lack or a weak tie with this connection could either signal a not well entrepreneur’s understanding of the marketplace or that the association does not think that the product is very useful.

The importance of this tie tends to increase per the sector. For instance, in the green energy sector the investor will check the presence of a national trade association in the entrepreneur’s network. In the case of absence, the investor will doubt about the entrepreneur and they will ask for explanations, looking for some sorts of reassurance. Another investor remarks the importance of this connection in the medical sector because this sector is very structured in U.K and without this kind of tie is very difficult to sell products.

‘If they do not have this relationship and they do not have an understanding of the market-place which come through their association [...] and if the entrepreneur does not know about that and does not understand that then that will be a very negative aspect’ (Investor 7)

### *Government agencies*

Investors reckoned the importance of the government agencies in helping the entrepreneur through the program of readiness or giving grants or another type of funds to them. Entrepreneurs able to achieve these funds increase their legitimacy in the eyes of the investors and consequently they are judged positively. If the entrepreneur obtains one of these funds, it means that he or she overcame a high-quality process of selection. Although the entrepreneur has never asked for funds to these government agencies, it is very important that he/she has a good relationship with them. Otherwise, this will represent a deal killer. Investors want entrepreneurs as they are raising their funding, to have access to as many options as possible, and getting grant support, contribution awards or overseas marketing.

‘If they do not have a good relationship with XXXX we will not invest [...]. They might not have spoken to the investment part of XXXX, but they might have a good relationship and getting 5 thousand of grants per year or something like that. If they have not, they might have some reasons for not doing it, but I want to understand’ (Investor 8)

However, for some private investors, investing alongside with these agencies is not always positive because of bureaucracy. Although government agency can be highly supportive and helpful, in providing occasions for networking and training opportunities to the companies, this comes at the price and at the difficulties in dealing with the public-sector institutions. Investors complain to have seen many times entrepreneurs get frustrated with that institutional process and bureaucracy. Furthermore, investors criticize that these agencies think more to protect their reputation than providing support to the companies. This is possible to observe especially when the government agencies refuse to give further money to start-ups that cannot meet the pre-defined milestones and hence help them in a needed moment.

‘The difficulty is that you have a public-sector institution trying to work in the private sector and trying to apply private sectors milestones and principles while at the same time it is having an eye in protecting the public pursue and do not make mistakes and do not make mistakes’ (Investor 9)

## Discussion and conclusion

This study has sought to expand the literature on business angels’ investment decision making process (Muzyka, Birley, and Leleux 1996; Paul et al. 2007). Indeed, while this literature has focused on criteria like the entrepreneur’s profile, market attractiveness and product to explain investors’ decision (Bruno and Tyebjee, 1984; Muzyka et al., 1996), it is clear from the analysis that during the pre-investment phase business angels consider also the entrepreneur’s network to judge the business opportunity. Therefore, even though Miloud et al. (2012) and Baum and Silverman (2004) found a positive correlation between the willingness to invest and the presence of a high number of entrepreneur’s alliances, we argue that business angels are more focused on the quality of the entrepreneur’s connections than on the size of the network. Furtherly, the relevance of this aspect tends to increase when a certain configuration of an entrepreneur’s network can lead to deal killers. In evaluating the entrepreneur’s network, in some cases, business angels critically assess the type of resources that are exchanged, such as in the case of suppliers and university, whereas, in other cases, they focus more on the quality of resource provider, as the case of connections with consultants and incubators. In the first case, the principle of the cost and benefit balance dominates the formation of the investor’s judgement whereas in the second case, it is the connection’s reputation that plays a key role.

Several implications can be derived from this analysis. First, this paper provides a major understanding of the importance of soft factors in shaping investment decision. Entrepreneur’s network analysis can be considered as a useful tool to achieve strategic information, which reduces the information asymmetry, speed-up the trust building process, and lowers the risk of the valuation. In fact, by conducting entrepreneur’s network analysis, investors are aware of the costs associated with the entrepreneur’s social capital and the resources that should be mobilized to compensate entrepreneur’s lack of management and leading ability, such as the ability to involve the right people in the company and to extract from the network the positive aspects and to deal with negative influence. Second, there is a need for a further exploration of the negative side of networks. In this regard, literature has been always more focused on explaining the positive aspect of networks whereas less is

devoted to explain the negative side of social capital to acquire resources (Tan, Zhang, and Wang 2015). In this paper, it emerges also the dark side of the entrepreneur's network because how the entrepreneur builds his network in terms of resources exchanged, the involved people and the mechanism of governance can undermine his or her likelihood to get external support from investors. Finally, all of this discussion has a practical relevance because our study increases an investor's understanding of their investment decision-making process and also informs start-ups about investors' preferences regarding the entrepreneur's network. We acknowledge that our work is deeply related to the specific location of Scotland and that results might change in another ecosystem. Future work might try to applicate the same analysis to another context to see if some generalizations could be found and to build a framework of evaluation.

## References

- Adams, Mackenzie, Maged Makramalla, and Walter Miron. 2014. "Down the Rabbit Hole: How Structural Holes in Entrepreneurs' Social Networks Impact Early Venture Growth." *Technology Innovation Management Review* 9(9): 19–28.
- Aernoudt, Rudy. 2004. "Incubators: Tool for Entrepreneurship?" *Small Business Economics* 23(2): 127–35.
- Al-mubarak, Hanadi, and Holger Schrödl. 2011. "Measuring the Effectiveness of Business Incubators: A Four Dimensions Approach From a Gulf Cooperation Council Perspective." *Journal of Enterprising Culture* 19(4): 435–52.
- Aldrich, Howard, and Marlene Fiol. 1994. "Fools Rush In? The Institutional Context of Industrial Creation." *Academy of Management Review* 19(4): 645–70.
- Alperovych, Yan, Georges Hubner, and Fabrice Lobet. 2015. "How Does Governmental versus Private Venture Capital Backing Affect a Firm's Efficiency? Evidence from Belgium." *Journal of Business Venturing* 30(4): 508–25.
- Arregle, Jean Luc et al. 2015. "Family Ties in Entrepreneurs' Social Networks and New Venture Growth." *Entrepreneurship: Theory and Practice* 39(2): 313–44.
- Baum, Joel A. C., Tony Calabrese, and Brian S. Silverman. 2000. "Don't Go It Alone: Alliance Network Composition and Startups' Performance in Canadian Biotechnology." *Strategic Management Journal* 21(3): 267–94.
- Baum, Joel A. C., and Christine Oliver. 1991. "Institutional Linkages and Organizational Mortality." *Source: Administrative Science Quarterly* 36(2): 187–218.
- Baum, Joel A C, and Brian S. Silverman. 2004. "Picking Winners or Building Them? Alliance, Intellectual, and Human Capital as Selection Criteria in Venture Financing and Performance of Biotechnology Startups." *Journal of Business Venturing* 19(3): 411–36.
- Bennett, Robert J., and Paul J.A. Robson. 1999. "The Use of External Business Advice by SMEs in Britain." *Entrepreneurship & Regional Development* 11(July): 155–80.
- Birley, Sue. 1985. "The Role of Networking in the Entrepreneurial Process." *Journal of Business Venturing* 1(1): 107–17.
- Brander, James A., Qianqian Du, and Thomas Hellmann. 2015. "The Effects of Government-Sponsored

- Venture Capital: International Evidence." *Review of Finance* 19(2): 571–618.
- Brüderl, Josef, and Peter Preisendörfer. 1998. "Network Support and the Success of Newly Founded Business." *Small Business Economics* 10(3): 213–25.
- Bruno, Albert V., and Tyzoon T. Tyebjee. 1984. "A Model of Venture Capitalist Investment Activity." *Management Science* 30(9): 1051–66.
- Burt, Ronald S. 2001. "Structural Holes versus Network Structure as Social Capital." *Social Capital: Theory and Research*: 31–56.
- Buss, Dale. 2016. "Incubators Help Startups to Grow and Succeed." *Area Development Site and Facility Planning* 51.1(13): 2016.
- Colombo, Massimo G, and Marco Delmastro. 2002. "How Effective Are Technology Incubators ? Evidence from Italy." *Research Policy* 31: 1103–22.
- Davidsson, Per, and Benson Honig. 2003. "The Role of Social and Human Capital among Nascent Entrepreneurs." *Journal of Business Venturing* 18(3): 301–31.
- Deffains-Crapsky, Catherine, and Peter G Klein. 2016. "Business Angels, Social Networks, and Radical Innovation." In *Contemporary Entrepreneurship: Multidisciplinary Perspectives on Innovation and Growth*, eds. Dieter Bögenhold, Jean Bonnet, Marcus Dejardin, and Domingo de Lema. Cham: Springer International Publishing, 275–90.
- Dubini, Paola, and Howard Aldrich. 1991. "Personal and Extended Networks Are Central to the Entrepreneurial Process." *Journal of Business Venturing* 6(5): 305–13.
- Ensley, Michael D, and Keith M Hmieleski. 2005. "A Comparative Study of New Venture Top Management Team Composition, Dynamics and Performance between University-Based and Independent Start-Ups." *Research Policy* 34(7): 1091–1105.
- Fiet, James O. 1995. "Risk Avoidance Strategies in Venture Capital Markets." *Journal of Management Studies* 32(4): 551–74.
- Franke, Nikolaus, Mark Gruber, Harhoff Dietmar, and Joachim Henkel. 2008. "Venture Capitalists' Evaluations of Start-Up Teams: Trade-Offs, Knock-Out Criteria, and the Impact of VC Experience." *Entrepreneurship: Theory and Practice*: 459–83.
- Freear, John, Jeffrey E. Sohl, and William E. Wetzel Jr. 1995. "Who Bankrolls Software Entrepreneurs?" In *Frontiers of Entrepreneurship Research*, eds. W. D. Bygrave et al. Babson College, 394–406.
- Fried, Vance H., and Robert D. Hisrich. 1994. "Toward a Model of Venture Capital Investment Decision Making." *Financial management* 23(3): 28–37.
- Granovetter, Mark. 1973. "The Strength of Weak Ties." *The American Journal of Sociology* 78(6): 1360–80.
- Harrison, R.T.; Mason, C.M.; Girling, P. 2004. "Financial Bootstrapping and Venture Development in the Software Industry." *Entrepreneurship and Regional Development*.
- Harrison, Richard T., and Claire Leitch. 2010. "Voodoo Institution or Entrepreneurial University? Spin-off Companies, the Entrepreneurial System and Regional Development in the UK." *Regional Studies* 44(9): 1241–62.
- Harrison, Richard T., Colin Mason, and Donald Smith. 2015. "Heuristics, Learning and the Business Angel Investment Decision-Making Process." *Entrepreneurship & Regional Development* 27(9–10): 527–54.
- Harrison, Richard T, Mark R Dibben, and Cohn M Mason. 1997. "The Role of Trust in the Informal Investor's Investment Decision: An Exploratory Analysis." *Entrepreneurship Theory and Practice* 21(4): 63–81.

- Harrison, Richard T, and Colin M Mason. 2000. "Editorial: The Role of the Public Sector in the Development of a Regional Venture Capital Industry." *Venture Capital* 2(4): 243–53.
- Harrison, Richard T, Colin M Mason, and Paul Girling. 2004. "Financial Bootstrapping and Venture Development in the Software Industry." *Entrepreneurship & Regional Development* 16(4): 307–33.
- Harrison, T Richard, Colin M Mason, and Paul Robson. 2010. "Determinants of Long-Distance Investing by Business Angels in the UK." *Entrepreneurship and Regional Development* 22(2): 113–37.
- Heuven, Joris, and Aard Groen. 2012. "The Role of Social Networks in Financing Technology-Based Ventures: An Empirical Exploration." *Venture Capital* 14(2–3): 131–49.
- Hoang, Ha, and Bostjan Antoncic. 2003. "Network-Based Research in Entrepreneurship A Critical Review." *Journal of Business Venturing* 18(2): 165–87.
- Hormiga, Esther, Rosa M. Batista-Canino, and Agustín Sánchez-Medina. 2011. "The Impact of Relational Capital on the Success of New Business Start-Ups." *Journal of Small Business Management* 49(4): 617–38.
- Hsieh, H.-F., and Sarah E. Shannon. 2005. "Three Approaches to Qualitative Content Analysis." *Qualitative Health Research* 15(9): 1277–88.
- Huggins, Robert. 2000. "The Success and Failure of Policy-Implanted Inter-Firm Network Initiatives: Motivations, Processes and Structure." *Entrepreneurship and Regional Development* 12(2): 111–35.
- Jack, S.L, and A.R Anderson. 2002. "The Effects of Embeddedness on the Entrepreneurial Process." *Journal of Business Venturing* 17: 467–87.
- Jones, Oswald, and Dilani Jayawarna. 2010. "Resourcing New Businesses : Social Networks , Bootstrapping and Firm Performance." *Venture Capital An International Journal of Entrepreneurial Finance* 1066.
- Kenney, Martin, and Donald Patton. 2005. "Entrepreneurial Geographies: Support Networks in Three High-Technology Industries." *Economic Geography* 81(2): 201–28.
- Kirby, David A, and Simon H King. 1997. "Accountants and Small Firm Development: Filling the Expectation Gap." *The Service Industries Journal* 17(2): 294–304.
- Landstrom, Hans. 1992. "The Relationship between Private Investors and Small Firms: An Agency Theory Approach." *Entrepreneurship & Regional Development* 4: 199–223.
- Lehtonen, Oskari, and Tom Lahti. 2009. "The Role of Advisors in the Venture Capital Investment Process." *Venture Capital An International Journal of Entrepreneurial Finance* 11(3): 229–54.
- MacMillan, I A N C, Robin Siegel, and P N Subba Narasimha. 1985. "Criteria Used by Venture Capitalists to Evaluate New Venture Proposals." *Journal of Business Venturing* 1: 119–28.
- Mason, Colin. 2006. "Informal Sources of Venture Finance." In *The Life Cycle of Entrepreneurial Ventures*, ed. S.C. Parker. New York, 259–99.
- Mason, Colin, Tiago Botelho, and Richard Harrison. 2013. "The Transformation of the Business Angel Market: Evidence from Scotland." *Working Paper, Adam Smith Business School, University of Glasgow and University of Edinburgh Business School*.
- Mason, Colin, and Richard T Harrison. 1995. "Closing the Regional Equity Capital Gap: The Role of Informal Venture Capital." *Small Business Economics* 7(2): 153–72.
- Mason, Colin M, and Richard Harrison. 1996. "Why 'Business Angels' Say No: A Case Study of Opportunities Rejected by an Informal Investor Syndicate." *International Small Business Journal* 14(2): 35–51.
- Mason, Colin M, and Richard T Harrison. 2002. "Barriers to Investment in the Informal Venture Capital

Sector." *Entrepreneurship & Regional Development* (14): 271–87.

- Mason, Colin, and Matthew Stark. 2004. "What Do Investors Look for in a Business Plan?: A Comparison of the Investment Criteria of Bankers, Venture Capitalists and Business Angels." *International Small Business Journal* 22(3): 227–48.
- Maxwell, Andrew L., Scott A. Jeffrey, and Moren Lévesque. 2011. "Business Angel Early Stage Decision Making." *Journal of Business Venturing* 26(2): 212–25.
- Mian, Sarfraz A. 1996. "Assessing Value-Added Contributions of University Technology Business Incubators to Tenant Firms." *Research Policy* 25: 325–35.
- Miloud, Tarek, Arild Aspelund, and Mathieu Cabrol. 2012. "Startup Valuation by Venture Capitalists: An Empirical Study." *Venture Capital* 14(2–3): 151–74.
- Munari, Federico, and Laura Toschi. 2015. "Assessing the Impact of Public Venture Capital Programmes in the United Kingdom: Do Regional Characteristics Matter?" *Journal of Business Venturing* 30(2): 205–26.
- Muzyka, D, S Birley, and B Leleux. 1996. "Trade-Offs in the Investment Decisions of European Venture Capitalists." *Journal of Business Venturing* 11(4): 273–87.
- Nunes, José Carlos, Elisabete Gomes Santana Félix, and Cesaltina Pacheco Pires. 2014. "Which Criteria Matter Most in the Evaluation of the Venture Capital Investments?" *Journal of Small Business and Enterprise Development* 21(3): 505–27.
- Paul, Stuart et al. 2007. "Towards a Model of the Business Angel Investment Process Towards a Model of the Business Angel Investment Process." *Venture Capital An International Journal of Entrepreneurial Finance* 1066.
- Pirollo, L, and M Presutti. 2010. "The Impact of Social Capital on the Start-Ups' Performance Growth." *Journal of Small Business Management* 48(2): 197–227.
- Powers, Joshua B., and Patricia P. McDougall. 2005. "University Start-up Formation and Technology Licensing with Firms That Go Public: A Resource-Based View of Academic Entrepreneurship." *Journal of Business Venturing* 20(3): 291–311.
- Putnam, Robert D. 2001. "Kennedy School of Government, Harvard University. 1." : 1–15.
- Renzulli, Linda a., Howard Aldrich, and James Moody. 2000. "Family Matters: Gender, Networks, and Entrepreneurial Outcomes." *Social Forces* 79(2): 523–46.
- Robson, Paul, and Robert Bennett. 2001. "SME Growth : The Relationship with Business Advice and External Collaboration." *Small Business Economics* 15: 193–208.
- Semrau, Thorsten. 2014. "How Exactly Do Network Relationships Pay Off? The Effects of Network Size and Relationship Quality on Access to Start-Up Resources." *Entrepreneurship Theory and Practice*: 501–25.
- Shane, Scott, Daniel Cable, Scott Shane, and Daniel Cable. 2002. "Network Ties , Reputation , and the Financing of New Ventures." *Management Science* 48(3): 364–81.
- Shepherd, DA, and Andrew Zacharakis. 1999. "Conjoint Analysis: A New Methodological Approach for Researching the Decision Policies of Venture Capitalists." *Venture Capital: An International Journal of Entrepreneurial Finance* 1(3): 197–217.
- Shepherd, Dean a. 1999. "Venture Capitalists' Introspection: A Comparison of 'In Use' and 'Espoused' Decision Policies." *Journal of Small Business Management* 27: 76–87.
- Silva, Jorge. 2004. "Venture Capitalists' Decision-Making in Small Equity Markets: A Case Study Using Participant Observation." *Venture Capital An International Journal of Entrepreneurial Finance* 6(2–3):



125–45.

- Smith, Helen Lawton. 2007. "Universities, Innovation, and Territorial Development: A Review of the Evidence." *Environment and Planning C: Government and Policy* 25(1): 98–114.
- Söderblom, Anna, Mikael Samuelsson, and Pär Mårtensson. 2016. "Opening the Black Box : Triggers for Shifts in Business Angels ' Risk Mitigation Strategies within Investments." *Venture Capital* 1066: 1–26.
- Sørheim, Roger. 2003. "The Pre-Investment Behaviour of Business Angels : A Social Capital Approach." *Venture Capital* 5(4): 337–64.
- Stam, Wouter, Souren Arzlanian, and Tom Elfring. 2014. "Social Capital of Entrepreneurs and Small Firm Performance: A Meta-Analysis of Contextual and Methodological Moderators." *Journal of Business Venturing* 29(1): 152–73.
- Steier, Lloyd, and Royston Greenwood. 2000. "Entrepreneurship and the Evolution of Angel Financial Networks.pdf." *Organization studies* 21(1): 163–92.
- Stinchcombe, Arthur L. 1965. "Social Structure and Organizations." In *Handbook of Organization*, ed. Rand McNally. Chicago, 260–90.
- Strauss, A, and J Corbin. 1990. *Basics of Qualitative Research : Grounded Theory Procedures and Techniques*.
- Stuart, Toby E, and Ralph C Hybels. 2016. "Interorganizational Endorsements and the Performance of Entrepreneurial Ventures." *Administrative Science Quarterly* 44(2): 315–49.
- Suchman, Mark. 2000. "Dealmakers and Counselors: Law Firms as Intermediaries in the Development of Silicon Valley." *Understanding Silicon Valley* (October): 27–97.
- Tan, Justin, Hongjuan Zhang, and Liang Wang. 2015. "Network Closure or Structural Hole? The Conditioning Effects of Network-Level Social Capital on Innovation Performance." *Entrepreneurship: Theory and Practice* 39(5): 1189–1212.
- Uzzi, Brian. 1996. "The Sources and Consequences of Embeddedness for the Economic Performance of Organizations : The Network Effect." *American Sociological Association* 61(4): 674–98.
- Witt, Peter. 2004. "Entrepreneurs' Networks and the Success of Start-Ups." *Entrepreneurship & Regional Development* 16(5): 391–412.
- Wright, Mike, Andy Lockett, Bart Clarysse, and Martin Binks. 2006. "University Spin-out Companies and Venture Capital." *Research Policy* 35: 481–501.
- Yin, Robert. 1984. *Case Study Research: Design and Methods*. Beverly Hills: Sage.

## Appendix

**Table 1 Network as a source of resources**

Type of Tie	Positive Influence	Negative Influence
Family and friends	Financial resources (Brüderl and Preisendörfer, 1998; Arregle et al., 2015)	Negative Tension (Arregle et al., 2015)
	Information/Experience (Davidsson and Honig, 2003)	Redundant Information (Renzulli et al., 2000)
	Emotional Support (Davidsson and Honig, 2003; Brüderl and Preisendörfer, 1998)	
Supplier	Unpaid Work (Brüderl and Preisendörfer, 1998)	
	Technological expertise (Baum and Silverman, 2004)	Signal of lowering patenting activity (Baum and Silverman, 2004)
	Strategic information (Bennet and Robson, 1999)	
University	Financial resources (Harrison et al., 2004; Freear et al., 1995)	Coercive market power relationship (Bennet and Robson, 1999)
	Endorsement (Uzzi, 1996)	
	Technological expertise (Baum et al., 2000)	Dealing with TTO office (Powers and McDougall, 2005)
Association	Endorsement (Baum et al., 2000)	Commercial activity (Baum and Silverman, 2004)
	Financial resources (Harrison and Leitch, 2010)	
Incubators	External endorsement (Baum and Oliver, 1991)	Attending specific rules (Baum and Oliver, 1991)
	Customers (Baum and Oliver, 1991)	
Customers	Technological support (Al-mubarak and Schrödl, 2011; Davidsson and Honig, 2003)	Fee (Buss, 2016)
	Networking (Al-mubarak and Schrödl, 2011; Davidsson and Honig, 2003)	
	Information (Al-mubarak and Schrödl, 2011; Davidsson and Honig, 2003)	
Other investors	Endorsement	Isolation (Pirolo and Presutti, 2010)
	Financial Bootstrapping (Harrison et al., 2004)	
Government agencies	Advice for product development (Pirolo and Presutti, 2010)	
	Technological expertise (Mason and Harrison, 1995)	Control (Bruno, 1984)
Horizontal alliances	Mentoring (Alperovych et al., 2015)	
	Business assistance (Davidsson and Honig, 2003)	No increase pace in gestation activity (Davidsson and Honig, 2003)
	Financial Resources (Bennet and Robson, 1999)	
Professional advisors	Endorsement (Baum and Oliver, 1991)	
	Strategic information about market penetration (Freear et al., 1995)	Learning races (Baum and Silverman, 2004)
	Endorsement (Uzzi, 1996)	
	Business and legal advice (Suchman, 2000)	Fee (Lehtonen and Lahti 2009)

Deal makers (Suchman, 2000)

Support with investment procedures and business plan elaboration (Lehtonen and Lahti 2009)

Accountants lack training and marketing of services provided (Kirby and King, 1997)

Source: compiled by authors

Table 2 Investors' characteristics.

<b>Investor</b>	<b>Background</b>	<b>Investment range</b>	<b>Sector-preference</b>	<b>Starting Year</b>
<b>Investor 1</b>	Entrepreneur	-	non sector specific	1992
<b>Investor 2</b>	consultancy and financial service	£75,000- £250,000	all sector except financial services and property	1993
<b>Investor 3</b>	consultancy and financial service	£50,000- £2,000,000	technology and life science sector	1991
<b>Investor 4</b>	Entrepreneur	£250,000- £4,000,000	high-tech	1997
<b>Investor 5</b>	Entrepreneur	£20,000- £500,000	all sector except retail and property	2010
<b>Investor 6</b>	consultancy and financial service	-	non sector specific	2007
<b>Investor 7</b>	consultancy and financial service	£250,000- £500,000	energy and water	2013
<b>Investor 8</b>	consultancy and financial service	£75,000- £500,000	technology, renewables and green	2006
<b>Investor 9</b>	consultancy and financial service	£10,000- £500,000	non sector specific	2006
<b>Investor 10</b>	Entrepreneur	£50,000- £250,000	non sector specific	2013



## **CHAPTER 3: A social network analysis of the early stage risk capital market: the case of Scotland**

### **Astract**

Private and public investors tend to co-invest, although they are motivated by different reasons. However, there is little research about how investors choose their co-investor partners and thus on how a co-investment network emerges in one region. By using social network analysis tools and the Exponential Random Graph Models, we analysed the early-stage investment network in one region – Scotland – with a well-developed risk capital market in terms of individual angel investors, angel groups and public-sector investors. After controlling for endogenous effects and node attribute variables, results confirm that geographical, cognitive, institutional and organisational proximities affect investment network structure formation.

**Keywords:** Social network analysis, Syndication, Exponential random graph models, Venture capital

### **Introduction**

When investors are presented with a business opportunity, they can decide to invest as individual investors or as a member of a syndicate. In general, most of the deals are characterized by syndication: for example, on average, a start-up receives funds from at least 2 investors in the USA (Nanda & Rhodes-Kropf, 2017). Syndication can be described as a common decision made under uncertainty, whose future payoff will be shared among the decision makers (Wilson, 1968). It occurs in two circumstances: when more than one investor decides to invest in the same financial round in the company and/or when two or more investors invest in the same company although in different financial rounds (Brander, Amit, & Antweiler, 2002). Given its importance, the investment literature has paid attention to study this aspect to explain the motives and the effects of syndication and how investors choose their partners. In the prior literature, two main reasons for syndication are proposed and tested: the selection and the value-added hypotheses. The former affirms that investors decide to co-invest because this can improve the selection process (Lerner, 1994) whereas the latter explains the advantages related to the second stage of the investment (Brander et al., 2002). Both reasons to syndicate implicitly require that investors should trust the other's judgement and their ability to add value to the company.

Therefore, the choice of the co-investors, although less investigated by the literature, is important. Overall,

two main, nevertheless opposing, theoretical perspectives might justify tie-formation. On one side, the main driver of tie formation is complementarity, people might choose distant and different partners from them to get non-redundant information (Granovetter, 1973). On the other side, several papers proposed that homophily is the main driver for choosing an investor partner to reduce communication and interaction costs (Gompers, Mukharlyamov, & Xuan, 2016). To test the homophily theory several papers were built on Boschma's proximities (Broekel & Boschma, 2012; Lazzeretti & Capone, 2016; Molina-Morales, García-Villaverde, & Parra-requena, 2014), namely geographical, cognitive, institutional, organisational and social proximity.

The aim of this paper is to investigate the role of four proximities, geographical, cognitive, institutional and organisational, in explaining tie formation among investors in the early stage equity market of a region, Scotland. More specifically, this study focuses on the analysis of the investment networks formed over a long period of time (2007- September 2017) by 72 Scottish investors with 197 relationships. We used social network analysis methodology and Exponential Random Graph Models to investigate the network structure (Robins, Lewis, & Wang, 2012).

This work contributes to the literature about syndication and network dynamics by providing evidence about how investors choose strategically their partners to eventually form investment networks. Studying networks is fundamental to better understand the improvement of an entrepreneurial ecosystem (Spigel & Harrison, 2018). Indeed, through these ties, investors can learn and acquire experience (Du, 2016) and help new investors to acquire important skills for helping new ventures to grow. Furthermore, by better understanding how these ties originate, public institutions can better incentivise best practice. This is true, especially in the case of Scotland, where public institutions have contributed to reduce the equity gap among start-ups and investors by encouraging the birth of the business angel trade association LINC Scotland and the growth of syndicates (Owen & Mason, 2017). In particular, the Scottish government, through the Scottish co-investment fund, has invested as a passive investor alongside private investors over the last 20 years (Harrison, 2018).

Our results show that geographical, cognitive and institutional proximity contribute to the structuring of the investment network whereas organisational proximity has a significant effect in explaining the investment network formed by business angel groups, venture capitalists and individual angels. Unlike the previous works (Gompers et al., 2016) in this paper, the co-investment has been mainly analysed by considering all types of investors operating in the early stage capital market. Therefore, as far as we know, we are the first to focus on

describing and explaining how the whole investment network ecosystem arises.

The article is structured as follows. In the next section, we present a brief description of the literature about syndication and about the different types of proximity. According to this literature, we formulated four hypotheses. Then, we present the data used to test these hypotheses and the methodology. Finally, we show and discuss the results of the analysis.

### Literature review

Previous literature has focused on the reasons behind syndication, its positive effects on syndicates' performance and how investors choose their partners (Brander et al., 2002; Lerner, 1994). Equity investors might be incentivized to co-invest for several reasons. The first reason is related to what is called the selection hypothesis: the investment decision derived from the analysis of two different investors has a higher quality than the one of standalone investments (Lerner, 1994). Indeed, when two investors are involved, the amount of information on the investment increases improving the quality of the due diligence process (Casamatta & Haritchabalet, 2007). Secondly, syndication adds value to the investment (Brander et al., 2002). Investors join their forces to increase start-ups' chance to succeed (Werth & Boert, 2013), providing new ventures with important resources, like consultancy and financial resources. Thirdly, by sharing the investment, they have an opportunity to diversify the risk (Brander et al., 2002). Finally, by co-investing two investors might have the opportunity to establish a trust based relationship that can be a source of favour reciprocation in the future (Coleman, 1988), i.e signalling future promising investment opportunities.

Overall, the literature showed higher returns for syndicated investments as compared to standalone investments (Brander et al., 2002). In particular, venture capitalists who have a better influential network position record a better performance of portfolio companies (Hochberg, Ljungqvist, & Lu, 2007). However, the negative effects of syndication can be observed if the wrong partner is chosen. Indeed, problems related to moral hazard, different strategies, different fund size and horizon can arise among investors, leading to damage the new venture as well as the entrepreneurs (Nanda & Rhodes-Kropf, 2017). Moral hazard among the investors might arise after the investment, leading to an important cost especially for inexperienced investors (Casamatta & Haritchabalet, 2007). Moreover, by signalling an investment opportunity to the wrong partner, an investor can risk to lose it. Consequently, who is the investor's partner sometimes is more important than who is the entrepreneur because once the start-up is funded, it could be expensive to break the bond with the co-investors.



Thus, how do investors choose their partners for syndication? Understanding the main drivers of this process is fundamental to better understand this phenomenon. The empirical evidence about investor's tie formation is mixed and different results are found. For venture capitalist firms, motives behind the choice of investment partnership are the net gain derived by trading resources, such as experience and capital available among investors (Hochberg, Lindsey, & Westerfield, 2015). On the other hand, Gompers et al. (2016) showed that VCS tend to syndicate with investors with the same gender and ethnicity although the collaboration derived by this affinity has a negative impact on venture success. Also, Du (2016) provided evidence in favour of the homophily theory: venture capitalists prefer to invest with similar partners in terms of experience and performance. Nanda & Rhodes-Kropf (2017) suggested homophily in terms of incentives and structure as a mechanism to reduce frictions in syndication. Moreover, Chung, Singh & Lee (2000) found that for investment banks, similarity plays an important role, by reducing agency costs.

The homophily theory finds evidence in the psychological and sociological literature. Especially in an uncertain context, decision-makers prefer to deal with familiar people. This explains also why investors tend to judge some entrepreneurs in a more positive way than others because of similarity in their attributes (Franke, Gruber, Dietmar, & Henkel, 2008). However, homophily can lead to negative output, such as lower investment performance. This is referred to the 'cost of friendship' and occurs because homophily discourages critical thinking which is imperative to improve the decision-making process (Gompers et al., 2016). Moreover, heterogeneity among partners represents a cost, but also a learning opportunity that allows syndicated partners to get benefits in the long run (Du, 2016).

Therefore, when we are analysing syndication for one type of investors, homophily seems to explain tie-formation. Does homophily explain also tie formation at the level of the national syndication network? Indeed, syndication might occur even among different types of investors. In this paper, we test this main hypothesis by considering the whole network of the equity market in Scotland. We try to explain the existence and continuation of this network through the homophily theory and other elements at the node, dyad, and structural network level.

### **Hypotheses development**

Network literature has remarked the importance of trust in tie formation and of homophily in generating it (Brass, 1995). Boschma (2005) proposed that geographical, social, organizational, cognitive and institutional

proximity play a role in network formation. These proximities might increase the awareness of other investors and facilitate communication among them. Several authors offered a definition of the different categories of proximities and on how to operationalise them into variables (Balland, 2011; Lazzeretti & Capone, 2016; Xavier Molina-Morales, Belso-Martínez, Más-Verdú, & Martínez-Cháfer, 2015). The basic idea is that the more two actors share some aspects, the more likely it is that they become partners because homophily reduces the agency costs related to the trust building process, when there is lack of information about the partner.

*Geographical proximity* could be measured as the spatial distance between two actors or it can be related to the different location of them (Knoben & Oerlemans, 2006). Tie formation among two actors co-located in the same city is encouraged by the frequent face-to face interactions. Face to face meetings helps actors to know better each other and to develop trust (Lazzeretti & Capone, 2016). Considering also the required attention to the funded new venture development, investors could prefer to co-invest with investors who are co-located in the same city.

Hypothesis 1: Investors are more likely to co-invest when their headquarters are co-located in the same city

*Cognitive proximity*: Some authors defined cognitive proximity as a relational attribute whereas others related this concept to a belonging to a community of practice (Knoben & Oerlemans, 2006). According to the first view, cognitive proximity can be interpreted as a shared knowledge or skills (Nooteboom, 1999). Organisations find easier to communicate with other organisations that have similar knowledge and expertise (Boschma, 2005; Molina-Morales et al., 2014). This is because routines, cultures, values and norms influence the way actors see and evaluate the world, therefore by sharing these elements coordination among actors is easier (Wuyts, Colombo, Dutta, & Nooteboom, 2005). In this paper, we interpret this concept in a broader way. According to the structure, investors can perceive differently the investment, they have different goals and a different approach to the investment. Indeed, differences are observed among these investors in terms of approach to the investment, ways to fund, main target and ex post investment monitoring (Alperovych, Hubner, & Lobet, 2015; Bruton, Filatotchev, Chahine, & Mike, 2010; Mason, Botelho, & Harrison, 2013; Munari, Sobrero, & Toschi, 2016; Tykvová, 2017). In turn, these differences might lead investors to enter into partnerships with investors belong to the same typology.

Hypothesis 2: Investors are more likely to co-invest when they have the same structural form.

*Institutional proximity* has different definitions. At a more general level, it is related to similarities in terms of formal and informal rules (Lazzeretti & Capone, 2016). More specifically, it attains the sharing of the same institutional form (Balland, 2011). Two actors have the same institutional form when they share the same mechanism of incentives and routines (Ponds, van Oort, & Frenken, 2007) while there is institutional distance otherwise. It is the case of public and private organisations. Indeed, public organisations are mainly called to incentivize the birth of start-ups and to push the regional development (Harrison & Mason, 2000). They pursue a general goal. Private organisations, on the other hand, mainly pursue profit. Hence, we propose the following hypothesis:

Hypothesis 3: Investors are more likely to co-invest when they have the same institutional form.

For some investors, especially the ones that are less structured, such as individual business angels, business angels group and venture capitalists, could be important to have had past business experience with partners before investing with them. Therefore, we test for organisational proximity. *Organization proximity* was defined differently by authors. Torre & Gilly (2000) suggested two logics at the base of this proximity: the similarity logic and the adherence logic. The former refers to the sharing of the same knowledge and reference space, whereas the latter to the sharing of same space of relations. This paper proposes a definition based on the second logic. This logic is broader and it attains to a structural view (Knoben & Oerlemans, 2006). By being a member of the same organisation, actors increase the opportunity to interact and they know better the possible partners, developing also the same knowledge. Therefore, it makes easier the cooperation among members (Torre & Rallet, 2005), increasing the relative cost of forming investment partners relation with actors outside the organisation. By having a previous working relationship in the same business organisation, investors increase the chance to meet each other and to share the same investment point of view and therefore, to reduce uncertainty about their behaviour. It is then expected that these investors are more likely to invest together.

Hypothesis 4: Investors are more likely to co-invest when they had a previous working experience in the same company.

## The study setting

### The Scottish investment sector.

This study investigates the specific case of the equity market in Scotland where different types of investors operate, such as angel groups, individual angels and institutional investors. Some main characteristics of the regional equity market suggest Scotland as a relevant case study. Firstly, the Scottish business angels' marketplace is among the most developed in Europe. It has experienced the fastest growth in the number of formal identifiable angel groups outside the USA (Mason et al., 2013) and the longest established business angel investment groups in Europe are based here (Archangel 1992, Braveheart Investment group 1997). Until today, more than 20 business angel groups are operating in Scotland (Gregson, Mann, & Harrison, 2013). Secondly, over the past years, the government has carried out and supported several initiatives with the aim to increase the contribution of early stage risk capital market to regional development, such as a favourable fiscal policy for investors and the use of co-investment funds (Harrison, 2018). Moreover, Scottish Universities, acknowledged worldwide for the research excellence, have an active role in the early stage equity market funding new companies (Young Company Finance, 2016) and also creating a higher number of spinouts in compared to the other regions of UK (Young Company Finance, 2012). All these factors and the positive private initiatives are contributing to establish an entrepreneurial ecosystem where already two worldwide known startups (Skyscanner and Fanduel) were born here, appreciated at over 1 billion USD (Spigel, 2017).

### Data collection

This study analyses the Scottish early stage market investment network formed by Scottish investors, operating both as organizations and individuals. This network derives from the analysis of 1261 investments, conducted over the period of 2006 - September 2017. These investments include first rounds and follow-on funding in Scottish companies. From these investments, we considered only Scottish investors, who represent almost all the sample. Unfortunately, the identification of the name of individual business angels was impossible for

some of these investments. We test our hypotheses on two networks: the second is a subnetwork of the first one. The first network is formed by 72 identified nodes and 197 links (FIG.1).

-----  
Insert Figure 1 about here.  
-----

This includes all the type of investors, namely individual investors, business angel groups, venture capital firms, investment banks, government office and universities, who were involved in syndication. Information about these investments and about the classification of different investors was gathered by Young Company Finance Scotland dataset. Its reports were already used in literature to explain the evolution of Scottish equity (Mason et al., 2013). Additionally, we collected further information about business angels from the Crunchbase dataset ([www.Crunchbase.com](http://www.Crunchbase.com)). This dataset was used for similar studies (Cumming, Walz, & Werth, 2016; Ter Wal, Alexy, Block, & Sandner, 2016). Once the nodes were identified, we gathered further information about each entity through their associated websites (Cumming et al., 2016).

The second network considers 60 out of 72 nodes of the first network for a total of 103 edges (FIG.2).

-----  
Insert Figure 2 about here.  
-----

This is a sub-network of the first one formed by only considering venture capitalists, business angel groups and individual angels. This allows us to test the fourth hypothesis about the importance of organisational proximity. To build the organisational variable, we used companies' websites and Endole suite web site ([www.endole.co.uk](http://www.endole.co.uk)) as a source. Endole Suite is one of the UK's largest business information platforms. This dataset collects information from a number of official bodies, including global data providers, registered company information and by the companies themselves. This tracks information about 6 million companies and 30 million directors. From this dataset, we hand-collected information on the main names of investment organisations, namely individual investors, the gatekeeper for business angel group and the CEO- founder for venture capitalists, and about their past and present career.

#### **Operationalisation of the variables:**

Our dependent variables are two one-mode co-investment networks that were constructed by considering the sharing of investment round (Brander et al., 2002). The data were organised in two relational matrices, one for

each network. In each matrix, the names of individual investors and organisations are listed in the columns and the rows. For each pair of nodes, the cell of the matrix assumes the value 0 when the investors did not invest together and the value 1 when they invested at least one time together. The whole network and the sub-network are represented in Figure 1 and Figure 2 respectively. The nodes are the Scottish investors whereas the lines in the networks represent a tie among them, which means that they invested in the same financial round of a new venture. Below, we describe the explanatory variables.

Geographical proximity is operationalised as the location of an investors' headquarters. The locations are Edinburgh, Glasgow, Perth, Aberdeen, Inverness and Dundee. In addition to these large cities, we have also classified the smaller cities where there is only one investor present per city. These cities are Stirling, Melrose, Dumfriesshire, and St. Andrews.

Cognitive proximity occurs when investors share the same structural form. In this paper, 6 types of investors participate in the network. These are: Individual business angels, Business angel groups, Venture capitalists, Investment banks, University Program and Government Office.

Institutional proximity is observed when two actors share the same institutional form. We classify actors as being either a private or a public investor.

Organizational proximity is measured by taking into account if investors worked for the same company before investing together or they had a role in the same investment association before investing together. This variable is a socio-matrix. For each pair of investors, cells in the matrix take the value 1 if a previous business relationship existed, otherwise it is 0.

As control variables we collect information about node-level attributes and endogenous effects attaining to the network structure. For the actors' attributes, we consider the number of investments in new companies and the number of follow-on rounds made in Scotland during the observed period. Furthermore, we decide to include the experience of the organisation because Lerner (1994) found that experienced organisations tend to invest with other similar investors in terms of experience, especially in first rounds. We operationalised the experience by considering the age of the entity (Hochberg et al., 2007) and in particular, we decide to use the square root of the number of years from when the entity was founded and 2017 (Belso-Martínez, Expósito-Langa, & Tomás-Miquel, 2016). In detail, for individual business angels we assume as starting year, the year of the first investment recorded in the dataset. To test, if two organisations with the same range of experience

tend to work together, we created a categorical variable that split the period into three time-windows: organisations that were born before the economic crisis (before 2007), during (2007-2009) and after it (after 2009).

We also include four structural terms to control for commonly observed endogenous forces in the network. These control for the density, preferential attachment, the multi-connectivity of actors and the tendency towards triadic closure. The terms used for accounting for these tendencies are: edges, GWDEGREE, GWDSP and GWESP respectively. Table I summarizes the operationalisation of the variables.

-----  
Insert Table 1 about here.  
-----

## Method

The network structure is analysed by using social network analysis tools: graph visualization, descriptive statistics and besides this, we implement an Exponential Random Graph Model (ERGM) to test the hypotheses. This model predicts the probability of a tie between two actors, conditional on all the rest of ties (Harris, 2014). The ERG model is fit with Monte Carlo Markov Chain maximum likelihood estimation, that is an algorithm based on simulation of graphs. The software used is the open source R and the ergm package from a statnet suite of packages.

This methodology is increasingly used in entrepreneurship literature to investigate ties among companies operating in the same region (Capone & Lazzeretti, 2016; Pol, 2017) because this model represents a solution to the problem of considering the dyadic dependence of observations when we are studying relational data (Desmarais, 2011). Indeed, standard regression models based on the assumption of the independence of observations do not take into account structural patterns of the network as explanatory variables. This leads to a biased estimation and to an impossibility to test theories regarding a different degree distribution of actors and the tendency toward triadic closure (Desmarais, 2011).

On the contrary, ERGM allows us to predict the observed network, the dependent variable, considering as explanatory variables both exogenous effects, such as investors' attributes (number of companies and investment rounds) and dyadic level attributes (homophily in terms of geography, institution, cognition, organisation and year of experience), and endogenous effect (edges, gwdegree, gwdsp, gwesp). The three terms

gwdegree, gwdspace, gwespace require calculating a parametric value alpha. To do that, we followed the procedure defined by Goodreau, Handcock, Hunter, Butts, & Morris (2008). We tried different values, starting with 0.1 and increasing until model fit no longer improved. The next section will present the results of our analysis.

## Results

Before running the analysis with ERGM, we visualized both networks with node color showing investors' attributes. This helps us to identify possible important structural patterns of ties among investors with different characteristics.

As can be seen in Figure 1, each node represents an investor. The first network includes all types of investors, and we see that the majority of them come from Edinburgh and Glasgow and they tend to co-invest with other actors from the same city and do so on a widespread geographical basis, whereas investors from other cities, such as Aberdeen and Inverness, are more peripheral in the network. Regarding the cognitive proximity, individual business angels tend to co-invest, whereas business angel groups co-invest with venture capitalists, suggesting that some degree of complementarity persists in the market despite polarization between angel investors and VCs following the global financial crisis. From the fourth graph, down-right, there appears to be a central big node that represents how the Scottish investment bank has a higher degree (high number of connections) than the other nodes, this shows its important role inside the network. This importance is also highlighted by the fact that removing this node, the network will be split into several sub-components.

Descriptive statistics offer insights about this network. Firstly, the density is not high (0,08), meaning that we deal with a sparsely connected network. However, in spite of this, the network is really compact, requiring only four steps to connect two actors. There is a moderate level of transitivity (0,24); that is, the tendency to create closed triangles (two investors who share the same co-investment partner tend to be involved in the same co-investment model). The degree (number of ties) of public entities (government and universities) is higher than the average and thus we can assume that they are more active in the co-investment ecosystem.

Shifting to the second network, if we consider only venture capitalists, business angels and angel group in the analysis, the network structure changes (Figure 2). The distance among nodes increases, requiring 6 nodes to connect one node to another one. There is also a lower density (0,06) and a higher level of transitivity (0,5).



Moreover, this subnetwork also shows 10 isolates, that are investors who did not invest with any other investors present in this second network.

Our hypotheses tested whether the different forms of proximity influence tie formation among investors. In detail, we tested the first three hypotheses on the first network. In the second network we tested the first two and the fourth. This because the subnetwork includes only private organisations.

Estimations are presented for both models in TABLE 2.

-----  
Insert Table 2 about here.  
-----

We present three models per each analysed network to show the improvement of the model as new variables are added. Overall, findings from the ERGM model indicate that the proximity variables influence tie formation. It is not possible to rank the different parameters in order of importance because they have a different scaling, but only the strength and the direction (Lusher & Robins, 2013). Concerning the first model, the results are presented in the first three columns under the heading 1 Network. Investors of the same type and coming from the same city tend to co-invest. Both coefficients are positive and significant (p-value <0,001), endorsing H1 and H2. Even the coefficient indicating the institutional proximity is significant (p-value <0,001), but negative, meaning that actors of the same institutional type tend not to co-invest (H3), reflecting the role played by the regional development agency run Scottish Co-investment Fund.

The results also illustrate how structural effects influence investors' tie formation. The negative and significant coefficient (p-value <0,001) of edges means a low propensity to create ties (Robins et al., 2012). By using the iterative procedure, we found that the best value of the alpha is 0,4 for the first network. The coefficient for transitivity is positive and significant (GWESP), meaning that if two investors share the same co-investment partner, they are more likely to become partners as well. In other words, there is a tendency for nodes to be linked directly among them and indirectly through a third node. We also controlled for GWDSP, that checks for the propensity of two actors to have partners in common regardless of whether they are tied or not. This coefficient is negative and significant (p-value <0,001), meaning that it is less likely that two investors who are not tied have shared partners. Another measure considered is gwdegree, that is positive and significant (p-

value  $<0,001$ ). This measure tests the presence of preferential attachment: well-connected investors are more able to get links than less connected investors. This is especially true by considering the role of public investor such as the government office.

We tested also if node attributes can influence the likelihood of a tie. We observed that there is a significant and positive relationship (p-values  $<0.001$ ) between the likelihood of forming a tie and the number of companies an investor funded. On the other hand, the number of investment rounds was not significant. This can be interpreted as investors tend to increase the number of connections when they fund new companies whereas they tend not to increase their ties for several rounds of funding. Moreover, the positive and significant coefficient (p-value  $< 0,001$ ) of year proximity signals that investors tend to co-invest with investors that were born during the same period whereas the non-significant result for the experience term means that age is not related to tie formation.

From the Fig.2, we observed that angel investors, angel groups and venture capitalists tend to create ties among them as compared to the other investors. Therefore, we further investigate this particular sub-network by including another variable that takes into account past business relationship among the main people within organisations, namely the organisational proximity. From the results of the model, shown in the last three columns in TABLE 2 under the heading *2 Network*, we found support for the organisational proximity hypothesis (H4). Indeed, the coefficient is positive and significant (p-value  $<0,001$ ), meaning that for these particular types of investors, organisational proximity impacts tie formation. This second model also confirms the other proximities (cognitive, geography and year): all the coefficients are positive and significant. We did not test the institutional proximity because in the second network only one entity is a public institution.

Moreover, when considering only these investors, we found that investors tend to form ties when they have to fund new companies but not when they have to provide follow on funding. The exogenous effect related to experience is not significant. The endogenous effects show that even in this sub-network the propensity to form ties is negative and significant (p-value  $<0,001$ ). As for the first network, the alpha has a value of 0,4. Furthermore, we observe a transitivity effect, *gwesp* is positive and significant, whereas the coefficients for the *gwdsp* and *gwedgree* terms are positive but not significant.

We assessed the quality of the parameter estimates by using the *mcmc.diagnostics* command and the goodness of fit (GOF) for both networks. From the first diagnosis, we see that the individual p-values are high signalling

that the model is globally significant as well as the joint p-values that are 0,46 for the first final model and 0,51 for the second final model. These results are also confirmed by the plots that show for both models that the values oscillate around the mean and a centered distribution of the values (Pol, 2017). We can see these plots in the appendix ( Figure 3 and 4). To check the robustness of our results, Goodness of Fit test was conducted, and results show a good fit. Moreover, the best model presents the lowest value of Bayesian Information Criteria (BIC) and the Akaike Information Criterion (AIC) measurements. As we added variables to the model, we saw a decreasing value of both indicators. We also calculated the R2, that for both networks has a value bigger than 0,50.

### Discussion and conclusions

In this paper, we investigated whether Boschma (2005) proximities in terms of geography, cognitive, institutional and organisational can explain the network structure of investors who invested in Scotland over a period of almost 10 years. To this aim, we employed the Exponential Random Graph Models, a statistical model used to predict tie-formation that includes variables at the node, dyad and structural network level.

Overall, the empirical results support the importance of these proximities in shaping both investors' networks. In particular, geographical, institutional and cognitive proximity help to elucidate the whole network including all type of investors. Geographical, cognitive along with organisational proximity play a role in explaining tie-formation of the second network, which includes only venture capitalists, business angel groups and individual business angels.

Several conclusions can be derived from this study. On one hand, we can observe the important role of public institutions that actively push the ecosystem through the co-investment fund. The negative institutional proximity confirms that investors look for this support and that the government as well as public universities are committed in the first line. On the other hand, we gather information about investor's preference, such as the preference to co-invest with investors near to their location and similar to them in terms of structure. Additionally, we can perceive the propensity to create ties with new partners only when they fund new companies whereas not for following financial rounds.

This paper contributes to the literature in several different ways. Firstly, we contributed to syndication literature. Previous studies mainly focused only on describing the reasons (Lerner, 1994), the effects of syndication (Brander et al., 2002) and less on investigating how investors choose their partners. In relation to

this area of research, we provided further evidence about the importance of homophily for ties-building process (Du, 2016; Gompers et al., 2016). Moreover, previous literature mainly focused the attention on one type of investor at a time while ignoring that different type of investors might be involved in the same syndication especially at the regional level. Therefore, from what we know, this paper is the first paper in the literature that provides insights and describes the main drivers that explain the whole regional investment ecosystem.

Mapping the whole investment ecosystem is also important to understand the exchange of resources among investors. Much of the earlier work already illustrated and investigated the ties among entrepreneurs (Belso-Martínez et al., 2016; Broekel & Boschma, 2012; Lee & Lee, 2015). It is observed that through these interactions, companies exchange important resources inside a region, that are in turn the basis for the exchange of knowledge and the creation of innovation. Despite their important role in the economic environment, there are few studies about the ties among venture capital providers. However, investors can exchange important resources through these ties such as experience and business opportunities that in turn benefit and leverage start-ups' ecosystem. Therefore, it is important to map the investor's ecosystem and understand how these ties arise.

Moreover, in comparison to other studies about syndication (Gompers et al., 2016) we investigated the connection among investors by using social network analysis and Exponential Random Graph Models. This methodology, which has been increasingly used to study entrepreneurial ecosystem (Belso-Martínez et al., 2016; Lee & Lee, 2015), allows us to consider also network endogenous elements that play an important role in explaining network formation. Endogenous elements such as the preferential attachment, the propensity to create ties or the tendency to form triangle can give important information about the network structure.

This paper contributes to the literature aiming at evaluating the impact of government scheme on the equity market in one region (Harrison, 2018; Owen & Mason, 2017). From our analysis it emerges that the Scottish co-investment fund is a connector in the network, because it links different type of investors, from angel groups to venture capitalists. Therefore, an additional added value of public investment fund could be their ability to leverage the regional social capital. Previous papers (Guerini & Quas, 2016; Harrison, 2018) evaluated government performance in this stage of the market only by looking at the financial result and the growth in number of investors but they do not consider before its role in increasing connections among investors. Therefore, the emergence of an investment network could be used as a parameter to evaluate the public policy

of co-investment funds.

Beside this, studying the roots of investment syndications is fundamental to maintain the ecosystem. So, for instance, given that geography is important to explain tie formation, public policy might aim at increasing fund in a geographical area where the risk capital is less supplied.

Implications of this study can be found also for entrepreneurs. Indeed, they are well-advised to choose their first investor strategically with regard to the investor's network or to move to areas with a high density of investor networks.

To conclude, over the last years, studies on the investment decision making process have focused on the individual investment entity. However, it is important to understand the network investment dynamics that might affect at the micro level the investment decision and at a macro level the nature of the economic development process of a region or country. This paper contributes to the literature about the importance of proximities in shaping networks, offering practical implications about which are the main drivers used by investors to choose their partners. From these results, it is possible to derive some practical insights that can inform public policy and improve their decisions about incentives for investment ecosystem. Furthermore, by understanding the equity market organization of Scotland, it will be possible to identify lessons which can be applied in other regions.

Nevertheless, this paper is not exempt from limitations. This is a quantitative study, so a qualitative analysis of how investors choose their partners is needed through interviews. Limitations of this study attain the ERG model. Indeed, this can deal only with binary data (Cranmer & Desmarais, 2011) and this can limit us to consider the number of times investors tend to co-invest. Another limitation derives from the difficulty to achieve data about individual business angels' investments (Mason et al., 2013). Moreover, the Scottish characteristics affect this analysis, such as the polarization of investors in two main cities Glasgow and Edinburgh, the business angel market organisation and the great public investment, both in terms of co-investment fund and fiscal incentives (Mason et al., 2013). Therefore, possible generalisations to other contexts may be limited. However, we believe that this paper might contribute to provide new insight into investors' ties formation and about how to study this type of network structure.

Future works can also study how different investor's network in terms of compactness and main ties formation drivers affect the entrepreneurial ecosystem. Moreover, further proximities can be investigated. In terms of

methodology, this type of network could be analysed by using the longitudinal network data model Stochastic Actor Oriented Models (SAOM) to investigate the dynamic of the network.

## References

- Alperovych, Y., Hubner, G., & Lobet, F. (2015). How does governmental versus private venture capital backing affect a firm's efficiency? Evidence from Belgium. *Journal of Business Venturing*, 30(4), 508–525.
- Balland, P. A. (2011). Proximity and the Evolution of Collaboration Networks: Evidence from Research and Development Projects within the Global Navigation Satellite System (GNSS) Industry. *Regional Studies*, 46(6), 741–756.
- Belso-Martínez, J.-A., Expósito-Langa, M., & Tomás-Miquel, J.-V. (2016). Knowledge network dynamics in clusters: past performance and absorptive capacity. *Baltic Journal of Management*, 11(3), 310–327.
- Boschma, R. (2005). Proximity and Innovation: A Critical Assessment. *Regional Studies*, 39(1), 61–74.
- Brander, J. A., Amit, R., & Antweiler, W. (2002). Venture-Capital Syndication: Improved Venture Selection vs. the Value-Added Hypothesis. *Journal of Economics & Management Strategy*, 11(3), 422–451.
- Brass, D. J. (1995). *A Social Network Perspective on Human Resources Management*. (G. Ferris, Ed.), *Research in Personnel and Human Resources Management* (JAI Press, Vol. 13).
- Broekel, T., & Boschma, R. (2012). Knowledge networks in the Dutch aviation industry: The proximity paradox. *Journal of Economic Geography*, 12(2), 409–433.
- Bruton, G. d., Filatotchev, I., Chahine, S., & Mike, W. (2010). Governance, ownership structure, and performance of IPO firms: The impact of different types of private equity investors and institutional environments. *Strategic Management Journal*, 31, 491–509.
- Capone, F., & Lazzeretti, L. (2016). Interorganisational networks and proximity: An analysis of R & D networks for cultural goods. *Sinergie Italian Journal of Management*, 53–70.
- Casamatta, C., & Haritchabalet, C. (2007). Experience, screening and syndication in venture capital investments. *Journal of Financial Intermediation*, 16(3), 368–398.
- Chung, S., Singh, H., & Lee, K. (2000). Complementarity, status similarity and social capital as drivers of alliance formation. *Strategic Management Journal*, 22, 1–22.
- Coleman, J. S. (1988). Social Capital in the Creation of Human Capital. *American Journal of Sociology*, 94, S95–S120.
- Cranmer, S. J., & Desmarais, B. A. (2011). Inferential Network Analysis with Exponential Random Graph Models. *Political Analysis*, 66–86.
- Cumming, D., Walz, U., & Werth, J. C. (2016). Entrepreneurial Spawning : Experience , Education , and Exit. *The Financial Review*, 51, 507–525.
- Desmarais, B. A. (2011). Inferential network analysis with exponential random graph models. *Political Analysis*, 19(1), 66–86.
- Du, Q. (2016). Birds of Feather or Celebrating Differences ? The Formation and Impact of Venture Capital

- Syndication. *Journal of Empirical Finance*, 39, 1–14.
- Franke, N., Gruber, M., Dietmar, H., & Henkel, J. (2008). Venture Capitalists' Evaluations of Start-Up Teams: Trade-Offs, Knock-Out Criteria, and the Impact of VC Experience. *Entrepreneurship: Theory and Practice*, 459–483.
- Gompers, P. A., Mukharlyamov, V., & Xuan, Y. (2016). The cost of friendship. *Journal of Financial Economics*, 119(3), 626–644.
- Goodreau, S. M., Handcock, M. S., Hunter, D. R., Butts, C. T., & Morris, M. (2008). A statnet Tutorial. *Journal of Statistical Software*, 24(9), 1–27.
- Granovetter, M. (1973). The Strength of Weak Ties. *The American Journal of Sociology*.
- Gregson, G., Mann, S., & Harrison, R. (2013). Business Angel Syndication and the Evolution of Risk Capital in a Small Market Economy : Evidence from Scotland. *Managerial and Decision Economics*, 107(January), 95–107.
- Guerini, M., & Quas, A. (2016). Governmental venture capital in Europe : Screening and certification. *Journal of Business Venturing*, 31(2), 175–195.
- Harris, J. (2014). *An Introduction to Exponential Random Graph Modeling*. Thousand Oaks, CA: Sage Publications.
- Harrison, R. T. (2018). Crossing the chasm : the role of co-investment funds in strengthening the regional business angel ecosystem. *Small Enterprise Research*, 0(0), 1–20.
- Harrison, R. T., & Mason, C. M. (2000). Editorial: The role of the public sector in the development of a regional venture capital industry. *Venture Capital*, 2(4), 243–253.
- Hochberg, Y. V., Lindsey, L. A., & Westerfield, M. M. (2015). Resource accumulation through economic ties: Evidence from venture capital. *Journal of Financial Economics*, 118(2), 245–267.
- Hochberg, Y. V., Ljungqvist, A., & Lu, Y. (2007). Whom You Know Matters: Venture Capital Networks and Investment Performance. *Journal of Finance*, 62(1), 251–301.
- Knoben, J., & Oerlemans, L. A. G. (2006). Proximity and inter-organizational collaboration: A literature review. *International Journal of Management Reviews*, 8(2), 71–89.
- Lazzeretti, L., & Capone, F. (2016). How proximity matters in innovation networks dynamics along the cluster evolution. A study of the high technology applied to cultural goods. *Journal of Business Research*, 69(12), 5855–5865.
- Lee, S., & Lee, C. (2015). Creative Interaction and Multiplexity in Intraorganizational Networks. *Management Communication Quarterly*, 29(1), 56–83.
- Lerner, J. (1994). The Syndication of Venture Capital Investments. *Financial Management*, 23(3), 16.
- Lusher, D., & Robins, G. (2013). *Example Exponential Random Graph Model Analysis. Exponential Random Graph Models for Social Networks: Theory, Methods, and Applications*. New York: Cambridge University Press.
- Mason, C., Botelho, T., & Harrison, R. (2013). The transformation of the business angel market: evidence from Scotland. *Working Paper, Adam Smith Business School, University of Glasgow and University of Edinburgh Business School*.
- Molina-Morales, F. X., García-Villaverde, P. M., & Parra-requena, G. (2014). Geographical and cognitive

proximity effects on innovation performance in SMEs : a way through knowledge acquisition. *International Entrepreneurship and Management Journal*, 231–251.

- Munari, F., Sobrero, M., & Toschi, L. (2016). The university as a venture capitalist? Gap funding instruments for technology transfer. *Technological Forecasting and Social Change*, (July), 1–16.
- Nanda, R., & Rhodes-Kropf, M. (2017). Coordination Frictions in Venture Capital Syndicates. *Harvard Business School Entrepreneurial Management Working Paper No 17-089. SSRN Electronic Journal*.
- Nooteboom, B. (1999). Innovation and inter-firm linkages : new implications for policy. *Research Policy*, 28, 793–805.
- Owen, R., & Mason, C. (2017). The role of government co-investment funds in the supply of entrepreneurial finance : An assessment of the early operation of the UK Angel Co-investment Fund. *Environment and Planning C: Government and Policy*, 35(3), 434–456.
- Pol, J. Van Der. (2017). Introduction to network modeling using Exponential Random Graph models ( ERGM ). <hal-01284994v2>.
- Ponds, R., van Oort, F., & Frenken, K. (2007). The geographical and institutional proximity of research collaboration. *Papers in Regional Science*, 86(3), 423–443.
- Robins, G., Lewis, J. M., & Wang, P. (2012). Statistical Network Analysis for Analyzing Policy Networks. *Policy Studies Journal*, 40(3), 375–401.
- Spigel, B. (2017). Entrepreneurial ecosystems as practices and resources. In *Academy of Management Conference* (pp. 1–29). Atlanta.
- Spigel, B., & Harrison, R. (2018). Toward a process theory of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal*, 12, 151–168.
- Ter Wal, A. L. J., Alexy, O., Block, J., & Sandner, P. G. (2016). The Best of Both Worlds: The Benefits of Open-specialized and Closed-diverse Syndication Networks for New Ventures' Success. *Administrative Science Quarterly*, 61(3), 393–432.
- Torre, A., & Gilly, J.-P. (2000). On the Analytical Dimension of Proximity Dynamics. *Regional Studies*, 34(2), 169–180.
- Torre, A., & Rallet, A. (2005). Proximity and localization. *Regional Studies*, 39(1), 47–59.
- Tykvová, T. (2017). Venture capital and private equity financing: an overview of recent literature and an agenda for future research. *Journal of Business Economics*.
- Werth, J. C., & Boert, P. (2013). Co-investment networks of business angels and the performance of their start-up investments. *International Journal of Entrepreneurial Venturing*, 5(3), 240.
- Wilson, R. (1968). The Theory of Syndicates. *Econometrica*, 36(1), 119–132.
- Wuyts, S., Colombo, M. G., Dutta, S., & Nooteboom, B. (2005). Empirical Tests of Optimal Cognitive Distance. *Journal of Economic Behavior & Organization*, 58(2), 277–302.
- Xavier Molina-Morales, F., Belso-Martínez, J. A., Más-Verdú, F., & Martínez-Cháfer, L. (2015). Formation and dissolution of inter-firm linkages in lengthy and stable networks in clusters. *Journal of Business Research*, 68(7), 1557–1562.
- Young Company Finance. (2012). *The risk capital market in Scotland 2009-2011*. Glasgow.



Young Company Finance. (2016). *The Risk Capital Market in Scotland: annual report 2016*. Glasgow.

## Appendix

**Table 1: Operationalization of variables**

Source: author's elaboration.

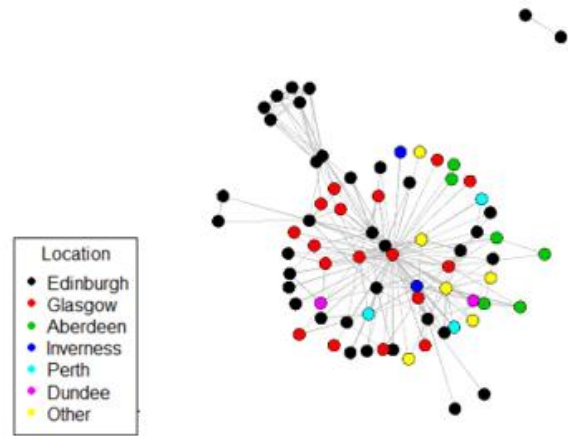
Variables	Operationalization	
Forms of proximity	Geographical proximity	Co-location
	Institutional proximity	Private/ Public institutions
	Cognitive proximity	Same structure
	Organisational proximity	Business relation
	Year proximity	Same founded year
	Density	Degree
Endogenous variables	Preferential attachment	Gwdegree
	Multi-connectivity of actors	Gwdsp
	Transitivity	Gwesp
	Investment experience in Scotland	Number of funded Scottish companies
Control variables	Investment rounds in Scotland	Number of investment rounds in Scottish companies
	Year of experience	Number of years since it was founded

Figure 1: Visualization of the Scottish investment network.

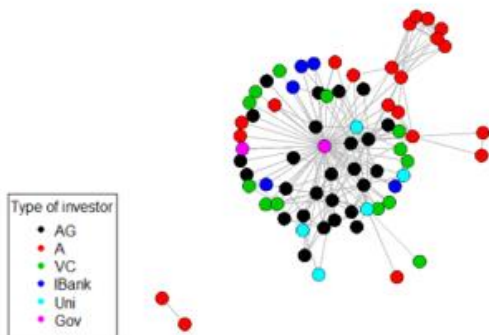
a) The investment network



b) The location of investors' headquarters



c) Type of investors



d) Type of institution

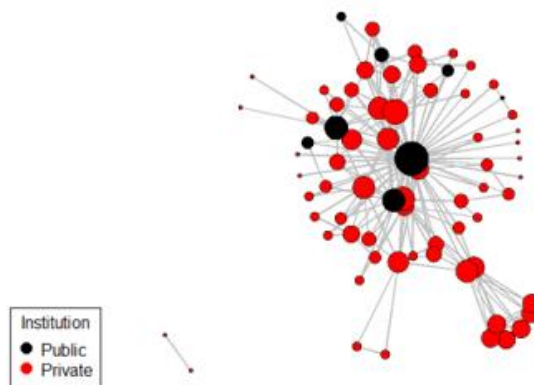
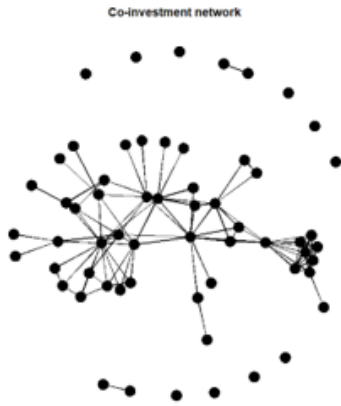


Figure 2: Visualization of network formed by business angels, business angel groups and VCS

c) The sub-network



d) The sub-network: Type of investors

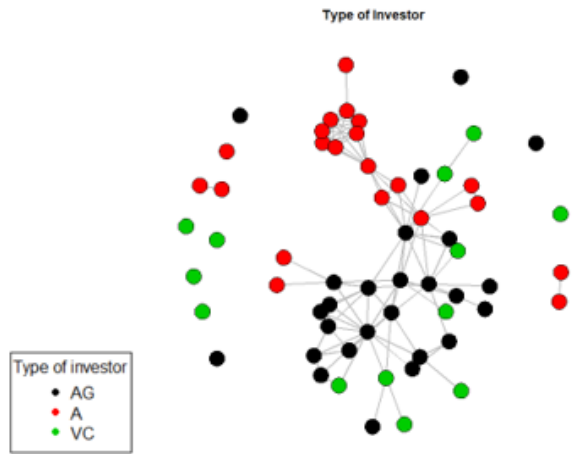


Table 2: Results of ERGM estimation: Model for testing homophily in Co-investment Network

Variables	1 Network			2 Network		
	Baseline Model	Intermediate Model	Final Model	Baseline Model	Intermediate Model	Final model
Edges	-3.51 *** (0,16)	-4.56 *** (0,36)	-7,11 *** (0,61)	-3,96 *** (0,46)	-6,67 *** (0,60)	-6,87 *** (0,75)
Experience	0.02 * (0,01)	0.02 - (0,01)	-0,01 (0,01)	0,07 (0,06)	0,008 (0,07)	-0,02 (0,05)
N° Companies	0.00 (0,00)	0.01 * (0,00)	0,06 *** (0,016)	0,06 * (0,02)	0,10 *** (0,02)	0,06 ** (0,02)
N° Rounds	0.00* (0,00)	0,005 (0,004)	-0,01 - (0,005)	-0,006 (0,007)	-0,01 * (0,00)	-0,01 (0,00)
Geographical Proximity		0,99 *** (0,18)	0,99 *** (0,16)		1,09 *** (0,24)	0,79 *** (0,20)
Cognitive Proximity		1,90 *** (0,22)	1,48*** (0,19)		2,10*** (0,27)	1,25 *** (0,22)
Institutional Proximity		-0,95 ** (0,29)	-0,89 ** (0,29)			
Organisational Proximity					2,06 *** (0,47)	1,87 *** (0,47)
Year		1,16 *** (0,19)	0,95 *** (0,15)		1,82 *** (0,26)	1,24 *** (0,21)
Preferential Attachment			2,01 *** (0,56)			0,39 (0,46)
Transitivity			2,07 *** (0,33)			1,57 *** (0,28)
Multi-connectivity of actors			-0,12 *** (0,02)			-0,01 (0,05)
AIC	1097	941,5	861,7	752,5	567,2	499,6
BIC	1221	988,2	926	774,4	611	559,9
For the final models	Null Deviance: 3543,4 on 2556 degrees of freedom			Null Deviance: 2453,7 on 1770 degrees of freedom		

Residual Deviance: 839,7 on 2545  
degrees of freedom

Residual Deviance: 477,6 on 1759  
degrees of freedom

Pseudo- R<sup>2</sup> Measures

$(Dn-Dr)/(Dn-Dr+dfn)$ : 0,51

$(Dn-Dr)/Dn$ : 0,76

Pseudo- R<sup>2</sup> Measures

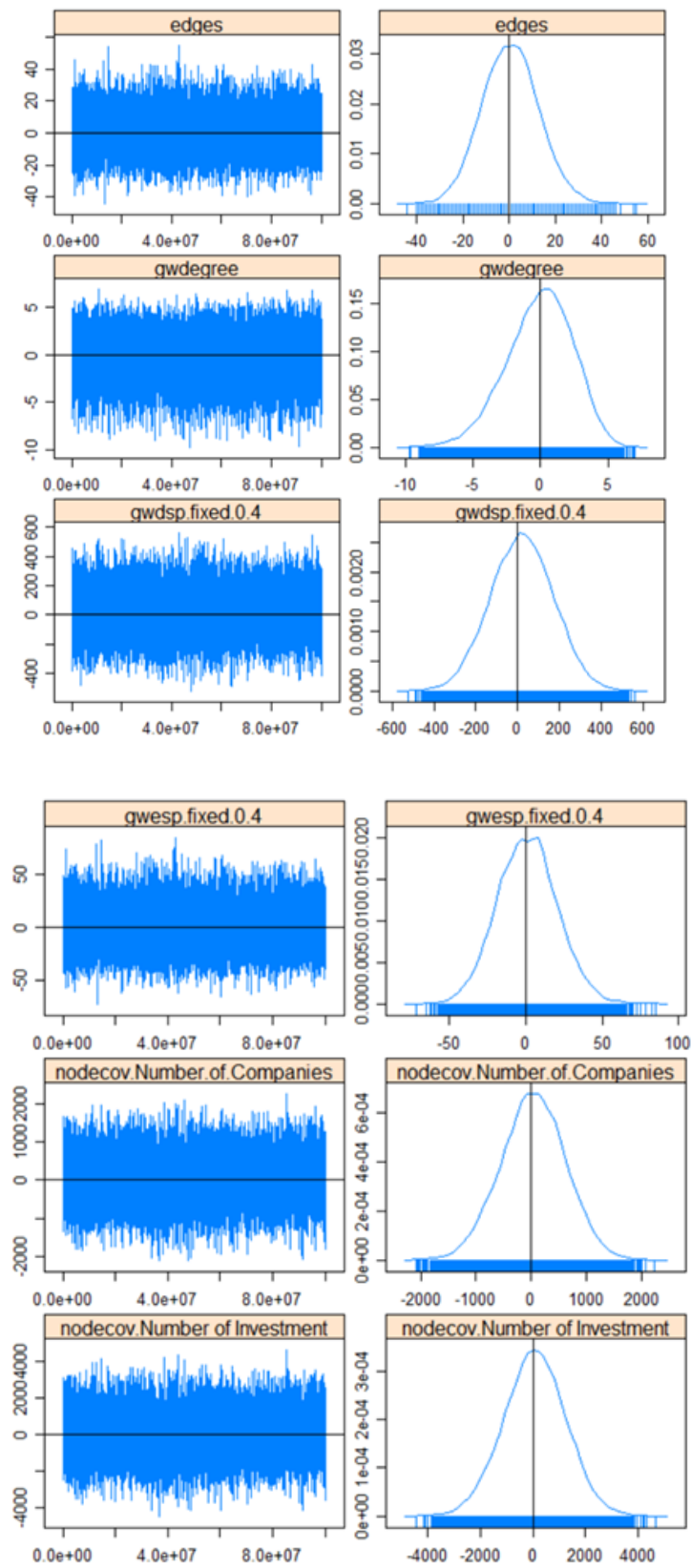
$(Dn-Dr)/(Dn-Dr+dfn)$ : 0.53

$(Dn-Dr)/Dn$ : 0,80

Notes: First network n=72. Second network= 60

Significance codes: \*\*\*p<0,001, \*\*p<0,01, \*p<0,05, - p<0,1

Figure 3: Robustness check Network 1 Final Model



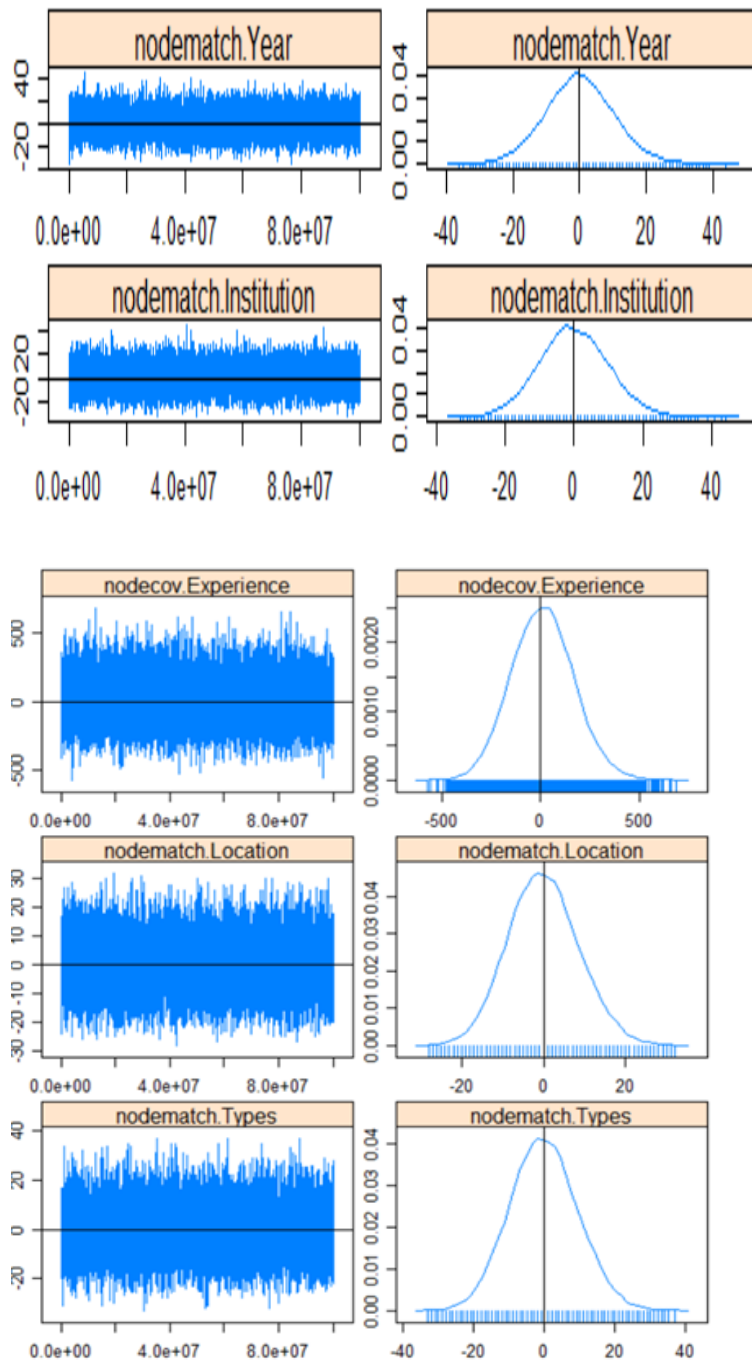
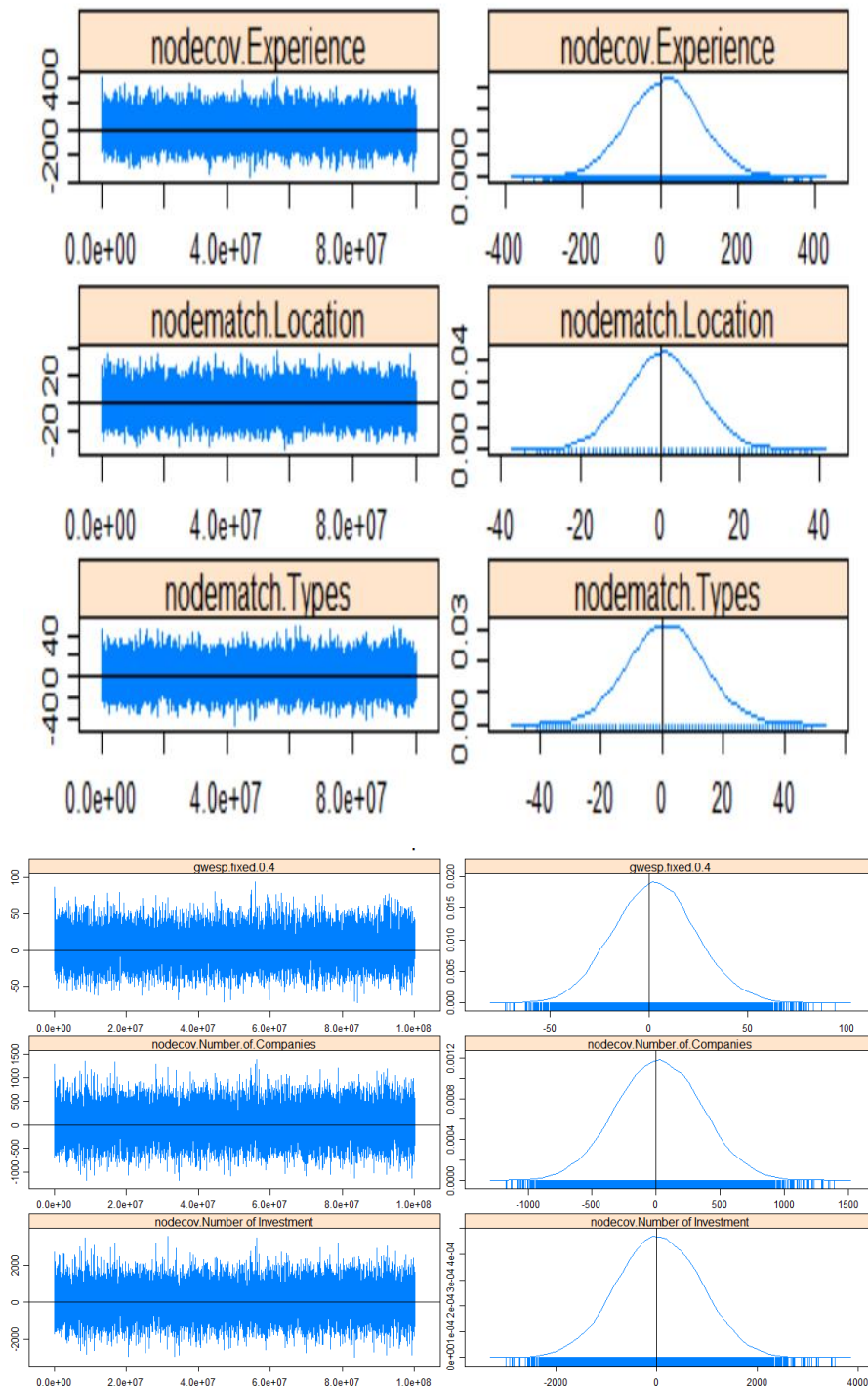
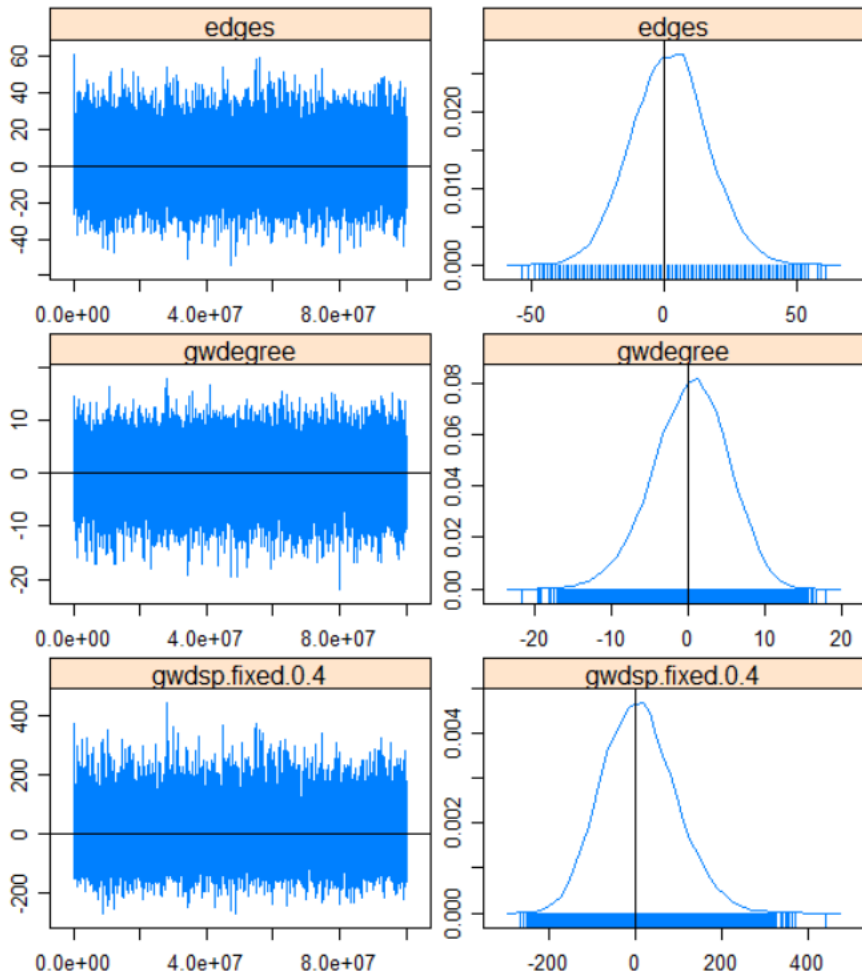


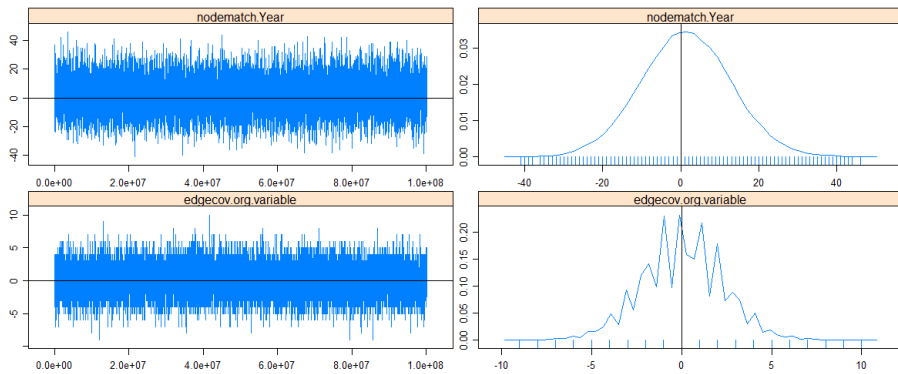


Figure 4: Robustness check Network 2 Final Model





sample statistics





## **CHAPTER 4: How does a venture capital network position influence the new venture performance?**

### **Abstract**

Syndications contribute to bound startups and investors together in a network. Although the importance of networks for entrepreneurs has always been underscored in literature, there is no evidence about the importance of the network derived from the financial event for entrepreneurs. Therefore, this paper investigates whether a startup's venture capital network position in terms of structure, relational embeddedness, and content can influence its survival. Based on a sample of 49 Scottish companies funded during the same time-period, our analysis shows that weak ties with other portfolio companies negatively impact on performance whereas network heterophily has a positive influence on it. Against previous literature, we did not find any evidence about the impact of network size, strong ties and the interaction of weak ties with the previous director's experience.

**Keywords:** venture capital network, new venture, performance, social network analysis.

### **Introduction**

Understanding the elements that lead a new venture to fail is of paramount interest in entrepreneurship literature (Clercq & Dimov, 2006; Peña, 2002). Although there are previous studies about the impact of interfirm linkages on performance (Baum, Calabrese, & Silverman, 2000; Baum & Oliver, 1991; Gulati, Nohria, & Zaheer, 2000), as far as we know, there are no studies about the impact of a start-up's network position in venture capital network on new venture's survival. However, venture capital providers' syndications create a network of relationship where investors and companies are bounded together. This network is considered the norm in early stage risk capital market (Bygrave, 1988; Nanda & Rhodes-Kropf, 2017) because investors prefer to syndicate rather than stand-alone investment (Hochberg, Ljungqvist, & Lu, 2007; Lerner, 1994). In this network, some companies have better positions than others, linked to more venture capital providers and other portfolio companies. There are different reasons to expect that a better venture capital network position could affect new venture's survival. First, according to the transitivity of social capital theory, two actors have a higher likelihood to develop a relationship if they share a strong tie (Batjargal, 2007b). Consequently, companies who share the same investor are more likely to get in touch with other funded companies and so to exchange important resources, such as critical knowledge and expertise. The same investors could encourage this tendency to create positive synergies (Proksch et al., 2017). The sources of

benefits coming from these ties could be also related to network heterogeneity of companies. In fact, this might affect performance because it can increase the opportunity of getting non redundant information and incentivize critical thinking (Beckman & Haunschild, 2002; Goerzen, Beamish, Goerzen, & Beamish, 2005). Second, new venture's tie with a higher number of investors could add more value to the company rather than a standalone investor (Lerner, 1994).

To measure the new venture's network position in venture capital network we borrow from graph theory and social capital theory. Previous literature measured individual social capital by considering three main aspects: the structure, the relational and the resource aspect (Batjargal, 2003). In this paper, we investigate how a better network position in terms of these aspects influences the new venture's survival. To do that, we employed probit models to test the hypotheses on a sample of 49 Scottish new ventures who received finance from different types of investors during the same time-period. After controlling for the sector and some variables related to human and financial capital, we find that new venture's network position influences its chance to survive.

This paper contributes to different streams of literature. First, although there are previous studies about networks in financial markets which describe the structure of syndication networks (Bygrave, 1988) and its effects for investors (Hochberg et al., 2007), this is the first study, from the best of our knowledge, that investigates the impact of venture capital network for new ventures. Second, we shed light on the importance for a new venture to choose the venture capitalist not only in relation to its brand name (Hsu, 2004), but also in relation to the other companies funded during the same period, by looking not only at the number but also at the heterogeneity of sector. Third, we provide preliminary evidence about the impact of the relationship among portfolio companies.

The context of this study is Scotland, where the syndication and co-investment were incentivized both by the public government (Harrison, 2018) and private initiatives. Moreover, there is a well -developed risk capital market in terms of business angels (Mason, Botelho, & Harrison, 2013).

The paper is organized as follows. Firstly, we revise the literature review concerning the impact of the network on new venture performance. From this literature, we then develop the main hypotheses. Subsequently, we present the method and data. Finally, we show the results and conclusion.

## Literature

Literature has studied the main elements who can strategically help new venture to survive. These are related to the initial conditions of human capital, financial capital and social capital (Batjargal, 2007a; Baum et al., 2000; Cooper, Gimeno-gascon, & Woo, 1994; Dahlqvist, Davidsson, & Wiklund, 2000; Hung, 2006; Marvel, Davis, & Sproul, 2016). A major role is always more acknowledged to this last element (Gronum, Verreynne, & Kastle, 2012; Stam, Arzlanian, & Elfring, 2014). Social capital, namely the resources embedded in a network (Nahapiet & Ghoshal, 1998), has had a role for both old and new ventures. Indeed, through network companies can get important resources, which are at the basis of a competitive advantage according to the resource-based theory (Barney, 1991; Hung, 2006). For new ventures especially, it can help them to cope with two main obstacles which lead to fail: the liability of newness and smallness (Clercq & Dimov, 2006; Stinchcombe, 1965). Indeed, companies at this stage suffer more than established companies from a lack of legitimacy which can in turn constrain resource-acquisition from third parties.

Therefore, previous literature has mainly focused to study which particular relationship of new venture's network influence the new venture performance (Hung, 2006; Lee, Lee, & Pennings, 2001). In doing so, the umbrella concept of social capital was split in different configurations: the structural aspect, the relational aspect and the resource or network content (Batjargal, 2003; Hoang & Antoncic, 2003; Stam et al., 2014). In detail, the first aspect attains at the network structure, the second to the strength of ties and the third to the mobilized resources.

Moreover, several formal and informal networks were analysed as having an impact on new venture performance, such as alliances (Baum et al., 2000), partnership and sponsorship linkages (Lee et al., 2001) and entrepreneur's own personal network (Brüderl & Preisendörfer, 1998). However, little is known at present about the role that the ties derived by a financial event has on new venture success (Atuahene-gima & Li, 2004; Lee et al., 2001). This network is the result of two main behavioural tendencies observable in the early stage equity market. The first one is a frequent event: the syndication among investors (Nanda & Rhodes-Kropf, 2017). This occurs when two or more investors decide to share the risk of the investment and its relative payoff (Wilson, 1968). This is justified by different reasons related to the value added hypothesis (Brander, Amit, & Antweiler, 2002), the improvement of the due diligence process (Lerner, 1994), the risk diversification and to obtain information about a future investment opportunity, namely reciprocation (Bygrave, 1988; Lockett &

Wright, 2001). The total number of syndications form a network made up of companies and investors where resources are exchanged (Bygrave, 1988). The second tendency which contributes to increase network size is the fact that investors tend to fund more than one company at a time (Gorman & Sahlman, 1989; Jaaskelainen, Maula, & Seppa, 2006; Kanninen & Keuschnigg, 2003; Sahlman, 1990) which can operate in different sectors as a result of diversification risk strategy (Norton & Tenenbaum, 1993). The size of this portfolio relies on a trade-off among diversifying the risk and the amount of investor's assistance required by companies (Jaaskelainen et al., 2006).

Although previous literature has focused the attention on the benefits of these links for investors (Brander et al., 2002; De Clercq & Sapienza, 2004; Hochberg et al., 2007), and on how entrepreneurs are more likely to survive in relation to who are the investors and if they are funded through a syndication (Clercq & Dimov, 2006), as far as we know, there is no previous literature which focuses on the consequences of the whole financial network for a new venture according to a network approach and so, on disentangling the relative importance for new venture's survival of developing ties inside this financial network with investors and other portfolio companies belonging to the same time- period investment network.

Therefore, the purpose of this paper is to address the following main research question: How does the new venture network position inside of a venture capital network affect its survival? By addressing this main question, this paper contributes to social capital literature and in particular, it offers new insight about the importance of social capital derived by investment financial rounds.

### **Theoretical Framework**

If we map all the financial events in a longitudinal way during a specific time-period, it is possible to visualize an early stage network where each venture according to its financiers has its own position. Previous literature has mainly focused its attention on describing two main sources of the impact of a network (Rodan & Galunic, 2004). On one side, structural embeddedness theory and on the other side relational embeddedness theory (Batjargal, 2003; Semrau, 2014). However, another aspect which is always more considered is the content of the network (Rodan & Galunic, 2004). To include all perspectives, we tested hypotheses concerning different theories.

### **Structural embeddedness**

Structural embeddedness attains at the structure of the network (Batjargal, 2003). Thus, the first measure that can be used to record the impact of the network on new venture performance is the total degree, and so the number of entrepreneur's ties. The effect of this network measure on firm performance is one of the most studied although results are still inconclusive. In fact, some authors found a positive relationship among network size and new venture performance (Aldrich, Rosen, & Woodward, 1987; Baum et al., 2000; Semrau, 2014). This because the higher the number of ties, the higher the probability to be central and so to receive a variety of resources such as information and knowledge (Greve & Salaff, 2003; Hochberg et al., 2007). Other authors did not find any significant evidence of this relationship (Batjargal, 2003, 2007a). Here, we propose that the effect is positive given that new ventures suffering from legitimacy need to rely on more contacts as possible. Therefore, the first hypothesis can be formulated as it follows:

*H1: The greater the size of the new venture's network, the higher is its probability to survive*

### **Relational embeddedness**

The literature on social capital distinguishes two types of ties in relation to their strength: strong ties and weak ties (Granovetter, 1973). With this regard, the social capital theory provides two opposing views about the benefits of these different configurations of network structure. On one side, strong ties, because of trust and cooperative actions that undermine opportunistic behavior, are seen as the best source of resources which can help new ventures to achieve their goals (Coleman, 1988). On the other side, weak ties, are considered as a strategic source of non-redundant information, opportunities and different resources which are at the basis of competitive advantage (Burt, 2001). Previous literature found mixed results in support or against each theory. To remark these two opposing views, previous papers formulated alternative hypotheses in relation to these ties (Batjargal, 2003) as if the impact of strong ties is an alternative to the weak ties. In this paper, we propose two different and separate hypotheses to investigate the impact. This because two different type of actors, and so resources, can be related to the strong ties and weak ties.

Usually strong ties are identified in entrepreneurship literature as family and friends (Brüderl & Preisendörfer, 1998). In a network derived by the financial event, the strong ties are the ones that a start-up has with investors because of their involvement in the company. These were considered partner based-linkage because of their



bilateral exchange of resources (Lee et al., 2001). Weak ties are instead identified in the links that a start-up has with other companies funded by the same investors.

In relation to the identified strong ties, the impact of venture capital providers on new venture has been already studied in the literature, although mixed results can be found (Clercq & Dimov, 2006; Proksch et al., 2017). On one hand, the higher the number of investors, the higher is the likelihood of negative inter-partner dynamics (Clercq & Dimov, 2006). On the other hand, the presence of venture capital has a positive impact on new venture performance (Lee et al., 2001). In fact, this capital is defined as “smart capital” because of not only its financial value, but also the managerial value provided by experienced investors (Baum & Silverman, 2004; Proksch et al., 2017; Sapienza, Manigart, & Vermeir, 1996). Indeed, investors can acquire a different degree of involvement in the company that can strategically improve new venture performance. Therefore, these strong ties are associated with a positive relationship with new venture survival as the following hypothesis states:

*H2: The greater the number of new venture's strong ties with investors, the higher is the probability to survive.*

Weak ties are generally identified as business contacts or acquaintances (Batjargal, 2003; Brüderl & Preisendörfer, 1998), in this paper they are the other portfolio companies. The relationship among new ventures funded by the same investors can impact in different ways new venture performance. In fact, if two start-ups have more than one investor in common, their contact could be more likely to be interested in transitivity. Transitivity is the tendency of two actors tied by a third one to develop a relationship over time (Batjargal, 2007b; Granovetter, 1973). Through these ties, new ventures could exchange important resources, such as knowledge and expertise. Sharing the same experience impacts on new business performance (Peña, 2002) and it is important to be able to stay in the industry (Darr & Kurtzberg, 2000).

Moreover, an investor who funds other startups during the same period can improve their performance by increasing the experience (Clercq & Dimov, 2006) and might create contacts among their portfolio companies to generate positive synergies (Proksch et al., 2017). Given these premises, we propose the following hypothesis:

*H3: The greater the number of new venture's weak ties with firms funded by the same investors, the higher is the probability to survive.*

The contact with weak ties could be influenced by the previous director's experience. Indeed, experienced directors could be more able to exploit connections with other enterprises and thus to extract information and opportunity from the network (Brüderl, Preisendörfer, & Ziegler, 1992). This in turn can affect new venture survival (Batjargal, 2007a). Therefore, it is important to test the interaction effect of the previous director's experience and the presence of weak ties on new venture performance. Thus, we tested the following hypothesis:

*H4: Weak ties with portfolio companies make the new venture more likely to survive, if at least one director has previous experience in other startups.*

### **Network content**

Apart from the structure, also network content could influence the performance (Rodan & Galunic, 2004). Previous literature has already highlighted the importance of network heterogeneity for firm performance (Batjargal, 2003). This is the degree to which an ego centered network contains different alters. However, its impact is still argued. On one side, the exposure to heterogenous knowledge could enhance the manager's performance (Rodan & Galunic, 2004) and the learning process (Levinthal & March, 1993). On the other side, network heterogeneity could be a cost to manage that hinders new venture performance (Goerzen et al., 2005) whereas similar knowledge is the basis to develop a better quality exchange of resources (Lane & Lubatkin, 1998). However, we think that especially for new ventures having contacts with start-ups operating in different sectors could be beneficial because it allows them to get non-redundant information and to exploit opportunities that would be difficult to detect without a different knowledge. This could be the case for the application of new technology in new sectors. Thus, the following hypothesis is proposed:

*H5: The greater the new venture is exposed to network heterophily, the higher is the probability to survive.*

The Table1 summarizes the five hypotheses developed and tested in this paper.

-----  
Insert Table 1 about here.  
-----

### **Scottish context**

Scottish context has been already used in literature as the study-setting of many papers (Harrison, 2018; Hood, 2000; Mason et al., 2013; Paul et al., 2007). This is an interesting landscape where to study the impact of syndication networks on entrepreneurship for several reasons. First, syndication is incentivized by the Scottish

government which in 2003 set up one of the long-lasting co-investment fund in U.K: the Scottish co-investment fund (Harrison, 2018). Second, here we have different types of investors involved in syndications. A large part of them is individual business angels and business angels groups whose marketplace organization is one of the most developed in Europe (Harrison, 2018). Indeed, here we have the birth in 1992 of the Business Angel Network LINC of Scotland. This business angel association has the role to connect investors (Mason et al., 2013). Therefore, all these elements have created an ecosystem where important worldwide start-ups were already set up such as Skyscanner and Fanduel (Spigel, 2017).

## Data

Our sample is made by Scottish companies who were established in 2009 and 2010 and received capital from investors in the following years, from 2009 to 2013. Our analysis is focused on 49 new companies operating in different sectors. This sample size is in line with previous studies (Batjargal, 2003; Grandi & Grimaldi, 2003; Hanlon, 2001; Hansen, 1995). These Scottish companies were identified in the investment deals list provided by Young Company Finance Scotland. This data set was already used by other authors (Mason et al., 2013). In the list, we found investors in the form of venture capital, public government, universities and business angel groups. We included also individual business angels when it was possible to identify them. For each company further data were collected by using their web sites, and two main platforms devoted to collect data about U.K companies, that are Beta Companies House ([beta.companieshouse.gov.uk](http://beta.companieshouse.gov.uk)) and Endole suite ([www.endole.co.uk](http://www.endole.co.uk)). In detail, we collect all the incorporations document and the balance sheet. We decided to consider the new ventures who were born after the financial crisis to avoid biases derived from the economic situation.

## Methodology

### Dependent- variable

Literature has measured startups performance in different ways. In this paper we are considering the dichotomous variable new venture survival, which assumes the value of 1 if it survived after 8 years and 0 otherwise (Batjargal, 2007a; Ciavarella, Buchholtz, Riordan, Gatewood, & Stokes, 2004; Hochberg et al., 2007). Of 49 companies, 35 survived and 14 failed. The choice of this variable derived by the fact that it is really difficult to use measures related to net-income because new ventures have during the first years of activity negative returns ratios and revenue (Baum et al., 2000).

### **Independent variables**

The independent variables are network size, strong ties, weak ties and heterophily among new ventures. These were extracted from the network. Networks change continuously, therefore to build the venture capital network, we restrict the data set to only syndications which interested Scottish startups which were founded during 2009-2010 and which received funds during the 2009-2013.

To build the network we use UCINET, a social network analysis software. Firstly, we create a 2-mode network, where in the columns we put all 58 names of investors of the analysed new ventures whereas in the rows all the new ventures (80), which were born and funded during the time period 2009-2013. This 2-mode network was then modified in a 1-mode network which identifies ties among the funded start-ups. Thus, we decided to include in the network startups which are operating at the same stage. Figure 1 shows the venture capital network, the black nodes represent the new ventures whereas the grey nodes are the investors. Each tie indicates that an investor funds a new venture. From these two networks it was possible to identify the following independent variables.

**Network size:** this is the ego-network size, namely the total number of ties of a start-up (Batjargal, 2003), considering not only investors ties but also all the ties with other new ventures funded during the same period.

**Strong ties:** these are the ties that a new venture develops with investors. So, for each start-up we count how many investors funded it.

**Weak ties:** these are the ties that a new venture has with other start-ups funded by at least the same two investors. We decided to consider a threshold of at least 2 because almost all start-ups receive funds from the Scottish Co-investment fund, which can be considered a passive fund (Harrison, 2018).

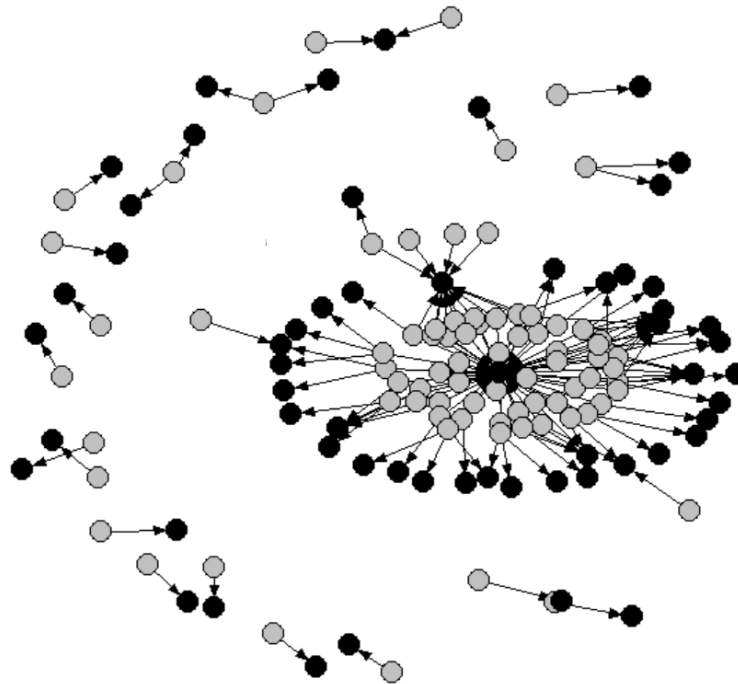
**Heterophily:** this could be expressed by a ratio and so the number of companies operating in different sectors divided the total number of weak ties for each start-up (Batjargal, 2003).

### **Control Variables**

Firstly, we controlled for the sector by using the Standard Industry Classification to classify the companies (Ruef, 2002). In detail, the 49 companies operate in the following sectors: manufacturing, trade, services, finance, insurance and real Estate, agriculture, public administration and transportation. As reported in Table 2, we decided to group together the sector into three main categories: manufacturing and agriculture, services and other services. The first group was considered as a reference category in the analyses. The geography

variable is a binary one which assumes value 1 if companies come from Edinburgh, Glasgow and Aberdeen, which are the main cities in the sample, and 0 otherwise. We also included the firm origin to take into account the fact that in our sample some companies are academic spin-out or academic spin-off.

Figure 1. Early stage risk capital network 2009-2013



This because university connection could impact in new venture survival (Harrison & Leitch, 2010). Beyond sector and geography, we controlled for several variables which include financial and human capital aspect (Cooper et al., 1994). Thus, we considered the amount of financial capital received by the new venture as previous papers did (Batjargal, 2007a). Regarding human capital, we controlled for the number of directors present in the incorporation document. Indeed, companies started by a group of entrepreneurs rather than solo entrepreneur have a higher likelihood to survive (Pena, 2004; Peña, 2002). Furthermore, we included also the previous director experience. We build this variable by using Beta Companies House and Endole Suite dataset where it is possible to find information about the role of each director. This variable assumes value 1 if at least one director was the director of a company before, value 0 otherwise. Previous experience is always considered in the analyses, although the different effects on new venture performance are recorded in literature with both positive (Batjargal, 2007a) and negative (Ruef, 2002) effects. Finally, we included also a gender variable which assumes 0 if no woman is involved in the company and 1 if at least one of the director is a woman. This because

previous literature showed that women-owned ventures performance worse than male-owned ventures (Cooper et al., 1994).

**Table 2. Distribution of industries**

<b>Standard Industrial Classification (SIC)</b>	<b>N</b>
Manufacturing and Agriculture	13
Retail, Transport, Financial, Insurance and Real Estate	10
Services and Public Administration	26

## Results

Given that our dependent variable is dichotomous, and thus it assumes value 0 if the new venture did not survive and value 1 if it survives after 8 years, we tested our hypotheses by using the probit statistical model. These models study the probability of a new venture according to its characteristics to fall into one of these two possible values.

Table 3 shows the results of the four probit models predicting the new venture survival as a function of social capital derived by venture capital network. In brackets it is possible to see the coefficients' standard errors.

The first model is the baseline model that studies the impact of the following control variables university connection, geography, sector, number of directors, gender, previous director experience and amount of capital on new venture survival. All the coefficients are insignificant but previous director experience which is negative ( $b=-1.35, p<0,05$ ), number of directors ( $b=0.71, p<0.05$ ) and money first round ( $b=0.05; p<0.1$ ). The model is statistically significant (chi-square 14.29;  $p<0.10$ ). The second model other than the control variables adds the network size, which has a negative impact ( $b=-0,04$ ) on survival although the coefficient is not significant. Model 2 is not significant.

The third model includes all the previous control variables apart from the network size because it was highly correlated with the other network variables. This model inspects the effect of strong ties, weak ties and heterophily on new venture survival. The strong ties coefficient is positive but not significant ( $b=0.30$ ), the weak ties coefficient is negative and significant ( $b=-0.22, p<0.05$ ) and the heterophily coefficient is positive and significant ( $b= 1.91, p <0.10$ ). The model is significant (chi-square 19.33,  $p \text{ value} < 0.10$ ). The fourth model examines the interaction effect of weak ties and the previous director's experience. This coefficient is positive but not significant ( $b= 0.13$ ). This model confirms previous results in terms of sign and significance, and it is statically significant (chi-square 19.88;  $p \text{ value} < 0.10$ ).

Consequently, from Model 2 we can see that the first hypothesis (network size) of our paper is not supported as well as the second hypothesis (strong ties). We found evidence against the third hypothesis (weak ties) and we find support for the fifth hypotheses (heterophily). Finally, the last model does not confirm the fourth hypothesis (interaction effect).

-----  
Insert Table 3 about here.  
-----

## Discussion

The findings reveal that after controlling for some variables that have an impact in new venture performance, some network measures related to the relational aspect as well as network content could impact on new venture's survival.

Overall, our results confirm previous literature about the performance of female directors (Cooper et al., 1994), the not always beneficial previous experience (Batjargal, 2007a; Dahlvist et al., 2000) and the positive impact of the amount of financial capital (Cooper et al., 1994; Dahlvist et al., 2000). Moreover, being an academic spin-off or spinouts has a positive influence on survival, although the coefficient is not significant. This indicates that Scottish universities contribute to provide new ventures with the right resources that can improve their performance. Among these resources, a central one could be the legitimacy related to the high-reputation of Scottish University not only in Scotland but all over the world. Coming from the Edinburgh, Glasgow or Aberdeen indicates a lower probability to survive although the coefficient is statistically insignificant. In the literature, the difference among coming from the metropolitan and rural area did not find any evidence (Dahlvist et al., 2000).

We did not find evidence in favor of or against the ego-network size. This result is in line with previous research (Aldrich and Reese 1993) and against some other (Baum et al., 2000). Therefore, it is not possible to draw a conclusion about the importance of network size for new venture survival.

Moreover, strong ties positively influence the new venture survival although the coefficient is statistically insignificant. Having a higher number of investors involved is beneficial. This is coherent with the previous literature (Brüderl & Preisendörfer, 1998). Weak ties with other companies impact negatively performance. Weak ties results could be derived from the fact that investors should spread their attention to different

companies during the same period. Therefore, less time is reserved for a single new venture (Cumming, 2006; Kannianen & Keuschnigg, 2003). Moreover, the other portfolio companies could be perceived as competitors rather than sources of non-redundant resources. This could be related to the “dark” resources of social capital (Batjargal, 2003). Although the coefficient is not significant, the previous director’s experience seems to enhance the weak ties effect on new venture survival. This indicates that experienced directors are more able than unexperienced to leverage these ties and extract from them benefits which can impact positively the performance. This result is opposed to what Batjargal (2007) found.

Finally, against Batjargal (2003), being exposed to different sector companies and so heterophily gives beneficial results in terms of new venture survival. Although ties with other companies are negative, this result is positive so suggesting that if companies are from different sectors, it is reduced the direct competition and it is higher the probability to increase synergies opportunity that can impact positively on the performance.

### Conclusion

The previous research found an impact of social capital on new venture performance (Batjargal, 2003, 2007a; Baum & Oliver, 1991). This study enlarges the type of connections which can impact new venture performance by including the startup’s network position in venture capital network.

This paper shows that this network position in terms of ties with other companies and the exposure to the heterophily of these ties impact on the chance of a new venture to survive. This study confirms that during the first years of activity, strong ties enhance the new venture performance, whereas weak ties characterized by lack of trust and also competition could undermine the likelihood to survive. However, this negative effect is limited by the opportunity to be exposed to companies operating in different sectors which can be a source of positive synergies and by the previous director’s experience that seem to be able to better exploit the benefits from these ties. Therefore, a first conclusion could be that the network content is important as the relational and structural network aspect in explaining new venture performance.

Several contributions can be derived from this study. First, this study provides further evidence about the relationship among network position and new venture performance. Moreover, from the best of our knowledge, this is the first study which investigates the ties among portfolio companies funded by the same investors. Finally, we highlight the importance of network diversity to enhance new venture performance.



A practical implication could be that entrepreneurs should prefer investor who invest in different sectors to extract positive synergies and that do not have too many other start-ups funded during the same period.

Several limitations can be identified. First, although in line with previous papers (Batjargal, 2003; Grandi & Grimaldi, 2003; Hanlon, 2001; Hansen, 1995) the sample size is small, consequently it is difficult to generalize these results. The network measures, although already used in literature (Batjargal, 2003; Proefschrift, 2006; Stam et al., 2014), represent a proxy of real ties. The Scottish characteristics might impact the analysis and so generalization is difficult. One limitation regards also the data because as previous literature already stated (Mason et al., 2013; Sørheim & Landström, 2001), tracking information about individual business angels is very difficult because they prefer to be anonymous. Therefore, we could miss important information about the venture capital network.

Further research might deeply analyze the importance of ties among portfolio companies through a qualitative study which might address the question: How do the portfolio companies interact? How do investors extract synergies from letting portfolio companies interact with each other? Moreover, we think that more research should be devoted to investigate the dark side of social capital.

Finally, another context could be chosen as study setting to investigate the existence of possible patterns that can be generalized.

## Bibliography

- Aldrich, H. E., Rosen, B., & Woodward, W. (1987). The impact of social networks on business foundings and profit: a longitudinal study. *Frontiers of Entrepreneurship Research*, 154–179.
- Atuahene-gima, K., & Li, H. (2004). Strategic Decision Comprehensiveness and New Product Development Outcomes in New Technology Ventures. *The Academy of Management Journal*, 47(4), 583–597.
- Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*.
- Batjargal, B. (2003). Social Capital and Entrepreneurial Performance in Russia : A Longitudinal Study. *Organization Studies*, 24(4), 535–556.
- Batjargal, B. (2007a). Internet entrepreneurship : Social capital , human capital , and performance of Internet ventures in China. *Research Policy*, 36, 605–618.
- Batjargal, B. (2007b). Network triads : transitivity , referral and venture capital decisions in China and Russia. *Journal of International Business Studies*, 38(6), 998–1012.
- Baum, J. A. C., Calabrese, T., & Silverman, B. S. (2000). Don't go it alone: alliance network composition and startups' performance in Canadian biotechnology. *Strategic Management Journal*.
- Baum, J. A. C., & Oliver, C. (1991). Institutional Linkages and Organizational Mortality. *Source: Administrative Science Quarterly*, 36(2), 187–218.
- Baum, J. A. C., & Silverman, B. S. (2004). Picking winners or building them? Alliance, intellectual, and human capital as selection criteria in venture financing and performance of biotechnology startups.

*Journal of Business Venturing*, 19(3), 411–436.

- Beckman, C. M., & Haunschild, P. R. (2002). Network Learning : The Effects of Partners' Heterogeneity of Experience on Corporate Acquisitions. *Administrative Science Quarterly*, 47(1), 92–124.
- Brander, J. A., Amit, R., & Antweiler, W. (2002). Venture-Capital Syndication: Improved Venture Selection vs. the Value-Added Hypothesis. *Journal of Economics & Management Strategy*, 11(3), 422–451.
- Brüderl, J., & Preisendörfer, P. (1998). Network Support and the Success of Newly Founded Business. *Small Business Economics*, 10(3), 213–225.
- Brüderl, J., Preisendörfer, P., & Ziegler, R. (1992). Survival Chances of Newly Founded Business Organizations. *American Sociological Review*, 57(2), 227–242.
- Burt, R. S. (2001). Structural Holes versus Network Structure as Social Capital. *Social Capital: Theory and Research*, 31–56.
- Bygrave, W. D. (1988). The structure of the investment networks of venture capital firms. *Journal of Business Venturing*, 3, 137–157.
- Ciavarella, M. A., Buchholtz, A. K., Riordan, C. M., Gatewood, R. D., & Stokes, G. S. (2004). The Big Five and venture survival : Is there a linkage ? *Journal of Business Venturing*, 19, 465–483.
- Clercq, D. De, & Dimov, D. (2006). Investment Strategy and Portfolio Failure Rate : *Entrepreneurship Theory and Practice*, 28(6), 207–223.
- Coleman, J. S. (1988). Social Capital in the Creation of Human Capital. *American Journal of Sociology*, 94, S95–S120.
- Cooper, A. C., Gimeno-gascon, F. J., & Woo, C. Y. (1994). Initial Human And Financial Capital As Predictors Of New Venture Performance. *Journal of Business Venturing*, 9(5), 371–395.
- Cumming, D. J. (2006). The Determinants of Venture Capital Portfolio Size : Empirical Evidence. *Journal of Business*, 79(4).
- Dahlqvist, J., Davidsson, P., & Wiklund, J. (2000). Initial Conditions as Predictors of New Venture Performance: A Replication and Extension of the Cooper et al . study. *Enterprise and Innovation Management Studies*, 1(1), 1–17.
- Darr, E. D., & Kurtzberg, T. R. (2000). An Investigation of Partner Similarity Dimensions on Knowledge Transfer. *Organizational Behavior and Human Decision Process*, 82(1), 28–44.
- De Clercq, D., & Sapienza, J. H. (2004). When do Venture Capital firms learn from their portfolio companies? In *Vlerick Leuven Gent Working Paper Series 2004/03*.
- Goerzen, A., Beamish, P. W., Goerzen, A., & Beamish, P. W. (2005). The Effect of Alliance Network Diversity on Multinational Enterprise Performance. *Strategic Management Journal*, 26(4), 333–354.
- Gorman, M., & Sahlman, W. A. (1989). What do venture capitalists do ? *Journal of Business Venturing*, 4, 231–248.
- Grandi, A., & Grimaldi, R. (2003). Exploring the Networking Characteristics of New Venture Founding Teams. *Small Business Economics*, 21, 329–341.
- Granovetter, M. (1973). The Strength of Weak Ties. *The American Journal of Sociology*.
- Greve, A., & Salaff, J. W. (2003). Social Networks and Entrepreneurship. *Entrepreneurship Theory and Practice*, 1–22.
- Gronum, S., Verreyne, M., & Kastle, T. (2012). The Role of Networks in Small and Medium-Sized Enterprise Innovation and Firm Performance. *Journal of Small Business Management*, 50(2), 257–282.

- Gulati, R., Nohria, N., & Zaheer, A. (2000). Strategic networks. *Strategic Management Journal*, 215, 203–215.
- Hanlon, D. (2001). Vision and support in new venture start-ups 1. In H. J. Bygrave, W.D., Autio, E., Brush, C.G., Davidsson, P., Green, P.G., Reynolds, P.D., Sapienza (Ed.), *Frontiers of Entrepreneurship Research*. (p. 263–275.).
- Hansen, E. L. (1995). Entrepreneurial networks and new organization growth Eric L. Hansen. *Entrepreneurship: Theory and Practice*, 4(Summer).
- Harrison, R. T. (2018). Crossing the chasm : the role of co-investment funds in strengthening the regional business angel ecosystem. *Small Enterprise Research*, 0(0), 1–20.
- Harrison, R. T., & Leitch, C. (2010). Voodoo Institution or Entrepreneurial University? Spin-off Companies, the Entrepreneurial System and Regional Development in the UK. *Regional Studies*, 44(9), 1241–1262.
- Hoang, H., & Antoncic, B. (2003). Network-based research in entrepreneurship A critical review. *Journal of Business Venturing*, 18(2), 165–187.
- Hochberg, Y. V, Ljungqvist, A., & Lu, Y. (2007). Whom You Know Matters: Venture Capital Networks and Investment Performance. *Journal of Finance*, 62(1), 251–301.
- Hood, N. (2000). Public venture capital and economic development : The Scottish experience. *Venture Capital An International Journal of Entrepreneurial Finance*, 2(4), 313–341.
- Hsu, D. H. (2004). What Do Entrepreneurs Pay for Venture Capital Affiliation ? *The Journal of Finance*, LIX(4).
- Hung, H. (2006). Formation and Survival of New Ventures. *International Small Business Journal*, 24(4), 359–378.
- Jaaskelainen, M., Maula, M., & Seppa, T. (2006). Allocation of Attention to Portfolio Companies and the Performance of Venture Capital Firms. *Entrepreneurship: Theory and Practice*, 185–206.
- Kanniainen, V., & Keuschnigg, C. (2003). The optimal portfolio of start-up firms in venture capital finance. *Journal of Corporate Finance*, 9, 521–534.
- Lane, P. J., & Lubatkin, M. (1998). Relative absorptive capacity and interorganizational learning. *Strategic Management Journal*, 19(June 1997), 461–477.
- Lee, C., Lee, K., & Pennings, J. M. (2001). Internal capabilities, external networks and performance: A Study on technology- based ventures. *Strategic Management Journal*, 640, 615–640.
- Lerner, J. (1994). The Syndication of Venture Capital Investments. *Financial Management*, 23(3), 16.
- Levinthal, D. A., & March, J. G. (1993). The Myopia of Learning. *Strategic Management Journal*, 14, 95–112.
- Lockett, A., & Wright, M. (2001). The syndication of venture capital investments. *Omega*, 29(5), 375–390.
- Marvel, M. R., Davis, J. L., & Sproul, C. R. (2016). Human Capital and Entrepreneurship Research: A Critical Review and Future Directions. *Entrepreneurship: Theory and Practice*, 599–626.
- Mason, C., Botelho, T., & Harrison, R. (2013). The transformation of the business angel market: evidence from Scotland. *Working Paper, Adam Smith Business School, University of Glasgow and University of Edinburgh Business School*.
- Nahapiet, J., & Ghoshal, S. (1998). Social Capital , Intellectual Capital , and the Organizational Advantage. *The Academy of Management Review*, 23(2), 242–266.
- Nanda, R., & Rhodes-Kropf, M. (2017). Coordination Frictions in Venture Capital Syndicates. *Harvard Business School Entrepreneurial Management Working Paper No 17-089. SSRN Electronic Journal*.

- Norton, E., & Tenenbaum, H. (1993). Specialization versus diversification as a venture capital investment strategy. *Journal of Business Venturing*, (8), 431–442.
- Paul, S., Whittam, G., Wyper, J., Paul, S., Whittam, G., & Wyper, J. (2007). Towards a model of the business angel investment process Towards a Model of the Business Angel Investment Process. *Venture Capital An International Journal of Entrepreneurial Finance*, 1066.
- Pena, I. (2004). Business Incubation Centers and New Firm Growth in the Basque Country. *Small Business Economics*, 223–236.
- Peña, I. (2002). Intellectual capital and business start-up success. *Journal of Intellectual Capital*, 3(2), 180–198.
- Proefschrift, V. E. S. (2006). *The Early Growth of Academic Spin-offs*.
- Proksch, D., Stranz, W., Röhr, N., Ernst, C., Pinkwart, A., Schefczyk, M., ... Pinkwart, A. (2017). Value-adding activities of venture capital companies : a content analysis of investor ' s original documents in Germany. *Venture Capital*, 1066, 1–18.
- Rodan, S., & Galunic, C. (2004). More than Network Structure : How Knowledge Heterogeneity Influences Managerial Performance and Innovativeness. *Strategic Management Journal*, 25(6), 541–562.
- Ruef, M. (2002). Strong ties , weak ties and islands : structural and cultural predictors of organizational innovation. *Industrial and Corporate Change*, 11(3), 427–449.
- Sahlman, A. (1990). The structure and governance of venture-capital organizations, 27, 473–521.
- Sapienza, J. H., Manigart, S., & Vermeir, W. (1996). Venture Capitalist Governance and value added in four countries. *Journal of Business Venturing*, (11), 439–469.
- Semrau, T. (2014). How Exactly Do Network Relationships Pay Off? The Effects of Network Size and Relationship Quality on Access to Start-Up Resources. *Entrepreneurship Theory and Practice*, 501–525.
- Sørheim, R., & Landström, H. (2001). Informal investors - A categorization, with policy implications. *Enterprise and Innovation Management Studies*, 5626(13), 351–370.
- Spigel, B. (2017). Entrepreneurial ecosystems as practices and resources. In *Academy of Management Conference* (pp. 1–29). Atlanta.
- Stam, W., Arzlanian, S., & Elfring, T. (2014). Social capital of entrepreneurs and small firm performance: A meta-analysis of contextual and methodological moderators. *Journal of Business Venturing*, 29(1), 152–173.
- Stinchcombe, A. L. (1965). Social Structure and Organizations. In R. McNally (Ed.), *Handbook of Organization* (J. March, pp. 260–290). Chicago.
- Wilson, R. (1968). The Theory of Syndicates. *Econometrica*, 36(1), 119–132.

## Appendix

Table 1: Hypotheses

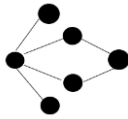
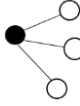
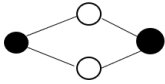
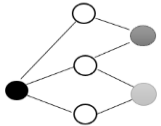
Social capital Theory	Network Configuration	Survival	Hypothesis	
Network structure		+	H1	
Relational Embeddedness		+	H2	
		Weak Ties	+	H3
		Weak Ties x previous director's experience	+	H4
Network content		+	H5	

Table 3: Probit models predicting new venture survival based on venture capital network variables  
N=49 companies

\*\*p<0.05; \* p<0.1

Variables	I model	II model	III model	IV model
<b>Control Variables</b>				
Intercept	-0.19 (0.89)	0.25 (1.06)	0.11 (1.06)	1.05 (2.00)
University connection	0.40 (0.46)	0.38 (0.47)	0.38 (0.50)	0.31 (0.51)
Geographic area	-0.73 (0.60)	-0.66 (0.61)	-0.65 (0.66)	-0.64 (0.67)
Sector2	0.13 (0.63)	0.00 0.66	-0.18 (0.72)	-0.18 (0.73)
Sector 3	0.78 (0.58)	0.64 (0.61)	0.47 (0.66)	0.37 (0.69)
<b>Human Capital</b>				
Number of directors	0.71 ** (0.35)	0.68 * (0.35)	0.47 (0.33)	0.48 (0.34)
Female	-0.53 (0.71)	-0.54 (0.71)	-1.66 * (0.97)	-1.72 * (1.00)
Previous director's experience	-1.35 ** (0.67)	-1.58 ** (0.75)	-1.78 ** (0.80)	-2.82 (1.99)
<b>Financial capital</b>				
Money first round	0.05 * (0.02)	0.05 ** (0.02)	0.06 ** (0.02)	0.07 ** (0.03)
<b>Social Capital</b>				
Network size		-0.04 (0.06)		
Strong ties			0.30 (0.30)	0.33 (0.31)
Weak ties			-0.22 ** (0.10)	-0.34 * (0.20)
Heterophily			1.91 * (1.09)	1.91 * (1.10)
<b>Interaction effect</b>				
Previous director's experience x Weak ties				0.13 (0.20)
Chi-square	13.8 *	14.29	19.33 *	19.88 *
-Log likelihood	-22.41	-22.16	-19.64	-19.37

Table 4: Marginal effects of network variables on probability of new venture's survival

Variables	New venture survival		
<b><i>Control Variables</i></b>			
University connection	0.10	0.10	0.08
Geographic area	-0.17	-0.16	-0.14
Sector2	0.00	-0.05	-0.04
Sector 3	0.19	0.13	0.09
<b><i>Human Capital</i></b>			
Number of directors	0.20**	0.13	0.12
Female	-0.18	-0.59**	-0.60*
Previous director's experience	-0.32***	-0.33***	-0.40***
<b><i>Financial capital</i></b>			
Money first round	0.015**	0.019**	0.019**
<b><i>Social Capital</i></b>			
Network size	-0.012		
Strong ties		0.08	0.08
Weak ties		-0.06**	-0.08**
Heterophily		0.53*	0.49*
<b><i>Interaction effect</i></b>			
Previous director's experience x Weak ties			0.036





## **CONCLUSION**

The three papers can be tied together, and they can tell one story. Indeed, the first one depicts how an entrepreneur's network is important for business angels, and also how the choice of the co-investor assumes a particular relevance in the investment decision-making process. This relevance is recalled by the second paper, that describes how investors choose their co-investment partners to fund new ventures reflecting the importance of homophily theory as a tool to reduce the uncertainty of the choice. Eventually, the third paper proposes that the venture capital network can be a source of social capital for the funded new venture. Indeed, by being ties with other companies and investors, the new venture has a different chance to survive.

All together these papers address a call for more sociology in analysing finance (Uzzi 1999) and entrepreneurship by using not only theories but also sociological methodology (Stuart and Sorenson 2005). Indeed, this thesis has explored some entrepreneurial financial phenomena such as syndications and investment decision under the liens of entrepreneurship network theory to enhance their understanding and sheds light on the importance of the network rather than a single unit of analysis in explaining entrepreneurship. Therefore, several conclusions can be drawn from this thesis both for the research community and practitioners. This thesis presents some limitations and some suggestions for future research. These are explained below.

### **Theoretical contribution**

By merging together theories derived from the entrepreneurial network and entrepreneurial finance research streams, this thesis provides several contributions. In detail, the results enrich research on studying the impact of the network on new ventures (Stam, Arzlanian, and Elfring 2014) and its formation (Boschma, Balland, and de Vaan 2014). In particular, paper 1, starting from the importance of entrepreneur's network for the new venture itself, acknowledged it as a soft factor which can influence the investor's decision-making process by signalling entrepreneur's managerial and leadership skills. In doing so, we enhanced also the venture capital literature which focused on describing the business angel investment decision-making process (Mason and Harrison 1996; Paul et al. 2007). Although different types of economic network were already analysed in the literature (Boschma, Balland, and de Vaan 2014; Giuliani 2013; Xavier Molina-Morales et al. 2015), paper 3 analyses for the first time the impact of venture capital network, that is the one derived by several syndication events during the same time period. In regard to the second line of research, despite the call for including networks in studying entrepreneurial ecosystem (Spigel and Harrison 2018), in paper 2 we are, to the best of

our knowledge, the first ones, to study the investment ecosystem formation of one region by using social network analysis methodology providing evidence in support of the homophily theory.

### **Methodological contribution**

This thesis analysed the impact of network and its formation by using different methodologies and software., Qualitative interview in the first paper and then probit regressions in the third one were used to study the impact of network. The network structure was instead investigated by using an exponential random graph model. The use of different methodology allows us to address different research questions and so overcoming some previous research limitations. For instance, the first qualitative paper explains the reasons behind the results of quantitative papers which found an association about network and access to financial resources (Baum and Silverman 2004; Miloud, Aspelund, and Cabrol 2012). The second methodology, the ERGM, allows us to include in the model some aspects that can play an important role in explaining network structure, such as triadic closure. This against the previous literature which studied network by using the mainstream regressions which base the analysis on the assumption of the independence of observations (Harris 2014). Lastly, in the third paper a combination of mainstream probit regressions and social network analysis approach, supported by a social network analysis software, UCINET, helped us to identify network variables and to study their effects.

### **Implication for practice**

This thesis provides entrepreneurs with new insights about how to structure their network before asking for funding and also how to choose the best investors in terms of opportunity derived by the position in venture capital network. For instance, entrepreneurs could prefer investors who can tie them with other companies operating in different sectors to increase the opportunity of synergies or move to a geographical area where several investors co-invest because of proximity to increase the chance to get more funding.

On the other side, investors can learn about their own decision-making process. Literature has depicted it previously (Paul et al. 2007), but it has never focused on the interaction among the investor and the entrepreneur's network. Therefore, unexperienced investors could include these elements in their analysis.

Last but not least, policy makers who are involved in public policy with the aim to push entrepreneurial ecosystems, as it is in Scotland, could be aware of the importance of social dynamics in shaping them and so

the need to contemplate also networks as an element that can influence the outcome of a policy. For instance, given the importance of proximity, they could decide to provide funding in a specific area where there is a low number of investors to increase the probability of syndications rather than provide funding where there is already a well-established connection among investors.

### **Limitations and future research**

Some of the limitations can be identified and suggestions for future research can be drawn from them.

The first limitation is related to the difficulty to study networks because of their dynamics and evolution overtime. Indeed, some boundaries to identify the observed networks needed to be set. Although the researcher's choice has been based on previous literature, it is not possible to exclude the presence of the researcher bias. Therefore, the literature should investigate furtherly the social network data research to set rules which can better guarantee the reliability and validity of the analysis.

Secondly, limitations stem from the use of forefront methodology: the exponential random graph model. Although this model has been already used in the literature (Belso-Martínez, Expósito-Langa, and Tomás-Miquel 2016; Robins, Lewis, and Wang 2012), it requires statistical improvements in terms of dealing with network effects correlation and robustness test (Robins 2014).

Moreover, limitations derive from the difficulty to collect data about investments, especially the ones made by business angels, who prefer to be anonymous (Mason and Harrison 2008).

Given the geographical and temporal focus, the generalisability of the results is not possible. However, future authors could study this type of networks in other regions to identify possible patterns that can be analysed to build a possible general theoretical framework.

## References

- Baum, Joel A C, and Brian S. Silverman. 2004. "Picking Winners or Building Them? Alliance, Intellectual, and Human Capital as Selection Criteria in Venture Financing and Performance of Biotechnology Startups." *Journal of Business Venturing* 19(3): 411–36.
- Belso-Martínez, José-Antonio, Manuel Expósito-Langa, and José-Vicente Tomás-Miquel. 2016. "Knowledge Network Dynamics in Clusters: Past Performance and Absorptive Capacity." *Baltic Journal of Management* 11(3): 310–27.
- Boschma, Ron, Pierre-Alexandre Balland, and Mathijs de Vaan. 2014. "The Formation of Economic Networks : A Proximity Approach." *Regional Development and Proximity Relations*: 243–66.
- Giuliani, Elisa. 2013. "Network Dynamics in Regional Clusters: Evidence from Chile." *Research Policy* 42(8): 1406–19.
- Harris, Jenine. 2014. "An Introduction to Exponential Random Graph Modeling."
- Mason, Colin M, and Richard Harrison. 1996. "Why 'Business Angels' Say No: A Case Study of Opportunities Rejected by an Informal Investor Syndicate." *International Small Business Journal* 14(2): 35–51.
- Mason, Colin M, and Richard T Harrison. 2008. "Measuring Business Angel Investment Activity in the United Kingdom : A Review of Potential Data Sources." *Venture Capital An International Journal of Entrepreneurial Finance* 10(4): 309–30.
- Miloud, Tarek, Arild Aspelund, and Mathieu Cabrol. 2012. "Startup Valuation by Venture Capitalists: An Empirical Study." *Venture Capital* 14(2–3): 151–74.
- Paul, Stuart et al. 2007. "Towards a Model of the Business Angel Investment Process Towards a Model of the Business Angel Investment Process." *Venture Capital An International Journal of Entrepreneurial Finance* 1066.
- Robins, Garry. 2014. "Exponential Random Graph Models for Social Networks." *The SAGE Handbook of Social Network Analysis*: 484–500.
- Robins, Garry, Jenny M. Lewis, and Peng Wang. 2012. "Statistical Network Analysis for Analyzing Policy Networks." *Policy Studies Journal* 40(3): 375–401.
- Spigel, Ben, and Richard Harrison. 2018. "Toward a Process Theory of Entrepreneurial Ecosystems." *Strategic Entrepreneurship Journal* 12: 151–68.
- Stam, Wouter, Souren Arzlanian, and Tom Elfring. 2014. "Social Capital of Entrepreneurs and Small Firm Performance : A Meta-Analysis of Contextual and Methodological Moderators." *Journal of Business Venturing* 29(1): 152–73.
- Stuart, Toby E, and Olav Sorenson. 2005. "Social Networks and Entrepreneurship." In *Handbook of Entrepreneurship Research: Interdisciplinary Perspectives*, eds. Sharon A Alvarez, Rajshree Agarwal, and Olav Sorenson. Boston, MA: Springer US, 233–52.
- Uzzi, Brian. 1999. "Embeddedness in the Making of Financial Capital : How Social Relations and Networks Benefit Firms." *American Sociological Review* 64(4): 481–505.
- Xavier Molina-Morales, F., José A. Belso-Martínez, Francisco Más-Verdú, and Luis Martínez-Cháfer. 2015. "Formation and Dissolution of Inter-Firm Linkages in Lengthy and Stable Networks in Clusters." *Journal of Business Research* 68(7): 1557–62.

