The business of venture capital in open source software

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Abstract. A growing body of literature has explored the motivation of firms to take part in open source software (OSS) development, yet the role of venture capitalists and their role in OSS projects is largely unattached. Based on information from publicly available data we investigated the investment behavior of 37 VCs investing in 45 OSS projects. To understand how these venture capitalists try to reduce their perception of uncertainty and risk we developed a 2*2 matrix of different investment approaches. While the X axis represents the average age of a community / OSS product at the time of investment, the Y axis reflects the average round of a venture capitalist’s entry. This exploratory study illustrates how venture capitalists limit the level of risk inherent in certain OSS investments and results in a number of implications for communities seeking for external funds as well as for investing firms.

Keywords. Open Source Software, Venture Capital, Risk, Investment Strategies.
1 Introduction

Venture capital (VC) has become an increasingly important source for financing the development of new technologies or the foundation of nascent companies. No one would doubt that without VC investment, many technical and entrepreneurial developments never would have been possible. The final goal of a venture capitalist usually is to liquidate an investment, either through initial public offering (IPO) or in form of selling (parts of) the company. Therefore one of the major tasks is to help a company to build a sustainable business which attracts possible future shareholders (Tyebjee & Bruno 1984, Hellmann 2006).

Since investments generally are more likely to be made in cases of a relatively low level of perceived risk and uncertainty, especially high-tech investments are protected by intellectual property regimes like patents (Cochrane 2005). However, in recent years an exponentially growing number of VC deals were announced¹, that at first hand seem to be paradoxical, namely the investment of for-profit organizations in open source software (OSS), a product available for free and – in popular perception – developed by a community of individuals who typically receive no financial compensation for their work (Hertel et al. 2003). Given the nature of OSS with missing classical protection mechanisms and a high level of inherent risks², the activity of private equity and classical venture capital funds with the goal of maximizing the return of their investment is surprising. In other words, why should an organization with the final aim to liquidate an investment at the highest possible rate invest in a product which is accessible to anyone for free, produced by a community of enthusiasts and hobbyists where trust seems to be the only suitable governance mode?

¹ For numbers according to the increased VC investments in OSS see Aslet (2009).
² It is worth noting that despite the fact that OSS is available for free and that it is possible to build business models upon, by law, the original programmers remain the owner of the software code (Mann 2006).
Following the predominant logic, technological features themselves have no benefit without a business model which transforms technology into economic value. Software vendors (in their role as copyright holders) therefore usually generate their revenue through the sale of owned IP in the form of (technological) products or services using licensing agreements (Dam 1995, Lichtenthaler 2009, Teece 1986). In contrast, open source licences allow every licensee not only to use the software but also to look into the source code and to manipulate it (Open Source Initiative 2009). Although previous work on commercialization of OSS revealed a number of strategic approaches to appropriate from technological innovation without having ownership like the sale of complementary goods and services (Alexy 2009, Bonaccorsi et al. 2006, Fosfuri et al. 2008, West & Gallagher 2006), many issues on how to appropriate from communities’ work remain unclear from a venture capitalist’s perspective.

One of the prominent examples, the one billion dollar acquisition of MySQL AB by Sun in 2008 delivers a first hint. Whereas for Sun it was mainly an external technology acquisition to overcome lack of internal resources and to complete its product portfolio (Van de Vrande et al. 2009), a number of venture capitalists who invested in MySQL AB in early stages to grow the business finally benefited from the acquisition (MySQL 2003). Although a number of studies dealt with the motivation of developers to voluntarily contribute to a code base (Bitzer et al. 2007, Hertel et al. 2003, Shah 2006), the motivation of firms to participate in a OSS community (Dahlander & Magnusson 2008, Henkel 2004, Iansiti & Richards 2007), and the motivation of VCs to invest in high-tech products in general (Fried & Hisrich 1994, Gompers 1996, Sahlmann 1990, Smart et al. 2000), only little is known about the motivation and resulting strategies of venture capitalists to invest specifically in OSS.

To sum up, investing in OSS means to invest in a technology with a high endogenous and exogenous uncertainty. While exogenous uncertainty like environmental turbulence is

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3 MySQL AB is the world leading open source database system and is running a dual licensing strategy
also to be found in typical high-tech investments (Folta 1998, Van de Vrande et al. 2009), in the case of OSS an investor additionally has to deal with increased endogenous uncertainty due to a community of usually unpaid individuals, unanswered questions of ownership, and increased competition as potentially any competitor can build a business model upon the same type of (freely available) software code (Bonaccorsi et al. 2006).

Focussing on risk assessment and risk affinity, the aim of the paper therefore is to exploratory investigate how venture capitalists invest in OSS based on factors like type of software, business model or number of co-investments.

To address the research question, we focused on publicly available data from various websites, starting with the biggest VC deals in OSS in the last five years. Using a snowball method to get from one website to the next we ended up looking at 37 VC firms investing in 45 OSS projects. We find that while risk affinity is rather average, venture capitalists can be clearly distinguished in terms of diverse approaches to overcome risks inherent in OSS.

The rest of the paper is structured as follows. Section 2 outlines the theoretical background dealing with the business of venture capital, the role of risk as well as characteristics and business models of OSS. Section 3 describes the research setting and the data collection. Section 4 deals with findings and ends with propositions. In section 5 we will discuss the implication of this investigation for research and practice.

2 Literature review

2.1 Venture capital investment

At the very beginning, a start-up is usually operated and financed by the entrepreneurs himself (Hall & Woodward 2007). In the following, to be able to grow a venture requires external funding. In principal, an entrepreneur can chose between two funding institutions: banks and venture capitalists. Both face the problem of information asymmetry in the sense that a new start-up has a lack of track record (Binks & Ennew 1997, Mason & Stark 2004).
Whereas banks monitor less intensively, but are able to provide funds at relatively low costs, venture capitalists are more likely to monitor more intensely but demand higher cost of capital (Winton & Yerramilli 2007). New businesses in the information-based economy usually are not able to provide hard assets which could possibly secure the debt. Therefore, the value a firm provides is intangible and difficult to measure. In order to adequately cover the risk inherent in a start-up an institution has to demand a higher charge on loans than allowed by law, which oftentimes makes it impossible for banks to invest (Zider 1998). This gap in the capital market was closed by venture capitalists. Instead of lending money at a specific rate, VCs buy a stake in an entrepreneur’s idea (Huyghebaert 2003). It is worth noting that only a small amount of venture capital investment is used to finance basic innovation. Following Zider (1998), about 80% of the money invested by a venture capitalist goes into establishing an environment to grow the business. According to Winton & Yerramilli (2007), “venture capital finance is optimal only when (1) the aggressive continuation strategy is not too profitable, ex-ante; (2) the uncertainty associated with the risky continuation strategy (“strategic uncertainty”) is high; and (3) the firm’s cash flow distribution is highly risky and positively skewed, with low probability of success, low liquidation value, and high returns if successful”. Additionally, empirical studies of VC investments show, that venture-capital backed firms are more likely to have higher measures of professionalism and performance than other start-ups (Gompers 1995, Hellmann & Puri 2002, Kortum & Lerner 2000).

For our study we further want to distinguish between venture capital funds and corporate venture capital (CVC). Whereas “venture capital refers to financing the startup, development, expansion or purchase of a firm, in the act of which the venture capital investor acquires, by agreement, a proportion of the share capital in the business in return for providing funding” (Hsu 2008), CVC investments can be defined as a “set of organizational systems, processes and practices that focus on creating businesses in existing or new fields,
markets or industries—using internal and external means” (Narayanan et al. 2009) or simply as “equity investments by established corporations in entrepreneurial ventures” (Dushnitsky & Lenox 2005a, 2006). As our investigation couldn’t expose significant differences between the two groups we use the term venture capitalist for both, although this is hiding the fact that they possibly run different strategies.

As argued in the introduction, any investment is related to risk. In this regard, risk in its general meaning can be defined as a situation or the exposure to a proposition where the outcome is uncertain (Kaen 2005). Following Folta (1998), we distinguish between two types of uncertainty: exogenous and endogenous. Exogenous uncertainty is typically unaffected by firm actions like environmental turbulence or technological newness in the sense of the uncertain technological and business potential of the product. This type of uncertainty decreases over time as the technology gets more mature. In contrast, endogenous uncertainty refers to uncertainty that “can be decreased by actions of the firm” (Folta 1998). Based on the above reasoning, if a technology or start-up is in a very early stage, the level of uncertainty raises and investments are more likely to be rather small due to the increased level of risk (Ahuja & Lampert 2001, Dushnitsky & Lenox 2005b, Lukach et al. 2007). Consequently, Van de Vrande et al. (2009) argue that there is a positive relationship between environmental uncertainty, perceived risk, and the use of less integrated governance modes like VC instead of more integrated ones like acquisition of a venture.

In the context of investments, risk is more precisely described as variability in outcomes concerning the expected value (Harrington & Niehaus 1999, Maula et al. 2009). In order to minimize risk, venture capitalists run a number of various strategies. A major task besides the funding itself is to help building a successful company by active participation and controlling strategic decisions as well as the monetary situation (Gompers 1995, 1996, Hellmann & Puri 2002). It is worth noting that although venture capitalists play an active role, they usually do not participate in the day to day management (Dotzler 2001). Furthermore,
venture capitalists make use of a structured process to judge on investments. Quite a number of empirical studies dealt with the structure of such processes (Tyebjee & Bruno 1984). For instance, interviewing 18 VC fund managers, Fried and Hisrich (1994) propose a six-stage model of investment decision making with steps like *Origination*, *VC Firm-Specific Screen*, *Generic Screen*, *First-Phase Evaluation*, *Second-Phase Evaluation*, and *Closing*. According to their findings, in average it takes about 97.1 (s.d.=45.0) days for an investment to pass these six stages before the final funding is granted. In addition, there is another common way of risk protection called staging. It involves sequential disbursements of capital from a VC fund to a company, often dependent on whether the company has satisfied predetermined goals or not (Hsu 2008, Krohmer et al. 2009). As most ventures have no track record, this consequently leads to high information asymmetries in favor of the entrepreneur. That implies an extensive monitoring process and therefore high agency costs. Since early stage investments assume a higher degree of information asymmetries agency costs are higher, too.

In favor of reducing financial risks a sequential payout ties less money to a single venture. If a company is doing well, investors can put additional money into the venture at a predetermined price and increase their stakes below market price. According to the returns, this has an additional leveraging effect. Finally venture capitalists secure themselves from risks by co-investing with other companies. In most cases investments are made in groups of a few investors, leaders and followers (Gompers 1995, 1996).

To sum up, compared to other governance modes like mergers & acquisitions, VC investment is a less integrated governance mode (Van de Vrande et al. 2009) and venture capitalists have installed a number of ways to reduce especially endogenous uncertainty and to protect the investment like (1) participation, (2) use of a structured decision process, (3) the concept of staging or (4) co-investing (Hellmann & Puri 2002). However, it remains unclear how venture capitalists deal with the characteristics and – in popular perception increased – risks of investing in OSS, like the fear of losing control, the required trust in a community of
developers or the enlarged competition in complementary markets based on a product available for free. Do they still make use of these four mechanisms or do they run additional strategies to reduce the risk inherent in OSS?

2.2 The open source software phenomenon

In contrast to proprietary software developed by profit-oriented software vendors, OSS development projects are developed by a community of geographically dispersed individuals (Lakhani & Von Hippel 2003, Von Hippel & Von Krogh 2003, Von Krogh et al. 2003). Members typically rely on the internet and several mailing lists as a means of communication and coordination (Mockus et al. 2002, O’Mahony & Ferraro 2007). In the early days of OSS, the motivation of participating in such projects mainly based on intrinsic factors like joy and fun in programming or being stimulated by creative problem solving (Bitzer et al. 2007, Hertel et al. 2003).

Although the output of these production communities, the software code itself, is available for free to anyone – and therefore is a public good –, the programmers still own the IP of the part they developed. Furthermore, it is worth noting that software can be termed open source independent of how or by whom it has been developed – as long as the software is delivered under a license approved by the Open Source Initiative (OSI) (Open Source Initiative 2009, O’Mahony 2005, Von Hippel & Von Krogh 2003).

In recent years, with the ongoing commercialization of OSS products, many communities received financial support by firms either direct or indirect as firms allow their employees to work in OSS projects during their work time (Dahlander & Magnusson 2008, Fosfuri et al. 2008). Due to the increasing presence of firms in OSS projects, it is necessary to distinguish between community founded and firm-founded (and mostly firm-driven) communities (Dahlander 2007, O’Mahmony 2007, West & O’Mahony 2008). Whereas community founded projects still inherent the initial ideology of the OSS movement and the
concept of meritocracy, those founded and driven by firms have to function to align with firms’ interests. In the latter case, it is further important to distinguish between transparency and accessibility as open strategies. “Transparency allows outsiders (i.e. non-sponsors) to understand what is happening and why — and, in the case of an open source community, allows use of the community’s final product, the source code. Accessibility allows external participants to directly influence the direction of the community to meet their specific wants and needs, regardless of whether the external party is a hobbyist or an organizational adopter. In some cases, external contributors could be sellers of goods and services that might either compete with or complement the sponsor’s business” (West & O’Mahony 2008).

The economic value delivered by OSS was underestimated for a long time (Perens 1999, Lerner & Tirole 2002). However, the potential of OSS to create value is mirrored in a number of possible business models. Due to overlapping and missing comparative studies, many categorizations of business models and commercialization modes exist (Alexy 2009, Dahlander & Magnusson 2008, Bonaccorsi et al. 2006, West & Gallagher 2006). To give a brief overview on how OSS economics might work, we will rely on four different, but non-exclusive commercialization approaches derived from a mixture of those provided by Alexy (2009) and West & Gallagher (2006), namely business transformation, cost and risk reduction, dual licensing, and sale of complementary services and goods. Notwithstanding, some of the following examples could be mapped to more than one business model.

In case the company has developed a new technology with the goal of being adopted rapidly, giving access to anyone by opening it up to users and competitors will increase the speed of diffusion (Alexy 2009). In other cases, a technology is no longer of use for a firm especially when it does not contribute to the firm’s performance or does not fit in the corporate strategy. Firms then stop maintaining a product and leave it to those who developed it. Freed from firms’ stranglehold these spinoffs oftentimes are able to perform well as observable in the case of Xerox and Adobe (Chesbrough 2003). These long-term and not
primarily finance-oriented motivations are referred to as *business transformation* (Fitzgerald 2006).

Another valid business model is the concept of *dual licensing*, a model where software is being distributed under both an OSS licence with basic functionalities and a proprietary one with a number of add-ons and professional features. Whereas the OSS version is still available for free, the producing firm demands monetary compensation for the use of the enlarged proprietary version – oftentimes combined with a service package (Henkel 2004, Välimäki 2003). MySQL is maybe the most prominent example of a dual licensing strategy. It is worth noting that dual licensing is only possible in the case a company owns the entire rights to the source code, what might be a problem when making use of communities (Välimäki 2003).

Based on interviews with CEOs of software start-ups, West & O’Mahony (2008) explain how expensive commercial marketing channels are relative to the marketing benefits that could be derived from an open source community. According to their insights, from every dollar a company earns from licensing, 70 cents goes to fund the sales and marketing efforts. For an entrepreneurial firm, the barriers to entry into this market is not building a better product, it is having $50-60 million a year just to spend on sales and marketing (West & Mahony 2008). Using the OSS model therefore has the potential to *reduce costs* of sales and marketing tremendously.

*Selling complements* means that firms are giving away innovations for free to generate revenue from complementary goods or services (Boudreau 2008, West & Gallagher 2006). In the case of separated target groups, like the video game or web server industry, where firms address consumers as well as developers, a two-sided pricing strategy can increase the overall

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4 See also Larry Augustin’s presentation at the 2008 Open Source Meets Business Conference in Nürnberg, Germany (Augustin 2008)
profit although “consumers of one segment in a two-sided market need never acquire the complement” (Gallaugher & Wang, 2002).

To sum up, the development of OSS products has evolved from a purely altruistic approach mainly driven by hobbyists and voluntary individuals to an economically valuable method of software production, which attracts more and more firms (Fitzgerald 2006, Stewart & Gosain 2006). Although a number of strategic and financial reasons exist for firms to either open their proprietary product or to engage in existing projects, still little is known about the success and inherent risks of different commercialization approaches, especially from a venture capitalist’s perspective. For instance, what does it mean to run a dual licensing approach without having the entire rights to the code? Is it really possible to gain access to a market without intense sales and marketing activities? Does working with a community of volunteers mean the loss of control?

However, answering these questions is crucial for possible investors to be able to evaluate the level of risk hidden in OSS projects like the loss of control over the investment due to missing protection systems. As literature on VC investment in OSS is limited, we start with an exploratory investigation based on public information to identify investment as well as risk reduction strategies.

3 Methodology

The fundamental question behind our research was directed at motives of venture capitalist or venture capital funds to invest in OSS communities. As noted above, the special interest derives from the fact that OSS communities and OSS companies are obviously lacking classical and proven business models based on protecting the source code as intellectual property (Dam 1995, Krishnamurthy 2003, Lichtenthaler 2009, Stewart & Gosain 2006).

In order to determine the decision making process of venture capitalist firms, we initially based our research on publicly available data gathered by an Internet-based search for venture
capitalists investing in OSS communities. We started searching for announcements of OSS deals in various technical online journals and news portals like Heise, Golem or Business News America (e.g. http://www.bnamericas.com/). We then derived information from a project’s website or, if listed and available, from the sourceforge.net portal followed by including website data from a venture capitalist’s website. In total we chose to examine the portfolio of 37 venture capital firms according to their official websites resulting in 45 different OSS projects. This relatively small number of projects can be explained by overlapping investors. As a consequence, we decided to extend our examination to attributes relating to these firms as well as to attributes of single OSS projects, which resulted in 91 data sets. Each data set represents a combination of a certain investor and a certain OSS product containing additional attributes, which are to be discussed as follows.

First we determined the type of investor, namely private equity firms, corporate venture capitalist or business angels. As we could not find significant differences according to these types in our dataset, we decided to drop type of investor from our investigation. For each venture capitalist\(^5\) we then counted the number of OSS projects in each ones portfolio compared to the total number of projects / companies a VC invested in. Furthermore we examined the different business segments each investor focused on. Due to evaluation constraints we reduced the total number of diverging fields to four major areas: ICT, Life Sciences, Industrial Production, and Others. As a next step we enquired the specific investment rounds, respectively the related investment sum connected to each OSS project. In each case, we also tried to gather data on the initial funding date as well as on eventual exit dates, wherever possible.

Regarding the OSS projects on the other side we examined both general market segments (Consumer Application Software, Enterprise Application Software, or System

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\(^5\) We here see venture capitalist as either business angel, or private equity firm or corporate venture capital firm.
Software) and detailed market segments (e.g. ERP, CMS, etc.) to which they could be related. We orientated ourselves to the classification of the “list of software categories” of Wikipedia (http://en.wikipedia.org/wiki/List_of_software_categories). As it has been proven to be a reliable source in former research, we assume that Wikipedia contains a reasonably representative picture of open source and software issues (Iansiti & Richards 2007). Additionally, we analyzed which kind of business model each OSS project pursued. As discussed earlier these were either Business Transformation, Cost and Risk Reduction, Dual Licensing, Sale of Complementary Goods or Services. It is worth noting that as long as no disjunct distinction between different commercialization approaches exists, it is hardly possible to come up with a reasonable mapping of projects to business models. Again, since this study has exploratory character, we based our categorization for business models on factors like type of license and further information available from the projects’ websites like whether or not a professional service is available. Consequently, in our categorization many projects belong to more than one specific business model.

Furthermore we determined the community size regarding both, the number of participating / registered members and the number of core developers. It can be assumed that both, a large user community as well as a high number of core developers affect an investment decision because they mirror the risk inherent in an OSS project. Dahlander (2007) points out that the time of existence of a community is also a highly critical factor which might have an impact of a venture capitalist’s strategy. Building upon this fact, we additionally documented the funding year, the license type and individual release cycles of each project. To build the bridge to data we had on investors we also marked the total number of investors ever participated in the project and, if procurable, the acquisition year and the acquisition amount, in case the OSS project was completely sold to a venture capitalist or a software vendor. Unfortunately, not in all cases it was possible to draw a full picture of co-investments due to missing publicly available data.
To enhance the meaning of our gathered data and in order to increase its value we added and constructed additional variables and attributes. A major and interesting factor in this context was the total investment sum for each project according to the recorded investment rounds as well as the number of co-investors. Another important factor regarding the different strategies to deal with risk was the calculated relative share of OSS projects in each investor’s portfolio. Additionally we retained the total number of investment rounds as well as the age of the communities. To analyze our data and to be able to work out correlations and to build clusters, we used cross-classified tables utilized by pivot tables. Table 1 shows the result of using the pivot table for one out of the 37 venture capitalists with the OSS projects he invested in, as an example.

--- Please insert table 1 about here ---

4 Findings

4.1 Descriptive Statistics
Venture capitalists had an average share of 4.1% OSS projects in their portfolio. This low percentage could implicate a rather cautious and skeptical approach in dealing with OSS by venture capitalists. This might be based on the potential risks of OSS for investors like the fear of losing control over an investment. On the other hand it is worth noting that the OSS market only makes up to 20% of the overall ICT market which also explains the relative low percentage (Augustin 2008). When we looked at the industry segments the venture capital firms invested in, we found out that each venture capitalist in our sample data invested in information and communication technology (ICT). Thus, it can be assumed that venture capitalists which invest in OSS already have a remarkable experience in that specific area. 56.8% of the venture capitalists also invested in life sciences, 45.9% in industrial production
and also 45.9% in other sectors. Traditionally it’s assumed that venture capitalists invest in industries that are still relatively young and have strong growth prospects but on the other side are also somehow established and provide a certain level of security (Zider 1998). From this point of view the distribution of different industries in the investment portfolio of the venture capitalists in our data sample seems to be quite typical.

The average total investment sum for an OSS project in our sample data was $23.3 million. Most of the OSS projects were focusing on system software (55.6%). Another favored market segment was the one of enterprise application software (26.7%). Application software and computer programming tools only played a minor role (11.1% / 6.7%). In order to characterize the business models of the OSS projects in our sample data we used the four models as proposed earlier.

By far the most common business model in our sample data was a combination of dual licensing and sale of complementary services (46.7%). The second most frequently used business model, the sale of complementary services, followed up in considerable distance (17.8%). Other business models only played a minor role. The distribution of business models in our sample data seems to confirm statements in the literature which attest a combination of dual licensing and sale of complementary services to be most suitable for many OSS projects (Alexy 2009).

4.2 Results of data analysis

In order to categorize venture capitalists in terms of their risk affinity we developed a two-dimensional framework, containing the average age of projects being invested in (X axis) and the average funding round of entry for each venture capitalist (Y axis). We assumed that investing in established OSS projects and funding projects in later stages is predicted to be perceived as a less risky investment as at least some performance indicators, like number of downloads or volume of early investment rounds, are observable. By choosing these two
dimensions we used a measurement that is mainly suitable to describe the precautions against losses and investment in information, not necessarily the level of risky activities or diversification.

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Concerning the two-dimensional framework, we identified 11 venture capitalists that seem to show strong risk affinity by investing in relatively new OSS projects and entering the funding process in early stages. Nine venture capitalists seemed to show low risk affinity by tending to invest in more established OSS projects and entering the funding in later stages. Eight respectively seven venture capitalists seemed to show at least some risk affinity by either investing in new projects or entering the funding in early funding rounds. For two venture capitalists no categorization was possible due to a lack of data.

To further examine the four types of venture capitalists we looked at the average share of OSS software in the venture capitalist’s portfolio and the average investment sum. As we were not able to identify any investment sum for any co-investor, we further assumed that higher average investment sums also indicate higher investment sums for individual venture capitalists.

The group of venture capitalists with high risk affinity surprisingly was characterized by a relatively low share of OSS projects in their portfolios. With an average share of 2.6% the value was below the average share for the whole sample data and it was the lowest value for a field in our framework concerning this variable. This group could also be clearly distinguished by a quite low average of investment sum concerning the OSS projects. The average investment sum for the OSS projects of each venture capitalist in this group was about $20.8 million. This was the second lowest value in our framework concerning this variable und also below the average investment sum for the OSS projects of each venture capital...
capitalist in the whole sample data. These results indicate that venture capitalists in this group are not categorically more risk affine than other venture capitalists (in contrast to what could be concluded from the categorization framework). In fact they seem to apply just another form of loss control, in particular by reducing the level of risky activities (low share of OSS projects in portfolio/low average investment sum). Especially a low share of OSS projects in a portfolio points to risk aversion. From an OSS perspective, venture capitalists seem to compensate the risk inherent in young OSS projects by combining the investment with a large stock of alternative (less risky) investments. In other words, this type of venture capitalist recognize OSS investment as a rather than to build a sustainable VC business upon.

Proposition 1a: The larger a venture capitalist’s preexisting stock of alternative investments is, the more likely he is to invest in young OSS projects.

Proposition 1b: The larger a venture capitalist’s preexisting stock of alternative investments is, the more likely he is to spend relatively low investment sums.

The group with seemingly strong risk aversion was characterized by a high share of OSS projects in its portfolio. Here the average share was 4.7% which was the second highest value in the framework concerning this variable and above the average share of the whole sample data. The average investment sum was also quite high. With $31.3 million it was second highest value in the framework relating to this variable and again above the average investment sum of each venture capitalist in the whole sample data. Again, this result does not support the above depicted categorization framework. We cannot assume these venture capitalists to be less risk affine since they show a high level of risky activity. In return they seem to exercise loss control via strong precautions and to invest in information. On the other hand one could argue that the reason of spending relatively high sums is based on OSS
investment experience represented by a relatively high share of OSS investments in the portfolio. We therefore propose:

Proposition 2: The larger a venture capitalist’s relative amount of OSS investments is, the more likely he is to spend relatively high investment sums.

The group with venture capitalists that invested in older OSS projects and entered funding in early stages showed a relatively high share of OSS projects in its portfolio. With 5.6% it showed the highest value in the framework regarding this variable and was considerably above the average share of the whole data. In relation to the average investment sum for the OSS projects of each venture capitalist the value was quite low with about $18.1 million. This was the lowest value regarding this variable in the framework and significantly below the average of the overall data. Obviously these venture capitalists combine different methods of loss control and internal risk reduction by e.g. using different portfolios. They show as well aspects of low risk activity (low average investment sum) and precautions against risk respectively investment in information (investing in older projects). So again we cannot simply assume that these companies being more or less risk affine than others.

Finally the group containing venture capitalists that invested in younger OSS projects and entered the funding process in later stages was characterized by a relatively moderate share of OSS projects in its portfolio. The average share was the second lowest in the framework concerning this variable (4.6%) but still above the average share of the whole sample data. Concerning this group the average investment sum in OSS projects by each venture capitalist was very high. It was the highest value in the framework (about $38.1 million) and considerably above the average of the whole data. Again we find a combination of different loss control and internal risk reduction approaches: reducing risky activities (low
share of OSS projects in portfolio) and precautions against loss respectively investing in information (entering funding in later stages).

In summary, it can be stated that our findings did not support the proposition that venture capitalists differ fundamentally in terms of their risk affinity when investing in OSS projects. Instead we found evidence that venture capitalists just exercise different approaches of risk management. Not surprisingly, the four protection mechanisms provided in section 2.1, namely (1) participation in the venture, (2) use of a structured (investment) decision process, (3) the concept of staging, and (4) co-investing, seem to be practiced in the case of OSS investment as well. However, we could observe additional strategies depending on (relative) investment sum and especially on the venture capitalist’s portfolio.

From this point of view it seems more reasonable to categorize venture capitalists that invest in OSS in respect of their risk management methods, rather than on simply risk affinity as illustrated in table 3.

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5 Conclusion

The aim of this research was to deal with the phenomenon of VC investment in OSS. Drawing on the stream of OSS literature, a number of economic and strategic reasons exist for firms to either start a new or participate in / make use of existing OSS projects (Henkel 2004, West & Gallagher 2006, West & O’Mahony 2008). However, as the commercial use of OSS is still in an early stage, valid results on how effectively different commercialization approaches work are missing. Furthermore, the investment is not protectable using traditional protecting mechanisms like patenting which potentially leads to an increased competition, especially in complementary markets.
Despite these rather uncertain environments, venture capitalists exponentially invest in OSS products and firms (Aslett 2009). As investing in public goods like OSS contains a high level of (perceived) risk, venture capitalists obviously have to use non-traditional strategies to reduce the level of risk to secure their investments. With this exploratory study we contribute to this rather new field by looking at investment strategies of a set of 37 VCs investing in 45 OSS projects. Our research showed that venture capitalists that invest in OSS do not seem to differ from other venture capitalists or in terms of their risk affinity in general but in terms of their risk management approaches when dealing with OSS projects.

With regard to communities trying to obtain funding this insight could be a trigger to shift their focus towards a deeper investigation of a potential investor’s risk management strategies rather than looking for investors that in general tend to be more optimistic towards OSS than others. Understanding the risk management approaches of different venture capitalists could help OSS communities to identify appropriate investors when needed. By knowing which risks venture capitalists intend to minimize and which risks they are willing to take eventually, it’s more likely for leaders of OSS projects to identify suitable investors.

Moreover, our results might improve the understanding of how venture capitalists assess the risks of investments in OSS. The fact that we could not find any differences in risk affinity on part of current investors could suggest that venture capitalists have by tendency similar perceptions about the potentials and risks of OSS. The low average share of OSS projects in each portfolio and the fact that each venture capitalist showed both risk affine and risk adverse risk management aspects could indicate that venture capitalists, while realizing the potential benefits of OSS projects, generally still tend to exercise caution when concerning OSS.

Like any exploratory study, this investigation has certain limitations. Firstly, with regard to the methodology, using a snowball method to identify VC investment in OSS it is impossible to guarantee a full picture of VC investments in OSS. As mentioned before, we
concentrated on the biggest VC announcements in recent years. While this was appropriate to identify the most important players in this market, it may also be possible that venture capitalists behave differently when dealing with small investments only. Given the intensity of our search we suggest the number of existing venture capitalists which invest in OSS to be only slightly different from our findings, if at all.

Secondly, our results are based on the relative number of OSS investments in a venture capitalist’s portfolio. We simply argue that investing in OSS is more risky than to invest in other (proven) ICT business models. However, we have to admit that it could be possible, that some of the investments in the portfolio are even more risky than an investment in OSS. Again, this has to be validated in further interviews.

Thirdly, in this study we were only able to report our findings concerning the average age of a community and average investment round, respectively. It is important to know that factors like business model and the size of a community were not taken into account to generate our matrix. However, especially factors like the presence of a firm in a community, size of the core development team and governance mode within a community influence the perception of the risk inherent in an OSS project. For instance, the presence of a firm can increase the level of professionalism in a community while at the same time can lead to tensions between the openness on the one side and the wish for control of both, a firm and/or the venture capitalist, on the other side (O’Mahony & Ferraro 2007, West & O’Mahony 2008). Additionally, with our data it is not possible to address the question of how the influence of a venture capitalist would affect voluntary commitments of individuals at all. We also were not able to observe significant patterns regarding the differences between classical venture capitalists and corporate venture capitalists. We would speculate that venture capitalists are more likely to invest in finance-oriented business models like dual licensing or sale of complementary services while corporate venture capitalists are more likely to invest in cost and risk reduction business models. As mentioned before, cost and risk reduction is
related to the collaboration with other firms and therefore a means of external technology acquisition to complement a firm’s software infrastructure. Again, in our sample no such behavior was significant.

To sum up, although it is not paradoxical to invest in a product available for free, the level of risk seems to be rather high due to the specific characteristics of OSS. Whereas a number of questions remain unanswered, we were able to provide first insights into the business of VC investments in OSS. In our opinion, this research can be a starting point to address open questions which then can help to deepen our understanding about the commercialization of OSS products. Nevertheless, the trend towards OSS is clearly visible and might become even more distinct once the symbiosis of OSS communities and investors continues to be reinforced by further success stories like MySQL.
6 References


# Appendix

**Table 1**: Example of analysis of a venture capitalist’s activities

**Venture capitalist:**

*Azure Capital Partners*

<table>
<thead>
<tr>
<th>Type</th>
<th>Private equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of OSS projects</td>
<td>3</td>
</tr>
<tr>
<td>Number of all projects in portfolio</td>
<td>28</td>
</tr>
<tr>
<td>Percentage of OSS</td>
<td>10.71%</td>
</tr>
</tbody>
</table>

**Investing in**

[ICT, Life Sciences, Industries, Others] [1,0,0,0]

<table>
<thead>
<tr>
<th>OSS investment in:</th>
<th>Fonality Tribox</th>
<th>Medsphere</th>
<th>Zend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market segment</td>
<td>System Software</td>
<td>Enterprise Application</td>
<td>System Software</td>
</tr>
<tr>
<td>Community size</td>
<td>n.a.</td>
<td>430</td>
<td>31403</td>
</tr>
<tr>
<td>Number of core developers</td>
<td>5</td>
<td>23</td>
<td>n.a.</td>
</tr>
<tr>
<td>Founding year of community</td>
<td>2004</td>
<td>2002</td>
<td>1999</td>
</tr>
<tr>
<td>Age of community (after first release)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of investors</td>
<td>3</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Investment start (of VC)</td>
<td>2006</td>
<td>2005</td>
<td>2004</td>
</tr>
<tr>
<td>Investment end (of VC)</td>
<td>No liquidation yet</td>
<td>No liquidation yet</td>
<td>No liquidation yet</td>
</tr>
<tr>
<td>License</td>
<td>GPL</td>
<td>GPL</td>
<td>New BSD license</td>
</tr>
<tr>
<td>Overall investment sum</td>
<td>$ 24,600,000</td>
<td>$ 37,000,000</td>
<td>$ 43,700,000</td>
</tr>
<tr>
<td>Funding Round A [this VC y/n]</td>
<td>$ 600,000 [n]</td>
<td>$ 5,700,000 [n]</td>
<td>$ 2,700,000 [n]</td>
</tr>
<tr>
<td>Funding Round B [this VC y/n]</td>
<td>$ 5,000,000 [y]</td>
<td>$ 18,300,000 [y]</td>
<td>$ 6,000,000 [n]</td>
</tr>
<tr>
<td>Funding Round C [this VC y/n]</td>
<td>$ 7,000,000 [y]</td>
<td>$ 13,000,000 [y]</td>
<td>$ 8,000,000 [y]</td>
</tr>
<tr>
<td>Funding Round D [this VC y/n]</td>
<td>$ 12,000,000 [n]</td>
<td>-</td>
<td>$ 20,000,000 [y]</td>
</tr>
<tr>
<td>Funding Round E [this VC y/n]</td>
<td>-</td>
<td>-</td>
<td>$ 7,000,000 [n]</td>
</tr>
</tbody>
</table>
Table 2: Typology of risk affinity

<table>
<thead>
<tr>
<th>Average round of VC entry</th>
<th>Average age of projects a VC invested in</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mature</td>
</tr>
<tr>
<td>late</td>
<td>9 (risk aversion)</td>
</tr>
<tr>
<td>early</td>
<td>7 (moderate risk affinity)</td>
</tr>
</tbody>
</table>
Table 3: Categorization of investment strategies

<table>
<thead>
<tr>
<th>Examples for risk reduction</th>
<th>VC mainly reducing level of risky activities</th>
<th>VC mainly increasing precautions against loss/investing in information</th>
<th>VC using multiple approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low share of Oss projects in portfolio</td>
<td>Entering funding in later stages</td>
<td>Low share of Oss projects in portfolio or low average investment sum in Oss</td>
<td></td>
</tr>
<tr>
<td>Low average investment sum in Oss</td>
<td>Investing in established projects</td>
<td>Entering funding in later stages or investing in established projects</td>
<td></td>
</tr>
<tr>
<td>Remaining risk</td>
<td>Entering funding in early stages</td>
<td>High share of Oss projects in portfolio or high average investment sum in Oss</td>
<td></td>
</tr>
<tr>
<td>Investing in young projects</td>
<td>High average investment sum in Oss</td>
<td>High share of Oss projects in portfolio or high average investment sum in Oss</td>
<td></td>
</tr>
</tbody>
</table>