Learning from own and others' previous experience: the contribution of the venture capital firm to the likelihood of a portfolio company's trade sale

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Abstract The objective of this paper is to examine to what extent different venture capital firms contribute to the likelihood that the portfolio company in which they invested will realize a trade sale. We use arguments from learning theory to hypothesize the relationship between vicarious, experiential and congenital learning of the venture capital (VC) firm and the trade sale hazard of its portfolio companies. Based on our analysis of 206 VC-backed UK start-ups, we find that both trade sale experience of the VC and learning from syndicate partners with trade sale experience significantly increase the trade sale hazard. The routines and procedures learned from experienced syndicate partners complement experience accumulated through trial and error. Congenital trade sale experience of the investment managers on the contrary has no significant influence on the acquisition hazard.

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1 Introduction

Trade sales have been recognized as the most likely exit route for venture capital (VC)-backed start-ups (Cumming and MacIntosh 2003). An exit by trade sale or acquisition happens if the entire firm is sold to a third party, often a strategic acquirer (Cumming and MacIntosh 2003). Despite the fact that trade sales are such an important exit route, there is little theory about the factors influencing trade sale likelihood. The entrepreneurship literature has identified a number of contextual level factors which have a positive impact on the likelihood of a trade sale. Gans et al. (2002) highlight the environment in which companies start up, and more specifically the appropriability regime, as an important element of a likely trade sale. Start-ups in tight appropriability regimes can protect their technology more easily and hence are more likely to realize a trade sale. Others have focused on the strategic choices made by the VC-backed company to explain potential trade sale success. Porrini (2004) shows that cooperation with potential acquirers increases the likelihood of a trade sale for the VC-backed firm. The main reason why previous alliances

increase trade sale likelihood is that they reduce information asymmetry between acquirer and target (Porrini 2004; Reuer and Ragozzino 2008).

One important actor for trade sale success, which—so far—has been understudied is the venture capitalist (VC). This is in contrast to the amount of studies of Initial Public Offerings (IPOs) as an exit. Furthermore, within the private equity literature, there is extant literature suggesting that VCs monitor and add value to the companies in which they invest (Sapienza et al. 1996; Knockaert et al. 2006). In other words, they are assumed to add value beyond the money they provide. Various studies have tried to link the value-adding activities VC firms bring to portfolio companies with portfolio company performance. Sapienza (1992) and Sapienza and Timmons (1989) for instance detected positive correlations between VCs' management support intensities and portfolio company performance. Schefczyk (2001) found that VCs who take an active role in their portfolio companies significantly increase the success rate of these companies. These studies have typically looked at revenues (Schefczyk and Gerpott 2001), growth in revenues and/or employment (Bottazzi and Da Rin 2002; Davila et al. 2003) or a combination of financial and technical performance shortly after investment decisions (Baum and Silverman 2004). However, despite the importance of trade sales as potential indicators for success of VC-backed companies, the possible contribution of particular VC firms to the likelihood of a trade sale of their portfolio firm is an area which so far has been largely neglected in the received literature.

To fill this gap, this paper uses learning theory to evaluate the role played by the VC firm and its investment managers in their portfolio companies. Increasingly, researchers have argued that learning from previous own experiences or vicarious learning from others' experiences is an important way to acquire knowledge (Kim et al. 2007). We would therefore expect that the experience a VC firm has with previous trade sales will have a positive impact on the likelihood of a subsequent trade sale of its portfolio companies. The learning literature distinguishes between three types of learning. Experiential learning includes the knowledge which is acquired from own past successes or failures (Ingram and Baum 1997). Vicarious learning is defined as learning from the trade sale experience of other VC firms (Kim and Miner 2007). Finally, congenital learning or congenital

experience refers to the experience which has already accrued in the industry before the particular VC firm is founded (Meyer and Rowan 1977). This kind of experience or learning is induced into the VC firm by, for instance, recruiting experienced investment managers.

This research is based on the analysis of a sample of 206 VC-backed UK start-ups. In addition, we conducted a qualitative investigation in which we interviewed eight VCs[1] with diverse levels of experience in liquidation events. In presenting our hypotheses, the quotes and insights obtained from these interviews are used to illustrate and clarify the learning processes taking place in the VC firm. They are not meant to generate strong empirical findings to build theory upon, but rather to illustrate that the theory we used to develop our hypotheses accurately reflects our empirical findings.

This paper starts with a literature review in which we review the extant literature on the value-adding role of VCs. In addition to the value-adding role of VCs, we also briefly discuss the entrepreneurship literature on trade sales. In the following section, we outline the role played by the VC firm in increasing the likelihood of a trade sale. We suggest that the previous experience embedded in the VC firms, the experience of the investment managers setting up and/or joining the firm and the experience gained through the syndicate partners will play a significant role in determining the trade sale likelihood of the portfolio companies. Subsequently, we measure the effects of the different learning and experience variables, controlling for certain portfolio company and VC firm level characteristics. We conclude with a discussion of our findings and suggestions for future research.

2 Literature review

Researchers have devoted much attention to the influences of VCs on the formation of start-ups (Barry et al. 1990) and further on the multiple ways in which VCs might enhance a start-up's performance (Baum and Silverman 2004). In a recent literature review on

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[1] We interviewed one investment manager from each of the following VC firms: Imperial Innovations, Index Ventures, Amadeus Capital, Debaeque Venture Capital, Alta Partners, Allegis Capital, VentureScout and Aster Capital.

the value added of VCs to their portfolio companies, Large and Muegge (2008) conclude that the different value-adding inputs of VCs can be classified as internally or externally oriented. Externally oriented roles are usually linked to the image or legitimacy, and to some extent to the credibility, of the portfolio company towards external stakeholders (Fried and Hisrich 1995). Internal contributions in the portfolio companies include recruitment (Murray 1996), controlling (Ehrlich et al. 1994), strategic consulting (Timmons and Bygrave 1986) and entrepreneurial mentorship (Busenitz et al. 2004). Although informative, this type of research remains mainly atheoretical, leaving the question *why* VCs can better play this role than entrepreneurs unanswered.

A second stream has adopted a more theoretical approach to why and how VCs add value to their portfolio companies beyond the capital invested. For instance, Dimov and Shepherd (2005) have taken a human capital perspective to explain the potential value added by VCs and demonstrate that general human capital contributes to the portion of IPOs realized by the VC firm. Knockaert et al. (2006) further extend the human capital perspective by arguing that VC investment managers who have previous entrepreneurial experience will be more engaged in value-adding activities than investment managers who lack that experience. Baum and Silverman (2004) not only include human capital as a potential determinant but also highlight the importance of other forms of capital such as intellectual and social capital in explaining the coaching role of VCs in their portfolio companies. In summary, this literature has mainly used a resource-based perspective to explain differences in the behavior of VCs.

In parallel, a stream of VC literature with roots in the finance literature has looked at the performance of VCs at the portfolio company level, mainly focusing on IPOs of the portfolio companies. In this literature stream, measures of VC firm experience such as age, accumulative aggregate investment amount and number of investment rounds have been analyzed for their impact on IPO success or aggregate portfolio performance (Lerner 1994; Gompers 1996). More recently, indirect experience variables, such as the network position of the VC firm (Hochberg et al. 2007), connectedness of the VC firm (Sorensen 2007) or a composite measure of both experience and connectedness (Nahata 2008), were added to explain the

performance of VCs and their portfolio companies in terms of IPOs. In this empirically driven literature stream, there seems to be a clear consensus that the experience of the VC firm and its position within the networked community of VCs have a positive impact on the performance of the VC, measured by the IPO success of its portfolio companies.

Despite the fact that many papers have investigated the contribution of the value-adding role of the VC to performance at VC firm level or portfolio company level, the impact of these value-adding inputs on outcomes has been inconclusive so far (Large and Muegge 2008). Much of this confusion has been attributed to the lack of consensus for measuring the outcome of those value-adding roles. Some studies have investigated performance at portfolio company level and studied the impact on outcomes such as company growth (e.g., Davila et al. 2003; Bottazzi and Da Rin 2002) or time to exit (Giot and Schwienbacher 2007), while other studies have considered performance at the VC firm level (e.g., Dimov and Shepherd 2005; Jaaskelainen et al. 2006). Usually, investors and VCs earn their returns when the venture in which they invested is sold to another organization or when the shares of the company become publicly traded (IPO). Therefore, Large and Muegge (2008) conclude that future studies should place a greater emphasis on measuring directly observable events in companies' life cycle, such as realizing an exit.

Cumming and MacIntosh (2003) argue that the trade sale of a portfolio company is the most common exit route for a VC-backed company, followed by secondary exits or IPOs. Even though IPOs tend to lead to higher returns, the majority of the returns realized by VCs are still derived from trade sales (Gompers 1996). Figure 1 provides an overview of the number of IPOs and trade sales realized each year in the period 2000 to 2008, comparing Europe with the UK. These numbers verify that trade sales are indeed a more likely exit route than IPOs. Only in the dotcom bubble of 2000 was the number of IPOs higher than the amount of trade sales. In all other years, IPOs are only a fraction of trades sales. A similar trend can be noted when considering the deal value of those two exit routes. Figure 2 displays the total amount of money raised for each type of exit. Again, the total amount of money raised with trade sales is consistently larger than for IPOs, with exception of the dotcom year 2000. Hence, the portfolio's ability to realize a trade sale is

Fig. 1 Annual evolution of trade sales and IPOs in Europe and the UK: number of companies
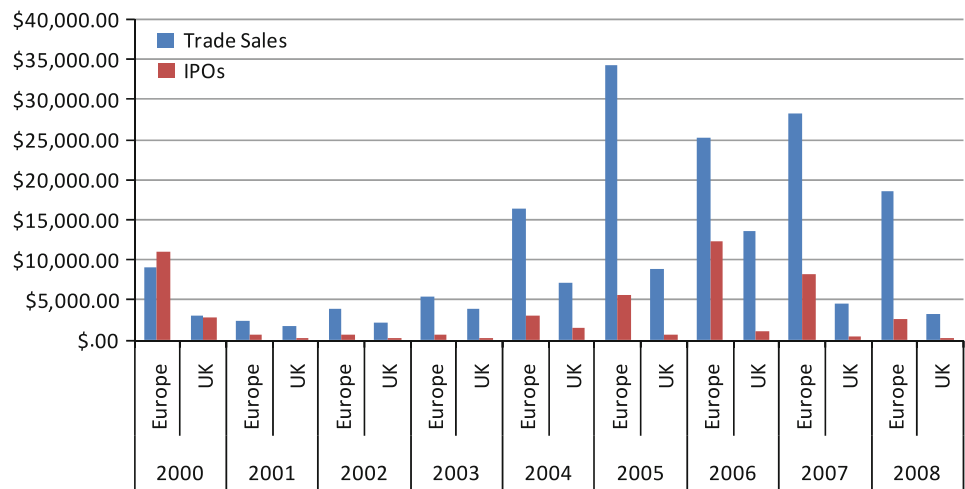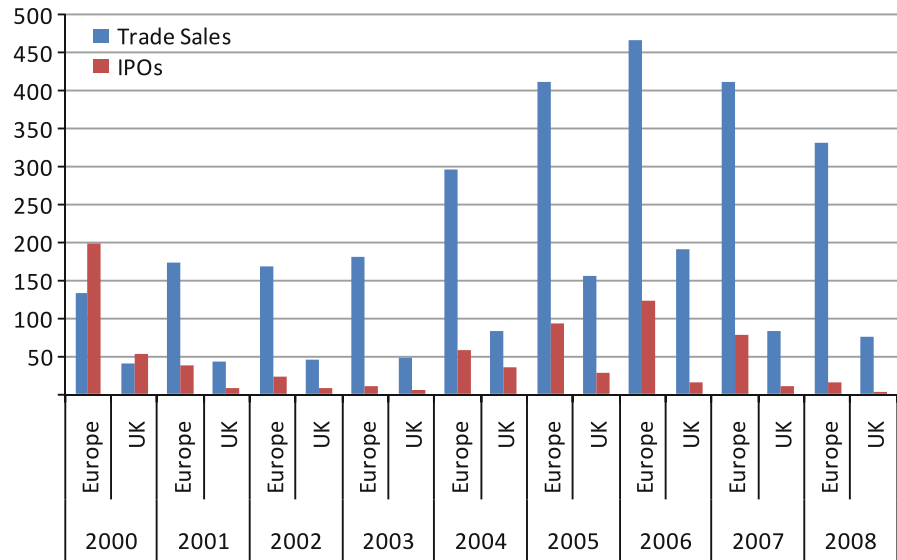

Fig. 2 Annual evolution of trade sales and IPOs in Europe and the UK: total amount of money raised (million US$)

equally important for a VC firms' exit success as the ability to realize IPOs. Surprisingly, trade sales have not been analyzed as an indicator of portfolio company success in the venture capital literature.

Even in the entrepreneurship literature, the evidence on which factors determine the potential for a trade sale is very weak. Gans et al. (2002) considered trade sales as a form of cooperation between start-ups and incumbents and concluded that the strength of the appropriability regime increased the chances of realizing a trade sale. Start-ups operating in environments where the technology is easy to protect have a higher

chance of a trade sale than start-ups operating in weak appropriability environments. Other studies such as Porrini (2004) have specifically focused on the managerial decisions which a start-up can take to increase the likelihood of realizing a trade sale. Porrini (2004) shows that collaborating with potential acquirers increases the likelihood of the start-up to be acquired by one of those collaborating partners. Cooperation in a pre-acquisition stage is supposed to decrease the information asymmetry between a start-up or young firm and its potential acquirer and hence increases the likelihood of acquisition.

As trade sale success is such an important variable for both the start-up and the VC firm investing in the company, a major research question which remains to be investigated is then to which extent a VC firm can contribute to the trade sale of a portfolio company. In this paper, we build on the results of the VC literature in finance, but add a theoretical perspective to explain why experience of VCs might have a positive effect on the likelihood of realizing a trade sale. The theoretical perspective used to explain this is learning theory.

3 Hypothesis development

The learning literature distinguishes between three clear forms of learning (Kim and Miner 2007): vicarious, experiential and congenital learning. Vicarious learning refers to learning from other organizations' experiences (Ingram and Baum 1997). Experiential learning refers to the learning that takes place in a history-dependent, routine-based incremental way (March 1991). Finally, the learning literature refers to congenital experience as experience that has already accrued within an industry before a focal firm is founded (Meyer and Rowan 1977). We will build upon these three different concepts adopted from the learning literature to elaborate our hypothetical framework.

3.1 Experiential learning

This notion of learning is rooted in the behavioral theory of the firm: an organization's behavior and actions are viewed as based on past activities and previously developed routines (Cyert and March 1963). VC firm level experience might still be considered the primary source of learning among VC firms with regard to trade sales. Trade sales are complex events, which tend to involve a high amount of tacit knowledge. This knowledge is argued to be cumulated through discovery, learning by doing and experience, each of which are indicators of experiential learning (Yang et al. 2009).

Experiential learning thus assumes that VC firms learn from conducting activities repeatedly and adapting their routines to their past experiences. This kind of learning requires repetition, as VC firms need to evaluate the outcome responses to their actions. In

other words, VC firms need to evaluate whether or not decisions which have led to previous trade sales were successful and which components can be translated into routines that might become a roadmap for future trade sales. Existing routines are then assumed to be the outcome of this trial and error process along with the selection and retention of routines and procedures developed in the past.

Experiential learning implies that the more experience a particular VC firm has with trade sales, the more routines it will have developed to guide future trade sales. Interestingly, learning theory assumes that both positive and negative trade sales will generate a learning experience which provides value added in comparison with those VC firms that do not have any trade sale experience at all or very little trade sale experience.

Our qualitative investigation supports the value of experiential learning as a process taking place at the level of the VC firm. Four of the eight VCs we interviewed mentioned explicitly that they share their liquidation experiences among the different investment managers of the VC firm, which indicates that experiential learning takes place at the firm level. In two cases, this knowledge has been used for developing standard processes to better steer the exits, including internal reporting and standard six-monthly evaluation of later stage companies in the portfolio. In two other cases, this common knowledge about liquidation experiences has been transformed into rules such as *always syndicate investments, work only with certain investment and operational partners,* and *invest in serial entrepreneurs*.

Therefore we argue:

Hypothesis 1 The more trade sale experience the lead VC firm has, the greater the likelihood that its portfolio company will end up in a trade sale.

3.2 Vicarious learning

Theories of organizational learning imply that successful experiences in the VC community (such as trade sales) are important sources of vicarious learning (Lant and Mezias 1990). Such previous trade sales are composed of rich, complex information, which can be embedded in a series of accumulative events, which form the process leading to the closure of a successful trade sale (Kim and Miner 2007). A large number of

trade sales in the industry provide VCs with many opportunities to observe the underlying factors which have potentially led to the successful trade sale. In other words, the observed trade sales serve as a series of experiments and are an essential source of information. VC firms observe other firms' trade sales to gain information to make new investments and to adjust the strategy of their portfolio companies. However, as much of the trade sale information tends to be complex information, traditional learning theory suggests that VC firms will experience difficulties to learn from that information unless they have direct access to the VC firms possessing this information (Cyert and March 1963).

VC firms do have a particular way of learning from each other, namely syndication. It has been shown in the VC literature that VC firms syndicate to have a chance to benchmark their own thinking against other knowledgeable sources (Wright and Lockett 2003; De Clercq and Dimov 2008). If two or three firms syndicate, they contrast each other's opinions (Lerner 1994). Moreover, they exchange templates of procedures and share best practices to optimize the decision-making within the syndicate. This kind of knowledge exchange is what is called vicarious learning in the learning literature. Along this line of reasoning, we would expect that a VC firm which is syndicated with other VC firms that have an in-depth experience in trade sales, will learn from their syndicating partners and transpose this knowledge towards their own portfolio companies.

The interviewees provided qualitative evidence that syndication partners are an important source of knowledge, both for junior as well as for more senior investors. A senior investor stated:

> After eight acquisitions and one IPO as investment manager, I am still learning from the syndicating partners. I learn management skills from older VCs, and I also learn to identify the best entrepreneurs, passionate, smart and flexible. This is probably the most difficult task for a VC.

Possibly but not necessarily, the vicarious learning takes place in the specific syndicate that has invested in the focal portfolio company. However, it is more likely that the VC firm also learns from colleague VCs that have syndicated with the VC firm in other portfolio companies than the one studied. Therefore, we take into account that a specific VC will have

access to a broader network of VCs, representing the accumulation of syndicates and exit experiences in which the VC firm takes part. A VC shared an example with us:

> We invested in a drug discovery start-up in syndication with three other experienced VCs. It was the syndicating investment manager at SV Life Sciences who helped the company recruit a chairman who recently completed a trade sale of a similar company. Our business was subsequently sold to the same trade buyer and so I have no doubt that the experience and networks of the syndicate made a difference.

Therefore, we argue:

Hypothesis 2 The more a lead VC firm is syndicated to other VC firms with experience in trade sales, the greater the likelihood that its portfolio firm will end up in a trade sale.

3.3 Congenital experience/learning

Congenital experience refers to the experience that has already accrued within an industry before a focal firm is founded (Meyer and Rowan 1977). This type of experience results from the knowledge brought into the firm by recruiting experienced investment managers or—in case of a new VC firm—by setting up the VC firm with general partners/investment managers with past experiences in the VC industry. If a new VC firm is created, it is unlikely that this new firm will have to build up its practices and rules from scratch. It is more likely that the general partners setting up the firm have personal experience from working with other VC firms. The availability of congenital experience when the VC firm is created is likely to influence its future learning outcomes (Huber 1991). In other words, the experience of the investment managers setting up and/or joining the firm is likely to determine the decisions that are taken afterwards and the way in which these decisions are taken.

Congenital learning thus goes beyond vicarious learning from syndicate partners. It touches upon the experience accumulated at the individual level, regardless where this experience comes from. Our qualitative investigation provided evidence of the learning experience that was available at the moment the partners started the VC firm. For instance, the

founder of the search engine Ask.com who, after his company was traded on the NASDAQ stock market and retired upon its acquisition by InterActiveCorp at US$1.85 billion, started a VC firm. He said:

> Selling a company is like a selling a car. Once you learn how to sell a car fast and for a high price, you just do it every time you want to sell another car.

The previous example shows how congenital learning is transferred from one job experience to a new VC firm. The general partners who set up a VC firm and the investment managers working for a VC firm have probably gone through trade sales while working for other VC firms, or may have taken their own companies through a trade sale as an entrepreneur. The stock of knowledge accumulated through these experiences is likely to determine their decision-making process and to change the way in which they prepare the portfolio companies for a trade sale. Three of the VCs mention that hiring plays an important role in accessing congenital experience. For example, one of the interviewees stated that his VC firm gained significant knowledge about exits by hiring the VP of a big multinational corporate venture. The partners at the VC firm learned how to build and prepare a company to be acquired by a big corporation. In some other cases, the interviewees have pointed to the benefits of hiring partners with entrepreneurial experience and coming from experienced VC firms as they bring along very valuable knowledge to the firm.

Therefore, we argue:

Hypothesis 3 The more trade sale experience the managers raising/joining a VC firm have, the greater the likelihood that its portfolio firm will end up in a trade sale.

4 Methods

4.1 Sample

To test our hypotheses, a unique hand-collected sample of 206 VC-backed companies was constructed. As a sample frame, we used the VentureSource database provided by Dow Jones. VentureSource offers a comprehensive database which tracks the key developments of more than 30.000 venture-backed companies situated in the US, Europe, Israel and China. The ventures in our sample are all situated in the UK. Furthermore, the database offers detailed company reports which track the financing history in addition to information about target markets, products, milestones, financial performance, key customers, management team and board members. Besides these company profiles, VentureSource also provides access to investor profiles. These give a detailed overview of the fund-raising activity, the general partners and/or investment managers managing the VC firm, and how the portfolio is diversified in terms of industry, geography and investment stage. This information allows us to analyze VC firms' performance by measuring the number of companies that realized an IPO, were sold or went out of business. In other words, this information allowed us to calculate the success of each investor with respect to realizing trade sales.

We started the construction of our sample by searching in VentureSource for all acquired ventures situated in the UK. Subsequently, we used the matched pair methodology introduced by Megginson and Weiss (1991) to identify similar VC-backed companies which have not been acquired. For each acquired firm in our sample, we identified a similar company that was not acquired. As matching criteria, we used the sector, founding year and nationality of the companies. To match the companies as closely as possible, we used the three-digit sector classification. If no companies matched that profile, sector classification was extended to match the two-digit classification. This resulted in a sample of 206 VC-backed companies situated in the UK, of which 106 companies were acquired by 2009. The companies in the matched sample were still active in 2009. All companies in the sample were created between 1982 and 2006, and the acquired companies were acquired between 1997 and 2008. Consequently, our window of observations covers the period 1982 to 2009, implying all companies were tracked from year of founding until 2009.

4.2 Survival analysis

Our statistical analysis relies on survival analysis. Survival analysis techniques are highly suitable to address our research hypotheses as we are interested in explaining the factors that contribute to the hazard of being acquired. Furthermore, the non-acquired firms

in our sample were still active in the year 2009 (i.e. the last year of our window of observation), implying that these firms are still at risk of being acquired. Together, these factors make survival analysis the most appropriate technique of analysis. More specifically, this paper uses the Cox proportional hazard model. The Cox proportional hazards regression model (Cox 1972) asserts that the hazard rate for the jth subject in the data is

$$h\big(t|\mathrm{x}_{1j},\ \mathrm{x}_{2J},\ \dots,\ \mathrm{x}_k\big) = h_0(t)\exp$$
$$\big(\beta_1\mathrm{x}_{1j} + \beta_2\mathrm{x}_{2j} + \dots\beta_k\mathrm{x}_{kj}\big)$$

The major advantage of the Cox model is that it avoids making potentially untenable distributional assumptions about the hazard rate. Although this model does not make any assumptions about the baseline hazard, there is one important assumption which should be taken in account, namely the assumption of proportionality. This assumption implies that the survival curves for two strata must have hazard functions that are proportional over time (i.e. constant relative hazard). The validity of this assumption is often questionable as the impact of many covariates are clearly time dependent. This issue can be tackled by introducing time-dependent covariates in the model which represent the interaction of the original covariate with time (Allison 1990).

4.3 Dependent variable

Given the use of survival analysis as our method of analysis, our dependent variable is the hazard that a subject will be acquired in a given year. As trade sales have been identified as the most likely exit route for VC-backed firms (Cumming and MacIntosh 2003), the hazard of being acquired is a suitable dependent variable in our research design.

4.4 Independent variables

To capture the three forms of learning previously defined, we used the information provided by the investor profiles in VentureSource. We only considered the impact of the lead investor (Higgins and Gulati 2006) in the latest round of financing, i.e. the financing round closest to exit, as we expect that the lead investor of the latest financing round will have the highest impact on the exit process. According to

learning theory, which suggests that actors learn both from positive and negative experiences, we considered all trade sales rather than limiting the study to the successful ones. Some of the trade sales realized by a VC have a negative return (i.e. the acquisition price is lower than the amount of VC received), while other trade sales are highly successful as the acquisition price is a multiple of the amount of venture capital received. The first type of trade sales can be seen as failures, while the second type of trade sales are clearly successes. Several studies on the outcome of learning from success and failure have confirmed that organizations learn both from failures and successes (e.g., Kim et al. 2009; Lant and Montgomery 1987).

4.5 Experiential learning (VC_experiential)

Experiential learning or learning by doing refers to the knowledge base the VC firm has built over the years by performing similar activities repeatedly. Therefore, the amount of experiential learning is closely related to the number of trade sales the VC firm has realized in the past. To capture this, we counted the number of trade sales in the portfolio of the VC firm in a given year. Experiential learning is thus measured as the accumulated number of trade sales realized by the VC.

4.6 Vicarious learning (VC_vicarious)

In order to capture the extent of vicarious learning by each lead investor, we needed both information on the number of syndicate partners each VC firm has and the experience of these partners in trade sales. Using the information provided by VentureSource, we identified the VCs with whom the lead VC syndicated and the experience of these partners with trade sales. Vicarious learning was measured as the total number of trade sales of all syndication partners of the lead VC.

4.7 Congenital learning (VC_congenital)

To gauge congenital learning, we analyzed whether the general partners/investment managers who set up and/or joined the VC firm already had previous trade sale experience before their appointment in the firm. The trade sale experience could either be as an entrepreneur who had sold his company or as an investment manager previously working for another VC firm. We used the information available from VentureSource to check

whether each of the investment managers/general partners has been involved in trade sales before. A dummy variable was constructed, indicating whether or not the investment managers/general partners of the firm had trade sale experience. As soon as one of the general partners has previous experience with trade sales, this dummy takes value one.

4.8 Control variables

We controlled for a number of variables, some of which relate to characteristics of the portfolio company itself, while others relate to the lead VC firm investing in the portfolio company. Regarding the VC firm, we controlled for VC age, for the fact whether or not the lead VC is a corporate VC and for the fact whether or not the lead VC was already involved in the first financing round. Controlling for VC age (VC_age) is important, as age may be an indicator for its experience. The older the VC firm, the more likely it will have built up experience in realizing trade sales (Dimov and Shepherd 2005). In addition, we also controlled for whether the lead investor is a corporate VC (Corp_VC_dummy). This is important as many large companies use corporate VC as a window on future technologies and as a first step in acquiring promising technology-based ventures (Benson and Ziedonis 2009). Finally, we used a dummy to control for the fact whether or not the lead investor had already invested in the first financing round (VC_first_round_-dummy). Doing so, we controlled for reverse causality since it might be possible that VC firms with a lot of experience in trade sales tend to enter syndicates as lead investors in the last financing round, when the likelihood of a trade sale is already very high.

At the level of the portfolio company, the following controls were included: patent stock, number of financing rounds, amount of VC financing received, number of syndicate VC partners and number of team members. First, we controlled for the accumulated number of patents (patent_stock) in possession of the portfolio companies in a given year. The work of Gans et al. (2002) indicates that strong appropriability regimes positively affect the likelihood of being acquired. Patents are typically used as indicators of the strength of the appropriability regime (e.g., Gans et al. 2002). Second, number of team members at start-up is included as control measure (N_start_team). Previous research indicates that human capital is

crucial for the success of young technology-based ventures (e.g., Eisenhardt and Schoonhoven 1990; Cooper et al. 1994) and influences investor decisions (Higgins and Gulati 2006). As a result, we expect that it also contributes to the attractiveness of a young technology-based firm as an acquisition target. A study of Graebner (2004) confirms that much of the value of technology ventures depends on the human capital. If key employees leave after acquisition, the value of the human capital decreases. Finally, we included some controls relating to venture capital deals made by the portfolio company such as the total amount of VC financing received by the firm (VC_amount), the number of financing rounds (N_fin_rounds) and the number of syndicate partners (N_syndication), as all three variables are potential indicators of the quality of the venture and thus contribute to the likelihood of being acquired (Nahata 2008). VCs constantly monitor the performance of the ventures in which they invest, continually evaluating the venture's promise, need for additional capital, use of capital and whether or not to liquidate the investment. Consequently, VCs will only provide additional capital and follow-on funding when the company continues to do well (Gompers 1996). In addition, Brander et al. (2002) provided evidence that syndicated VC deals obtain higher returns. As a result, one might expect that they also have a higher likelihood of being acquired. We controlled for this by taking into account the number of syndicate partners of the lead VC.

Thus, in our model the hazard of being acquired is the following function:

$h(t|\text{trade sale}) = h_0(t) \exp[(\beta_1 + \beta_2 t)\text{Patent\_stock} + (\beta_3 + \beta_4 t)\text{N\_fin\_round} + \beta_5\text{N\_syndication} + (\beta_6 + \beta_7 t)\text{VC\_amount} + \beta_8\text{N\_start\_team} + (\beta_9 + \beta_{10} t)\text{VC\_age} + \beta_{11}\text{Corp\_VC\_dummy} + \beta_{12}\text{VC\_first\_round\_dummy} + (\beta_{13} + \beta_{14} t)\text{VC\_experiential} + \beta_{15}\text{VC\_vicarious} + \beta_{16}\text{VC\_congenital}].$

For those variables that vary in time, an interaction term of the respective variable with time was included in addition to the original variable.

5 Analyses

5.1 Descriptives

Table 1 provides the descriptive statistics of our sample, including the mean and standard deviation.

Table 1 Descriptives of complete sample

Variable	Definition	Mean	SD	Min	Max
Trade sale	Equals 1 if company realized a trade sale in a given year	0.0496	0.2172	0	1
VC_age	Age of the lead VC investor in a given year	13.3174	15.8772	0	73
VC_first_round_dummy	Dummy indicating whether the lead VC already invested in the first round	0.7231	0.4475	0	1
Corp_VC_dummy	Dummy indicating whether the lead VC is a corporate VC	0.0310	0.1734	0	1
Patent_stock	Accumulated number of patents in a given year	1.0175	7.8492	0	171
N_fin_round	Accumulated number of financing rounds in a given year	1.5034	1.4416	0	9
VC_amount	Accumulated amount of VC received	6,705,985	14,900,000	0	160,000,000
N_syndication	Number of syndicate partners	2.4806	2.9414	0	14
N_start_team	Number of team members at start-up	5.0129	2.6489	1	19
VC_experiential	Accumulated number of trade sales the VC has realized in a given year	24.1011	57.9186	0	465
VC_vicarious	Accumulated number of trade sales realized by the syndication partners of the VC	285.3151	574.5636	0	2269
VC_congenital	Dummy indicating whether the general partners setting up the VC firm have experience with trade sales	0.4140	0.4927	0	1

Table 2 Comparison of acquired and non-acquired firms in year of acquisition

	Non-acquired			Acquired			Results t test	Results Wilcoxon ranksum test
	Median	Mean	SD	Median	Mean	SD		
VC_age	9.5	17.73	17.75	16.00	20.29	17.87	–	–
VC_first_round_dummy	1	0.75	0.43	1.00	0.78	0.41	–	–
Corp_VC_dummy	0	0.04	0.19	0.00	0.06	0.24	–	–
Patent_stock	0	1.40	8.65	0.00	1.22	3.20	–	–
N_fin_round	3	3.09	1.95	2.00	2.59	1.54	**	*
VC_amount	4,456.592	10,100.000	15,500.000	6,400.019	12,000.000	13,700.000	–	**
N_syndication	1	2.24	2.93	1.00	2.24	2.80	–	–
N_start_team	5	4.93	3.01	5.00	4.88	2.35	–	–
VC_experiential	5.5	40.06	75.35	11.50	53.26	81.97	*	**
VC_vicarious	142	461.97	706.43	173.50	634.48	818.36	**	*
VC_congenital	0	0.28	0.45	0.00	0.44	0.50	***	**

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 2 compares the status of the acquired and non-acquired firms in the year of acquisition.

There are a number of significant differences between the group of the non-acquired companies and the acquired companies. Regarding the measures at portfolio company level, it seems that the two groups mainly differ in terms of the financing they receive. On average, the non-acquired companies went through 3.09 financing rounds, which is significantly more than the acquired firms who on average

went through 2.59 financing rounds. In terms of amount received, however, it looks as if the acquired firms have accumulated a larger amount of VC financing (about 12 million British pounds against 10.1 million for the non-acquired firms). A finding which is confirmed by the *t* test. The medians, however, do not significantly differ. There seem to be no significant differences between the acquired and the non-acquired firms in term of intellectual capital, number of team members at start-up and number of syndicate partners.

The two groups also demonstrate some differences regarding the lead VC. The lead investor investing in the acquired firms is on average 20.29 years old, while the lead investor of the non-acquired firms has an average age of 17.73. The differences are even bigger when looking at the medians. While these differences seem substantial, they are not significant as the *p* values for the *t* test and Wilcoxon ranksum test are above 10%. More important, however, are the differences regarding the various types of experience. For all three types, we find significant differences between the acquired and non-acquired firms. The lead VC of the acquired firms has realized on average 53 trade sales, while the lead VC of the non-acquired firms counts on average only 40 trade sales in his portfolio. Furthermore, we find that the lead VC of the acquired companies has an average of 634 trade sales in his syndication network, while the lead VC of the non-acquired companies has a network which represents on average only 462 trade sales. Finally, with respect to the congenital experience of the VC firms, about 44% of the lead VCs had previous congenital experiences with trade sales. This is substantially more than the lead VCs of the non-acquired firms, where only 28% of the VC firms had congenital experience with trade sales.

5.2 Main model

To determine whether the above differences play a role in estimating the probability of exit by trade sale, we performed a Cox proportional hazard regression. Model 1 summarizes the results for the base model, only including the control variables. None of the control variables seems to have a significant impact on the hazard of being acquired. In the next three models, the impact of each type of learning is entered

separately, while in the last model, all three modes of learning are entered simultaneously.

In model 2 of Table 3, the first explanatory variable, experiential learning of the VC is introduced in the model. In comparison with model 1, the patent stock now has a positive impact on the hazard of being acquired, although this influence is only marginally significant, with a *p* value lower than 0.10. More important however, is the influence of experiential learning on the hazard of being acquired. While the coefficient in the main model is positive and significant, the coefficient in the time-varying covariates equation is negative and significant. Together, these results imply that experiential learning has a significant positive impact on the acquisition hazard, which decreases over time. These findings are confirmed in model 5 where all explanatory variables are included. Experiential learning continues to have a significantly positive but decreasing impact as the *p* value even drops below 0.01. We thus find manifest support for the first hypothesis.

In model 3 of Table 3, the impact of vicarious learning (i.e. learning through trade sale experience of other VCs) is tested. In this model, the only variable with a significant impact is the explanatory variable vicarious learning. The *p* value is below 0.01 implying support for hypothesis 2. Again, the significant impact of vicarious learning is also confirmed by the full model ($p < 0.05$).

Finally, in model 4, the third explanatory variable, congenital experience, is introduced. According to this model, there is no support to accept hypothesis 3. The full model confirms this. Thus, hypothesis 3, which states that congenital experience has a positive impact on the hazard of being acquired, cannot be accepted.

6 Discussion

In this paper, we have evaluated the extent to which VCs contribute to the potential trade sale of their portfolio companies. More specifically, we have taken a learning perspective in order to examine alternative explanations for the behavior of different VC firms.

The results of our analysis show that, among the three types of learning, experiential and vicarious learning of the VC firm significantly contribute to the likelihood of a trade sale of its portfolio companies,

Table 3 Results of Cox regression

	1 Base model	2 H1	3 H2	4 H3	5 Full model
Main					
VC_age	−0.6341	−0.6542	−0.7747	−1.4417	−3.3705
	(0.5758)	(0.5006)	(0.5847)	(0.0971)	(2.2278)
VC_first_round_dummy	0.1883	0.1394	0.0534	0.1847	0.0562
	(0.2418)	(0.2437)	(0.2490)	(0.2488)	(0.2539)
Corp_VC_dummy	−0.3221	−0.1938	−0.2095	−0.2858	−0.1516
	(0.5386)	(0.5657)	(0.5332)	(0.5102)	(0.5242)
Patent_stock	39.56	55.63*	41.1943	36.5693	57.3015*
	(32.46)	(31.11)	(33.1577)	(32.6540)	(34.5827)
N_fin_round	43.38	43.45	28.9631	45.669	27.5455
	(100.48)	(101.81)	(99.4842)	(101.0767)	(101.3849)
VC_amount	6.33E−06	−3.43E−06	6.52E−06	8.42E−06	−1.14E−06
	(6.57E−06)	(7.83E−06)	(7.26E−06)	(6.99E−06)	(8.73E−06)
N_syndication	−0.0628	−0.0636	−0.0815	−0.0497	−0.0636
	(0.0522)	(0.0503)	(0.0562)	(0.0531)	(0.0569)
N_start_team	−0.0021	−0.0071	−0.0081	−0.0051	−0.0112
	(0.0348)	(0.0347)	(0.0355)	(0.0343)	(0.0353)
VC_experiential		3.1585**			4.0716***
		(1.2743)			(1.4033)
VC_vicarious			0.0004***		0.0004**
			(0.0001)		(0.0002)
VC_congenital				0.2041	0.1662
				(0.2137)	(0.2203)
tvc					
VC_age	0.0003	0.0003	0.0004	0.0007	0.0017
	(0.0003)	(0.0002)	(0.0003)	(0.0005)	(0.0011)
Patent_stock	−0.0197	−0.0277*	−0.0205	−0.0182	−0.0285*
	(0.0161)	(0.01555)	(0.0165)	(0.0163)	(0.0172)
N_fin_round	−0.0216	−0.0217	−0.0144	−0.0228	−0.0137
	(0.0501)	(0.0508)	(0.0496)	(0.0504)	(0.0505)
VC_amount	−3.15E−09	1.72E−09	−3.24E−09	−4.19E−09	5.77E−10
	(3.28e−09)	(3.90E−09)	(3.62E−09)	(3.48E−09)	(4.35E−09)
VC_experiential		−0.0016**			−0.002***
		(−0.0006)			(0.0007)
No. observations	2,112	2,112	2,112	2,112	2,112
No. subjects	206	206	206	206	206
No. failures (i.e. trade sales)	105	105	105	105	105
Log likelihood	−522.99	519.50	−519.08	−521.78	−515.28

Variables in tvc equation interacted with _t

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

but congenital learning has no significant impact. These findings seem to suggest that VC firms build up their own routines over time through a process of trial and error, while the knowledge that investment managers had before joining the venture capital firm—congenital knowledge—becomes irrelevant.

Even if the investment managers of the VC firm have trade sale experience before founding the firm, these routines and procedures developed before the start-up of the VC firm tend to change over time as the firm develops its own insights through learning by doing. Therefore, one might expect that the impact of congenital experience fades away over time, potentially explaining why congenital experience makes no significant contribution to the hazard of being acquired. Regarding vicarious learning, the results are in line with previous findings in the VC literature which tend to emphasize the importance of syndicate partners as sources of knowledge. Syndicate partners are often seen as valuable sources of information which can complement the lack of experience of the lead investors in one or more domains. However, when comparing the coefficients of both forms of learning, it is clear that experiential learning contributes more to the hazard of being acquired than vicarious learning. We can explain this through the fact that certain types of knowledge such as tacit knowledge are difficult to transfer and can only be learned through learning by doing (Hansen 1999). However, an alternative explanation might be that experienced syndicate partners are attracted to lead investors which have built up their own experience resulting in the emergence syndicate networks of experienced VC firms, which outcompete those of relatively inexperienced partners. Recent work of Hopp (2010) provides some evidence in line with this reasoning, as his results demonstrate that greater industry experience is associated with more syndication. Moreover, our data suggest that experienced lead VCs also have access to more experienced syndication partners. In a post-hoc analysis, we compared the vicarious learning of experienced lead VCs with unexperienced lead VCs. A Wilcoxon ranksum test confirmed that the experienced lead VCs have significantly more trade sales in their syndication network than the unexperienced lead VCs.

Furthermore, as we control for VC age, these results seems to suggest that it is not experience as such which contributes to the trade sale hazard but the specific knowledge a VC has with trade sales. In this respect, this study contributes to previous research in the VC literature, which has predominantly operationalized experience as age of the VC or a dummy. We find that age of VC firms is not a good indicator. Certain firms might survive in the long term because they can,

for instance, tap into various sorts of public money, but despite their long-term presence, they are not necessarily more likely to contribute to the trade sale hazard of their portfolio firms.

7 Conclusions, practical recommendations, limitations and future research

We can conclude from the analysis above that working with *experienced* VC firms is beneficial for portfolio companies aiming for a trade sale. If a VC firm has realized one or more trade sales before, this significantly increases the probability that the portfolio company will be able to realize a trade sale. The marginal impact of more trade sales, however, decreases over time. This suggests that working with a VC firm which has done no trade sales at all is the most risky strategy for a new venture as the chances of a trade sale are then very low. Moreover, this relatively inexperienced VC firm might not be able to form a good syndicate (Hopp 2010) which in turn further decreases the chances of a good trade sale.

Congenital learning, on the contrary, does not significantly contribute to the hazard of being acquired. This is in contrast with the insights gained from our qualitative study which suggested that the more experienced investment managers point to congenital learning as one of the most important learning forms. Although the practitioner literature suggests that experienced investment managers are more successful in securing funds, their experience does not seem to contribute to trade sales. We have no straightforward explanation for this. Potentially, our operationalization is a too rough as approximation of congenital experience. Our dummy variable is an indicator of the presence of congenital experience but does not capture the amount of it. A better way to capture this might be to consider the total number or percentage of investment managers with prior trade sale experience.

Regarding vicarious learning, both experienced as well as junior VCs agreed that this type of learning is an important source of knowledge. Furthermore, they pointed towards being part of and syndicating with the VC firms in the "cluster of the best" as the key method for maximizing vicarious input. However, when comparing the coefficients for experiential learning and vicarious learning, we notice that

the contribution of experiential learning is considerably higher.

The interview data we have on this subject tend to suggest that VCs do indeed learn from one another about methods and best practices such as converting loans into equity before trade sale negotiations, overviews of off-balance liabilities to facilitate due diligences, data room disclosure and the way in which preferred liquidation rights with carried interest are stipulated in shareholder agreements.[2] These best practices tend to include codified knowledge, which can easily be transferred. However, experiential learning seems to include a more tacit knowledge, which cannot easily be transferred from one VC firm to the other. This tacit knowledge involves business model decisions in the years after start-up and the way trust can be created among the various partners in the company.

In practice, however, we see that many VC firms underestimate the complexity of trade sales and overestimate the amount of vicarious learning they can do to catch up when they are lacking congenital experience at the start of the VC firm. In some cases, this vicarious learning does not even take place through syndicate networks but is based on a much weaker form of knowledge transfer, for instance informal networking at symposia. The results in the paper clearly indicate that this form of learning will never substitute for the lack of experience. This is important as many government funds are set up as co-investment schemes with the specific objective to learn from syndicate partners rather than developing all the knowledge in house. Other public or university-related funds are only allowed to perform small investments per deal and therefore do not recruit experienced investment managers, but prefer to syndicate with so-called "experienced" partners to learn the business. The complexity of a trade sale seems to require many different forms of knowledge, which go far beyond the exchange of best practices in a typical syndicate.

As any other study, this one is also fraught with a number of limitations which provide opportunities for further research. First, the paper only includes learning variables at VC firm level, ignoring the entrepreneurs' perspective. Both the learning and the VC literature could benefit greatly from this kind of hierarchical analysis in which data at different levels are collected. An insight in the interaction of individual and firm level learning would contribute to our understanding of how different learning processes interact with each other. Second, the study only includes the measurement of trade sale as a dummy, ignoring the value of the trade sale. Other dependent variables such as time to trade sale and trade sale under- or over-pricing might be equally if not more important.

These two limitations are certainly areas for further research which could contribute both to the entrepreneurship and the learning literature. Additional research is also needed to identify the way and mechanisms in which the knowledge is transferred among VC firms and among investors within the VC firm. Finally, more research is also required to identify the driving mechanisms of a trade sale and thus the type of learning that determines entrepreneurs' and VCs' success. One of the senior VCs interviewed emphasized:

> The VC industry is one of the most difficult businesses. Around 1995–1997, we thought that we knew everything about this business. But then we realized we had a lot to learn. Today, VCs are still learning and I am continuously learning as well.

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[2] In one case, a VC told us that the preferred liquidation rights in their initial shareholder agreements were so aggressive that only afterwards they realized that the entrepreneurs in a potential trade sale would keep less than 5% of the value added, which they then had to share with the management. In a number of portfolio companies, this had explained why the entrepreneurs were so passive in looking for trade sale opportunities or even neglected opportunities.

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