Empirical Evidence on the Syndication of Venture Capital and Shared Real Option Ownership

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Abstract

This paper aims at analysing the syndication behavior of VC organisations and the factors influencing their overall propensity to co-invest in the context of managerial real options. Moreover it sheds some light on the factors influencing an investment firm's willingness to syndicate and the impact on the value of the inherent real options that affect the value of the project. The overall impression the existing studies and articles suggest is that syndication itself is a value, which can be explained by different frameworks such as portfolio diversification or value adding. However, little effort has been made to research in depth why most VC investments are actually not syndicated. It is rather striking that there exists no study revealing the reasons why venture capitalists refrain from syndicating in or -out an investment and under which circumstances this is the case. Based on a dataset of 1,800 VC investments in Germany we will hypothesize investment behavior under uncertainty when the real option is shared. We then compare these hypothesis to the actual empirical evidence from the data set in order to see whether real option thinking can indeed be used to explain the observed behavior for syndicated venture capital investments. Consequently, in this paper it will be analysed what the impact of shared option ownership will be compared to the case of single ownership in regular VC investments. We can see that uncertainty per se is not the main driving force behind syndication behavior and that other factors such as coordination costs have an impact on the observed behavior of Venture Capital investors. Moreover we show that a real options perspective gives rise to the Resource Based View of VC syndication. We find evidence that a lower level of experience and expertise fosters the need to syndicate an investment.

1 Introduction

Cooperation among financial institutions is a persistent feature of the equity issuance process. Consequently, the syndication of venture capital investments is common practice among venture capitalists. Despite the importance of syndication, surprisingly little is known on the motives and structure of syndication [Manigart et al. (2002)]. This paper aims at analysing the syndication behavior of Venture Capital (VC) organisations and the factors influencing their overall propensity to co-invest in the context of managerial real options. Moreover we will shed some light on the factors influencing an investment firm's willingness to syndicate and the impact on the value of the inherent real options that affect the value of the project due to managerial flexibility in the financing process.

Starting with the evidence from empirical studies that were carried out on this topic we will discuss the general theory on syndication, which is thought to be independent from peculiar VC industries. Hence, this will serve as the framework throughout this paper which we will augment with the theory of real options and the influence that sharing of particular options will have on the project value of a venture business. Firstly, this paper gives a theoretical overview on general motives of VC syndication, thus discussing the rational behind VC syndicates. Additionally, various factors influencing the propensity of VC investors to syndicate are analysed. In the second part of the paper we will review the use of the concept of real options in order to capture the value of syndicated venture capital investments. Finally, we will combine the existing theory of real options with the impact of syndication on the value of shared real options.

The overall impression the existing studies and articles suggest is that syndication itself is a value, which can be explained by different frameworks such as portfolio diversification or value adding. However, little effort has been made to research in depth why most VC investments are actually not syndicated. It is rather striking that there exists no study revealing the reasons why venture capitalists refrain from syndicating in or -out an investment and under which circumstances this is the case. Consequently, in this paper it will be analysed what the impact of shared option ownership will be compared to the case of single ownership in regular VC investments. Overall this paper contributes on the one hand to the understanding of syndicated Venture Capital Investments and on the other hand enriches the general literature on real option theory by shedding light on a new area of application.

The article is organized as follows. In section 2, we give a brief overview on the nature of venture capital and the presence of real options due to staging of investments. In section 3 we will consider the rationale for venture capital syndication and potential problems associated with it. In section 4, we will discuss various other studies that aimed at drawing conclusions on the syndication of

venture capital. Section 5 tries to shed light on the problems that might arise when multiple companies share the payoff and exercise of the embedded real options. Based on this argument we will hypothesize several effects that are likely to be observed when venture capital investments are syndicated based on the real options rational. The data set used is described in section 6. In section 7 we will test the hypothesized arguments against evidence from a data set incorporating venture capital investments in Germany. Section 8 concludes.

2 Venture Capital and the Presence of Real Options

The VC industry, unlike most other parts of the financial sector, lacks a precise legal or regulatory definition. Looking at the broad variety of common definitions of VC, they usually focus on four characteristics. The first characteristic sees VC as a source of financing for privately held companies. Secondly, this sort of financing happens usually in form of either equity or long term convertible debt. Thirdly, the venture capitalist is seen as an intermediary between investor and entrepreneur [Schilit (1991)]. Lastly, the combination of equity investments and active involvement in the development of the company is a unique characteristic of the VC industry [Kunze (1990)]. The principle of venture capital is to provide high potential growth companies with the required funds and market expertise they need to make their business model a success. Venture capitalists strive for substantial capital gains and returns in the medium or sometimes long term, compensating them for the high risk and uncertainty [Sahlmann (1990)]. The ability to select investment opportunities from a wide range of expected returns is vital to any venture capital organisation. Different to other institutional investors, venture capitalists face an informational disadvantage as they do not invest in public quoted companies [Fama (1991)]. With regard to deal selection and monitoring, venture capital firms have developed different strategies to reduce uncertainty in their high risk environment. Among these strategies staging of Venture Capital is a common mean to react to an uncertain environment. Moreover in recent years VC companies have been striving to syndicate investments with other venture capitalists [Manigart et al. (2002), Wright and Robbie (1998)]. In the following we will therefore analyze these two strategies in conjunction.

As pointed out in Sahlman (1988) the world in which venture investments take place is marked by uncertainty about future market conditions. That is, future cash flows are unknown in amount and timing and two parties analysing the same deal might come to different conclusions due to either disagreement about future potential of the investee, conflict of interest or asymmetric information between the investment firms involved. Moreover staging of venture capital is

fostered by the idea of information becoming available over time thus reducing uncertainty. Consequently, it will be valuable to stage investments as opposed to making a huge payment upfront. Managerial flexibility to react to favourable or unfavourable changes in the environment, which are inherent in a staged investment can be captured by the concept of real options. These take into consideration that the management of the VC firm has always the option to change the state of the investment project to mitigate uncertainties, i.e. to commit more or less capital to it. The overall (net present) value of the investment can be expanded by the additional value of flexibility inherent in the decision making process.

The nature of staged investments corresponds to a multi-option problem, as the initial investment leads to the exercise of follow-on investment opportunities. Therefore they can not be seen as independent investments but have to be seen as a chain of interrelated decisions, where the earlier ones are prerequisites for later ones [Amram and Kulatilaka (1999)]. Figure 1 graphically illustrates the decisions faced by VC Companies which correspond to a portfolio of real options.
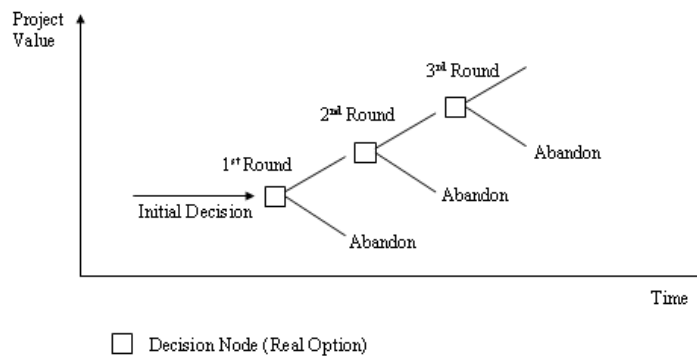
Figure 1: *Initial Investment Decisions as a Bundle of Real Options*

Trigeorgis (1996) points out that Management initially only has to make the first decision, whether to accept or reject the project. Moreover one has to realize, that the immediate current choice will affect (and will be affected by) the feasibility and attractiveness of upcoming events, as a decision today can only be optimal if all future decisions are themselves optimal. At time 0, a VC firm only has to determine whether it wants to accept or reject the initial project, as any time-0 policy, which will affect future decisions, can be revised when uncertainty is resolved and information gathered over time. So if, for example, management finds that a certain investment stage has not met management's expectation concerning value creation, they can decide not to go on with the project, i.e. abandon it. The asymmetry due to the flexibility of abandoning a

project early (for the salvage value of the assets) provides a downside protection for the management. The opportunity to abandon will occur more than once during the life of the project, as management can determine after each completed stage, that it would be optimal not to go on with the project, and thus could avoid value destruction by sticking to the course of action. When management decides to stop a project after a certain stage, it will not have to incur the instalment cost necessary to further develop the investee company. Consequently, we can see that investment staging corresponds to a sequential real option problem. As the aim of this paper is to analyze the effect of syndication on the value of the embedded real options we will in the next section introduce the prevailing theory of syndication and link it to the concept of real options (that are brought to life when investment are staged) in order to be able to draw conclusions on investment behavior under uncertainty that we can test against our data set later on.

3   The nature of Venture Capital Syndication

As Lerner (1994) points out, cooperation among financial institutions is an enduring feature of the equity issuance process. An equity syndicate involves several venture capitalists taking an equity stake in an investment [Lockett and Wright (2001)]. It involves "[. . .] a group of individuals who must make a common decision under uncertainty that will result in a payoff to be shared jointly among them" [Wilson (1968), p. 119]. There exist two dominant competing views as to why venture capitalists syndicate, which are the traditional finance-related perspective and the resource-based perspective. All rationales are described from a perspective to syndicate out an investment. Lockett and Wright (1999) find that the motivation to join a syndicate is explained by the same factors to syndicate out an investment: the traditional finance perspective and the resource-based perspective.

3.1   The Finance Perspective

The finance-related rational for syndication originates from finance theory and is therefore also seen as the traditional approach. The finance perspective is to see syndication as a mean for venture capitalists to build up a well-diversified portfolio and reduce risk without reducing return. The relevant risk-consideration for a VC investor is the contribution of an investment to the overall risk of his portfolio. This depends on the covariance of the portfolio and the investment opportunity. There are two subdivisions of risk involved in an equity investment. While the market component is systematic and cannot be eliminated, the firm specific risk component is non-systematic and can therefore be reduced by holding a well-diversified portfolio. In a well-balanced VC portfolio there exists a

minimum level of co-variance between the different investments [Manigart at al. (2002), Lockett and Wright (2001), Markowitz (1959)].

The constraints on investment activities are based on Modern Portfolio Theory. Its main principle is the efficient diversification of investments ([Elton and Gruber (1995)]. Firstly, venture capitalists encounter the difficulty to obtain a well-diversified portfolio, since they do not invest in listed stocks as institutional investors. The difficulty arises on the one hand from ex-ante asymmetric information and also from the size of the funds required (capital restraints). This demonstrates that through syndication smaller venture capitalist can actually invest in deals with a high amount of required funds.

3.2   The Resource Based Perspective

Frequently syndication occurs in the VC industry even though the amount of funding required for the investment opportunity is relatively modest compared to the financial resources of the venture capitalists. The resource-based perspective raises the question why venture capitalists still syndicate in such situations. [Brander (2002)]. The resource-based approach sees the VC market as a pool of productive resources in which a VC organisation can access resources of another venture capitalist through syndication [Manigart et al. (2002), Bygrave (1987)].

At the *pre-investment stage*, Lerner (1994) suggests the *Selection Hypothesis* as a rational for VC syndication. Under this hypothesis the evaluation process before the selection of an investment opportunity is undertaken by more than one venture capitalist. The evaluation of the same venture proposal by different VC companies operating in a syndicate reduces therefore the potential danger of adverse selection [Lerner (1994) and Houben (2002)]. The combined effort to assess the quality of a venture helps VC investors to overcome informational asymmetries as the entrepreneurs typically know more about the investment opportunity they seek funding for and might overstate the attractiveness of his business proposal [Sorenson and Stuart (1999)]. Sah and Stiglitz (1986) compare the decision-making process under different scenarios: In the first scenario the project is already accepted when a single party thinks that it is worth undertaking. In the second scenario, however, two or more separate parties must be convinced by the investment opportunity before the project is undertaken. Sah and Stiglitz (1986) conclude that the decision making process is more efficient and leads to better results if the project is only undertaken when approved by two or more parties.

Transferred to the situation of a VC syndicate this means that the involvement of two or more venture capitalists leads to better decisions whether to invest in

a venture or not. The same investment opportunity is screened and evaluated by different VC firms under different aspects. If all potential syndicate members believe that it is worthwhile to invest in the venture this is a good indication for the success of the investment. However, Brander (2002) takes a different view on the common assessment of an investment opportunity by analyzing two extreme scenarios of a very bad and a very promising project and comes to the conclusion that syndication occurs in the intermediate range of the assessed project quality. If the evaluating venture capitalist is not able to clearly identify a project as profitable it will pass it on to other VC firms for their review and evaluation. In case different other VC providers evaluate the venture and believe that it is profitable enough then an investment syndicate may be formed for the project of intermediate quality [Brander (2002)].

The Value Added Hypothesis in terms of managerial activities is a resource-based motive for syndication which holds for the *post-investment stage.* Under the Value Added Hypothesis venture capitalists are considered to add value to the performance of the venture after they invested their capital. This contrasts with the selection hypothesis, where syndication helps investors to select the best projects, but does not influence the performance of the investee company (Brander (2002)). A lead investor acts according to the Value Added Hypothesis when he believes that the involvement of other venture capitalists would add some value to the venture. The benefit of involving co-investors is derived from heterogeneous skills and information different venture capitalists can contribute to the management of the venture company. The need for such additional resources is anticipated to be greater in earlier stages of an investment, than in later-stage investments. This is mainly due to the fact that more mature investee-companies already have an established management structure and market position and have already built relationships with suppliers and customers [Lockett and Wright (1999), Brander (2002)].

Considering the possibility that both motives and hypothesis could operate at the same time it could be assumed that "Syndication is a response to the need to share informational resources in the ex ante selection and ex post management of investments."(Lockett and Wright (1999), p. 307).

3.3 Potential Problems with Venture Capital Syndication

The existing literature on VC syndicates mostly focuses on the rationales for co-investing without explicitly researching the potential downsides of syndication. Predominantly, coordination of syndicated investments may be more difficult than non-syndicated investments. The decision making process involves a number of different VC firms that all must agree on important managerial issues.

Especially larger syndicates can impose particular difficulties in terms of coordination and decision timing. Wright and Lockett (2002) come to the conclusion that "[...] syndication imposes a management cost that is reflected in terms of coordination and timing difficulties regarding decision making." [Wright and Lockett (2002), p. 4].

Syndicates potentially increase the problems associated with venture capital investments. Lead investors are highly careful with the choice of their investment partners and select those venture organisations which are trustworthy and which they know from past interaction. However, diverse objectives and diverse management approaches become especially apparent when a large number of investors are involved. These coordination and management problems further increase when the investee company performs badly and the shareholders cannot jointly agree on the best way forward. In the following we will therefore shed some light on the possible consequences that syndication might have have on the value of the embedded real options that a VC firm holds.

4   Evidence on the Syndication of Venture Capital

Different empirical studies over the last years come to varying conclusions as to whether the desire to share risk and increase portfolio diversification is a more important rationale for syndication than the desire to add value through increased informational resources. As this is the prevailing controversy and issue in the literature on VC syndication, it is appropriate to draw a comparison to what conclusions the existing empirical studies come. Bygrave (1987) found that there is more co-investing when there is a higher level of uncertainty. His comparison of the more conservative consumer and the more risky computer industry in the USA showed a clear tendency of co-investing in the high innovative computer sector. There was also more syndication in early-stage investments than later-stage investments, even though the investment amount required was on average 40% lower for early-stage investments. These findings seem to question the finance-based rational as it assumes higher syndication for deals requiring a larger amount of funding. Thus, Bygrave (1987) concluded that the main motive for syndication was rather the sharing of experience and other intangible resources than capital restraints and the spreading of financial risk. In his findings he also refers to Pfeffer and Salancik (1978) who found similar evidence in their studies on joint ventures. In another publication, Bygrave and Timmons (1992) again emphasise the great role uncertainty plays in the decision to syndicate which can be reduced by the sharing of information and the access to resources from the syndicate members.

In 1997, Chiplin et al. (1997) also drew conclusions in favour of the resource-based motive in their study. They found greater support for syndication as a mean to improve deal selection through joint decision making. Chiplin et al. (1997) acknowledge the importance of costs in the VC market, but can only find weak support for the risk sharing perspective as a motive to syndicate. Contrary to this, Lockett and Wright (1999) are with their findings on the UK market clearly in favour of the financial-based rational as a primary explanation for syndication. They find that the large size of a deal compared to the funds that are available to a single venture capitalist is significantly more important than all other factors. The need for additional information before making a decision turned out to be the least relevant explaining factor. This leads to the conclusion that that the ex-ante Superior Selection Hypothesis is less important than the ex-post Value Added Hypothesis both being allocated to the resource-based perspective. According to Lockett and Wright (1999), the best explanation for syndication, however, is based on the traditional finance perspective.

Lockett and Wright (1999) split the UK venture capitalists into two groups. On the one hand those with a maximum investment preference of £5 million and on the other hand those with a minimum investment preference of £5 million. The reasoning behind this is to separate those VC firms that exclusively invest in MBO/MBI later stage in-vestments from the rest of the sample being characterized by a higher degree of uncertainty and variability in outcomes. They find that the two groups with their different minimum investment preference have different attitudes towards syndication in a way that they have different financing requirements. The level of risk associated with smaller early stage investments is considerably higher than for late stage investments. Thus, venture capitalists that have a preference or limitation to smaller minimum investment amounts need to diversify away the greater risk through the creation of a portfolio of syndicated investments. They come to the conclusion that both the finance-based rationale and the resource-based rational are more important to VC firms with a lower minimum investment preference with the finance motive being generally significantly more relevant.

In 2000, Hoje Jo (2000) again focuses on the resource-based rational to conduct his research. However, he emphasizes that it is unclear to him to what extent risk sharing aspects influence venture capitalists to syndicate. Maula and Murray (2000) support this view in their study. They identify the need for complementary resources, including in-tangible assets like industry experience or tangible assets like warehousing. They offer no explicit findings regarding to what extent the financial perspective is involved as a motive for syndication. In 2002, Brander et al. (2002) concentrate like Maula and Murray (2000) on the re-source-based rational. In his conclusion, they clearly favour the Value Added Hypothesis.

This is underlined by the finding that syndicated investments have higher rates of return than stand-alone investments. They acknowledge the value of a second opinion in the investment selection process, but state that their empirical analysis identifies the value added effect as the driving force behind VC syndication. They conclude that risk-sharing might play a role, but emphasize at the same time that they see capital constraints only as an issue in some special cases and rather not for large VC firms which do most of VC investing.

Finally, Manigart et al. (2002) pick up the study by Lockett and Wright (1999) on the UK and extend it to a European context. In their study of six European countries, they come to the conclusion that the traditional finance perspective is significantly more important than all other perspectives and motives. It is remarkable that this finding is consistent across all European countries of the study. Overall, the results of this study suggest that the financial motive is the only important motive European VC firms consider when syndicating.

5 Venture Capital Syndication and the Shared Ownership of Real Options

In the first parts of the paper we have elaborated on the process of venture capital staging and explained that this technique can be seen as a bundle of real options. In the following we will therefore link the presence of real options to the case of multiple investors undertaking a syndicated venture capital deal. We will try to analyse the potential drawbacks that syndication might impose on the value of the inherent options and presume which actions the initiators of such a deal might put in place in order to overcome those drawbacks. Thus, we will hypothesize investment behavior under uncertainty when the real option is shared and compare it to the actual empirical evidence from the data set of 1,800 VC investments in Germany. This allows us to see whether real option thinking can indeed be used to explain the observed syndication behavior of venture capitalists. Also it helps us to offer a potential answer to the question why most VC investments are actually not syndicated despite the finance and resource-based motives. Consequently, in this part of the paper it will be analysed what the impact of shared option ownership will be compared to the case of single ownership in regular VC investments.

5.1 Shared Option Ownership

Trigeorgis (1996) suggests that management should focus on assessing the relevant options and their strategic nature. When evaluating an investment proposal

a VC firm should also address the point of option ownership (or exclusiveness of the option). Based on the firms capabilities, exclusiveness refers to a firms ability to appropriate the option value for itself. High barriers to entry, such as a patent with no close substitutes, or unique skills make it impossible (at least for some time) for competitors to duplicate such real options. A second criterion concerns the inter-project or intra-project interactions. Here one has to analyze whether an investment itself is valuable or whether it only acts as a prerequisite for subsequent investment opportunities. When considering the staging of venture capital we pointed out earlier that exercise of a discretionary investment option yields further investment opportunities (further real options) in the future. The last point management should be concerned with is the urgency of the decision, whether a project is deferrable to a later point in time. Concerning the timing of additional funding (the exercise of a subsequent real option) one can argue that not the point of time is important, but rather the value of the underlying project triggers early investment. Management will therefore link their decision on the prospective value it can appropriate in subsequent steps. Figure 2 summaries the strategic considerations laid out above.
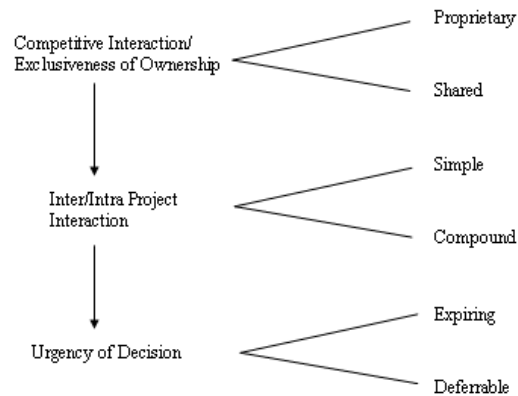

Figure 2: *Classification of Real Options [Trigeorgis (1996)]*

5.2 Noisy VC Investments and Syndication

In the last paragraph it has been examined in which way the value of options is affected by sources like competition, ownership and the presence of subsequent options. As the staging of venture capital is intended to yield additional future options as pointed out in chapter 3 and competition about investments might only arise in the bidding phase, we will in the following determine what the effects and possible consequences of joint ownership could be on the value of the inherent real options.

With respect to a Venture Capital Investment one can argue that the investment itself is unique to some extent, meaning that one will hardly find any one-to-one comparable investment projects. The uniqueness can on the one be explained by the very true nature of VC investments and secondly by the characteristics of the investee company, that usually is a recently established company having no substantial history of operations. Consequently, for an investor it might prove tricky to replicate the payoff resulting from such a venture. Hence, without actually selling the stake (via an asset sale or an IPO) there will hardly by any available information that can result in informing about the true value of such a venture. This results in VC firms making their estimates about the true state of their investee company with error. Here the error comes into play when VCs have to make decisions concerning the exercise date of the option, as they might have no information about the true value of the investment opportunity. Thus, the distortion with respect to some noisy information yields problems in making optimal decisions. Speaking in terms of Childs, Ott and Riddiough (2001) noise tends to slow down the rate of information arrival, which in turns leads to a lower value of the contingent claim (stemming from the imprecisions in exercise decisions) and consequently leads firms to acquire additional information in order to overcome the difficulties in decision making.

When referring to tradable assets one could argue that arbitrageurs might bring the observed asset price back to their fundamental values. When, looking at Venture Capital investments, however, transaction costs and/or a given level of market incompleteness makes this process difficult, if not impossible. Following the arguments brought forward by Childs, Ott and Riddiough (2001) only limited arbitrage can serve the price finding process.

As a consequence we will follow the representation of Childs et al. (2001) and introduce a noise term that distorts the value process that describes our VC investments. Here, the noise process is assumed to be mean reverting such that the observed value co-integrates with the unobserved full information. Historic information about the venture could be used in order to construct an efficient and unbiased estimate of the asset value incorporating the full set of information.

The estimation about the venture value will therefore be formed by using current

and historic data about its profitability in order to separate noise from the available information set. Thus, the process will follow the dynamics in Childs et al. presented below, where the underlying asset value follows a process of the form:

$$dX(t) = \mu_x dt + \sigma_x dW_1 \tag{1}$$

Which is distorted by the option holder by a noise process:

$$dY(t) = -\kappa Y(t)dt + \sigma_y dW_2 \tag{2}$$

Consequently, the combined (observable) asset value resolves to:

$$dZ(t) = (\mu_x - \kappa(Z(t) - X(t)))dt + \sigma_x dW_1 + \sigma_y dW_2 \tag{3}$$

Where dW_1 and dW_1 are increments of uncorrelated Wiener Processes. Here the true value of the underlying asset follows the typical GBM process, whereas one adds a mean reverting noise term, where past errors will dissipate over time. Consequently, markets are incomplete (in an Arrow-Debreu sense) and the VC companies will have difficulties in making correct judgments about the true value of the underlying investment. That is, cash flows stemming from the venture cannot be used to perfectly replicate its value. Using the equations presented above we can conclude that the observed value equals the sum of the true value and the noise term. Past errors in the equation will die out with a rate of κ. The argument here is that actions undertaken by the agents might help to keep the observed value from wandering to far away from their fundamentals. In the case of a VC investment we can think of the VC taking certain initiatives in order to improve their view on the portfolio company. Here regular meetings and a constant information flow with respect to operations of the portfolio companies might help to keep track of the underlying company value. If the estimate wanders to far away the VC might intensify his relationship with the investee company to keep track with operations or loosen communication if he is too optimistic about reaching the prespecified goals.

With a mean reverting noise a larger weight is given to current observations and a smaller weight to the initial staring conditions and older information. This also reflects the need for a certain proximity to actual market conditions, as in the case of an asset sale or an IPO VCs could only anticipate appropriating a price close the current market valuation of comparable firms. Consequently, the latest information with respect to the profitability of the venture will be the most important one in order to reflect the value of the underlying venture.

With respect to the noise term one can say that once new signals coming in are highly informative it will be possible for the option holder to keep track with the evolvement of the underlying asset. Consequently, there will hardly be any

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differences in exercise policies and option values. However, if the signal turns out to be highly uninformative there will be no further benefit from waiting for new information as the new information set will not help to make better predictions. Thus the value estimate before and after the information arrival will be similar and waiting to resolve uncertainty has a very low value (Childs et al. argument by comparing the variance of the underlying process and the revealed variance stemming from the arrival of new information). In addition higher noise volatility drives the optimal investment threshold down to the classical NPV case [Childs et al. (2001)]. We can think of the noise component as making it more difficult to judge about the true dynamics of the underlying asset. That is, noise clearly affects the optimal exercise policy and leads to distortions in the informative character of news processed by the option holder.

Here we can see that an option holder might benefit from making better predictions using the available information set in order to be better able to track the underlying asset value. More precise estimates therefore are valuable and a VC should be willing to incur some costs in order to acquire new information. We pointed out earlier that entrepreneurs typically know more about the investment opportunity they seek funding for and might overstate the attractiveness of their business proposal. Therefore, the combined effort to assess the quality of a venture helps VC investors to overcome informational asymmetries which apparently is more important to inexperienced VC investors or VC firms investing in non core industries.

5.3   VC Syndication as a costly information acquisition

The presented dynamics show that there might be a need for the option holder to acquire additional information in order to overcome errors in exercising the options. The process of syndicating an investment with a partner can be regarded as an example of purposefully acquiring new information to make better predictions about the true asset value. In this case the Venture Capitalist would involve a new partner that brings in a new set of information (with a given level of precision, so that new information will not fully disclose the value of the underlying venture). Consequently, the initial option holder can reduce the variance of the noisy information set and make better and precise decisions with respect to its options. As a result the value of the option will therefore increase due to a higher option value of waiting to resolve uncertainty.

Moreover, based on Brander et al. (2002) conclusion regarding investment opportunities that syndication occurs in the intermediate range of the assessed project quality, we can see that the sensitivity to estimates in the underlying value drivers is quite high. In terms of an option point of view, we can conclude that most of

the projects we are dealing with seem to be in this intermediate range, thus representing at-the-money projects. Here it is of higher importance to syndicate in order to widen informational resources to overcome informational asymmetries. Consequently, VC firms that don't posses the required industry expertise might be faced with a higher noise level and will therefore face a greater difficulty in structuring the VC deal correctly.

Apparently, the trade off here would be to compare the incremental costs associated with involving a partner with the value of the additional information. Interestingly the benefits will the greatest the closer the option is at-the-money. The more we move away in either direction the less beneficial will an information acquisition be.

When two or more companies are involved in a syndicated deal, several additional complications and costs might arise. Potential informational asymmetries that can result from the substantial difference in the level of interaction between the lead firm and other syndicate members are dealt with through contracting arrangements between the lead and non-lead investors. A legally protected syndicated investment agreement specifies the items to be disclosed and their timing, the rights of the contracting parties and, if predictable, future commitments to additional financing rounds. However, in the management of syndicates non-legal sanctions are more important than legal sanctions. The reason for this is that a lead member who misleads his syndicate partners in sharing information will suffer from a lasting damage to his reputation and a lower probability to be included in future deals [Wright and Lockett (2002)].

In order to reduce coordination costs, Lockett and Wright (2002) point out that the lead syndicate member has the greatest involvement with the management of the portfolio company and passes this information on to the other syndicate members on a periodic basis.Wright and Lockett (1999) find that the ease with which a firm can work with its syndicate partner is a function of past interaction, reputation of trustworthiness and investment style. These are the most important factors for the selection of syndicate partners. Both past interaction and the level of trustworthiness are especially vital with regards to the ex-post management of investments that underperform. Because under difficult circumstances the strength of the syndicate relationships is really tested.

With respect to a multi-period option problem (a compound option for example) Childs et al. conclude that it might be worthwhile to acquire information in small increments in order to reduce possible ex-post over- or underinvestment in information. Here we can see that theory would tell us, that VC companies should usually move step by step in involving partners into their syndicates. Moreover, it might be advisable for the option holder to start with a low level of precision and move towards higher precision (if further information is needed) during the process of investment later on.

As the scope of this paper is to empirically test whether real options can yield insights into the investment behavior of syndicate members under uncertainty we will test in the next chapter the consequences that noisy investments pose for the Venture Capitalist and to which extent they make use of syndication as a mean to costly acquire new information.

6 Data and Methodology

As mentioned earlier in this paper we want to test propositions on the syndication behaviour of VC firms under uncertainty and make explicitly use of the concept of real options. In order to analyse whether our propositions hold for the German VC market, a data base is used which lists VC investments in German portfolio companies. In the following chapter we will elaborate in more detail on the database used in order to be able to built and test the propositions in the next chapter.

6.1 Distribution of the Sample

The sample consists of a total of 3,230 transactions where a VC investor (German or non-German) takes in some way an equity stake in a German portfolio company. Each transaction is described by a number of variables, providing further information on the transaction. The bottom line information on each transaction are the names of the participating investor and portfolio company. The 3,230 transactions are distributed on 812 different VC investors and 1,962 portfolio companies. 1,377 transactions (42.6%) are investments in companies that have only one VC investor, the other 1,853 transactions (57.4%) involve co-invested companies with more than one investor. The number of investments per single VC provider ranges from 1-120 recorded transactions. The 812 investors of the sample have on average four different portfolio companies with VC investors with only one investment being the most represented group. If only considered those investors with two or more investments, the mean number of investments per VC provider significantly increases to nine, with two being the most frequent value.

The sample indicates a strong dispersion of VC investors in Germany: Firstly, some very few VC firms are involved in remarkably many investments. Secondly, the number of different VC investors distinctively grows with a decreasing number of investments. Thus, the 812 VC providers consist of very few large investors (with tbg being the biggest one with 120 transactions) and a strong majority of small ones. 511 investors (62.9%) were invested in only a single company. Moreover, the number of VC providers with less than ten investments accounts for over 90% of the total sample. There are only 31 VC firms with 20 or more

investments, which accounts for 3.8% of the total number of investors. However, those 31 firms made almost 40% of all 3,230 transactions of the sample. In contrast to this, the 511 investors with only a single transaction account for 62.9% of all investors in the data set, but cover only 15.8% of the transactions in the sample.

For our analysis, we classify the 812 investors according to their number of transactions in groups of "one time investor" (1 investment), "very small VC" (2-3 inv.), "small VC" (4-6 inv.), "lower middle field VC" (7-10 inv.), "upper middle field VC" (11-20 inv.), "large VC" (21-50 inv.) and "very large VC" (> 50 inv.).

6.2   Syndication Ratio of Investors

For the purpose of the upcoming analysis it is interesting to describe the propensity to syndicate of the VC investors in the sample. The propensity of an investor to co-invest is expressed in this paper by its ratio of syndicated investments to the total number of deals undertaken. The Syndication Ratio divides the number of co-invested deals by the total number of deals the investor completed in the sample. The higher the Syndication Ratio of an investor, the more he tends to invest in portfolio companies that are funded through a co-investment. A syndication ratio of "0" indicates that the specific investor invested exclusively on his own and was not involved in any co-investment of the sample. This is the case for 126 investors (15.5%). All other 686 investors of the sample (84.5%) participated at least in one syndicate during their investment activities. By far the most VC providers (N=501; 61.7%) have a syndication ratio of "1", meaning that they invested solely in companies that were funded through a co-investment. Based on all 812 VC investors the mean syndication ratio is striking 73.5%, saying that the investors of the sample tend by far more to invest in portfolio companies that have more than one investor than to invest in companies that have no other investors.

However, it is important to note that this number is biased in a way. In the sample, there are 511 investors who did only one single VC investment. If this particular company was funded through a syndicate, the single time investor gets the maximum syndication ratio value of 100% (1.0). Still it would be misleading to reason that this single time investor has a higher propensity to syndicate than for example 3i Deutschland, which invested in 94 companies and has a Syndication Ratio of 70%. [1] Therefore, the 511 one-time investors which can only have a syndication ratio of either "1.0" or "0.0" were excluded from the calculation of the next mean. In doing so, the new mean of the overall syndication ratio of the

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[1]Depending on the particular problem set during the inductive statistical analyses later in the text, this bias was inhibited by either excluding those investors with only one investment or those transactions with non-syndicated companies.

sample is 0.6 and applies to the remaining 301 VC investors of the sample which have at least two investments.

6.3 Syndication Index and the Number of Portfolio Companies

The 3,230 transactions are distributed on a total of 1,962 different capital seeking companies. The range with regards to the number of investors involved in the funding of a single company is between 1-17. More than 70% (N=1,377) of all investee companies in the sample have only one investor and 92% of them are funded by not more than three different VC investors. Companies with more than five investors account for 3% of the sample. Finally, there are only nine portfolio companies being funded by ten or more VC providers.

For the analysis in this paper, each portfolio company is allocated a syndication index. It simply calculates how many different investors a company has. A syndication index of four means that the company is funded by a co-investment of four different VC providers, for example. From all transactions results an average of 1.65 investors per portfolio company (syndication index=1.65). However, if only calculated on the basis of the companies that have at least two funding investors (N=585) the mean almost doubles to 3.17. Thus, if it comes to a co-investment of a portfolio company in the sample, the average number of investors is 3.2. According to their number of investors, each of the 1,962 companies is allocated to one of the following groups: "one single investor", "small syndicate" (2-3 investors); "middle syndicate" (4-5 investors), "large syndicate" (6-9 investors), and "very large syndicate" (>9 investors).As already stated, only 30% of the portfolio companies have more than one investor. The aggregated 30% share of those companies with at least two investors (N=585) is portioned out on 435 companies funded by a small syndicate (22.2%), 94 funded by middle syndicates (4.8%), 47 funded by large syndicates (2.4%) and nine portfolio companies funded by very large syndicates (0.5%)

6.4 Limitations of the Data Set

The statements resulting from the statistical analysis of the 3,230 transactions have to be made with an urgent note of caution: The data set provides no information as to how many financing rounds each of the 1,962 portfolio companies had or which investor joined the investment at what time. From the number of transactions in the data set a portfolio company is involved in, one can only conclude on the total number of investors that invested in it during its life span.

Thus, it may well be that there are investors who did fund an investee company during the first financing rounds on their own and not through a syndicate. However, if this investee company gets funded by more investors at later stages, who might even replace the original investor, it is recorded in the data set as being a syndicated company because it appears in two or more transactions with two or more different investors. Consequently, when calculating the Syndication Ratio for the original investor, such a portfolio company is recorded as being syndicated and also increases the syndication ratio of the first investor although he may have invested on his own. With regards to the Syndication Ratio of the overall sample, this means that it would not be correct to conclude that 74% of the investments by the 812 VC firms of the sample were all syndicated in the narrow sense of the definition of syndication. The very correct interpretation is that the VC investors were at 74% invested in portfolio companies that have had more than one investor since their foundation. This inaccurateness of the data set probably widely explains why the number of syndicated investments is double the overall syndication ratio reported by the BVK (2002) for Germany (37.5%), which is based on the narrow definition of syndication. It is important to point out this important characteristic of the sample. Keeping in mind that the analyses in this paper are carried out on the basis of the broad definition of syndication (as it was emphasised before in the text) the statistics still come to valuable findings on syndication patterns in Germany.

7 Empirical Evidence from Germany on Venture Capital Syndication and Shared Option Ownership

Using the sample described in the last section we will analyze the investment behaviour of venture capitalists under uncertainty and review how they try to mitigate the problems pointed out in chapter 5 when we regarded the investment problem as a bundle of shared real options. Moreover, it is pointed out in which way the concept of real options can be used to better understand the rational behind venture capital syndication.

Based on the arguments brought forward in the lasts chapters we can identify drawbacks for syndication as the costs of coordination are caused to rise. Due to this adverse effect the syndicate partners are inclined either to reduce the negative impact of coordination costs by establishing longer relationships and get involved with a small number of partners with whom they can best work with and agree upon goals or on the other hand to overcompensate the cost effect by involving new partners that can bring in skills and capabilities that are not present in the other investor company (for example an established VC co-invests

with an industry specialist). This behavior would then clearly favor the resource based perspective on venture capital syndication. Another point that would underpin the support for the resource based perspective is the need to overcome the difficulty in judging on the correct value path of the underlying venture in order to correctly anticipate the investment potential and its respective returns that are necessary to correctly structure the deal. Here, less experienced VC's are likely to be faced with a higher level of noise distorting the estimation and are therefore more inclined to overcome this informational asymmetry by syndicating. Consequently, we would expect to find evidence for the resource driven motives that are fostered by the real options perspective.

In the following we will analyze the investment behavior of venture capitalists under uncertainty and see how they try to mitigate the problems pointed out in chapter 6 when we regarded the investment problem as a bundle of shared real options. Moreover, one will be able to see in which way the concept of real options can help us to better understand the rational behind venture capital syndication.

Proposition 1: A higher level of uncertainty fosters the propensity to syndicate

To see whether a higher degree of co-investing in riskier industries can be confirmed with the database, a univariate linear model is run with the Syndication Index of the investee companies as dependent variable and their industry as independent factor (likewise one could also take the sector volatility as the explaining variable). Here only those portfolio companies are analysed that have at least two VC investors. Thus, it is analysed how many investors the companies from the different industries on average have if it actually comes to a co-investment. Table 1 shows for the different industries the average number of investors if a company actually is co-invested.

Biotechnology firms (4.2 VC investors) rank before Internet Service Providers (3.9). If it comes to a co-investment, the number of VC investors involved is approx. the same for companies from the Internet- (3.4), Life Science & Pharmaceutical- (3.4), B2C- (3.2) and B2B industry (3.3). Portfolio companies from the Hardware & IT- (2.1), Services- (2.7) and Media & Communication (2.8) sectors are at the other end of the distribution having on average the lowest number of investors. There is an overall high significance of the portfolio company industry on the variance of the number of investors accounting for 7.8% of the variation in the dependent variable. But the means of the Syndication Index of the different industries are not found to be significantly different in their direct comparison. As an example the significance table for the biotechnology industry is shown in the Appendix explaining the effect of the industry factor on the differences in the propensity to syndicate.

Dependent Variable: Number of investors per Portfolio Company			
IC Industry - categorised	Mean	Standard Deviation	N
Biotechnology	4,24	3,235	85
Internet Service Providers	3,90	2,269	20
Electronics	3,50	,707	2
Internet	3,42	3,118	12
Life Science & Pharma	3,40	2,197	15
E-Commerce B2C	3,22	1,647	64
E-Commerce B2B	3,30	1,670	43
Consulting	3,00	1,414	5
Infrastructure & Logistics	2,97	1,426	31
Technology	2,96	1,509	26
Software	2,95	1,509	141
Media & Communication	2,77	1,054	44
Services	2,73	1,087	56
Industry & Construction	2,67	,866	9
Venture Capital	2,29	,488	7
Finance & Banks	2,13	,354	8
Hardware & IT	2,13	,352	15
Total	3,17	1,934	583

Table 1: Influence of Industry on Syndication Index

Overall, there is no evidence that portfolio companies from certain industries have statistically significant more or less investors than companies from other industries. However, it is at least noticeable that companies in high market risk industries such as Biotechnology, E-Commerce and Internet Service Providing have a clearly higher Syndication Index than firms from less risky industries such as Finance & Banks, Industry & Construction and Infrastructure & Logistics. The average number of investors in a syndicate in the different industries varies by up to two investors.

As a result from chapter 5 one could see that firms can overcome the informational asymmetries by syndicating the investment. Thus, the noise over the true value of the underlying investment favors the need to syndicate an investment. As information acquisition is costly, it is not only the industry uncertainty that drives the need to syndicate. Rather, also other factors might influence the propensity to syndicate, as for example the aforementioned additional coordination costs that come along when an investment is syndicated. Therefore, the interplay between incremental coordination costs and uncertainty jointly affects the decision to syndicate an investment.

Proposition 2: Inexperience creates a need for additional expertise to ensure success in the ex-post stage of the management of the investments and therefore fosters the propensity to syndicate an investment

Based on the number of investments per VC investor as a size criterion (similar to Manigart et al. (2002)), it is analysed how the categorised size classes of the venture capitalists differ in their propensity to syndicate. Here we take the size of an investor also as a proxy for his level of experience to test the proposition.

In order to test the relation between experience and the propensity to syndicate a univariate linear analysis is done with both the Syndication Index and Syndication Ratio as dependent variable and the classified number of investments as independent variable.

Dependent Variable: Syndication Ratio

number of investments per investor - categorized	Mean	Standard Deviation	N
one time investor (1 Inv.)	,8141	,38942	511
very small VC (2-3 Inv.)	,6877	,38299	119
small VC (4-6 Inv.)	,6241	,31334	78
lower middle field VC (7-10 Inv.)	,4996	,27233	41
upper middle field VC (11-20 Inv.)	,4595	,25057	32
large VC (21-50 Inv.)	,4645	,21485	25
very large VC (>50 Inv.)	,5183	,25713	6
Total	,7345	,38433	812

Table 2: Syndication Ratio of investors according to their size

Table 2 shows the overall pattern that the propensity to syndicate decreases with increasing size of the VC organisation. Single time investors have the highest Syndication Ratio (0.81) followed by very small- (0.69), small- (0.62), lower middle field- (0.50), upper middle field- (0.46) and large (0.46) VC investors. The six very large venture capitalists with more than 50 investments have a higher Syndication Ratio (0.52) than the middle field and large VC firms, which seems not to fit into the overall trend. However, this is explained by the biggest venture capitalist in the sample, tbg, that has a Syndication Ratio of 96%. If this special case is left out of the top group, then the new average Syndication Ratio of the very large VC firms is 43% and thereby the lowest mean of all size classes. Thus, the decreasing propensity to syndicate with increasing size of the VC firms now applies to all categories of the factor. Overall, the factor size of the VC firm explains moderate 9.4% of the total variance of a VC investor's propensity to syndicate (see table on the significance of the factor VC size in the Appendix).

As expected, from the direct comparison of the factor values results that one-time investors have a significantly higher Syndication Ratio of up to 38% more syndicated investments than all other categories. This is not very surprising considering the fact that 17.2% of the one time investors are Business Angels, 16.6% Foreign-, 17.4% Non-Professional VC investors and 22.3% not specified VC types which all have a higher propensity to syndicate mainly due to resource-based aspects (see frequency distribution of single time investors in the Appendix).

Very small VC investors (2-3 investments) have a significantly lower propensity to syndicate than one-time investors but syndicate else wise significantly more than the other categories (except for small VC investors where the higher Syndication Ratio is not found to be significant). The same applies to small VC investors (4-6 investments). They also have a significantly higher propensity to syndicate than all larger size classes but a significantly lower one than single-time investors.

Lower middle field- (7-10 investments), upper middle field- (11-20 investments), large- (21-50 investments) and very large VC companies (>50 investments) reveal the same pattern: They all syndicate significantly less than one-time-, very small- and small VC investors. Overall this pattern is in line with our expectations drawn from chapter 5 where we expected less experienced firms to be more inclined to syndicate as they might not have the necessary expertise in order to be able structure the staged investment deal correctly. Moreover, we therefore argued that this might favor the resource-driven motive to syndicate. The effect of involving a new partner into the deal is fostered by the idea to overcome informational asymmetries and to reduce the noise distorting the true observable asset value. More accurate information on the input parameters finally leads to a better anticipation of deal characteristics and facilitates decision making.

As the data set involves different classes of investors we can even distinguish between different types of investors so that we can test whether inexperienced VC firms are more likely to co-invest new ventures due to the need to narrow down the broader bandwidth of uncertainty about industry characteristics (as for example technical feasibility of products and volatility of earnings) by syndicating with more experienced partners:

Proposition 2a: Foreign and Non-Professional Investors are more inclined to co-invest Venture Capital deals

Table 3 lists the average Syndication Ratio for each type of VC investor in the sample. Most noticeable in this table is that Non-Professional VC providers have a syndication ratio of 1.0, meaning that none of the 89 one-time-occasion VC investors funded their portfolio company on their own. But also practically all of the 123 different Foreign VC investors, which are mostly professional venture capitalists, invested in their German portfolio companies together with a number of co-investors (Syndication Ratio=0.88).

Private VC Investors are at $\frac{3}{4}$ invested in portfolio companies with more than one investor, which is similar to Corporate/Media- (0.79) and Bank VC firms (0.78). The eleven Specialists in the sample have the lowest Syndication Ratio (0.37) followed by Incubators (0.41). Young Specialists (0.56) and Established Specialists (0.58) have almost the same ratio of co-invested to non-co-invested deals. Also Public venture capitalists (0.65) and Business Angels (0.65) do not differ in their propensity to syndicate. The analysis of variance rejects the hypothesis of no effects with a p-value of 0.000. Also 22% of the total variance of the VC investors' propensity to co-invest can be explained by its type (see table on significance of factor VC type for non-professional and foreign VC investors in the Appendix).

The contingency table, comparing the influence of the VC Type on the syndication ratio, reveals that Non-Professional- and Foreign VC investors syndicate sig-

Dependent Variable: Syndication Ratio

VC Firm Type	Mean	Standard Deviation	N
Non professional VC	1,0000	,00000	89
Foreign VC	,9286	,23068	123
Corporate/Media	,7856	,30429	14
Bank-VC	,7778	,37062	31
Private	,7600	,43589	25
Corporate/Consulting	,7419	,37550	8
Unknown VC	,7105	,45961	38
Corporate/Industry	,7043	,32562	32
Business Angel	,6522	,47312	92
Public VC	,6502	,41087	43
Corporate/Internet	,5796	,35937	13
Established Specialist	,5763	,29134	40
Young Specialist	,5639	,30849	71
Sparkassen-VC	,5106	,44257	21
Incubator	,4086	,34696	23
Specialist	,3669	,20889	11
Gesamt	,7352	,37533	674

Table 3: Syndication Ratio of Investor Types

nificantly more deals than Business Angels, Incubators, Established Specialists, Young Specialists, Specialists, Public- and Sparkassen VC investors. All other direct comparisons between the average Syndication Ratios of the VC types show no significant differences. Thus, although there are noticeable differences in the Syndication Ratio of the VC types, they are not found to be significant except for Non-Professional- and Foreign VC investors who co-invest up to 60% more than VC types with the lowest Syndication Ratio. To summarize, the dominant propensity to syndicate of Foreign Venture Capitalists, Non-Professional- and also Private VC investors seems to lend support to the resource-based motive. The latter two VC types are exclusively single time VC investors who do not have an active portfolio of investee companies, which they need to diversify. It is evident that these types of investors are not professionally engaged in the (German) VC business and lack the experience and know-how of classic (German) VC organisations to process a VC investment. Private- and Non-Professional VC investors mostly do not have the capabilities to develop a venture on their own but rely on professional co-investors. Their motive to syndicate their single-time VC investment is therefore more resource- than finance-based. Foreign Investors, as the VC type with the second highest Syndication Ratio and highest number of co-investors, are mostly professional venture capitalists but still a special category. Their rational to co-invest in a company is also likely to be resource driven as it may help them to overcome barriers such as language, distance, legal or even cultural peculiarities of the German VC industry. This also supports the argumentation put forward in chapter 5 that investors unfamiliar with the market situations are more inclined to co-invest their deals as they might be uncertain over the correct estimate of the underlying deal value in order to structure the VC deal in the most economical way. Consequently, by the means of syndication they can involve partners with the corresponding knowledge and skills that are

needed to operate in the market. Hence, foreign and non-professional investors can make better predictions and are therefore able to correctly anticipate the potential of a certain deal with the according risk-return tradeoff that best fits their investment needs.

Proposition 2b: Specialists are more willing to make a deal on their own, as they posses the needed skills to survive in their niche market

Sorenson and Stuart (2002) suggest that VC firms which are more specialised either in terms of geographical reach, industry or investment stage have a higher propensity to syndicate than general VC firms as it serves as a mean to increase their investment scope. In this paper we argue the other way around. Established and experienced investment firms are acquainted with the needed skills and expertise to survive in their niche or industry and therefore do not have to rely on syndication in order to make better investment decisions in the ex-ante and ex-post investment stage. Moreover, firms that specialise in a specific market already know in advance about the capital requirements and act accordingly, when pulling together their investment fund with institutional investors. Moreover, knowing in advance about the necessary level of funding needed to participate in certain deals also does not lend support to the financial perspective on VC syndication as firms know early on how much money would be needed when they start setting up their investment fund. Therefore only special circumstances would urge a VC specialist to make a joint investment. Thus, we would propose that specialists are less inclined to syndicate, as the additional (informational) benefit is limited.

To test if specialised VC firms have a higher or lower propensity to syndicate than less specialised ones, the VC types Specialist, Young Specialist and Established Specialist are aggregated to one category "Specialised VC" in the new variable "Specialist yes/no". All other types of VC investors are grouped as "Other" in this variable. Moreover, only those VC investors are selected for the analysis having at least two investments. This is necessary because most of the 512 single time investors have a syndication ratio of one and would be allocated to the category "Other" thereby strongly increasing its Syndication Ratio. Afterwards a t-test is done to see if the two categories differ in their average Syndication Ratio.

The above mentioned points favor the Value Added Hypothesis on venture capital syndication, under which venture capitalists are considered to add value to the performance of the venture after they invested their capital. This contrasts with the selection hypothesis, where syndication helps investors to select the best projects, but does not influence the performance of the investee company [Brander (2002)]. As pointed out earlier, a lead investor acts according to the Value Added Hypothesis when he believes that the involvement of other venture capitalists would add some value to the venture. The benefit of involving co-investors is

derived from heterogeneous skills and information different venture capitalists can contribute to the management of the venture company.

As reported in the Appendix, Specialised VC firms are found to have a Syndication Ratio of 0.51, which is significantly less than Non-Specialised VC organisations (0.65). This contradicts the findings by Sorenson and Stuart (2002) and Manigart et al. (2002) who expect specialised VC firms to have a higher propensity to syndicate.

Also Chiplin et al. (1997) postulate the hypothesis which sees less experienced venture capital firms as more likely to syndicate deals. The results indicate that, holding all other factors constant, a higher degree of experience of a VC firm lowers its likelihood to syndicate investments. As Manigart et al. (2002) found, young VC organisations start syndicating early on both as lead and non-lead investors. Generally, the propensity to syndicate decreases with increasing maturity of the VC organization while the proportion lead/non-lead appears to remain constant over time.

The results found in our analysis support the conclusions put forward by Chiplin et al. that with a higher level of experience VC firms are less inclined to syndicate a deal with a partner. We have given a rational for this finding in chapter 5 when we argued that due to the high level of noise affecting the estimates it might be worthwhile for less experienced VC companies to involve a partner company in order to make better predictions. Therefore more experienced VC firms do not have to rely on external expertise and the additional benefits of syndicating in order to acquire new information might not be as high as to overcome the additional costs associated with monitoring and coordinating the deal together.

8 Conclusion

In this paper we made the effort to shed some light on the syndication behavior of Venture Capitalists in Germany. Using a sample of 1800 VC investments undertaken in Germany we hypothesized investment behavior under uncertainty and tested the potential consequences arising from sharing of the inherent real options against the actual empirical outcome of the data set. Here we could see that real option thinking helps us to better understand the rationale of VC syndication. We showed how noise over the true value of an underlying venture and the acquisition of new information on the expense of coordination costs affect the optimal decision. Consequently, we demonstrated that uncertainty does not fully explain why VC firms syndicate an investment. Therefore we can conclude that uncertainty per se is not the main driving force behind syndication behavior of VC investors and that other factors such as the acquisition of new information and their corresponding coordination costs have an impact on the propensity to syndicate. Moreover we showed that the real options perspective gives rise to the resource-based rationale for VC syndication as informational asymmetry could be overcome when partners are involved into the decision making process in the pre- and post-investment stage. We find evidence that a lower level of experience and expertise fosters the need to syndicate an investment. This indicates the validity of the concept of real options and volatility sensitivity brought forward in this paper.

The lack of additional comprehensive studies on the syndication behaviour of European venture capitalists calls for further research in this field. Recent literature refrains from transferring findings from the US VC industry one-to-one to Europe and pays growing attention to the individual characteristics of VC markets in different regions [Jeng and Wells (2000)]. As Sapienza et al. (1996) point out, there is a range of economic, legal, institutional and cultural differences influencing the environment in which VC organisations operate. Thus, the miscellaneous and comprehensive conclusions drawn on the North American VC market are not necessarily applicable to the European VC industry. Therefore, further comparisons on the syndication practices in Europe, the US and Asia are needed and an interesting avenue for further research. Further studies are also needed to reveal if the European VC industry is becoming more uniform and standardised and to what degree trans-national syndicates have helped to establish common norms and working methods. Also, the relationship between syndication and firm value of the investee company is far from being clarified and not even rudimentary researched for the European or even German VC market. In the style of Maula and Murray (2000), "hard" data such as IPO valuations or investment outcomes can possibly quantify the added value through syndication.

Finally, we have indicated that more attention needs to be drawn to the difficulties and potential downsides syndicated investments may yield. The existing literature commonly discusses syndication in the light of the interest what kind of advantages it can bring to a VC investor. The overall impression the existing studies and articles suggest is that syndication itself is a value, which then can be explained by different frameworks such as portfolio diversification or value adding. However, little effort has been made to research in depth why most VC investments are actually not syndicated. It is rather striking that there exists no study revealing the reasons why venture capitalists refrain from syndicating in or -out an investment and under which circumstances this is the case. Overall, it can be concluded that our analysis yields valuable insights into the motives behind VC syndication and that based upon our research we might be better able to understand in which cases it might be worthwhile to syndicate. Furthermore, it is the first study of its kind explicitly focusing on the German market and using actual outcome data. So far, the only two empirical studies on syndication practice in Europe by Manigart et al. (2002) and Lockett and Wright (1999) are wholly based on questionnaires. Another difference is that the sample does not only contain transactions by professional VC organisations being members of the BVK but also includes foreign investors, business angels, private- and one-time VC investors which were found to play an important role in the VC financing of German portfolio companies. This allows examining the whole spectrum of VC investments in Germany and helps to reveal the actual co-investment behaviour of the different VC types in the industry. The results of this paper also reveal some insights on the differences of the syndication behaviour of different types of VC investors that have not yet been discussed in the literature in this way and might provide a starting point for further research.

9 Appendix

Comparison of Multiple Groups
Dependent Variable: Number of Investors
Scheffé-Procedure

(I) Industry	(J) Industry	Mean Difference (I-J)	Standard Error	P-Value	95%-Confidence Interval	
					Lower Limit	Upper Limit
Biotechnology	Consulting	1,2353	,86664	1,000	-3,2330	5,7035
	E-Commerce B2B	,9330	,35243	,972	-,8841	2,7500
	E-Commerce B2C	1,0165	,31168	,829	-,5904	2,6235
	Electronics	,7353	1,34725	1,000	-6,2109	7,6815
	Finance & Banks	2,1103	,69647	,904	-1,4806	5,7011
	Hardware/IT	2,1020	,52742	,463	-,6173	4,8213
	Industry & Construction	1,5686	,66016	,991	-1,8350	4,9723
	Infrastructure & Logistics	1,2676	,39514	,849	-,7697	3,3048
	Internet	,8186	,58076	1,000	-2,1757	3,8129
	Internet Service Providers	,3353	,46804	1,000	-2,0778	2,7484
	Life Science & Pharma	,8353	,52742	1,000	-1,8840	3,5546
	Media & Communication	1,4626	,34976	,358	-,3407	3,2659
	Services	1,5032	,32413	,165	-,1680	3,1743
	Software	1,2849	,25861	,080	-,0484	2,6183

* Indicates significance at the 5% Level

Table 1: Significance Table Industry Factor

	VC Type	Frequency	Percentage	Cumulative Percentage
Valid	NA	114	22,3	22,3
	Non professional VC	89	17,4	39,7
	Business Angel	88	17,2	56,9
	Foreign VC	85	16,6	73,6
	Unknown VC	36	7,0	80,6
	Private	25	4,9	85,5
	Public VC	22	4,3	89,8
	Bank-VC	15	2,9	92,8
	Young Specialist	11	2,2	94,9
	Sparkassen-VC	7	1,4	96,3
	Corporate/Industry	5	1,0	97,3
	Incubator	5	1,0	98,2
	Corporate/Consulting	3	,6	98,8
	Corporate/Internet	2	,4	99,2
	Established Specialist	2	,4	99,6
	Corporate/Media	2	,4	100,0
	Total	511	100,0	

Table 2: Frequency distribution of the single-time investors according to their type

Comparison of Multiple Groups
Dependent Variable: Syndication Ratio
Scheffé-Procedure

(I) Industry	(J) Industry	Mean Difference (I-J)	Standard Error	P-Value	95%-Confidence Interval Lower Limit	Upper Limit
Foreign VC	Bank-VC	,1508	,06760	,992	-,1887	,4903
	Business Angel	,2764*	,04637	,003	,0435	,5092
	Corporate/Industry	,2243	,06675	,731	-,1110	,5595
	Corporate/Internet	,3490	,09810	,629	-,1437	,8417
	Corporate/Media	,1430	,09488	1,000	-,3336	,6195
	Established Specialist	,3523*	,06123	,005	,0448	,6598
	Incubator	,5200*	,07642	,000	,1362	,9038
	Young Specialist	,3647*	,05013	,000	,1129	,6164
	Non Professional VC	-,0714	,04681	1,000	-,3065	,1637
	Public VC	,2783	,05959	,117	-,0210	,5776
	Private	,1686	,07380	,990	-,2021	,5392
	Sparkassen-VC	,4180*	,07942	,026	,0191	,8169
	Specialist	,5616*	,10586	,023	,0300	1,0933
	Unknown VC	,2180	,06243	,664	-,0955	,5316

* Indicates significance at the 5% Level

Table 3: Significance Table Factor VC Type for foreign investors

Comparison of Multiple Groups
Dependent Variable: Syndication Ratio
Scheffé-Procedure

(I) Industry	(J) Industry	Mean Difference (I-J)	Standard Error	P-Value	95%-Confidence Interval Lower Limit	Upper Limit
Non Professional VC	Foreign VC	,0714	,04681	1,000	-,1637	,3065
	Bank-VC	,2222	,07015	,816	-,1301	,5745
	Business Angel	,3478*	,05001	,000	,0967	,5990
	Corporate/Industry	,2957	,06933	,256	-,0525	,6439
	Corporate/Internet	,4204	,09987	,281	-,0812	,9220
	Corporate/Media	,2144	,09671	,993	-,2713	,7001
	Established Specialist	,4237*	,06403	,000	,1021	,7453
	Incubator	,5914*	,07868	,000	,1963	,9866
	Young Specialist	,4361*	,05352	,000	,1673	,7049
	Public VC	,3498*	,06247	,009	,0360	,6635
	Private	,2400	,07614	,822	-,1424	,6224
	Sparkassen-VC	,4894*	,08160	,002	,0796	,8993
	Specialist	,6331*	,10750	,003	,0932	1,1730
	Unknown VC	,2895	,06518	,187	-,0379	,6168

*Indicates significance at the 5% Level

Table 4: Significance Table Factor VC Type for non-professional investors

(I) VC Category	(J) VC Category	Mean Difference (I-J)	Standard Error	P-Value	95%-Confidence Interval Lower Limit	Upper Limit
one time investor (1 Inv.)	very small VC (2-3 Inv.)	,1391*	,02086	,000	,0650	,2131
	small VC (4-6 Inv.)	,1972*	,01927	,000	,1288	,2657
	lower middle field VC (7-10 Inv.)	,3141*	,01972	,000	,2441	,3841
	upper middle field VC (11-20 Inv.)	,3545*	,01801	,000	,2906	,4185
	large VC (21-50 Inv.)	,3503*	,01618	,000	,2928	,4077
	very large VC (>50 Inv.)	,3760*	,01893	,000	,3088	,4432
very small VC (2-3 Inv.)	one time investor (1 Inv.)	-,1391*	,02086	,000	-,2131	-,0650
	small VC (4-6 Inv.)	,0582	,02226	,337	-,0209	,1372
	lower middle field VC (7-10 Inv.)	,1750*	,02265	,000	,0946	,2554
	upper middle field VC (11-20 Inv.)	,2154*	,02118	,000	,1402	,2906
	large VC (21-50 Inv.)	,2112*	,01965	,000	,1414	,2810
	very large VC (>50 Inv.)	,2369*	,02197	,000	,1589	,3149
small VC (4-6 Inv.)	one time investor (1 Inv.)	-,1972*	,01927	,000	-,2657	-,1288
	very small VC (2-3 Inv.)	-,0582	,02226	,337	-,1372	,0209
	lower middle field VC (7-10 Inv.)	,1168*	,02120	,000	,0416	,1921
	upper middle field VC (11-20 Inv.)	,1573*	,01961	,000	,0876	,2269
	large VC (21-50 Inv.)	,1530*	,01795	,000	,0893	,2168
	very large VC (>50 Inv.)	,1787*	,02047	,000	,1061	,2514

* Indicates significance at the 5% Level

Table 5: Significance Table Factor VC Category

Group Statistics

	Specialist yes/no	N	Median	Standard Deviation	Mean Standard Error
Syndication Ratio	Specialist	109	,5057	,26998	,02586
	Other	196	,6485	,35837	,02560

Test with independent Samples

		Levene-Test of equal variances		t-Test for equal means					95% Confidence-Interval	
		F	P-Value	T	df	Sig. (2-sided)	Mean difference	Standard Error	Lower	Uppper
Syndication Ratio	Equal Variances	21,492	,000	-3,625	303	,000	-,1427	,03938	-,22023	-,06524
	Non-Equal Variances			-3,923	276,37	,000	-,1427	,03639	-,21437	-,07111

Table 6: t-test on the Syndication Ratio of Specialised- and Non-Specialised investors

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