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"VC Syndication in the DACH Region:

A Strategic Mean to Ensure Firm Survival."

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Abstract

This study proposes a new perspective to explain what drives venture capital (VC) firms located in the in the German-speaking countries of the EU, the so-called DACH region, to engage in syndication behaviour. By taking a context-sensitive approach, it postulates that these VC firms are driven to engage in syndication behaviour by the need to ensure future firm survival. Drawing upon resource dependence- , as well as signalling theory, a conceptual framework is developed to explain this reasoning, suggesting that in environments characterized by risk averse and inexperienced investors in respect to venture capital, VC firms face increased difficulties to collect sufficient capital for future firm existence. Especially those firms exhibiting unfavourable firm characteristics, alienating hesitant investors even more, face an accelerated risk of business failure. This study investigates which VC firm characteristics serve to explain that the syndication behaviour of VC firms in the DACH region is indeed need-driven. It proposes that a VC firm's early stage- and dispersed industry focus, low access to financial resources, small HR capacity, as well as the opportunity to establish informal ties significantly influence a VC firm's propensity to syndicate. Applying multiple linear regression, findings shows that a VC firm's early stage- and dispersed industry focus, as well as its access to financial resources indeed have a positive influence, whereas its human resources capacity as well as alternative opportunities to establish ties have a negative influence on its decision to syndicate.

Keywords: Venture Capital, Syndication Behaviour, VC Co-Investment Network, Resource Dependence Theory, Signaling Theory

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LIST OF ABBREVIATIONS

AVCO – Austrian Private Equity and Venture Capital Organisation
AVCAL – Australian Venture Capital Association Limited
BVK – Bundesverband Deutscher Kapitalgeber
BVC – Bank-related Venture Capitalist
CVC – Corporate Venture Capitalist
DACH – Abbrevation for the German (D), Austrian (A) and Swiss (CH) region
EVCA – European Venture Capital Association
GDP – Gross Domestic Product
IPO – Initial Public Offering
IVC – Independent Venture Capitalist
LBO – Leveraged Buyout
MBO – Management Buyout
MCAR – Data missing completely at random
NVCA – National Venture Capital Association
ROI – Return on Investment
SECA – Swiss Private Equity and Corporate Finance Association
SNA – Social Network Analysis
US – United States of America
UK – United Kingdom
VC – Venture Capital

1. INTRODUCTION

During the last decade, venture capital (VC) has become an important driver of economic growth. In more concrete terms, Meyer (2010) found a robust, positive correlation between VC investments and real economic growth, showing that "An increase of VC investments of 0.1% of GDP is statistically associated with an increase in real GDP growth of 0.30 percentage points" (p.1). While the USA has the largest and most sophisticated venture capital market in the world, its European counterpart has only slowly begun to develop (Frommann and Dahmann, 2005). Past research showed that this deliberate market development can, amongst other things, be devoted to the scarcity of individuals willing to take on the associated high risks of providing capital to newly founded ventures (Fohlin, 2006). This phenomenon can in turn be explained by looking at the nature venture of capital.

As a type of private equity capital, VC constitutes an important funding source for new ventures and small businesses with high future growth potential that are however rated to be too risky for receiving funding from standard capital markets or banks. Principally, for investors, the market for venture capital creates an alternative investment option to traditional options such as stocks and bonds. Although investing capital in venture capital projects bears a higher investment risk compared to more traditional investment opportunities, it also entails the chance of receiving above-average returns. VC is pooled in so-called VC funds, managed by VC firm managers, who primarily make investments in promising new companies by using the financial capital of their third-party investors. Often, such funds are set up with a fixed horizon and a particular target set of investors, e.g. wealthy individuals (Brander, Amit and Antweiler, 2002). Just like in the case of investment bankers, by transferring the investment responsibility to the fund's managers of the fund, investors must trust them in their doing, expertise and skills to make high-quality investment decisions on behalf of themselves. Investors are thus dependent on the investment ability of the VC management team. However, in case of doubt, they still have the aforementioned traditional investment options in which they can alternatively invest their money in. In contrast, VC firms are fully dependent upon receiving capital from investors to be able to operate in the first place (Jääskeläinen, 2012). Thus, to successfully raise further funds, they must make sure to be perceived as an appealing, trustworthy and compelling investment opportunity. Yet, if VC firms exhibit characteristics indicating competitive resource deficiency or firm characteristics that do not meet the expectations of potential investors, they will most likely encounter difficulties to attract sufficient capital. As a direct consequence, the needed amount of capital and resources for operations will continuously diminish, which will compromise the firm's long-term survival.

Prior studies in the field of venture capital have introduced VC syndication (synonymous to co-investment) as an efficient strategic tool to mitigate resource deficits. In general, VC syndication takes place, when two or more VC firms take an equity stake in the same investment project, either during the same round or at different points of time (Brander et al., 2002). By building these formal ties with other market players, VC firms have the opportunity to position themselves in a VC syndication network, thereby profiting from the beneficial effects of syndication. Besides a better access to critical resources, earlier studies have found other positive effects, such as reduced risk through portfolio diversification, (Jääskeläinen, Maula and Seppä, 2006), superior deal selection (Lerner, 1994; Dimov and Milanov, 2010) and enhanced deal flow through an increased amount of information received (Bygrave, 1987; Fritsch and Schilder, 2008). Most of the existing research has focused on the beneficial effects when explaining motives for syndication behaviour, thereby somewhat ignoring the underlying drivers that might potentially *force* VC firms to syndicate (Jääskeläinen, 2012). Furthermore, the majority of research has been conducted with data extracted from the US or UK VC market. In general, Anglo-American countries are said to exhibit less risk-averse behaviour in respect to investment decisions (McKinsey, 2014). Also, the market for VC in the US and UK has already been established for a longer period of time, having generated a considerable number of highly successful VC investment exits. Consequently, investors in these regions have become increasingly interested and accustomed to the opportunity of investing their money in VC projects, to reap the benefits from future project success stories.

Yet, in regions characterized by a more nascent VC industry, alternative investments in form of venture capital may not yet be perceived as an attractive alternative investment option to prevalent investment instruments, such as stocks or bonds. Here investors are not accustomed to the procedures and practices behind venture capital projects. The result is a group of potential investors being reluctant to opt for venture capital investments. Furthermore, this reservation towards VC investments can even become intensified in regions known for a rather risk-averse attitude and uncertainty avoidance behaviour. VC firms might therefore face profound difficulties in raising enough capital to ensure their future firm existence. In light of this challenging background for successful future firm existence, it is reasonable to assume that VC firms might engage in syndication out of necessity rather than free will. Here, syndication works as a strategic action to mitigate the risk of business failure, with its beneficial effects serving as reassuring quality signals towards hesitant investors. As such, the decision to syndicate is driven by a VC firm's strategic need to ensure future fund collection and consequently its own survival.

Against this background, this study sets out to analyse the syndication behaviour of VC firms located in the DACH region, which is characterized by a high degree of risk aversion as well as a short history of venture capital [1]. More explicitly, it investigates certain firm characteristics potentially influencing a VC firm's propensity to syndicate, as they might be of hindering nature in the process of convincing hesitant investors to devote their money to the VC fund. Drawing upon resource dependence theory, as well as signalling theory, a conceptual framework is developed which provides the basis for identifying relevant firm characteristics as well as delineating how the effects of syndication may help to send reassuring signals of quality towards investors, thereby increasing the likelihood of future firm existence. The guiding research question of this study will therefore be:

> ***"****Which VC firm characteristics serve to explain that the syndication behaviour of VC firms headquartered in the DACH region is driven by the need to ensure future firm survival?"*

To answer this question, the paper is structured as follows. The subsequent chapter gives a brief overview on the attitude of German-speaking investors, followed by an introduction of how venture capitalists' business models work. Further, it introduces the syndication of investment deals as a possible strategic action employed by VC firms. Building upon this basic understanding of VC syndication, the chapter three provides an overview of existing research on VC syndication, describing applied theories and directions of prior studies. Next, drawing upon resource dependence, as well as signalling theory, a conceptual framework is developed. Chapter four deals with the development of hypotheses and is followed by chapter five on the overall methodology. Chapter six contains the empirical analysis, while chapter seven presents the analysis of the statistical results. Afterwards, chapter eight provides a discussion on these findings, followed by implications for both practitioners and researchers. Finally, chapter nine discusses the limitations of the study and possible future research directions.

2. VENTURE CAPITAL INVESTMENT CYCLE AND SYNDICATION

To gain a better understanding of the study's context, the following part gives a brief introduction to the organization and function of VC firms, the investment cycle and VC

[1] DACH is an acronym used to represent the region of the three German-speaking countries in Europe, Germany (D), Austria (A) and Switzerland (CH). This region has been chosen as the study's area of focus given the common spoken language among the three countries as well as the effort to work with a manageable data set in terms of scope and scale.

syndication itself, as well as the on the risk-averse attitudes of German-speaking investors, grounded in its culture and experience with the investment instrument of venture capital.

2.1. Venture Capital Organization

Venture capital is pooled in so-called VC funds. Most venture capital funds are organized as limited partnerships, with venture capital firms (general partners) acting as intermediaries, raising capital from investors (limited partners), such as pension funds, educational endowments, foundations, insurance companies or wealthy individuals, willing to invest their capital into a portfolio of promising ventures (Frommann et al., 2005; Leach and Melchier, 2010). This intermediary function distinguishes VC firms from e.g. angel investors, who mainly invest their own money. In general, the overall goal of a VC firm should be, to provide the highest return on investment possible to its investors, for them to continue providing their capital for further investment projects. How VC firms operate to achieve these goals can best be described by the so-called Venture Capital Cycle, which was introduced by Gompers and Lerner (2004) in their same-titled book. This cycle consists of three main parts: The fundraising phase, the investing phase and the divesting (exit) phase (see Figure 1). As already indicated by its name, during the fundraising phase, venture capital firms aim at raising a fund of a given size from the limited partner, by e.g. praising their unique investment strategy, past performance, experience or expertise in a particular industry. Next, during the investment phase, the general partner decides upon investments in promising new ventures, which subsequently become a part of a VC firm's overall investment portfolio. During the exit phase, investments are divested, thereby selling portfolio companies via an IPO, merger, acquisition, leveraged buyout or management buyout (Schwienbacher, 2005). As pictured in Figure 1, in order to successfully raise enough capital to operate (1), VC firms need to make high-quality investment decisions (2), to increase the likeliness of successful exits (3), which will in the end determine the return on investment to their investors (4). Although often said that the success of VC firms depends on the ability to profitably exit their portfolio companies (Espenlaub, Khurshed and Mohamed, 2014), the investment phase (2) should be considered just as important. The explanation is as follows: A VC firm's portfolio, and thus past investment decisions, may serve as the first indicator in respect to a VC firm's experience, past performance or the willingness to take risk is.

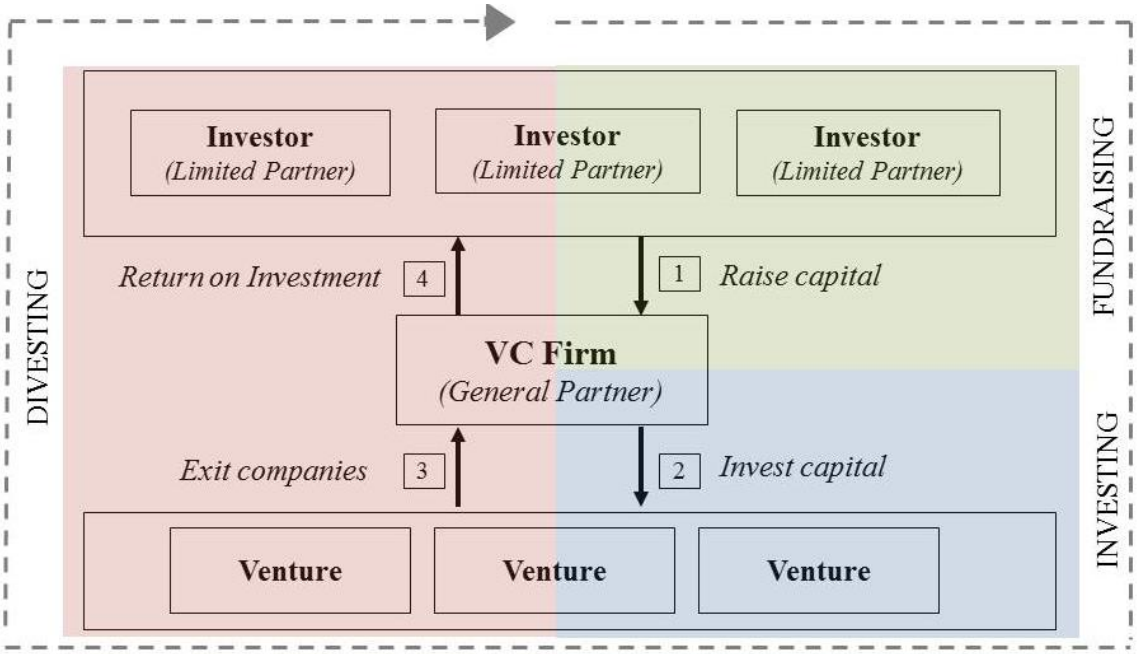

Figure 1. The Investment Cycle. *Adapted from Gomper and Lerner (2004).*

For example, few exits among all portfolio companies may signal a VC firm's poor past performance, as well as investing in many companies in an early stage status may indicate a rather high risk investment strategy. Also, with portfolio companies in many different kind of industries, investors may assume a VC firm to have less of the desired expertise in any industry. As VC firms are dependent upon a continuous supply of capital by their existing or new limited partners to continue their operations and thus ultimately to survive, they need to convince potential and current investors to keep providing capital into their fund managed. This is accomplished by developing an investment portfolio, firm characteristics and performance outcomes that meet an investor's expectations and requirements. However, if a VC firm, based on its past performance, resources and investment decisions, cannot convince investors to deliver high future returns on investment, the VC firm will likely face difficulties to collect enough capital to continue its operations at all. If this is the case, VC firms may not be able to survive on their own, but must pursue strategic actions to increase the probability of future firm existence. One way of doing so is to engage in syndication relationships with other VC firms, which result in co-invested deals among a VC firm's investment portfolio.

2.2. Venture Capital Syndication

Existing studies show that a significant amount of venture capital investments are managed jointly, providing evidence that VC firms often opt to syndicate their investments with other VC firms, rather than investing alone (Hochberg, Ljungqvist and Lu, 2007; Lerner, 1994). In more concrete terms, approximately 40–80% of all investments made by venture capitalists are syndicated (Jääskeläinen et al., 2006; Manigart, Lockett, Meuleman, Wright, Landström,

Bruining, Desbrières, and Hommel, 2006; Wright and Lockett 2003). Although this positive finding must be considered with caution for the less developed European VC market, syndication is nevertheless also common in Europe, resulting in a web of relationships among VC firms through current and past syndicated investments (Manigart, Lockett, Meuleman, Wright, Landström, Bruining, Desbrières, and Hommel, 2002; Hopp and Rieder, 2011; Hochberg et al. 2007). To get a brief overview of the existing syndication network among DACH VC firms, a sub goal of this study is therefore calculation and visualization of such syndication network.

Syndication is not a unique strategy to venture capitalists. Rather it is quite similar to any joint venture constellation where "one party to a project brings in partners" (Brander et al. 2002, p. 424) and also occurs with other types of investment. Per definition, syndication arises when venture capitalists jointly invest in projects. However, different opinions exist when it comes to define the point of time at which a syndicated relationship between two VC firms is established. On the one hand, VC syndication " is often taken to mean that two or more venture capitalists share a particular round of financing" (ibid. 2002, p. 242), whereas "the term is [also] used more broadly to refer to situations where different venture capitalists invest in a given project at different times" (ibid. 2002, p. 424).

The data available for this study only provides information about the last date at which a VC firm has invested into a company. As a consequence, it is unclear whether a VC has participated in previous investment rounds in a venture already. Therefore, it can only be measured whether two VC firms have made an investment in the same venture, but not whether they did so at the same point of time. Thus, the study follows the aforementioned, rather broad definition of syndication, as the presence of a co-investment is defined to be present if two VC firms hold the same companies in their active investment portfolios. This is based on the assumption that a VC firm, being invested in a company, keeps providing money to this company as long as it is in its active portfolio. Hence, the moment a second or third VC firm starts investing into the same company (called venture capital-staging), a co-investment is established.

2.3. Investment Attitude of German speaking Investors

To understand what drives VC firms located in the DACH region to employ certain strategic actions for ensuring firm survival, e.g. syndication, a closer look at the attitude of investors in the immediate environment is useful.

In general, German-speaking investors providing capital to VC funds and consequently firms are rare in number. In a recent study, McKinsey & Company (2014) find that Germany considerably lags behind the US and UK market when it comes to the availability of venture capital as a percentage of GDP. The study goes on to explain this situation by referring to the German culture as significantly more risk-averse, compared to Anglo-American regions, indicating that German-speaking investors prefer secure investment opportunities and consider start-ups as speculation with an unforeseeable high risk attached (ibid., 2014). This is in line with a study on German investment behaviour by the Gothaer Asset Management AG (2013), which finds that Germans profoundly avoid investing money in high-risk opportunities, as their most important guiding investment principle is security. Further, by investigating 22 different countries around the world, Rieger, Wang and Hens (2014), show that risk preference is indeed culturally driven and differences in risk aversion between countries and cultural regions are large. This notion is not new. Building upon Hofstede's cultural dimension theory (1980), the GLOBE discusses this line of thought, by empirically establishing nine cultural dimensions that allow to capture the similarities and differences among societies in respect to their norms, values, practices and beliefs avoidance (Gupta and Hanges, 2004). In particular, Germany scores highest of the 61 sample countries in the dimension uncertainty avoidance, which measures "in how far a collective relies on social norms, rules as procedures to alleviate unpredictability of future events" (p. 19. Although Hofstede explicitly states that "uncertainty avoidance does not equal to risk aversion" (2001, p.148), it still measures the extent to which a society can bear uncertain or ambiguous situations. Hence, the higher the uncertainty avoidance index, the less a society can cope with uncertain settings. Given the nascent existence of venture capital investment options in the DACH region, and the consequential majority of inexperienced investors when it comes to the general functioning of the venture capital market, VC investments will likely be associated with high investment risk. This risk-attached perception of venture capital can consequently act as a major deterrent in the investment decision process of potential investors located in German-speaking regions.

Applying this condition to the study's context, it can reasonably be assumed that the process of collecting fund from German-speaking investors might be of greater hassle for VC firms, than e.g. for VC firms located in Anglo-American regions. In addition, if VC firms exhibited characteristics, which stoked investors' reservations towards VC investments, the complexity became even more severe, up to the point where VC firms faced their own downfall due to an eventually ceasing capital inflow from investors in their own country. Thus, VC firms located

in the DACH region could be driven to pursue certain strategic actions by the urgent need of convincing hesitant investors of devoting their capital to VC funds, to increase the likelihood of future firm existence. This is in line with the implications from the findings of a study conducted by Lüde (2013) which showed, that investors in the DACH region are less concerned with losing their invested money if there seemed to be real chances that the risk taken were worthwhile. From this, a direct implication for VC firms could be to employ strategic actions in order to achieve such positive effect among investors. This study proposes VC syndication to be a mean for generating positive investor perceptions, especially for VC firms exhibiting less predestinated firm characteristics, as it enables VC firms to send reassuring signals about their strategy and achievements to the market. As a direct consequence, this will increase the VC firms' likelihood of persuading reluctant investors in their investment decision. In order to understand the overall reasoning behind these propositions, the following part will give a brief overview on existing research on VC syndication.

3. PAST RESEARCH

Based on Jääskeläinen's literature review (2012) the existing research on VC syndication can be grouped into several categories, where category explores factors that influence the syndication partner selection process, while a second investigates the effects of syndication on portfolio company, VC firm and fund firm performance, whereas a third examines motivations driving a venture capitalists' propensity to syndicate. The following chapter outlines all three categories. However, given the paper's aim to ascertain which firm characteristics influence a VC firm's propensity to syndicate, the focus will primarily be on research dealing with syndication motives.

3.1. VC Partner Selection

According to Jääskeläinen (2012), a syndicate "combines the interests of multiples investors for a number of years before the venture is exited from, and therefore requires co-ordination and interaction between venture and VC firms" (p.450). However, rather than investigating the structuring, composition and dynamics of the relationship between a company and its multiple venture capitalists investing in this particular venture, the majority of past research has focused on the relationships occurring at the venture capital firm level (ibid., 2012). That is, the topic on VC partner selection has drawn significantly more contributions, often supporting the findings from the general literature on alliance partner selection (e.g. Chung et al., 2002; Gulati and Gargiulo, 1999). Among others, the researched criteria influencing

partner selection are the role of previous relationships, which will increase the level of perceived trust (Meulemann, Wright, Manigart and Locket, 2009), the role of investment partner homophily in terms of similar investment focus, experience and success (Trapido, 2007) and the position's role in the overall syndication network (Dimov and Milanov, 2010).

3.2. Performance Effects

As it will become evident throughout the paragraph on motivational factors of syndication, the propensity to syndicate is mostly driven by beneficial outcome effects. Hence, it can reasonably be assumed that engaging in co-investment relationships will have a positive influence on the portfolio firms, VC firm and fund performance and value. However, according to Jääskeläinen (2012), differences in evidence exist in respect to portfolio firm, VC firm and fund level performance. The majority of evidence shows that syndication has a positive effect on *portfolio firm performance*, indicating that portfolio companies being backed with venture capital in fact benefit from syndicated investments (e.g. Brander et al., 2002; Hege, Palomino and Schwienbacher, 2003). According to Jääskeläinen (2012), this positive effect on performance can be explained by the venture's access to accumulated resources of the VC firms co-investing in a venture, its increased legitimacy and credibility due to the affiliation with a potentially prominent investor group and a higher degree of reputational capital, which in the end may serve to ensure a venture's quality and pricing correctness during an exit process (Megginson and Weiss, 1991). However, on *VC firm and fund level*, only little research exists trying to show how syndication affects a VC firm's performance. This evidence scarcity can mainly be explained by the absence of publicly available data on VC firm performance. As privately held firms, they are not required to publish any performance-related data, thus leaving researchers to choose measures, believed to proxy best for VC firm performance, on their own (Jääskeläinen, 2012). Nevertheless, by taking a VC firm's network embeddedness as a measure for syndication and the number of successful IPOs as performance measure, Echols and Tsai (2005) find no significant relationship between both variables. However, Bothner, Kang and Lee (2008) find that a VC firm's status in the syndication network has a positive effect on its future existence. Investigating the UK Venture Capital Market as well, Checkley, Higón and Angwin (2010) are able to find a positive effect of a VC firm's position in the syndication network on its performance, stating that a central position will positively influence the share of IPOs among a VC firm's overall investment portfolio. To summarize, the status quo of research on performance effects through VC syndication, can hence be considered as numerous in respect

to portfolio company performance exist, whereas research regarding performance effects through syndication on VC firm or fund level remains scarce.

3.3. Syndication Motives

Throughout the existing literature on syndication motives, the following prominent views have been used to explain VC firms' syndication behaviour, often claimed to be the drivers behind syndication. However, following Jääskeläinen (2012), they are indeed the beneficial effects resulting from syndication behaviour.

The most prevalent approach, explaining why VC firms syndicate, stems from ***finance theory,*** with the guiding motives for syndication being risk reduction and sharing through portfolio diversification (Manigart et al. 2002, Jääskeläinen et al. 2006). In general, syndicated investments enable VC firms to participate in larger deals, in respect to size and number, given that the invested amount is shared among all participating parties (Ferrary, 2010; Gottschalg and Gerasymenko, 2008). Consequently, each individual VC firm can in total invest smaller sums in a larger number of portfolio companies. The total sum invested is spread across a larger pool of investments, thereby reducing the overall risk of failure (Markowitz, 1952; Manigart et al., 2006). Overall, this results in reduced investment risk, given an increased portfolio diversification. Furthermore, syndication enables VC firms to share project-related investment risks with other participating investors. This benefit may be highly persuasive when considering engaging in syndication, given the VC industry's illiquidity and the resulting difficulty to adjust the portfolio for unanticipated higher risk by the act of divesting (Manigart et al., 2002). Certainly, by sharing a project's risks, venture capitalists must also share the project's proceeds. This can therefore be considered as one of the primary costs of VC syndication, which in turn stresses the assumption that primarily need-driven VC firms consider the benefits to be greater than the simultaneously occurring costs (Brander et al., 2002).

Second, a VC firm's motivation to syndicate can also be explained from a ***resource-based perspective***, addressing the pursued aim of leveraging existing resources, skills and information. Participating in syndicated deals may enable VC firms to attain additional or complementary ex-ante selection expertise and ex-post management skills from partners, which will in turn result in a more high quality investment portfolio (Mas, Vignes and Weisbuch, 2008; Dimov et al., 2010). Furthermore, through resource sharing and consequently reduced resource constraints, syndicated deals enable VC firms to increase their portfolio they can optimally manage (Manigart et al., 2002). Finally, engaging in syndicated

deals will increase a VC firm's degree of information inflow and exchange, enabling better understanding of market development, trends and the selection of promising venture investments. Thus, syndicates enable VC firms to increase their access to more, possibly high-quality investment opportunities, from which they can then select the best ones (Jääskeläinen, 2012; Manigart et al., 2006; Fritsch et al., 2008).

This notion is closely linked to the motive of ***superior deal selection.*** Following Lerner (1994), Brander et al. (2002) propose the selection hypothesis as a rationale for syndication. When evaluating a potential investment opportunity, based on its own evaluation, a venture capitalist might be unsure whether to invest in a company. By engaging in co-investment relationships, VC firms benefit from receiving a second opinion on the selected investment from its investment partners. Their willingness to co-invest in the potentially promising deal coupled with different perspectives and evaluation techniques, reassures the proposing VC of the deal's quality. Hence, syndication can offer the benefit of a more effective opportunity screening procedure, resulting in reduced danger potential of adverse selection, given the overall improved investment selection process (Pence, 1982; Lerner, 1994; Brander et al., 2002).

Fourth, from a portfolio management point of view, another motive to engage in co-investment relationship is the increased quantity and quality of ***deal flow,*** which is "the available amount of potentially promising investments" (Zheng, 2004, p. 26; Sorenson and Stuart, 2001; Locket and Wright, 1999). For a VC firm, it is crucial to have access to a maximum amount of potentially high-quality investment opportunities, in order to select the most promising among them (Manigart et al., 2006). By actively engaging in co-investment relationships, the amount of information inflow on deals considered worthy for further evaluation increases substantially, which will in turn lead to a higher probability of selecting the right investment in terms of future returns on investment.

However, in his literature review on VC syndication, Jääskeläinen (2012) identified a research gap in respect to the differentiation between causes and effect of syndications. More precisely he states, that by focusing on the aforementioned beneficial effects of syndication as motivational factors, the discussion has so far missed to investigate the drivers, which potentially force VC firms to syndicate. This study aims at contributing to the scarce discussion on the drivers of syndication behaviour, by proposing the following conceptual framework (see Figure 2): In environments characterized by high uncertainty, VC firms exhibiting characteristics that might endanger their survival will be driven to act upon this

situation by the urgent need to countervail the firm's otherwise inescapable business failure. Consequently, firms facing this dilemma will be induced to engage in certain strategic actions, e.g. enter interorganizational relationships, which can serve as a mean to achieve beneficial effects. These effects can in turn be utilized as reassuring signals towards hesitant investors, which will result in an increased likelihood of VC firms to convince them of providing money to their fund; the basic requirement to ensure a VC firm's future existence.

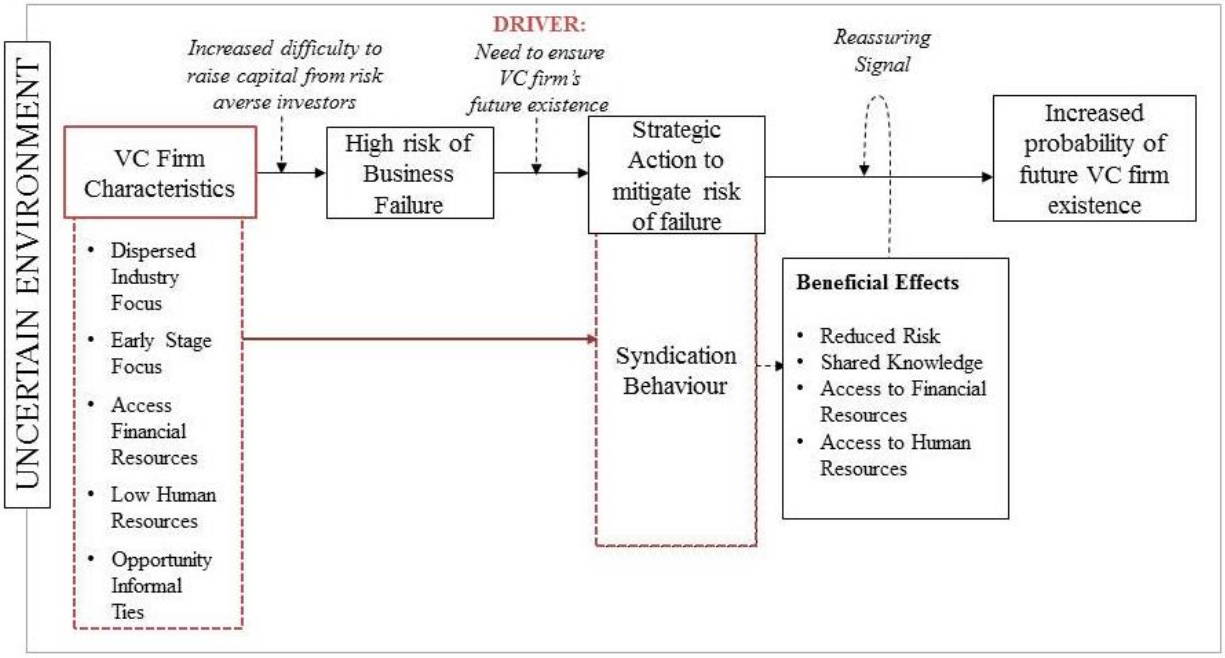

Figure 2. Conceptual Framework. *Constructed by author.*

Resource dependence theory provides a theoretical basis to explain how the strategic action of entering interorganizational relationship is driven by the need to ensure firm survival, postulating that for an organization to stay in existence it will need to establish relationships with external coalitions (Levine and White 1961; Pfeffer and Salancik, 1978). Here, the motivation to work together is not necessarily motivated by free will, but grounded in the need to overcome a lack of resources or to mitigate other factors jeopardizing firm existence (Lundin, 2007). Further, it proposes that organizations, facing high uncertainty in terms of the degree to which the outcome of an event cannot be predicted, or missing essential resources, which can only be derived from its environment, will seek to establish interorganizational relationships. By doing so, they become dependent upon other organizations, to obtain needed resources, gather and transmit information and reduce environmental uncertainty (Pfeffer et al., 1978; Stevens, Wartick and Bagby 1988; Hillman, Withers and Collins, 2009; Zheng, 2004). In turn, organizations that do not lack critical resources for survival will avoid entering cooperations, as the arising costs e.g. the loss of autonomy and sharing proceeds may

outweigh the received benefits (Lundin, 2007)[2].

In the context of this study, environmental uncertainty can be considered as particularly high, which can be explained as follows. Given the investors' risk-averse attitude and inexperience with venture capital, reliable future capital inflow is extremely unpredictable. Hence, no guarantee exists that VC firms having successfully raised sufficient capital at one point of time will be able to succeed in doing so during subsequent periods of fundraising. Additionally, VC firms that lack resources, expertise or market information are likely to face a considerably higher environmental uncertainty, as the probability of being confronted with a ceasing source of capital becomes even more apparent, given their disadvantageous position in the process of convincing investors to invest in their fund. Following resource dependence theory, they will consequently be driven to engage in interorganizational relationships all the more. By entering these need-driven interorganizational relationships, it can be assumed that firms will aid one another in antagonizing environmental difficulties, ultimately leading to an enhanced likelihood of firm survival. This outcome can best be explained by looking at the beneficial effects of such strategic actions, which hold the potential to serve as positive signals about a firm's intention and abilities. This assumption can best be explained by the intuitive nature of signalling. In general, signalling theory focuses on the deliberate communication of information in an effort to convey positive organizational attributes to third parties (Connelly, Certo, Ireland and Reutzel, 2011). Further, it states that signals conveying messages about an organization's activities, results and prospects influence investors in their investment decisions (Fama, 1970).

Although the focus of this study is on the identification of firm characteristics driving firms to engage in interorganizational relationships (e.g. syndicated investment deals) due to the need of ensuring firm survival, it proposes that the prior discussed beneficial effects of syndication serve as reassuring signals towards hesitant investors. This signalling effect is especially critical in the context of this study, given the capital providers' inexperience and risk-averse attitudes in respect to venture capital investment options. It is thus reasonable to assume that investors in the DACH region will only be willing to confide their money to firms that have established a certain degree of credibility e.g. through outstanding past performance or demonstrable expertise in certain industries. In contrast, VC firms exhibiting characteristics

[2] Two actors may only engage in a relationship if resource interdependence exists (Gulati, 1995). This means that cooperating firms must both see value in having access to each other's resources. In turn, this implies that firms bring different kind of resources to the deal, in the sense that organizations complementing each other in respect to their lacking resources will most likely end up in interorganizational relationships.

which have the potential to make investors even more insecure, such as poor past performance, the lack of critical resources to perform expected management tasks or an investment strategy with a risk level different than desired by the investors, will face an considerably higher hurdle to convince investors to trust them in their actions. Given their firm characteristics, these VC firms will be driven to engage in syndication behaviour by the need to ensure future capital inflow, as the effects of syndication can serve as a comforting signal towards outside investors.

This study is interested in determining which kind of firm characteristics can explain this need-driven behaviour. Resource dependence theory coupled with the basic assumptions of signalling theory provides a solid basis for explaining why VC firms operating in the DACH region *and* exhibiting certain characteristics potentially risking their future existence, will show a strong propensity to syndicate. To add to the discussion on drivers rather than effects of syndication behaviour, the rest of the paper will focus on identifying VC firm characteristics, presaging that a firm might face substantial difficulties of raising sufficient future fund in an environment characterized by risk-averse investors and therefore nurturing the need to engage in syndication behaviour, with the overall aim of mitigating the risk of business failure.

4. HYPOTHESIS DEVELOPMENT

The following part deals with the development of five hypotheses, which serve as the basis for the subsequent multiple linear regression analysis.

According to Jääskeläinen (2012), VC firms specialize in and focus their operations on specific industries to enhance the screening and monitoring of investment opportunities (Gupta and Sapienza 1992; Norton and Tenenbaum, 1993). This industry specialization will lead to an increased degree of industry experience and relevant external expertise readily accessible when required, which will in turn result in superior capabilities and skills to identify high-quality investment opportunities. In contrast, VC firms with little focus on one particular industry will more likely be exposed to a higher degree of information asymmetry and the consequent risk of poor investment decisions. It follows, that risk-averse, inexperienced investors being asked to provide capital to a VC firm without a lot of experience in any industry, will supposedly restrain from doing so, as they might seek to invest their money into less risky opportunities. Hence, these VC firms will be faced with an increased hurdle in the process of raising sufficient fund for operations and a subsequent greater risk of organizational failure.

To convince investors of trustfully placing their capital into the VC firms' funds nonetheless, such VC firms may be forced to adopt certain strategic action with the goal of gaining access to lacking expertise and market knowledge elsewhere. Syndication offers a mean to achieve this aim. In line with resource dependence theory (Pfeffer et al., 1978) this implies that organizations are driven to engage in interorganizational relationships by the need to acquire lacking resources. When entering in syndicated investment deals, VC firms can partner up with other VC firms in the same need driven position, thereby bundling each other's knowledge pools and market specific information received through prior investments in different industries. In doing so, they will increase their quality of selection and monitoring capabilities and subsequently the chance of successful future exits and enhanced firm performance (Sapienza, Manigart and Vermeir, 1996; Wright et al., 2003). More critically however, they will be able to send a comforting signal towards the group of outside investors, thereby increasing the chance to successfully raise sufficient fund and ensure future firm survival. Consequently, it can be assumed that VC firms with a dispersed industry investment strategy will be more inclined to co-invest with other VC firms, driven by the need to ensure their future survival, compared to VC firms exhibiting a more industry focused investment strategy. This leads to the following proposed relationship:

Hypothesis 1: *There is a significant, positive relationship between the number of different industries a VC firm invests in and its propensity to syndicate.*

Venture capital financing is a dynamic, multi-staged process. During each financing stage, several rounds of investments can take place (Brander et al., 2002). Although in Europe, venture capital is effectively understood as a sub category of private equity providing only early stage investment capital (BVK, 2014), data shows that DACH venture capitalists provide later stage capital as well. However, investments in seed and early stage ventures face a high viability in returns and thus a considerably higher expected risk of failure, which decreases during later investment stages (Ruhnka and Young, 1987). This can be explained by the fact that during early stages, new ventures are still in R&D processes or their product or service has just been launched to the market (Schefczyk, 2000). Hence, no proof of concept has taken place, which automatically translates into a higher risk associated with the investments made in such ventures. Especially when considering that the majority of investors in the DACH regions are known to behave rather risk-averse in their investment decisions, VC firms focusing on early and stage phase investments may be confronted with increased difficulties to persuade hesitant fund providers to choose to choose their fund as investment

option. Hence, in order to ensure the firm's long-term survival, these VC firms are forced to engage in strategic actions that help them in doing so. As discussed before, extant research has shown, that syndication enables the diversification of a VC firm's investment portfolio thereby reducing the variability of portfolio returns and the risk of producing low results (Lerner, 1994; Locket et al., 2001; Manigart et al., 2006; Verwaal, Bruning, Wright, Manigart and Lockett, 2010). Thus, VC firms primarily investing in stages associated with higher investment risks can use their syndication behaviour as a positive signal to convince hesitant investors of considering to provide capital to the fund nonetheless. Although this beneficial effect of syndication may be attractive to all VC firms, this paper proposes that VC firms located in the DACH region and following an investment strategy associated with an intensified degree of risk exposure, will be more inclined to engage in syndication behaviour, given their urgent need to attract sufficient future funds. Hence, the following relationship is proposed:

Hypothesis 2: *A VC firm's propensity to syndicate is significantly positive influenced by its early stage investment focus.*

Research has shown, that in the US and UK, VC syndication leads to improved VC firm performance (Jääskeläinen, 2012; Checkley et al., 2010). Yet, rather than investigating whether improved firm performance may serve as a motivational factor for VC firms to engage in syndication behaviour, this study looks at past performance as an indicators of VC firms being dependent upon receiving financial resources from other VC firms to ensure their own survival. As described earlier, the rationale behind a VC firm's business model is, that the more superior investment decisions it makes, eventually leading to exits in form of an IPO, Merger, Acquisition, LBO or MBO, the higher its chances will be to attract more investors and capital during subsequent fundraising phases. Consequently, if firm performance, measured by the dollar amount exited in proportion to the total sum invested, is poor, a VC firm risks to lose its current investors to better performing investment opportunities, while also facing difficulties to attract new investors at all. Moreover, given the inexperience and risk-averse investment attitude of German speaking investors, poor performance among VC firms will intensify their reservation towards venture capital investments. Even in the case of a positive decision to invest in venture capital projects, investors will in all probability exclude poor performing VC firms form their capital allocation process. These VC firms will be faced with a rapidly ceasing source of the necessary fund leaving them unable to invest in any project at all or only in few projects. In

turn, this increases the associated risk degree of their investment portfolio, given their inability to spread the total risk across different projects. To be able to withdraw from this downward spiral, these firms are bound to adopt certain strategic actions for acquiring the needed financial resources elsewhere. Research has shown that by engaging in syndicated deals, VC firms can gain access to additional financial capital through the sharing of financial resources with other VC firms (Manigart et al., 2002). This is in line with the resource dependence perspective, proposing that firms enter in interorganizational relationships in their urge to compensate for lacking resources in order to mitigate environmental uncertainty and ensure future firm survival (Pfeffer et al., 1978). In more concrete terms, by combining each other's financial resources, syndicated deals may be the only way for such VC firms to participate in investment projects at all, since they offer the chance of dividing the total sum required by a project, into smaller sums for each respective syndication participant. Consequentially, each VC firm will only need to contribute a smaller amount to the total investment sum, thereby enabling VC firms to continue their investment activities despite a restricted pool of financial resources. Moreover, given that it also provides VC firms the opportunity to invest in a larger number of smaller projects in terms of investment size, it reduces the overall risk of the fund (Manigart et al., 2002). As such, it can counteract the inhibiting message sent to investors by the firms' poor past performance, thereby increasing the chances to be reconsidered as a possible investment option at some point in the future. It can therefore reasonably be assumed that poor past performance has a negative influence on a VC firm's ability to attract future fund. In turn, this urges a VC firm to acquire lacking financial resources from an alternative source. Given that research has found support for the financial resource-sharing rationale for syndication, the following relationship can be assumed:

Hypothesis 3: *A significantly negative relationship between a VC firm's propensity to syndicate and its dollar exit rate exists.*

Continuing the same line of argumentation, VC firms may need to enter in inter-organizational relationships, when facing the situation of insufficient human resources to cope with the required management tasks, which fosters an increased risk of business failure as well. Compared to other financial intermediaries, VC firms are more actively involved in managing the funded firms (Cumming and Johan, 2007). This can best be explained when recalling the three phases of the investment cycle and the tasks that come along with them (see chapter two). Based on Gompers and Lerner (1994), Landström and Mason (2012)

distinguish between tasks concerning the raising of fund, making investments or exiting them. In general, the tasks of venture capitalists are aiming at three categories. First, investor-related tasks are concerned with establishing relationships to potential investors, hence fundraising activities, as well as continuously updating them about future plans and investments. Simply said, these are all tasks related to investor relationships and thus important for good and effective shareholder management. The next group concerns investment-related tasks, which is basically every task associated with making, managing and exiting investments, such as soliciting or creating investment opportunities, proposal screening, contract negotiating and structuring or due diligence tasks (Dotzler, 2010). Lastly, a great amount of time is also consumed by engaging in venture-related tasks, during which venture capitalists e.g. recruit and hire senior management or provide functional or managerial advice to their portfolio companies (Landström et al., 2012). To sum up, venture capitalists are supposed to manage a multitude of different tasks simultaneously, which only if managed well enough, will enable the firm to succeed in its doing while ensuring its future being. It follows, that the larger a VC firm, the more experts among its executives it will hire, which will in turn result in a greater capacity and pool of expertise in terms of time and knowledge devoted to the above-mentioned tasks (Verwaal et al., 2010). In contrast, VC firms with a smaller number of executives may be confronted with the fact that investors get the impression of the management team being overstrained by the wide array of tasks, which will most likely have a negative influence on the decision of providing capital to the fund. This perception can become even more intensified in a context characterized by inexperienced investors, given their newness in this fast moving environment with its general procedures and practices of venture capital firms. These investors might consider their capital to be in better hands at VC firms exhibiting a greater capacity in terms of manpower to execute all necessary tasks, which implicitly holds the increased likelihood of receiving a return on their investments. Consequently, VC firms with a comparably smaller executive base will be confronted with an increased degree of difficulty in the process of raising fund from outside investors. At this point, syndication can again serve as a suitable strategic tool to act upon this impeding situation. Prior research has shown that VC investment manager can only manage a certain amount of investments optimally due to resource constraints. However, engaging in syndicated deals can raise this number, by enabling them to share resources with other VC firms (Jääskeläinen et al., 2002; Kanniainen and Keuschnigg, 2003). As a consequence, VC firms can utilize this beneficial effect by sending a reassuring signal in terms of sufficient HR capacity to cope with all the necessary tasks towards outside investors. This will increase the

probability of attracting future capital inflow, which will consequently contribute to a VC firm's future existence. Overall, it can thus be assumed that VC firms headquartered in the DACH region, exhibiting a smaller employee base and thus a limited capacity to manage arising tasks in the VC investment process, will consider the syndication of their investment deals as an attractive strategy to enhance their own human resource capacity. Based on this line of arguments, the following relationship can be expected:

Hypothesis 4: *There is a significantly negative relationship between a VC firm's number of executives and its propensity to syndicate.*

However, there is reason to believe that VC firms also possess alternative mechanisms to expand their VC partner network to achievement organizational objectives. They can do so by establishing informal rather than formal relationships with other VC firms, thereby building a supplement to formal exchange links (Checkley et al., 2010). One apparent example is a VC firm's membership in so-called national venture capital associations. VC firms in the DACH region are provided with many opportunities to become a member of venture capital associations. Whereas on European level, the European Venture Capital Associations (EVCA) represents the private equity community across Europe, advertising itself as „a network of shared knowledge and experience" (EVCA, 2014), on national level, the German Venture Capital Association (BVK), the Austrian Private Equity and Venture Capital Organisation (AVCO) and Swiss Private Equity and Corporate Finance Association (SECA) offer a platform for cooperation, information and knowledge exchange among member VC firms. Worldwide, 35 venture capital associations exist, of which 16 are located in Europe (MyCapital, 2014). These associations organize workshops and meetings for their members to socialize and exchange knowledge while building trust-relationships, thereby enabling them to develop informal ties among each other. From a resource dependence perspective, these informal ties through shared association membership will ease a firm's chance to receive access to the resources of other group members, as it increases the chance to be invited in co-invested deals by other association members. From this perspective, a positive relationship between the number of syndicated ties and a VC firm's association memberships could be proposed. However, in the context of this study, the number of association memberships could also be considered as a potential supplement to syndication behaviour. The motivation behind this negative relationship can be explained by looking at the underlying signalling effect of group membership towards external groups. Being an accepted member of an association is likely to serve as a strong reassuring signal for hesitant investors, as it

indications a VC firm's acceptance and affiliation with other association members. As the study's framework proposes syndication behaviour of VC firms located in the DACH region to be driven by the overarching need to ensure future capital inflow from investors and thus firm survival, VC association membership might therefore enable VC firms to achieve the similar objective of positive signalling as facilitated by syndication behaviour, however at lower costs[3]. Based on this line of reasoning, the following relationship is proposed:

Hypothesis 5: *The number of VC associations a VC firm is member of has a significant negative influence on its propensity to syndicate.*

Figure 3 summarizes the hypotheses integrated in the conceptual framework, serving as the basis for the subsequent empirical analysis. Overall, the choice of hypotheses is influenced by the constraints of the underlying dataset, which only contains details for a certain amount of different variables. Consequently, it sets limits to the number of hypotheses to be formulated, as only the ones containing variables with sufficient data available can be properly tested in the subsequent multiple regression analysis.

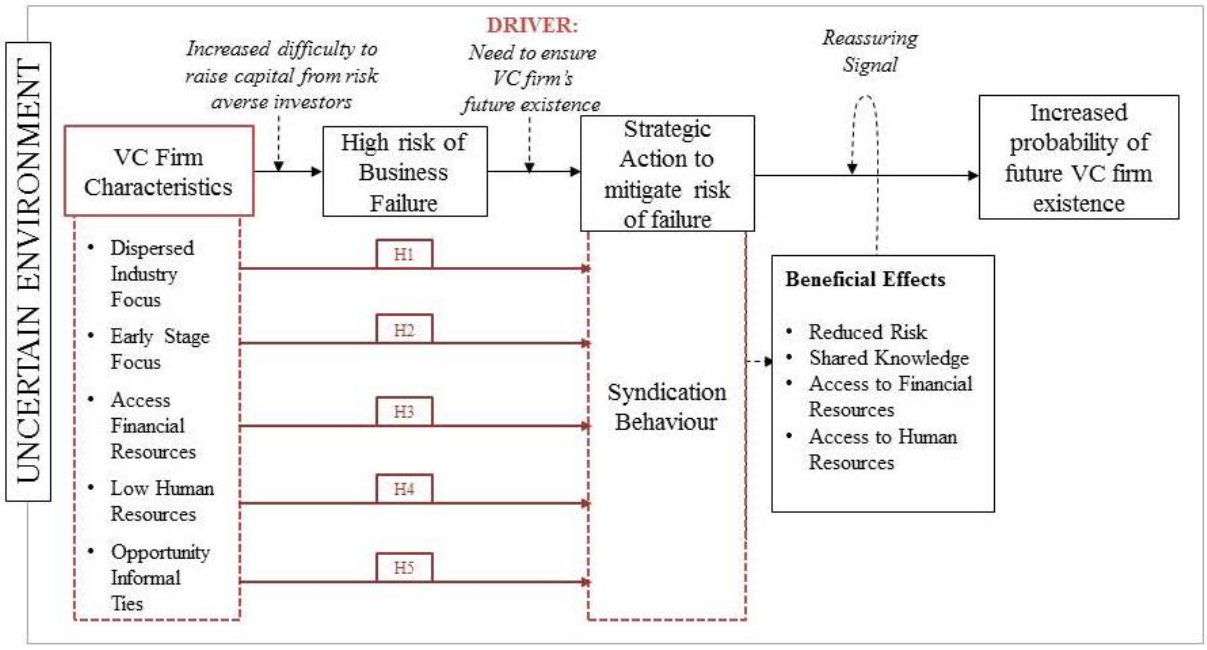

Figure 3. Conceptual Framework including Hypotheses. For large version please see Appendix A.

[3] Indirect costs of syndication are, e.g. transaction costs (Jääskeläinen et al. 2002), slower and less flexible decision-making processes (Hopp et al., 2011) or increased likelihood of conflicts and thus management costs (Bruining, Verwaal, Lockett, Wright, and Manigart, 2005).

5. METHODOLOGY

As the aim of this study is to investigate the syndication behaviour among VC firms located in the DACH region, it examines the co-investments made by all VC firms headquartered in this area. In this case, "all VC firms" refers to independent, corporate and bank-affiliated venture capital firms, located in Germany, Austria or Switzerland, having engaged in syndicated investment deals with at least one other VC located in the same area during 2006 – 2013.

5.1. Sampling Strategy

A random sampling approach has been applied, using data provided by the Venture Capital Magazine, as well as data extracted from the ThomsonOne Database. First, to get an overview of all VC firms that come into consideration for this study, the directors of the German Venture Capital Magazine (www.vc-magazin.de) were contacted. Given the magazine's focus on European venture capital activities, related topics and the regularly published column "deal monitors" listing the current investments during the past months, it has a large amount of venture capital data at its disposal. Generously making this data available for this study resulted in a self-compiled dataset of all reported investments during 2006 and 2013, with 1248 venture capital firms investing in 5822 companies. Filtering for German, Swiss and Austrian VC firms, yielded a sample of 598 firms. Next, as the data on hand so far only revealed the name of the VC firms and their respective investments, it was complemented by more firm-specific background data, which was extracted from the ThomsonOne Database. By only taking into account VC firms labelled as "actively seeking new investments", more detailed investment information was found for 340 of the 598 VC firms. This phenomenon of a large number of inactive VC firms can partially be explained by the fact that according to the European Venture Capital Association "in Europe 85% of EVCA listed funds have disappeared since the burst of the bubble and only 10% of the remaining funds are considered active" resulting in "a long non-contributing tail of European VC funds listed in the Thomson database" (Earlybird, 2011). By conducting a brief check on the websites of the excluded VC firms resulted in the impression that they were indeed rather small in size and investment activity. Hence, not including them into the final sample did not lead to a deficient composition of the VC co-investment network.

Since their company foundations, the resulting 340 VC firms have invested in 7960 companies. When setting the timeframe to 2003 to 2004, the number decreased to 6205 investments in total. Next, looking at the data from an investment perspective, the total amount of investments was decreased by only considering investments labelled as still being

in the investment portfolio of a VC firm. This resulted in a sample of 307 VC firms with 3056 investments. Lastly, as the focus of this paper was to draw conclusions on factors influence a VC firm's syndication propensity, only VC firms with at least one co-invested deal among their portfolio companies were taken into consideration. This was done by listing all 3056 investments and only containing ventures, which appeared at least twice. By doing so, a final list of VC firms was compiled, all of them exhibiting syndication behaviour to a certain extent all exhibiting syndication behaviour (see Appendix C).

5.2. Sample

The final sample includes 205 venture capital management firms headquartered in Germany, Austria and Switzerland with 1221 co-investments made between 2003 and 2014. Of these firms, 165 were German, 9 were Austrian and 31 Swiss. Table 1 contains demographic characteristics of the sample. Furthermore, any type of venture capital firm has been included, thus not limiting the sample to independent venture capitalists (IVC), which primarily invest capital of high net worth individuals and institutional investors through an external fund managed by a third party (Private Venture Capital, 2014). Rather, the sample also contains corporate (CVC) and bank-affiliated (BVC) firms, investing corporate or bank-related capital and the category "others", such as government-affiliated programs. This inclusion can be explained by the assumption that all venture capital management firms pursue the overarching goal of maximizing their return on investment with their available resources, independent of their nature and strategy. It could be however be argued that CVC firms, as well as BVC firms will not face situations in which they lack critical resources, as they are assumed to be backed and supported by their parents organizations. However, as this argument might only hold in respect to financial resources, as other resources e.g. market information or industry knowledge might as well be lacking for these kinds of VC types. Furthermore, in case of underperformance, they also risk that their parent organizations decide to cease providing future capital into the funds.

Table 1. Firm Characteristics of Sample VC Firms.

Demographic characteristics			
Country	% of total sample	Firm Type[a]	% of total sample
Germany	80.5%	IVC Firm	67.8%
Austria	15.1%	CVC Firm	19.5%
Switzerland	4.4%	BVC Firm	9.8%
		Other	2.9%

Note. [a] IVC= Independent VC Firm, CVC= Corporate VC Firm, BVC= Bank-affiliated VC Firm.

5.3. Social Network Analysis: An Instrument to find Patterns of VC Syndication

To measure a VC firm's propensity to syndicate, it must be examined of how well networked venture capitalists are, which requires specific measures and approaches. In this study, social network analysis (SNA) and the subsequent measures are employed to find the patterns of syndication.

The underlying theory of SNA is social network theory. Among the first scientists to conduct research on social networks was James Barnes, claiming that "social interactions are a set of points some of which are joined by lines" resulting in "a total network of relations" (1954, p.43). In general, the focus of networks is on the relationships among entities that make up the social system. These entities are called actors or nodes and can be of individual or collective nature. Further, they possess node-specific attributes, which differ from one actor to another, being of categorical or quantitative kind. A network's nodes are connected by so-called links or dyadic ties, which have characteristics as well (Knoke and Yang, 2008; Borgatti, Everett and Johnson, 2013). Consequently, network theory is about structure and position. As such, network theory takes an essentially relational perspective, viewing the world through a structural lens (Zaheer, Gözübüyük and Milanov, 2010).

Social network analysis (SNA) has emerged as a set of methods specifically geared towards investigating relational network data, consisting of contacts, ties and connections, which cannot be reduced to the properties of individual actors (Scott, 1991). Applied to the interorganizational level, SNA enables the analysis of social structures and relationships, with the overall goal of finding an explanation why an organization in a network of relationships is positioned, acts and performs the way it does (Zaheer et al., 2010). One of the analysis' generic hypotheses is that an actor's network position determines in part the constraints and opportunities he or she will encounter. Thus to predict an actor's performance outcomes and behaviour, it is important to identify his or her position in the overall network. In addition, SNA assumes that "what happens to a group of actors is in part a function of the structure of connections among them" (Borgatti et al., 2013, p.1).

To understand and interpret the structure and function of whole networks and their participants, several fundamental measures are available, including both, measures on the group-level (whole network characteristics) as well as lower-level (node and dyad characteristics) (ibid, 2013). Among the most well-known measures are degree centrality, betweenness centrality, closeness centrality and eigenvector centrality. *Degree centrality* indicates the extent to which an actor possesses direct ties with all other nodes in the network

(Knoke et al., 2008). Therefore, it is simply the total number of direct relationships a node has. *Betweenness centrality* is a measure indicating how often an actor lies on the shortest path between two other actors (Borgatti et al. 2013). It reaches its maximum value with the actor lying on every geodesic path (shortest distance) between every pair of other nodes, whereas an actor never lying along the shortest path between two other nodes will have a betweenness centrality of zero (ibid., 2013). *Closeness centrality* indicates how quickly one actor can reach all other actors and is defined as the inverse of farness, which in turn, is the sum of distances to all other nodes (Knoke et al., 2008). Lastly, *eigenvector centrality* measure embodies the statement: "an actors is only as central as its network", taking the total number of an actor's direct ties to other nodes, yet weighting each adjacent node by its centrality. Hence it indicates the extent to which an actor is connected to other well-connected actors and can consequently be considered as a variation of degree centrality (Borgatti et al., 2013). Given its intuitive interpretation, *degree centrality* will be employed to measure venture capitalist's propensity to syndicate in the subsequent multiple linear regression.

5.4. Statistical Techniques

Given the two-step research design of constructing the DACH VC syndication network followed by testing for relationships between VC firm characteristics and syndication behaviour, this study makes use of two kinds of statistical techniques.

First, to calculate the network measures UCINET 6.0, a comprehensive program for the analysis of social networks, is applied (Borgatti, Everett and Freeman, 2002). It allows calculating all four measures mentioned earlier. To visualize the relationship ties among the VC firms, Netdraw is used, which is a subprogram of UCINE. It delivers visual representations of networks in 2D or 3D space (Zheng, 2004). Second, as the overall goal of the study is to draw conclusions on the relationship between more than two variables, multiple linear regression is utilized. The most appropriate data analysis method is multiple regression analysis (Black, 1999). To do so, IBM SPSS Statistics is used, which is a widely applied software package for statistical analysis in social sciences.

Before running the regression analysis, standardized z-values were computed for all independent variables, to detect possible outliers. To avoid a bias in the results, scores with z-values less than -3.29 or greater than +3.29 – cut-off 0.1% – were removed from the sample. Following the assumptions for a linear regression a data transformation was applied to achieve a normal distribution for the variables used in the analysis. However, only in the case of *capital under management*, a log-transformation resulted in a significantly improved

normal distribution. Further, missing data was handled with a listwise deletion approach, thereby omitting all cases with any missing value of the variables included (Fullerton and Maltby, 2009). Consequently, from the originally 205 VC firms in the final sample, 95 and 70 are included in the regression models 1 and 2 respectively. Although, this might on the one hand result in an overall reduced statistical power of the regression models, with data missing completely at random (MCAR), it also produces strongly unbiased regression slope estimates (Howell, 2012; Humphries, 2012). Further, the decision to calculate two models was motivated by the aim to separately examine the effects of *early stage focus* and *dollar exit rate*, which content wise measure opposing effects: If a VC focuses on seed and start-up stage investments, it can be assumed that it will most likely exhibit a lower dollar exit rate, compared to VC firms mainly focusing on later stage investments. Consequently, the model 1 will test investment strategy related hypotheses (H1 and H2), whereas model 2 will focus on testing the remaining hypotheses (H3, H4, H5). Plotting the expected versus the observed residuals for both models, the normal P-P-Plots of both regression models show that the residuals cluster along the regression line, indicating that the normality assumption has been met respectively. Next, looking at both models' scatterplots, no clear pattern among the residuals can be detected, implying that the relationship between the variables is linear. In addition, both Durbin Watson Test statistics are larger than 1.0 (Model 1: 1.488, Model 2: 1.682), indicating that the values of the residuals are independent. To test for multicollinearity in both models, variance inflation factors (VIF) have been calculated for the independent variables, all depicting values below 5.0, which Urban and Mayerl (2006) suggest as the critical upper boundary when testing for multicollinearity in weaker models. Hence, it can be concluded that no multicollinearity is present.

5.5. Variables

To test the hypotheses, several variables have been defined, all of them being measured at a ratio level of measurement (Black, 1999). The dependent variable, *propensity to syndicate*, is measured by degree centrality, indicating a VC firm's engagement in co-investment relationships. Degree centrality is calculated, using the following formula, where d_i is the degree centrality of an actor i and x_{ij} is the (i, j) entry of the overall adjacency matrix (Borgatti et al., 2013).

$$d_i = \sum_j x_{ij}$$

A VC firm participating in more syndicated deals will be "more central" in the sense that it will have a higher degree centrality score. Consequently, the higher the degree centrality

score is, the stronger a VC firm's propensity to syndicate. Further, the group of independent variables consists of *a) access to financial resources, b) human resource capacity, c) industry focus, d) early stage focus and e) opportunity to establish informal ties*.

As for *a) access to financial resources*, ceteris paribus, the higher the number of a VC firm's exits, defined as the portfolio companies successfully exited via an IPO (initial public offering) or sold to another company (merger, acquisition and leveraged buyout), the higher its return on investment (ROI) to the limited partners will be. The higher its ROI, the more attracted investors will be to further providing their capital to a VC firm. Hence, a VC firm's performance may serve as an indicator of its *access to financial resources* from outside investors. In the absence of publicly available data on VC firm returns, this study follows Hochberg et al. (2007), by measuring a VC firm's performance in terms of its dollar exit rate, defined as the fraction of the portfolio by invested dollars that has been successfully exited (Hochberg et al., 2007, p.260), which is calculated with the following formula:

$$f_i = \frac{\sum \$ \text{ exited}}{\sum \$ \text{ invested}}$$

This measure holds the assumption that all investments made by a VC are approximately of the same size. Furthermore, a dollar-measure ($) is employed since although the common currency among European VC firms is Euro (€), the data from ThomsonOne is only provided in dollar amounts.

Next, although Manigart et al. (2002) state that the number of executives may simply proxy for firm size, this paper departs from this perspective, by taking the number of executives as a measure of a VC firm's human resource capacity and thus the ability to efficiently perform all essential management tasks for the firm's success and survival. A VC firm's *b) human resource capacity* to perform VC management tasks is hence measured by the total number of executives employed.

Further, based on the available data from ThomsonOne, European VC firms choose to invest their capital along 13 different industries, with Internet and Computer Software receiving the most frequent VC investments. For measuring a VC firm's *c) industry focus*, the total number of different industries invested in is taken. The higher the number of different, the more dispersed a VC firm's investment focus in respect to certain industries and vice versa. Moreover, during the financing process, several stages during which VC firms can decide to invest in a venture exist. The categorization of them is somewhat arbitrary (Brander et al., 2002).

ThomsonOne distinguishes between 16 different stages, ranging from the earliest seed stage to turnaround stage. To measure *d) early stage focus* and thus in how far a VC concentrates its investments on seed and start-up stages, the rate of seed and start-up stage investments is calculated, which is defined as the fraction of the portfolio receiving investments during the seed and start-up stage. The higher the fraction, the stronger a VC focuses its on investments on seed and start up stages. Hence, the following formula holds:

$$s_i = \frac{\sum \text{Seed and Start up Stage Investments}}{\sum \text{Total Number of Investments}}$$

Lastly, a VC firm's *e) opportunity to establish informal ties* through alternative ways, is measured by the number of a VC firm's membership in venture capital associations. Given the regular meetings, workshops and social events organized by national VC associations, the associations a VC firm is member of, the higher its ability to encounter situations in which it can establish relationships through other means than the formal syndication contract. Following prior research on VC syndication, a VC firm's *age*, measured by years since foundation is included as control variable in all regressions, as it is has been shown to affect a VC firm's syndication behaviour, but is not focus in the discussion of the hypotheses. Furthermore, also *firm size* is controlled for, measured by capital under management, as the larger the total sum of capital under management, the larger a VC firm in terms of dollar available to invest (de Clerq and Dimov, 2010; Manigart et al., 2006; Jääskeläinen, Maula and Seppä, 2002).

6. RESULTS

To compute the DACH region VC syndication network, an excel-based square adjacency matrix has been calculated, representing the relationships between the actors, with each cell containing the number of undirected ties between two VC firms. After entering this data set into UCINET, the outcome is a graphic as depicted in Figure 2, where very node represents one of the 205 VC firms. A larger version of this graphic can be found in Appendix B, followed by a list of all VC firms consecutively numbered in Appendix C. Furthermore, each line between two nodes represents a co-investment relationship, independent of the frequency in which two VC firms syndicate with each other. As soon as they have at least one co-investment, a tie is established. Overall, this graphic provides a first indication that syndication is a widespread phenomenon in the DACH VC industry as well.

Furthermore, UCINET provides a tool to calculate the degree centrality, closeness centrality, betweenness centrality and eigenvector centrality for each of the respective 205 VC firms (see

Appendix D), with degree centrality measures serving as input data for the dependent variable during the subsequent multiple linear regression.

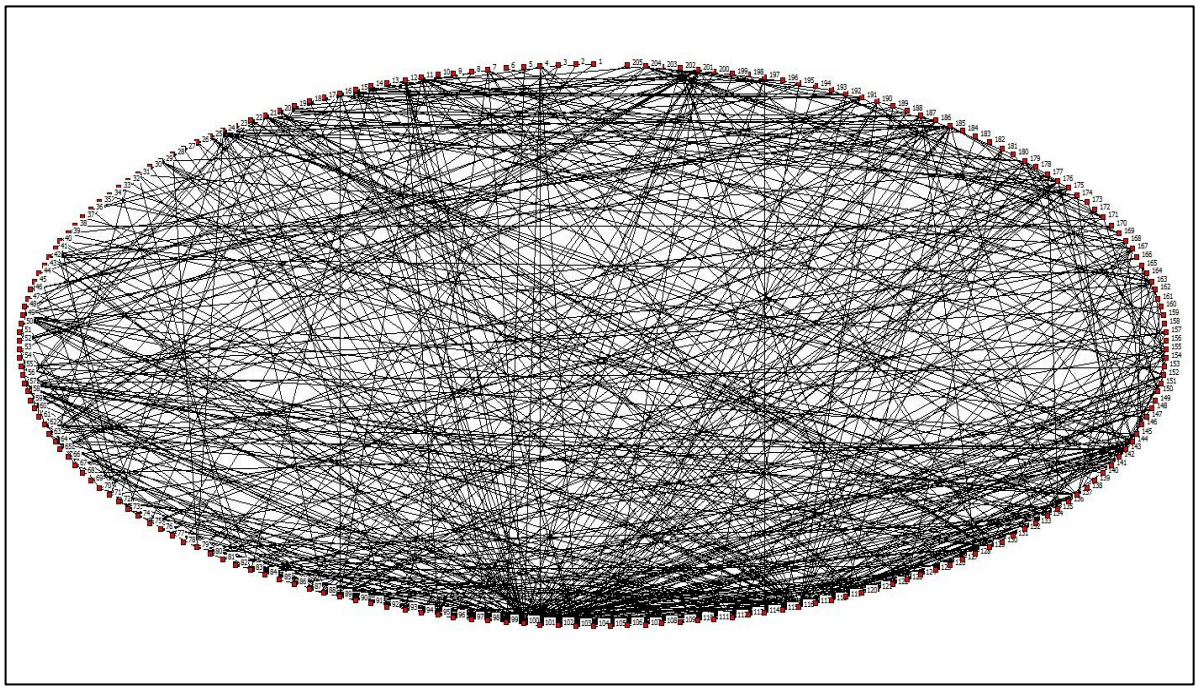

Figure 4. The DACH Venture Capital Syndication Network. *Developed and visualized with Netdraw.*

6.1. Multiple linear regression

With an adjusted r^2 of 0.317 and a regression coefficient significantly different from zero (F = 11.912, Sig.= 0.000***), **model 1** explains 31.7% of the total variance in *degree centrality.* Further, by looking at the respective t-tests of the individual regression coefficients, the results (see Table 3) show a positive, highly significant relationship between a VC firm's *early stage focus* and *its syndication behaviour* (B= 15.155, Sig.=0.000***). This means that one can confidentially state that VC firms with a focus on seed and early stage investments engage more often in co-investment relationships, than VC firms with *less* focus on the first stages of an investment cycle. Thus Hypothesis 1 can be supported. Furthermore, it reports a highly significant, positive relationship between *industry focus* and *degree centrality* (B=1.512***). For each additional industry a VC invests in, on average, degree centrality will increase by more than one unit. This indicates that VC firms with a dispersed industry investment focus will exhibit a stronger syndication behaviour than VC firms with a more focused industry investment focus. In terms of the variables relative importance, *seed and early rate* is the most statistically significant variable (β= 0.506), followed by the *total number of industries* (β= 0.501).

Overall, with an adjusted r^2 of 0.161 and a regression coefficient significantly differently from zero (F = 3.644, Sig.=0.006**), **model 2** explains 16.1% of the total variance in *degree centrality.* Although the model's quality in terms of % of variance explained is considerably lower than in model 1, it still allows drawing conclusions in respect to a VC firm's performance and characteristics influencing its propensity behaviour. To draw conclusions in respect to the individual variables in the regression model, the respective t-statistics are consulted, indicating that *dollar exit rate* has a highly significant, negative effect on the propensity to syndicate (B=-9.641**). This implies that VC firms which have performed well in the past in terms of the proportion of successfully exited dollars, do not seem to engage in co-investment relationships as much, as less well performing VC firms. These findings support Hypothesis 3. Next, the results show a highly significant, positive effect of the number of decision-making executives on a VC firm's propensity so syndicate (B=0.430**), indicating that other than expected, there is a positive relationship between the number of executives and the ability to syndicate, as one additional executive may lead to a 0.430 unit change in degree centrality. Consequently, Hypothesis 4 cannot be supported. Lastly, in respect to the influence of informal ties on the propensity to syndicate, the results show a significant, negative effect, indicating that indeed, the more associations a VC is member of, the weaker its propensity to syndicate (B= -2.631*). Based on these findings, only hypotheses 3 and 5 can be supported. In respect to relative importance, *dollar exit rate* is the most statistically significant independent variable (β= -0.386), followed by *number of executives* with an almost as high, standardized beta (β= 0.376) and *number of association memberships* (β=-0.316). Lastly, the control variables *age* and *capital under management* are statistically insignificant in both models, indicating that they do not influence the overall findings.

Table 3. Results of the multiple linear regression.

Multiple linear regression: Influencing factors on propensity to syndicate						
	Independent variable	***Regression coefficient beta***	***Stand. beta coefficient***	***p-value*** [a]	***t-test***	***VIF***
MODEL 1	Age	- 0.145	- 0.094	0.348	- 0.944	1.371
	Capital under $Mgmt_{Log}$	1.923	0.133	0.132	1.520	1.055
	Early Stage Rate	15.155	0.506	0.000***	5.531	1.153
	# of Industries	1.512	0.501	0.000***	4.988	1.390
	N=95 Adj. R^2 = 0.317 F= 11.912 Sig.= 0.000***					

	Independent variable	*Regression coefficient beta*	*Stand. beta coefficient*	*p-value* [a]	*t-test*	*VIF*
MODEL 2	Age	0.184	0.118	0.351	1.290	1.240
	Capital under $Mgmt_{Log}$	0.191	0.014	0.905	0.162	1.098
	Dollar Exit Rate	- 9.641	- 0.386	0.002**	- 3.203	1.192
	# of Executives	0.430	0.376	0.006**	2.866	1.414
	# of Association Membership	- 2.631	- 0.316	0.019*	- 2.405	1.416
	N=70 Adj. R^2 = 0.161 F= 3.644 Sig.= 0.006**					

Note. [a] Significance: p< 0.1*, p< 0.05**, p< 0.001***

7. DISCUSSION & CONCLUSION

This study aims at exploring, which firm characteristics influence VC syndication behaviour among venture capitalists located in the DACH region. Based on both, resource dependence theory and signalling theory, the argument is developed that in regions where venture capital is still a nascent industry, coupled with investors exhibiting risk-averse attitudes, VC syndication behaviour is driven by the need to ensure future firm existence. With the beneficial effects of syndication serving as reassuring signals in terms of lowered risk and access to critical resources towards hesitant investors, the likelihood of VC firm survival is enhanced. Using data from ThomsonOne, the empirical evidence of this study supports the underlying conceptual framework.

Whereas Manigart et al. (2002) find no impact of investment stage focus on the propensity to syndicate, the regression output indicates a highly significant, positive relationship between a VC firm's focus on seed and start-up phase investments and its propensity to syndicate. As seed and start-up phase investments are associated with a high level of investment risk, these findings are in line with the results of Hopp et al. (2011), who find that more risk associated with the underlying transactions calls for a higher degree of VC syndication. Also the findings by Bygrave (1987) imply that younger and more risky companies call for a higher level of syndication among the investing venture capitalists. In the context of this study, the findings can be well explained by the VC firm’s increased exposure to the prevalent environmental uncertainty, which according to resource dependence theory, ultimately results in stronger interfirm cooperation (Pfeffer et al., 1978). In other words, when investing in the most risky stages among the overall with risk associated venture capital projects, VC firms engage in syndicated relationships to deal with the fact that their investment strategy alienates potential

investors even more, given their general risk-averse attitude and inexperience. It can therefore be assumed that the need to counteract investors' ominous perceptions drives VC firms to employ strategic actions in order to correct the implicit message sent to investors about their investment strategies. Among prior discussed benefits of syndication are the opportunity to share the associated high risk of early and start-up investments with one or more partners in the same position, while also being able to invest a larger total sum of small investments in a greater number of companies (see chapter 3). Consequently, by engaging in syndicated deals, VC firms will enjoy these benefits, which in turn can be used to send a positive signal in term of overall lowered investment risk to investors. In doing so, the likelihood of convincing hesitating investors to engage in venture capital investments can be significantly increased, simultaneously decreasing the firm's probability of future decay. Critical voices could state that the explanatory power of these findings is low, pointing to the paper's definition of co-investments, which does not include a time factor. This means, that it does not distinguish between the different investment rounds during which investors may enter into an investment relationship with a respective portfolio company, but treats all investors throughout several investment rounds as having equal co-investment relationships with each other. Consequently, VC firms primarily investing in seed and start-up phases will always be counted as having a co-investment relationship with VC firms joining during later financing rounds. Thereby the total number of their co-investment relationships is automatically increased. Although this seems to refute the explanatory power of the current findings, fact is, VC firms with smaller financial resource capacity can only provide smaller sums to ventures seeking investments. It may thus be inferred that seed and start-up investments are the only applicable phases during which VC firms with less financial resources may participate. Since they will be unable to further finance the projects during later phases, they must therefore become dependent upon VC firms possessing more financial resources to join the financing process. Thus, from a resource related perspective, the findings can still confidentially be interpreted by saying that VC firms with a smaller pool of financial resources are bound to primarily invest in seed and start-up phases, as they are dependent upon other VC firms' financial resources to continue a venture's development during later financing stages. Consequently they will engage in co-investment relationships more often. This is in line with several past studies showing, that the dominant motive for syndication among European VC firms is to gain access to financial capital by sharing financial resources with syndication partners, implying that the urge to access financial resources positively influences a VC firm's decision to syndicate (Lockett et al., 2001; Manigart et al., 2006; Verwaal et al., 2010).

Likewise, the current findings for Hypothesis 3 support this line of research, indicating that VC firms with poor past performance in terms of dollar exit rate, engage in syndicated deals more often than well-performing VC firms. In the context of venture capital, poor performance and financial resources are related as follows: If VC firms have performed poorly in the past, investors will be reluctant to provide their capital for further investments, as they fear to loose their investments, and most likely decide to invest their capital somewhere else. VC firms exhibiting poor performance will therefore face the increased risk of future financial resource constraint. Especially in an environment characterized by investors seeking to invest in secure rather than risky investment options, in the race of collecting enough capital to ensure future firm existence, being unable to present success stories can be fatal for a VC firm. Hence, the significantly positive relationship between a VC firm's poor past performance and its propensity to syndicate can be interpreted as being driven by a VC firm's need to acquire lacking financial resources, resulting in beneficial effects in two ways. First, syndication will enable VC firms to make investments despite the lack of sufficient financial resources, by pooling their financial resources with other VC firms having similar needs. Second, as discussed before, syndication results in shared risk and a diversified investment portfolio of participating VC firms. Thus, by engaging in syndicated deals, VC firms may not only be able to make up for critical financial resources, but more importantly, will be able to send a rehabilitating message towards hesitant investors, thereby increasing the likelihood of a secured inflow of capital. However, examining the findings from a more dynamic perspective and the assumption that networks consistently change (Verwaal et al., 2010), VC firms pursuing syndicated investments to receive lacking financial resources due to poor past performance at one point of time, might not do so indefinitely. Research has shown that for VC firms in US and UK, syndication has a positive impact on performance (Hochberg et al., 2007; Checkley et al., 2010). If the same relationship holds for VC firms located in the DACH region, syndication will enable VC firms to gain status in the venture capital market and will therefore recover their ability to collect capital from investors in the future. Hence, VC firms currently being driven to syndicate by the need to compensate for their inability of financial resource acquisition may restrain from syndication behaviour in future times, if they perceive the formerly received benefits as less needed and the advantages of syndication offset by its indirect costs.

Next, in respect to a VC firm's investment strategy, a positive, highly significant relationship between the number of industries a VC firm invests in and its propensity to syndicate is found, from which it can be concluded that the more dispersed a VC firm's investment

strategy, the more frequently it will engage in co-invested deals. These findings are again contrary to Manigart et al.'s findings (2002), who state that "the more a VC [firm] is specialized in terms of industry sector, the higher its propensity to syndicate in general" (p.16), as well as Hopp et al.'s findings (2011) which show that VC firms use syndication as a mean to strengthen their focus on core industries. However, a reasonable explanation for the current findings can be provided when interpreting them from a more context sensitive lens. If a VC invests in many different industries, it is likely to have little expert knowledge in any particular industry, while simultaneously stretching its efforts over a wider range of different projects (Hopp et al., 2011). Also, given the DACH VC market's relative youth, potential investors do not have industry experience when it comes to venture capital investments on their own. What follows is that investor considering to provide money to a VC firm, will have to rely on a VC firm's expertise to make the best possible investment decisions. Consequently, VC firms exhibiting a higher degree of expertise in a particular area, e.g. by having a large portfolio of companies in the same industry, will likely to have an advantageous position in the fundraising process. In contrast, VC firms possessing investment portfolios containing companies in many different industries will impede the firm in its process of pursuing outside investors to provide money to their fund. This is due to the fact that VC firms with little expertise in a particular industry indirectly signal to investors, that the management team cannot provide the highest value added to its portfolio companies, such as addressing weaknesses in the business model or entrepreneurial team (Kaplan and Strömberg, 2004) or the professionalization of its portfolio companies (Hellmann and Puri, 2002), which will in turn diminish the chance of a high rate of successful investment exits. Furthermore and maybe even more critical, having no expertise in any particular industry increases the probability of making poorly informed investment decisions, thereby raising the overall risk of investment failure. Altogether this may heavily discourage outside investors to provide capital to a VC firm's fund, which will result in a VC firm having trouble to ensure its future existence. Again, syndication can serve as a mean, to counteract this outcome. By partnering up in co-invested deals, VC firms' respectively small knowledge pools can be bundled together, thereby complementing each other's knowledge resources in areas where VC firms left to their own device would not have be able to make well-informed and high quality investment decisions. In addition, partnering up with other VC firms facilitates entrance into more promising industries in terms of future return on investment potential, where a VC firm would have faced restricted access to otherwise. As such, VC firms having a dispersed investment portfolio in respect to industries invested in, are driven to syndicate by

the need to rely on other VC firms' knowledge to compensate for their own, lacking expertise and information access. Furthermore the effects of syndication serve as a signal of reassurance to investors thereby counteracting a VC firm's danger of being unable to collect enough funds for future venture capital investments.

Surprisingly, the assumption that VC firms' propensity to syndicate is also driven by the need to acquire lacking human resources, cannot be supported. In respect to Hypothesis 4, instead of a proposed negative relationship, the findings show a weak, yet significantly, positive relationship between the number of executives and a VC firm's propensity to syndicate. This is in line with the findings of Verwaal et al. (2010), stating that the need for management resources on average does not play an important role in the decision to syndicate, as well as the findings of Manigart et al. (2006), showing that VC firms with a larger number of executives, have a higher propensity to syndicate. Consequently, the current results do not support the assumption that VC firms possessing a larger pool of human resources may be less prone to syndication behaviour than VC firms with fewer executives being in need of external expertise and human capacity to cope with the wide array of management tasks in order to successfully continue its operations. Accordingly, the need to acquire lacking human resources may not serve as the most appropriate driver to describe the relationship between a VC firm's executives and its syndication behaviour. Manigart et al. (2002) ascribe this positive relationship to spontaneous internal industry dynamics, rather than a well-planned strategic decision. However, another explanation can be found when interpreting the findings from a group behaviour perspective. With an increasing number of decision-making executives, the probability of dissent among group members in respect to investment decisions is likely to increase, as they all bring different expertise, knowledge and investment ideas to the table. In order to avoid a hold-up situation or no investment decision at all, the most convenient way might thus be, to spread the total sum invested across multiple number of projects – in short, to diversify its investment portfolio. However, the respective sums invested may at some point become too small to fund a project on their own. Hence, the probability increases that, ceteris paribus, VC firms with more executives may engage in syndicated deals to receive complementary financial resources from syndication partners and be able to diversify their portfolio. Thus, the findings indicate that other than proposed, especially when a VC might have a large amount of human resources in terms of executives at its disposal, this may result in the need of seeking complementary financial resources through syndicated deals. Although a larger pool of executives might be able to manage the wide array

of the aforementioned tasks sufficiently on its own, it will face the challenge to cope with the increased amount of different executive opinions and preferred investment decisions.

Lastly, Checkley et al. (2010) suggest the investigation of possible ways of informal tie formation between organizations, potentially serving as a bypass to syndicated deals, while still allowing for information sharing and knowledge exchange among VC firms. The current study aims at testing this relationship, proposing VC national associations to offer VC firms a convenient setting to build informal ties among each other. Indeed, the findings show a negative relationship between association membership and syndication behaviour, indicating that the more VC associations a VC firm is member of, the less prone to syndication behaviour it will be. Explaining these findings from a resource dependence perspective, being member of an association community allows VC firms to countervail environmental uncertainty through an alternative mechanism than co-investments. Consequently, as associations offer VC firms a platform for frequent contact in informal settings, they enable them to acquire lacking resources in another way than engaging in formal contracts, such as syndicated deals. Nevertheless, during an informal interview in the course of this study, an executive from a German top tier VC firm stated that they would rather syndicate with someone whom they know e.g. from an association in which both are members. Henceforth, although the results show a significantly negative relationship between the number of association memberships and VC syndication behaviour, it could in turn be the case that shared association membership fosters syndication behaviour among this exclusive circle of members. Future studies could therefore analyse the relationship between the phenomenon of informal tie formation, shared association membership and its role in respect to a VC firm's propensity to syndicate.

Overall, this study proposes VC syndication in the DACH region to be driven by the strategic need of raising sufficient capital for firm operations and thus to ensure a VC firm’s future survival. In this context, the beneficial effects of syndication serve as reassuring signals towards investors. In particular, the study raises the notion that in environments characterized by risk-averse and inexperienced investors, certain firm characteristics which reinforce investors’ precariousness positively influence VC firms in their decision to engage in syndication behaviour. Empirical evidence supports this assumption, by showing that a VC firm’s early stage investment strategy, a dispersed industry focus, its past performance, its human resource capacity, as well as its opportunities to build informal ties have a significant influence on the VC firm's propensity to syndicate

Overall, the results of this study have implications for both, researchers and practitioners. First, by finding that in the DACH region especially VC firms exhibiting firm characteristics that antagonize potential investors in the decision to provide capital to a VC fund engage in syndicated relationships more often, this study contributes to the discussion on the drivers of VC syndication behaviour outside of the US Market. Further, drawing upon resource dependence theory, it raises the notion that syndication may consequently be driven by the need to mitigate high environmental uncertainty thereby increasing the chance of firm survival. This study adds a new perspective on existing research on VC syndication in the European market, by applying this context-sensitive approach to explain VC firms' propensity to syndicate. It postulates that in uncertain environments, the beneficial effects of syndication behaviour may serve as a signalling mean to convince risk-averse or inexperienced investors to decide in favour of investing their money in VC projects. Thus, especially in countries known for similar risk-averse attitudes among investors or a short existence of a venture capital industry, researchers could approach the analysis of VC syndication behaviour from a similar perspective. Lastly, this study also adds to the existing research on VC syndication, by raising the notion that the beneficial effects of VC syndication may serve as tool to influence the investment behaviour of risk-averse investors. Future studies in the field of behavioural sciences could investigate this assumption, thereby testing the validity of this notion.

Second, the results of this study are also important for practitioners. Managers of VC firms that exhibit characteristics, which potentially increase the degree of investment risk or resource shortage, should realize, that syndication may be a possible strategic vehicle for safely navigating their organization towards market survival, despite their increased difficulties of acquiring capital in a risk-averse and inexperienced environment for venture capital. On the one hand, actively applying syndicated investment deals as a strategic action, offers VC firms the opportunity to receive access to critical resources from other market players facing similar needs, as well as enabling them to reduce the overall risk associated with their investment strategy. Whereas these effects may themselves already emend a VC firm's future outlook, most importantly however, VC managers should understand that their engagement in co-invested deals and the subsequent beneficial effects have the potential to be used as a positive signal in terms of e.g. an overall lower investment risk and increased information access, towards their potential investors. Utilizing this signalling effect, VC firms can thereby ideally convince investors to see potential in the VC firm’s investment strategy and trust the management team with their investment decisions. Hence, when faced with difficulties of raising sufficient fund to continue operations, it could therefore be of great

importance for VC managers to focus on establishing syndication relationships with other VC firms in similar need, while openly communicating their co-investment engagement and the subsequent beneficial outcomes to the existing group of outside investors. In the long run, by embracing this kind of proactive approach to convince hesitating investors to invest their money in venture capital projects, the overall attitude towards venture capital investments may change, resulting in a less complex process of fund acquisition at the VC firm side.

8. LIMITATIONS AND FUTURE RESEARCH

The foremost limitation is the nature of the data. The study assumes ThomsonOne to yield adequate and up-to-date information on the investment activity of any VC listed in the database. Thus, by using secondary data, the quality of study is not only dependent upon the correctness and timeliness of the data, but also the analysis is restricted to a set of variables available from the data retrieved. Given this limit of different firm characteristics to be included in the analysis the consequence is a decreased degree of detail in respect to each firm and the measures utilized. In short, although yielding significant findings for this study, the nature of the data at hand does not allow for conclusions on all relevant aspects of syndication. To add more detailed firms characteristics determining a firm's syndication behaviour to be need driven, future studies can employ survey-based expert interviews or primary data such as annual reports if available (Manigart et al., 2002) .

Next, the final sample includes different types of VC firms. It can be argued that this distorts the overall power of the conceptual framework and findings, as BVC firms and CVC firms are, compared to IVC firms, face little risk of a ceasing capital inflow from outside investors. Hence, their syndication behaviour may not best be explained from a need driven perspective to ensure business survival in the context of risk-averse investors. However, it can be assumed that this risk-averse attitude towards venture capital among capital providers is the same for corporate or bank-related VC firms. Thus, future studies can investigate whether the proposed conceptual framework also holds when controlling for different types of venture capital firms.

In respect to the statistical models, limitations of the study may result from outliers among the residuals kept in the model, which potentially bias the results of the models. However, when looking at the outliers in more detail, it can be seen that by removing these VC firms from the network, the overall network constellation changes significantly as they belong to the group of the best connected players in the network, exhibiting the highest centrality values. Thus, although extreme values may indicate the presence of outliers, these VC firms should still be kept in the sample as they play a "knot-in-between" role, thereby facilitating the presence of a

VC syndication network among DACH VC firms in the first place. Overall, removing them from the sample would more dramatically decrease the results' quality than keeping and interpreting them thoughtfully. Furthermore, a slight funnel shape in the residual plot opening to the right indicates a weak violation of the homoscedasticity assumption. However, according to Tabachnick & Fidell (2007) an indicated slight heteroscedacity and therefore the violation of the assumption that the variance of the residuals is the same across all levels of the independent variables has a minimal effect on significance tests. Moreover, handling the missing values with a listwise deletion approach has reduced the explanatory power of the study's findings. Overall, the results of the study should therefore be interpreted and generalized carefully.

Also, as discussed before, the study's measure of co-investments did not include a time factor in terms of the specific rounds in which VC firms started to invest in a project together. Prospective studies can therefore add more detail to the discussion by including a time factor when establishing a measure for co-investment relationships. Further, it measured co-investments made only among VC firms located in the DACH region, thereby excluding syndication relationships existing with VC firms located in other countries. Thus, the present measure enabled to draw conclusions in respect to the syndication among VC firms in this area, however it does not allow to make any inferences about a VC firm's syndication behaviour in total, as it does not measure the extent to which the VC firms in the sample engaged in syndicated relationships with VC firms located outside of Germany, Austria or Switzerland. This decision can well be justified by the otherwise unmanageable scope of a study including all syndicated deals DACH VC firms have with any international VC. However, it must be noted that this also conveys the risk of finding VC firms located in the DACH region exhibiting only a weak propensity to syndicate, when in reality they heavily engage in co-invested deals on an international level. To augment this narrow perspective on the regional level, future studies could more explicitly test whether and why VC firms may, besides their regional co-investment relationships, engage in syndicated deals with international venture capitalists.

Next, the current study focuses on the part of the proposed framework, which addresses the relationship between certain VC firm characteristics and a firm's syndication behaviour. However, drawing upon signalling theory, the underlying framework also assumes that the beneficial effects of syndication serve as quality signals for potential investors. Prospective studies could therefore explicitly test for this signalling effect, by establishing measures helping to investigate whether the beneficial effects of syndication, such as shared investment

risk and resource access compensating for lacking capabilities, indeed serve as reassuring signal for hesitant investors in their investment decision process.

Working with longitudinal data of 8 years, this study develops a cumulative view of the VC co-investment network of VC firms located in the DACH region. Yet, any network is dynamic. Future studies could choose different years of investigations or analyse the development of the network over several years. Comparing their findings to the current ones could achieve higher scientific value, thereby advancing the research in this field of interest.

Further, the authors of this study agree with Verwaal et al. (2010) that in order to explain a complex phenomenon such as syndication behaviour more holistically, it is necessary to move beyond a single theory and research approach. This is also supported by the observation that although the measures' used in this study are commonly used in research on VC syndication, they are far from being understood and interpreted in a similar way among VC practitioners and researchers. Future studies could therefore approach the topic of venture capital syndication from a more descriptive perspective, to clarify, redefine or increase the common understanding of the phenomena of VC syndication, as well as to test the existing measures used in previous studies.

To conclude, the aim of the study has been, to identify VC firm characteristics that explain the need-driven syndication behaviour of VC firms located in the DACH region. However, the underlying framework, as well as the proposed hypotheses, has only been tested with a sample containing VC firms from Germany, Austria and Switzerland. Future studies could therefore apply the proposed framework to other countries of the EU or the US to investigate whether the need-driven hypotheses for VC syndication behaviour may also hold for other countries - or why it may not, given the cultural differences in respect to risk and investment attitudes (Rieger et al., 2014, McKinsey, 2014).

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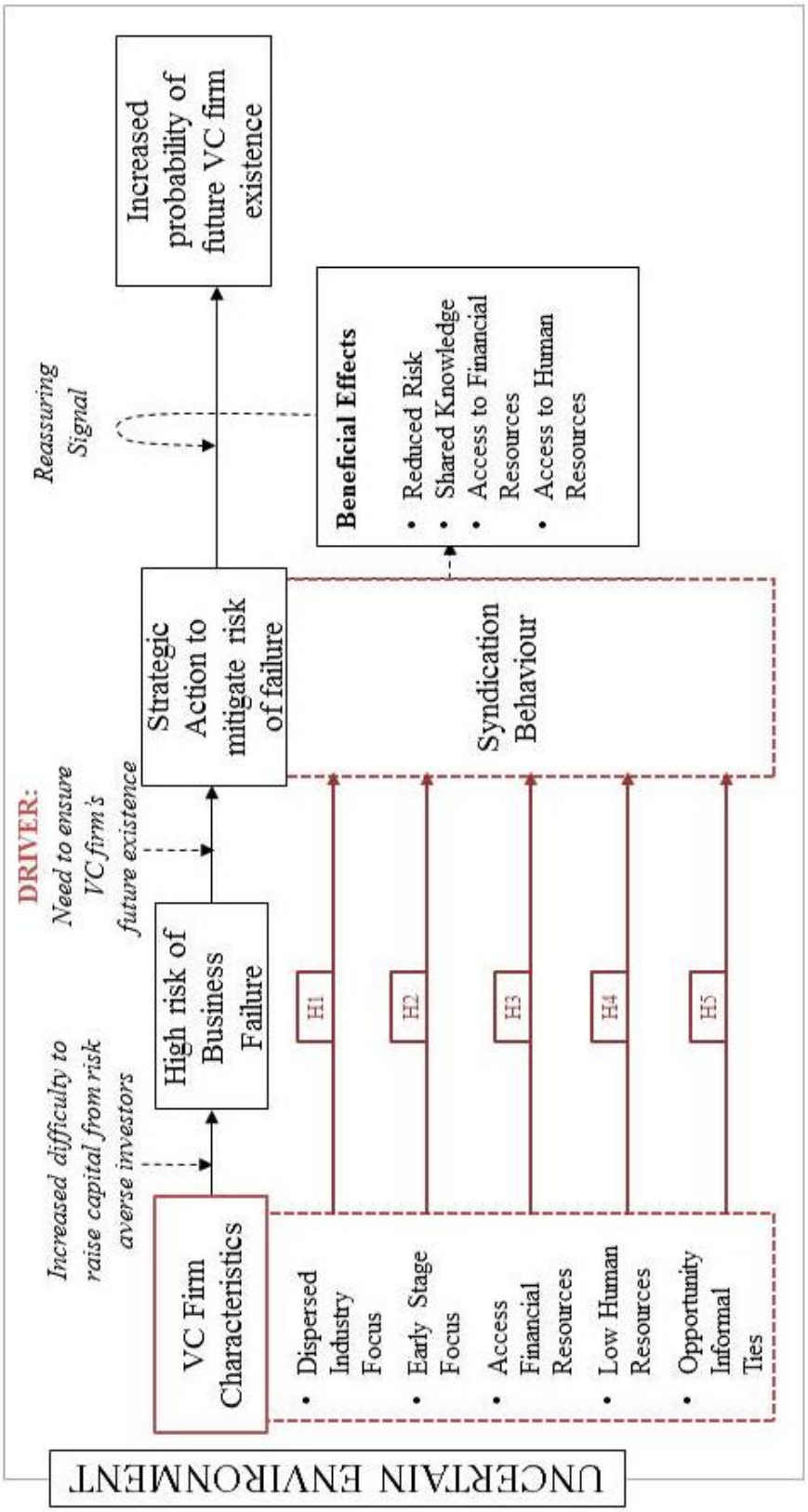
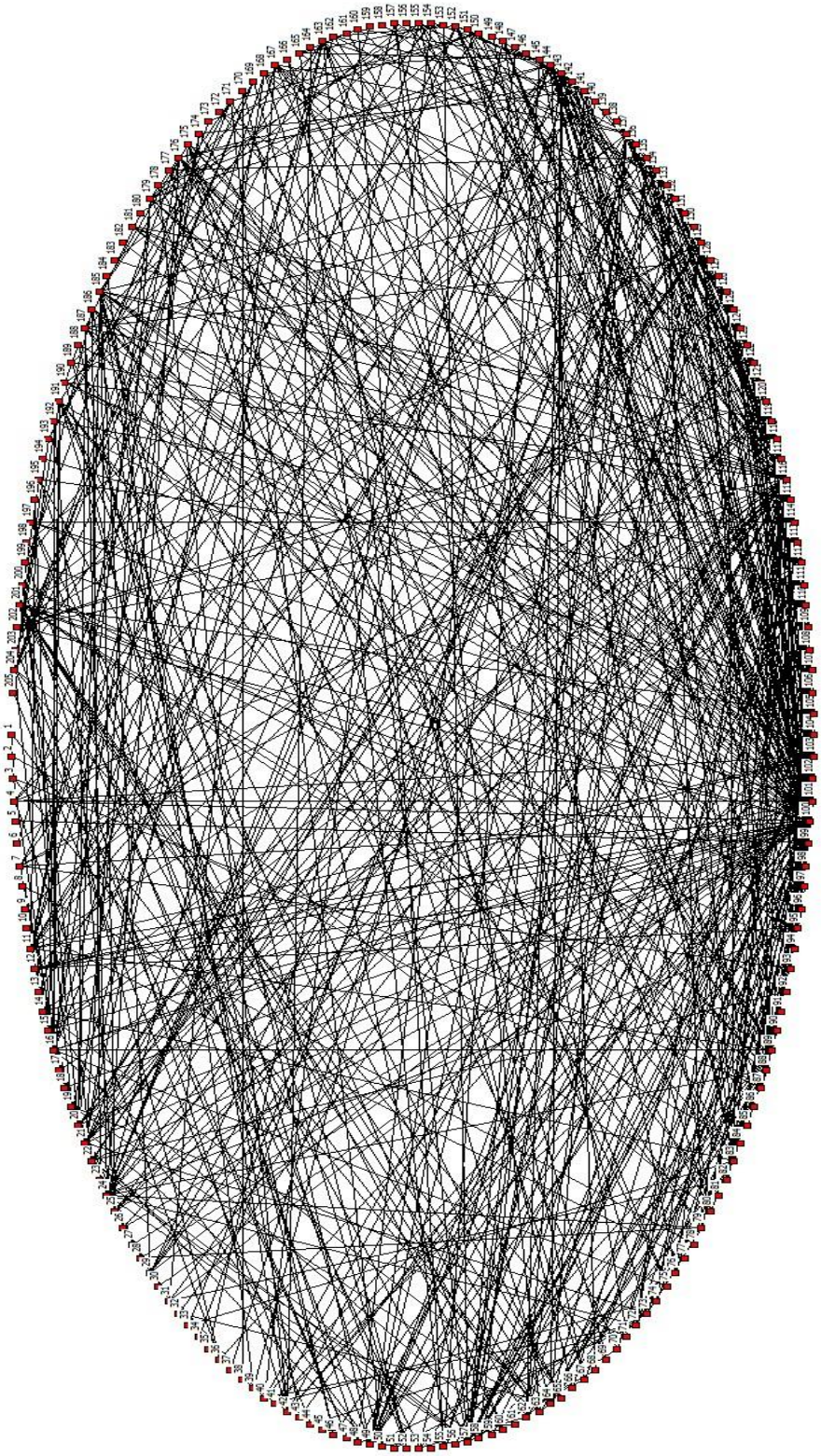
APPENDICES

Appendix A – Conceptual Framework



Appendix B – The DACH Venture Capital Syndication Network



Appendix C – List of all 205 VC firms included in the original sample

	Name	Adress	Website	Country (HQ)
1	3M New Ventures	c/o 3M ESPE AG ESPE Platz Seefeld, 82229		Germany
2	Abb New Ventures GmbH	Kallstadter Strasse 1 Mannheim, 68309	www.abb.de	Germany
3	Abb Technology Ventures Ltd	Affolternstrasse 44 Zurich, 8050	www.abb.com	Switzerland
4	Acton Capital Partners GmbH	Widenmayerstrasse 29 Munich, 80538	www.actoncapital.de	Germany
5	Aheim Capital GmbH	Schlossbergstrasse 1 Starnberg, 82319	www.aheim.com	Germany
6	Alfred Wieder AG	Muenchener Strasse 52 Pullach im Isartal, 82049	www.alfred-wieder.ag	Germany
7	Alternative Strategic Investment GmbH	Hindenburgstrasse 42 Hannover, 30175	www.alstin.de	Germany
8	Altira AG	Grueneburgweg 18 Frankfurt am Main, 60322	www.altira-group.de	Germany
9	Ammer Partners GmbH	Schauenburgerstrasse 27 Hamburg, 20095	www.ammerpartners.vc	Germany
10	Argantis GmbH	Jakob-Kaiser-Str. 13 Cologne, 50858	www.argantis.de	Germany
11	Astutia Ventures GmbH	Maximilianstrasse 45 Munich, 80538	www.astutia.de	Germany
12	Atlantic Capital Partners GmbH	Seestrasse 8 Munich, 80802	www.atlanticcp.com	Germany
13	Auctus Capital Partners AG	Prinzregentenstrasse 18 Munich, 80538		Germany
14	Aumenta GmbH	Cecilienallee 17 Duesseldorf, D-40474	www.aumenta.eu	Germany
15	Aurelia Private Equity GmbH	Kurhessenstrasse 1-3 Frankfurt, 60431	www.aurelia-pe.de	Germany
16	b to v Partners AG	Blumenaustrasse 36 P.O. Box 142 St. Gallen, 9004	www.b-to-v.com	Switzerland
17	Baigo Capital GmbH	Koenigsteiner Strasse 57 Bad Soden am Taunus, 65812	www.baigo-capital.com	Germany
18	Bamboo Ventures GmbH	Burgstrasse 8 Munich, 80331	www.bambooventures.net	Germany
19	BASF Venture Capital GmbH	4 Gartenweg Gebaeude Z 025 Ludwigshafen, 67063	www.basf-vc.de	Germany
20	BayBG Bayerische Beteiligungsgesellschaft mbH	Koeniginstrasse 23 Munich, 80539	www.baybg.de	Germany
21	Bayern Kapital GmbH	Laendgasse 135 A Landshut, 84028	www.bayernkapital.de	Germany
22	Bayernlb Private Equity Management GmbH	Ottostrasse 21 Munich, 80333	www.bayernlb-cp.de	Germany
23	Baytech Venture Capital GmbH & Co KG	Theatinerstrasse 7 Munich, 80333	www.baytechventurecapital.de	Germany
24	BC Brandenburg Capital GmbH	Steinstrasse 104-106 Potsdam, 14480	www.bc-capital.de	Germany
25	Berlin Ventures BG GmbH	Brunnenstrasse 181 Berlin, 10119	www.berlinventures.com	Germany
26	Bilfinger Venture Capital GmbH		www.vc.bilfinger.com	Germany
27	BioM AG	Am Klopferspitz 19a Martinsried, 82152	www.bio-m.org	Germany
28	Bm T Beteiligungsmanagement	Gorkistrasse 9 Erfurt, 99084	www.bm-t.com	Germany
29	bmp media investors AG	Schlueterstrasse 38 Berlin, 10629	www.mediainvestors.com	Germany
30	Boehringer Ingelheim GmbH	Binger Strasse 173 Ingelheim am Rhein, 55216	www.boehringer-ingelheim.com	Germany

31	BonVenture Management GmbH	Pettenkoferstrasse 37 Munich, 80336	www.bonventure.de	Germany
32	Born2Grow & GmbH Co KG	Edisonstrasse 19 Heilbronn, 74076	www.born2grow.de	Germany
33	Brandenburg Ventures GmbH	Rotherstrasse 20 Berlin, 10245	www.brandenburg-ventures.com	Germany
34	Brockhaus Private Equity GmbH	Myliusstrasse 30 Frankfurt Am Main, 60323	www.brockhaus-pe.de	Germany
35	BTH Berlin Technologie Holding GmbH	Unter den Linden 16 Berlin, 10117	berlinholding.com	Germany
36	Burda Digital Ventures GmbH	Hauptstrasse 130 Offenburg, 77652		Germany
37	Capcellence Mittelstandspartner GmbH	Caffamacherreihe 7 Hamburg, 20355	www.CAPCELLENCE.com	Germany
38	Capiton AG	Bleibtreustrasse 33 Berlin, 10707	www.capiton.de	Germany
39	Capvis Equity Partners AG	Talacker 42 Zurich, 8022	www.capvis.ch	Switzerland
40	Catagonia Capital GmbH	Neue Schoenhauser Strasse0 20 Berlin, 10178		Germany
41	CD-Venture GmbH	Bergheimer Strasse 45 Heidelberg, 69115	www.cd-venture.com	Germany
47	CEE Management GmbH	Speersort 10 Hamburg, 20095		Germany
42	Centralway AG	Binzstrasse 18 Zurich, 8045	www.centralway.com	Switzerland
43	CFH Beteiligungsgesellschaft mbH	Loehrstrasse 16 Leipzig, 04105	www.cfh.de	Germany
44	Cipio Partners GmbH	Ottostrasse 8 Palais Am Lenbachplatz Munich, 80333	www.cipiopartners.com	Germany
45	Co Investor AG	Kreuzstrasse 26 Zuerich, 8008	www.co-investor.com	Switzerland
46	Cologne Invest GmbH	Theodor-Heuss-Ring 23 Cologne, 50668	www.cologne-invest.com	Germany
48	CornerstoneCapital Verwaltungs AG	Ziegelhaeuser Landstrasse 1 Heidelberg, 69120	www.cornerstone-capital.de	Germany
49	Creathor Venture Management GmbH	Marienbader Platz 1 Bad Homburg, 61348	www.creathor.de	Germany
50	Debiopharm Investment SA	Chemin Messidor 5-7 Case postale 5911 Lausanne, CH-1002	www.debiopharm.com	Switzerland
51	Deutsche Effecten und Wechsel Beteiligungsgesellschaft AG	Fraunhoferstrasse 1 Jena, 07743	www.dewb-vc.com	Germany
52	Deutsche Telekom AG	Friedrich-Ebert-Allee 140 Bonn, 53113	www.telekom.com	Germany
53	Dievini Hopp Biotech Holding GmbH & Co KG	Johann-Jakob-Astor-Str. 57 Walldorf, 69190	www.dievini.com	Germany
54	DPE Deutsche Private Equity GmbH	Ludwigstrasse 7 Munich, 80539	www.pdpe.de	Germany
55	Dvc Deutsche Venture Capital	Richard-Strauss-Strasse 24 2nd Floor Munich, 81677	www.dvcg.de	Germany
56	Dw Capital GmbH	Vogelsanger Strasse 78 Cologne, 50823	www.dw-capital.de	Germany
57	Earlybird Venture Capital GmbH & Co KG	Torstrasse 109 Berlin, 10119	www.earlybird.de	Germany
58	Ecapital Entrepreneurial Partners AG	Hafenweg 24 Muenster, 48155	www.ecapital.de	Germany
59	Eckert Wagniskapital und Fruehphasenfinanzierung GmbH			Germany
60	Econa AG	Woehlertstrasse 12-13 Berlin, 10115	www.econa.com	Germany
61	EiKaM GmbH & Co KG	Fritz-Elsas-Strasse 36 Stuttgart, 70174	www.eikam.eu	Germany
62	EMBL Ventures GmbH	Boxbergring 107 Heidelberg, 69126	www.embl-ventures.com	Germany

63	Emerald Technology Ventures AG	Seefeldstrasse 215 Zurich, 8008	www.emerald-ventures.com	Switzerland
64	enjoyventure Management GmbH	Elberfelder Strasse 2 Duesseldorf, 40213	www.enjoyventure.de	Germany
65	Eps Value Plus AG	Zugerstrasse 8a Baar, 6340	www.epsvalue.ch	Switzerland
66	Equita Management GmbH	Am Pilgerrain 15 Inge Quandt Haus Bad Homburg vor der Hohe, 61352	www.equita.de	Germany
67	Estag Capital AG	Neue Kreisstrasse 23 Berlin, 14109	www.estag.de	Germany
68	European Founders Fund Management GmbH	Luisenstrasse 14 Munich, 80333	www.europeanfounders.com	Germany
69	EVA the Basel Life Sciences Agency	Hochbergerstrasse 60c Basel, 4057	www.eva-basel.ch	Switzerland
70	eVenture Capital Partners GmbH	Hohe Bleichen 21 Hamburg, 20354	www.evcpartners.com	Germany
71	Evonik Industries AG Corporate Venturing	Rellinghauser Strasse 1-11 Essen, 45128	venturing.evonik.com	Germany
72	EVP Capital Management AG	Bockenheimer Landstrasse 51-53 Frankfurt am Main, 60325	www.evp-capital.com	Germany
73	Extorel GmbH	Nussbaumstrasse 12 Munich, 80336	www.extorel.de	Germany
74	F Hoffmann La Roche AG	Grenzacherstrasse 124 Basel, 4070	www.venturefund.roche.com	Switzerland
75	Fastlane Ventures GmbH	Jungfernstieg 30 Hamburg, 20354	www.shortcut.vc	Germany
76	Fidura Capital Consult GmbH	Bavariaring 44 Munich, 80336	www.fidura.net	Germany
77	Findos Investor GmbH	Frauenstrasse 30 Munich, 80469	www.findos.eu	Germany
78	Frankfurt CapitalPartners FCP GmbH	Zeppelinallee 77 Frankfurt, 60487	www.frankfurtcapitalpartners.com	Germany
79	Fraunhofer Venture	Hansastrasse 27c Munich, 80686	www.fraunhofer.de	Germany
80	Gcp Gamma Capital Partners Beratungs & Beteiligungs AG	Schoenbrunnerstrasse 218-220 Stiege A / Top 4.04 Vienna, 1120	www.gamma-capital.com	Austria
81	GENEVEST CONSULTING GROUP SA	6, Cours des Bastions Geneve, 1205	www.genevest.ch	Switzerland
82	Genius Venture Capital GmbH	Hagenower Strasse 73 Schwerin, 19061	www.genius-vc.de	Germany
83	German Startups Group Berlin AG	Kaiser-Friedrich-Strasse 4A Berlin, 10585	www.german-startups.com	Germany
84	Germancapital GmbH	Erika-Mann-Strasse 7 Munich, 80636	www.germancapital.com	Germany
85	Global Equity Partners Beteiligungs Management GmbH	Mariahilfer Strasse 1 Getreidemarkt 17 Vienna, 1060	www.gep.at	Austria
86	Global Life Science Ventures GmbH	Maximilianstrasse 35 C Munich, 80539	www.glsv-vc.com	Germany
87	Good Energies AG	Grafenauweg 10 Zug, 6301	www.goodenergies.com	Switzerland
88	Goodvent Beteiligungsmanagement GmbH & Co KG	Kantstrasse 5 Magdeburg, 39104	www.goodvent.net	Germany
89	Grazia Equity GmbH	Breitscheidstrasse 10 Stuttgart, 70174	www.grazia.com	Germany
90	Gruenderfonds GmbH Co KeG	Ungargasse 37 Vienna, 1030	www.gruenderfonds.at	Austria
91	HackFwd Capital GmbH & Co. KG	Gaensemarkt 43 Hamburg, 20354	www.hackfwd.com	Germany
92	Hannover Finanz GmbH	Guenther-Wagner-Allee 13 Hannover, 30177	www.hannoverfinanz.de	Germany
93	Hanse Ventures BSJ GmbH	Am Sandtorkai 71-72 Hamburg, 20457	www.hanseventures.com	Germany

94	Haspa Beteiligungsgesellschaft fuer den Mittelstand mbH	Herrengraben 1 Hamburg, 20459	www.haspa-bgm.de	Germany
95	Hasso Plattner Ventures Management GmbH	Rudolf-Breitscheid-Strasse 187 Potsdam, 14482	www.hp-ventures.com	Germany
96	HBM Healthcare Investments AG	Bundesplatz 1 Zug, 6300	www.hbmbioventures.com	Switzerland
97	Heidelberg Innovation GmbH	Waldhofer Strasse 11/5 Heidelberg, 69123	www.hd-innovation.de	Germany
98	Heilemann Ventures GmbH	Saarbruecker Strasse 37a Berlin, 10405	www.heilemann-ventures.com	Germany
99	Heliad Equity Partners GmbH & Co KGaA	Grueneburgweg 18 Frankfurt am Main, 60322	www.heliad.com	Germany
100	High Tech Gruenderfonds Management GmbH	Schlegelstrasse 2 Bonn, 53175	www.high-tech-gruenderfonds.de	Germany
101	Holtzbrinck Ventures GmbH	Landsberger Strasse 187 Munich, 80687	www.holtzbrinck-ventures.com	Germany
102	HW Capital GmbH	Pienzenauerstrasse 2 Munchen, D-81679	www.hwcapital.de	Germany
103	IBB Beteiligungs GmbH	Bundesallee 171 Berlin, 10715	www.ibb-bet.de	Germany
104	Impera Total Return AG	Hausener Weg 2 Frankfurt, 60489	www.impera.de	Germany
105	Index Ventures	2, rue de Jargonnant Geneva, 1207	www.indexventures.com	Switzerland
106	Initial Factor Speed Invest GmbH & Co KG	Spengergasse 37-39 Third Floor Vienna, 1050	www.initialfactor.com	Austria
107	Innogy Venture Capital GmbH	Gildehofstrasse 1 Essen, 45127	www.innogy-ventures.com	Germany
108	Innovationsstarter Hamburg GmbH	Habichtstrase 41 Hamburg, 22305	www.innovationsstarter.com	Germany
109	Intelligent Venture Capital Management GmbH	Roermonder Strasse 386-388 Aachen, 52072	www.intelligent-venture-capital.de	Germany
110	Invest Unternehmensbeteiligung AG	Europaplatz 5a A-4020 Linz, 4020	www.investag.at	Austria
111	Invision AG	Grafenaustrasse 7 P.O. Box 4433 Zug, 6304	www.invision.ch	Switzerland
112	Iris Capnamic Management GmbH	Kaiser-Wilhelm-Ring 26 Cologne, 50672	www.capnamic.de	Germany
113	Iventurecapital GmbH	Wendenstrasse 21B Hamburg, 20097	www.iventurecapital.com	Germany
114	K New Media GmbH & Co KG	Rosenthaler Strase 42 Berlin, 10178	www.k-newmedia.de	Germany
115	K5 Advisors GmbH & Co KG	Waltherstrasse 23 Munich, 80337	www.k5advisors.com	Germany
116	KfW	Palmengartenstrasse 5-9 Frankfurt am Main, 60325	www.kfw.de	Germany
117	KI Kapital GmbH	Promenadeplatz 12 Munich, 80333		Germany
118	Kizoo Technology Ventures GmbH	Amalienbadstrasse 41 Karlsruhe, 76227	www.kizoo.com	Germany
121	L-EA Private Equity GmbH	Schlossplatz 21 Karlsruhe, 76113	www.l-ea.de	Germany
119	Lakestar Advisors GmbH	Utoquai 55 Zurich, 8008		Switzerland
120	LBBW Venture Capital GmbH	Koenigstrasse 10 C Stuttgart, 70173	www.lbbw-venture.de	Germany
122	Leonardo Venture GmbH & Co KGaA	Augustaanlage 32 Augusta Carree Mannheim, 68165	www.leonardoventure.com	Germany
123	Logan Capital AG	Dufourstrasse 121 St. Gallen, 9001	www.super-angel.ch	Switzerland
124	M Invest GmbH	Robert-Bosch-Strasse 4 Singen, 78224	www.m-invest.eu	Germany

125	Madsack Medialab GmbH & Co KG	Muehlenkamp 59 Hamburg, 22303	www.madsackmedialab.de	Germany
126	Media Ventures GmbH	Wesselinger Strasse 22-30 Cologne, 50999	mediaventures.de	Germany
127	MGO Digital Ventures GmbH	Gutenbergstrasse 1 Bamberg, 96050	www.mgo-ventures.de	Germany
128	Mic AG	Denisstrasse 1b Munich, 80335	www.mic-ag.eu	Germany
129	MIG Verwaltungs AG	Ismaninger Strasse 102 Munich, 81675	www.mig-fonds.de	Germany
130	Milestone Venture Capital GmbH	Mozartstrasse 57 Hoesbach, 63768		Germany
131	Monkfish Equity GmbH	Funkenburgstrasse 24 Leipzig, 04105	www.monkfish-equity.com	Germany
132	Mountain Partners AG	Poststrasse 17 St. Gallen, 9001	www.mountain-partners.ch	Switzerland
133	MVP Management GmbH	Hansastrasse 40 Munich, 80686	www.munichvp.de	Germany
134	netSTART Venture GmbH	Oststr. 11-13 (Rhein-Carre) Koln-Rodenkirchen Cologne, 50996	www.netstart-venture.de	Germany
135	Neuhaus Partners GmbH	Jungfernstieg 30 Hamburg, 20354	www.neuhauspartners.com	Germany
136	New Commercial Room GmbH	Rothenbaumchaussee 116 Hamburg, 20149	www.necoro.de	Germany
137	NRW Bank	Kavalleriestrasse 22 Duesseldorf, 40213	www.nrwbank.de	Germany
138	NWZ Digital Beteiligungsgesellschaft mbH	Peterstr. 28-34 Oldenburg, 26121		Germany
139	Oberbank Opportunity Invest Management GmbH	Hofgasse 1 Linz, 4020	www.oberbank-equity.at	Austria
140	Partners Group Holding AG	Zugerstrasse 57 Baar-Zug, 6341 Switzerland	www.partnersgroup.com	Switzerland
141	Paua Ventures GmbH	Linienstrasse 157 Berlin, 10115	www.pauaventures.com	Germany
142	PDV Inter Media Venture GmbH	Curt-Frenzel-Strasse 2 Augsburg, 86167		Germany
143	Peppermint VenturePartners GmbH	Kurfuerstendamm 21 Neues Kranzler Eck Berlin, 10719	www.peppermint-vp.com	Germany
144	Point Nine Capital Fund I & GmbH Co KG	Mohrenstrasse 60 Berlin, 10117	www.pointninecap.com	Germany
145	Polytechnos Venture Partners GmbH	Promenadeplatz 12 Munich, 80333	www.polytechnos.com	Germany
146	Pontis Venture Partners	Neuer Markt One Vienna, 1010	www.pontiscapital.at	Austria
147	Premium Equity Partners GmbH	Siesmayerstrasse 21 Frankfurt, 60323	www.premium-equity.de	Germany
148	Project A Ventures GmbH & Co KG	Julie-Wolfthorn-Strasse 1 Berlin, 10115	www.project-a.com	Germany
149	Prosiebensat 1 Media AG	Paul-Lincke-Ufer 39/40 Berlin, 10999	www.prosiebensat1.com	Germany
150	Redalpine Venture Partners AG	Pfingstweidstrasse 60 Zurich, 8005	www.redalpine.com	Switzerland
151	Rheingau Founders GmbH	Ohlauer Strasse 43 Berlin, 10999	www.rheingau-ventures.com	Germany
152	RI Digital Ventures GmbH	Alsterufer 46 Hamburg, 20354		Germany
153	Robert Bosch Venture Capital GmbH	Robert-Bosch-Platz 1 Gerlingen-Schillerhoehe, 70839	www.rbvc.com	Germany
154	Rocket Internet GmbH	Johannisstrasse 20 Berlin, 10117	www.rocket-internet.de	Germany
155	S Ubg AG	Markt 45-47 Aachen, 52062	www.s-ubg.de	Germany
168	S-REFIT	Sedanstrasse 15 Regensburg, 93055	www.s-refit.de	Germany

156	Saarlandische Wagnisfinanzierungsgesellschaft mbH	Franz-Josef-Röder-Straße 17 Saarbrücken, 66119	www.swgmbh.de	Germany
157	SAM Private Equity AG	Josefstrasse 218 Zurich, 8005	www.robecosam.com	Switzerland
158	Santo Venture Capital GmbH	Tölzer Straße 12, Holzkirchen, 83607		Germany
159	Seafort Advisors GmbH	Bremers Weg 3, Hamburg, 22587		Germany
160	Seed GmbH	Pfalzhaldenweg 10, Tuebingen, 76113	www.see-gmbh.de	Germany
161	SeedCapital Dortmund GmbH & Co. KG	Freistuhl 2, Dortmund, 44137	www.seedcapital-dortmund.de	Germany
162	SevenVentures GmbH	Medienallee 4, Unterfoehring, 85774	www.sevenventures.de	Germany
163	SHS Gesellschaft fuer Beteiligungsmanagement mbH	Bismarckstrasse 12, Tuebingen, 72072	www.shsvc.net	Germany
164	SIB Innovations- und Beteiligungsgesellschaft mbH	Leipziger Str. 116, Dresden, 01127	www.sib-dresden.de	Germany
165	Siemens Technology Accelerator GmbH	Otto-Hahn-Ring 6, Munich, 81739	www.sta.siemens.com	Germany
166	Siemens Venture Capital GmbH	Otto-Hahn-Ring 6 Munich, 81739	finance.siemens.com	Germany
167	Sirius Venture Partners GmbH	Biebricher Allee 22, Wiesbaden, 65187	www.sirius-venture.com	Germany
169	StartAngels Network	Zuerichbergstrasse 150, Zurich, 8044	www.startangels.ch	Switzerland
170	Steadfast Capital GmbH	Myliusstrasse 47, Frankfurt am Main, 60323	www.steadfastcapital.de	Germany
171	Swisscom AG	Alte Tiefenaustrasse 6, Worblaufen, 3048		Switzerland
172	sympasis innovation capital GmbH	Ottostrasse 1, Ettingen, 76275	www.sympasis.com	Germany
173	Syngenta Ventures	Schwarzwaldallee 215, Basel, 4058	www.syngentaventures.com	Switzerland
185	T-Venture Holding GmbH	Gotenstrasse 156 Bonn, 53175	www.t-venture.de	Germany
174	Taishan Invest AG	Dofourstraße 121, St Gallen, 9001	www.taishan-invest.com	Switzerland
175	Target Partners GmbH	Kardinal-Faulhaber-Strasse 10, Munich, 80333	www.targetpartners.de	Germany
176	Team Europe Management GmbH	Mohrenstraße 60, Berlin, 10117	www.teameurope.net	Germany
177	Technostart GmbH	Myliusstrasse 13, Ludwigsburg, 71638	www.technostart.com	Germany
178	Tecnet Equity NOE Technologiebeteiligungs Invest GmbH	Niederoesterreichring 2, Sankt Poelten, 3100	www.tecnet.co.at	Austria
179	Tengelmann E Commerce GmbH	Wissollstrasse 5-43 Muelheim an der Ruhr, 45478	www.e-tengelmann.de	Germany
180	The BioScience Ventures Group AG	Muelheim an der Ruhr, 45478	www.bsvg.com	Germany
181	Tiburon Partners AG	Maximilianstrasse 36 Munich, 80335	www.tiburon.de	Germany
182	Tivola Ventures GmbH		www.tivola-ventures.com	Germany
183	Triangle Venture Capital Group	Marktstrasse 65 St. Leon-Rot, 68789	www.triangle-venture.com	Germany
184	Triton Beteiligungsberatung GmbH	Schillerstrasse 20 Frankfurt, 60313	www.triton-partners.com	Germany
186	TVM Capital GmbH	Bonn, 53175	www.tvm-capital.com	Germany
187	V+Beteiligungs 2 GmbH	Kapuzinerweg 8 Landshut, 01309	www.venture-plus.de	Germany
188	Vattenfall Europe Innovation GmbH	Chausseestrasse 23	www.vattenfall.de	Germany
189	Venista Ventures GmbH & Co KG	Berlin, 10115	venista-ventures.com	Germany

190	Ventegis Capital AG	Kurfuerstendamm 119 Berlin, 10711	www.ventegis-capital.de	Germany
191	Venture Incubator AG	Baarerstrasse 86 Zug, 6302	www.vipartners.ch	Switzerland
192	venturecapital.de VC GmbH & Co. KGaA	Palais 22 Kennedyallee 70a	www.venturecapital.de	Germany
193	Verve Capital Partners AG	Grafenaustrasse 9 Zug, 6300	www.investiere.ch	Switzerland
194	VHB digital GmbH	Agrippinawerft 22 Cologne, 50678	www.vhbdigital.de	Germany
195	Vinci Capital Switzerland SA	Parc Scientifique PSE Batiment C Lausanne, 1015	www.vincicapital.ch	Switzerland
196	VM Digital Beteiligungs GmbH	Gutenbergstrasse 1 Schwarzach, 6858	www.vm-digital.net	Austria
197	Vogel Ventures GmbH	Lepiziger Strasse 126 Berlin, 10117		Germany
198	Vorndran Mannheims Capital Advisors GmbH	Graf-Adolf-Strasse 18 Duesseldorf, 40212	www.ventizz.de	Germany
199	Vorwerk Direct Selling Ventures GmbH	Muehlenweg 17-37 Wuppertal, 42270	www.vorwerk-ventures.de	Germany
200	VR Equitypartner GmbH	Platz der Republik Frankfurt am Main, 60265	www.vrep.de	Germany
201	Wellington Partners	Theresienstrasse 6 Munich, 80333	www.wellington-partners.com	Germany
202	ZFHN Zukunftsfonds Heilbronn GmbH & Co KG	Edisonstrasse 19 Heilbronn, 74076		Germany
203	Zuehlke Ventures Ltd	Wiesenstrasse 10a Schlieren, 8952	www.zuehlke.com	Switzerland
204	Zuercher Kantonalbank	Geroldstrasse 20 Zurich, 8005	www.zkb.ch	Switzerland
205	Zurmont Madison Management AG	Eisengasse 15 Zurich, 8034	www.zurmontmadison.ch	Switzerland

Appendix D – Different Network Measures of the DACH VC Firms

The venture capital firm scoring highest in term of degree centrality is *the High Tech Gruenderfonds* (HTGF), a venture capital investment firms headquartered in Bonn, Germany, founded in 2005. It is a government-affiliated public-private partnership with approx. 293 investments made, primarily focusing on seed and start up investments in high potential high-tech start-ups. Among the well-known portfolio companies are 6Wunderkinder, Mister Spex and Plista (HTGF, 2014). However, only 16 out of all 293 investments have been successfully been exited so far, resulting in an 8.7% exit rate. Second highest scores the *KfW Mittelstandsbank,* a subsidiary of the *KfW Bank,* provides equity financing to small and medium sized enterprises, including entrepreneurs and start-ups. With a total number of 161 investments made, out of which only 8.7% have been exited so far, the bank-related VC, based in Frankfurt am Main, Germany, focuses not only on early, but also on expansion stage financing. *IBB Beteiligungsgesellschaft,* an Berlin-based, bank-affiliated VC, with a total of 112 investments made, a 14.2% exit rate and primarily focussing on early and expansion stage investments, ranks third. Hereafter, *Holtzbrinck Ventures, Wellington Partners and Earlybird*

Venture Capital GmbH score next highest. All three are independent venture capital firms, headquartered in Munich and Berlin and all focussing on seed, early and expansion stages. With an investment portfolio ranging of 88 (Holtzbrinck Ventures), 77 (Earlybird) and 120 (Wellington Partners), an exit rate of 21.6%, 35% and 27.5% respectively can be denoted.

	VC Firm	Degree Centrality
1	High Tech Gruenderfonds Management GmbH	81
2	KfW	68
3	IBB Beteiligungs GmbH	40
4	Holtzbrinck Ventures GmbH	25
5	Wellington Partners	19
5	Earlybird Venture Capital GmbH & Co KG	19
6	MIG Verwaltungs AG	18
6	BC Brandenburg Capital GmbH	18
7	b to v Partners AG	17
7	T-Venture Holding GmbH	17
7	Point Nine Capital Fund I & GmbH Co KG	17
7	NRW Bank	17
7	Logan Capital AG	17
7	Bayern Kapital GmbH	17
8	Goodvent Beteiligungsmanagement GmbH & Co KG	16
9	German Startups Group Berlin AG	15
9	Astutia Ventures GmbH	15
9	LBBW Venture Capital GmbH	15
10	Grazia Equity GmbH	14
10	BayBG Bayerische Beteiligungsgesellschaft mbH	14
10	Creathor Venture Management GmbH	14

	VC Firm	Closeness
1	High Tech Gruenderfonds Management GmbH	0.425
2	KfW	0.402
3	IBB Beteiligungs GmbH	0.362
4	Holtzbrinck Ventures GmbH	0.361
5	Earlybird Venture Capital GmbH & Co KG	0.352
6	Goodvent Beteiligungsmanagement GmbH & Co KG	0.351
7	NRW Bank	0.348
8	T-Venture Holding GmbH	0.347
9	Grazia Equity GmbH	0.345
10	Wellington Partners	0.343

	VC Firm	Betweenness
1	High Tech Gruenderfonds Management GmbH	6931
2	KfW	3954
3	Wellington Partners	1836
4	IBB Beteiligungs GmbH	1752
5	CFH Beteiligungsgesellschaft mbH	1448
6	Vinci Capital Switzerland SA	920
7	Zuercher Kantonalbank	894

8	b to v Partners AG	821
9	Holtzbrinck Ventures GmbH	762
10	Earlybird Venture Capital GmbH & Co KG	644

	VC Firm	**Eigenvector**
1	BASF Venture Capital GmbH	0.418
2	venturecapital.de VC GmbH & Co. KGaA	0.371
3	Dievini Hopp Biotech Holding GmbH & Co KG	0.234
4	CD-Venture GmbH	0.168
5	Innogy Venture Capital GmbH	0.152
6	Catagonia Capital GmbH	0.143
7	HackFwd Capital GmbH & Co. KG	0.139
8	Milestone Venture Capital GmbH	0.133
9	Gcp Gamma Capital Partners Beratungs & Beteiligungs AG	0.133
10	Vogel Ventures GmbH	0.131