Valuation of venture capital backed firms - guess or professional judgment of agency risks and observable firm characteristics?

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Abstract

Valuing young and innovative companies is a challenging task. Still, determining their economic value is one of the most important issues for investors and entrepreneurs engaged in venture capital financing. We analyze how venture capitalists determine enterprise values of their portfolio firms. We find that the anticipated magnitude of agency risk is a major value driver for young and innovative firms. However, even taking into account agency risks, accounting information and observable firm characteristics remain important value drivers. As a result we provide a valuation framework in which venture capital backed firms may be valued as precise as publicly traded firms. This shows that valuation of venture capital backed firms is not a guess.

JEL classification: G24, G32
Keywords: valuation, venture capital, agency risk, investment opportunity, accounting information

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1. Introduction

Anecdotal evidence suggests that the valuation of young and innovative firms is often a guess, May and Simmons (2001). This assumption may not be unreasonable as these firms exhibit only short term historical information, high levels of uncertainty and no benchmark valuations due to the innovativeness of the underlying project. Apart from business risk, by definition entrepreneurial success is closely tied to the entrepreneur as a person, which may lead to severe information asymmetries between the founder and the potential investor.

To cope with uncertainty a primary approach in venture capital is financial contracting. To overcome agency risks, venture capital investors arrange milestone based capital infusion, Gompers (1995), make use of complex covenants, Kaplan and Strömberg (2003) and form syndicates, Casamatta and Haritchabalet (2007). Unfortunately, failure rates of 30%, Cumming and MacIntosh (2003), and negative internal rates of return for many venture capital investors suggest, that the expected development of young and innovative firms is far from foreseeable. Inevitably, financial contracting within venture capital is never complete. Therefore, despite all risk mitigating efforts venture capital investors face tremendous risks.

Within the corporate finance literature, the standard instrument to cope with risk in firm valuation[1] is to discount expected future cash flows with appropriate risk adjusted cost of capital, Rubinstein (1976) and Koller, Goedhart, and Wessels (2005) amongst others. On the contrary promising assumptions about firm prospects will result in higher expected cash flows. That these prospects may be huge can easily be seen by the success of venture backed firms such as eBay or Google. Given the high risk but also significant prospects to earn money within this industry it is straightforward to assume that risk and opportunity assessments may have severe impact on firm valuation. Astonishingly, this issue has rather been neglected within venture capital research. Although, determining the fundamental value of an innova-

[1] Since debt plays such a minor role for venture backed firms, we use enterprise value, equity value and firm value interchangeably. Still, in a strict sense the analyzed firm value represents the equity value.

tive project is one of the most important issues for venture capital investors and entrepreneurs seeking capital.

In this paper, we explore the impact of venture capitalists' risk and opportunity expectations on entrepreneurial firm valuations. But what will risk and opportunity assumptions be based on? Prior accounting research, such as Hand (2005) and Armstrong, Davila and Foster (2006), finds that financial statement items, such as cash and revenues, and non-financial but also externally observable firm information, such as number of patents, drive firm values of venture capital backed companies. Still, their studies rely only on public information. For this reason they cannot control for any degree of informational asymmetries. However, asymmetric information and agency risks are one of the key issues venture capitalists face as addressed in Kaplan and Strömberg (2004). Based on their analysis we employ direct measures of agency risks and strengths and analyze the impact on firm valuation. Thereby, we address two closely interrelated research questions. First, is it a guess or do value drivers exist that are commonly applied in venture valuation? Second, given that one knows about these value drivers, is a precise value estimate for young and innovative firms possible? To answer these questions, we use a unique, hand-collected data set of 294 venture capital investments of 339 different investors from 1999 to 2008. Our results are as follows:

Venture valuation is not a guess. Venture capitalists base their valuations on common factors. Within the venture capital market, expected agency risk and strength assessments play a key role in venture valuations. Investors' perceptions regarding investment opportunity, management team, deal terms and financing environment are key factors in explaining start-up equity values. Still, even taking into account all privately available information, financial statement information and externally observable firm characteristics, such as patents, are able to explain a significant share of variation in venture valuations. Using all three information sets in a regression framework, variation in pre-money valuations can be explained

up to 63%. Additionally, given that one is conscious about the importance of agency risk and strength assessments, non-financial information and financial statements, precise valuation of venture backed firms is possible. Using a simple regression valuation approach we are able to achieve out of sample forecast errors of less than 36% in 126 venture capital transactions for the years 2006 to 2008. This is a remarkable result if put into perspective to the valuation errors of publicly traded, mature firms, which are seldom better than 30%, Francis, Olsson and Oswald (2001). We contribute to the literature in two ways:

First and foremost, we show that investors' expectations about agency risks and firm prospects play an important role in venture valuations. Investors impose risk discounts, a firm value penalty for expected risk, when they deem the founding team inexperienced, price additional monitoring costs due to moral hazard risks and charge for hold-up problems induced by complex product development strategies. These effects are economically large. E.g. whenever venture capital investors notify an internal risk given by an inexperienced management team, firm equity values drop by 22%. On the other hand, venture valuations rise once investors notify investment opportunities. With each additional internal firm strength, such as positive prior team performance, valuations rise by 19%. Being conscious about the price effects of these factors may help investors and founders alike to reduce double sided informational asymmetries.

Second, within this study we analyze the value relevance of financial statements, non-financial information and agency risks and opportunity expectations for venture capital backed firms. We find that given these information sets, precise valuation of young and innovative firms is possible. For skilled venture capitalists, the valuation of their firms is no guess. In fact, the professional judgment of agency risk and business strength, combined with hard facts, like financial statement information and other observable factors such as the number of patents leads to precise value estimates. Additionally, even solemnly relying on the

hard facts alone explains a considerably share of variation (51%) in young and innovative firms' equity values. Therefore, our findings will help entrepreneurs and co-investors alike to determine an indicative value for their firms by relying on financial statement items and other observable factors, such as patents or market conditions.

The remainder of this paper is structured as follows. Section 2 presents theory and hypotheses on the value drivers of young and innovative firms. Section 3 presents our sample and section 4 carries out the empirical analysis. Section 5 presents valuation errors and section 6 deals with robustness checks. Section 7 concludes.

2. Investment prospects, agency risks, financial and non-financial value drivers

To value an entrepreneurial firm venture capitalists need information about the risks and prospects of the investment opportunity. This information is obtained through extensive due diligence activity. To evaluate risks and strengths investors basically can rely on three different sources of information: more or less subjective assessments of the venture's strengths and weaknesses, objective non-financial information and -if available- information drawn from the balance sheet and the income statement. Within this context prior literature, Hand (2005), established that hard factors such as financial statements and non-financial information, e.g. patents or firm age will both be value relevant. Besides these two information sources, venture capital theory suggests that especially agency risks play a pronounced role in the financing of young and innovative firms. Astute investors will price the risk they face. Therefore, Jones and Rhodes-Kropf (2004) argue that investors use discount rates in the evaluation of investments to compensate for the risks their investments bear. While risks are important for valuation, on the contrary significant upside potential

must be given in order to induce investments in start-up firms in the first place. Thus, the value of any start-up will be primarily driven by the investment's prospects. This has two reasons: First, given the moderate amounts invested in early stage rounds, venture capital investments incorporate an options structure as argued by Wu and Knott (2006). Second, being agents, venture capitalists have to justify their investments to their limited partners; consequently their focus will primarily be on investment opportunities.

Before going into details a clarifying remark about the notion of risk and strength is necessary. If a characteristic is marked as a risk factor it is not meant in the sense of volatility or any other dispersion measure but as a realized weakness that lead the venture capitalist to be concerned about a substantial threat of severe losses. Strength on the other hand indicates that the venture capitalist realizes an opportunity to earn high returns.

2.1 Agency risks and investment prospects

Within their seminal article Kaplan and Strömberg (2004) classify the venture capitalists' assessments of the venture's risks and strengths into three major categories that influence venture capitalists' investments: internal, external and execution risks and strengths. The first group primarily consists of uncertainties about which the entrepreneur is better informed than the venture capitalist. External risks and strengths are factors that are equally uncertain for both parties. Finally, there may be firm risks and strengths related to both, internal and external factors. In the sense of Kaplan and Strömberg (2004) these are factors primarily related to the business concept and its execution.

Internal risks and strengths are centered on the entrepreneur. Amit, Glosten, and Muller (1990) argue that at the heart of entrepreneurial success lies the entrepreneur's ability to combine tangible and intangible assets in such new ways to deploy them to meet

customers' needs in a manner that cannot be imitated easily.[2] This ability may be known to entrepreneurs but unknown to potential investors. To cope with inexperienced teams and uncertainty investors will monitor and control firms more closely, Sapienza and Gupta (1994). Given that the investor's managerial resource is scarce and effort costly, as expressed by Kanniainen and Keuschnigg (2004), an investor will assign deal terms in which he is compensated for additional efforts dealing with an inexperienced founding team. Furthermore, the venture's success depends critically on the entrepreneur's willingness to work hard. Both, the entrepreneur's skills and the effort he spends are known to the entrepreneur but are difficult to observe for the venture capitalist. Next to risks and strengths related to the founder, the value of an investment might also be influenced by potential syndication partners. As Casamatta and Haritchabalet (2007) argue, syndication partners can mitigate risks of adverse selection. Additionally, co-investors may discipline the management team in the sense of Brandner, Amit and Antweiler (2002). Assuming that different investors possess different expertise the existence of several investors may also increase a firm's prospects with regard to product development or the speed at which the firm enters new markets. On the other hand, different investors might pursue different goals so that syndications might even increase agency problems as stated in Cumming (2005). Thus, syndication may either be seen as an internal risk or as an opportunity. Summing up, while there are other deal specific issues to be considered within this category, we argue that internal factors evoke primarily out of informational asymmetries between founder and investor.

External risks and strengths include contingencies that are equally uncertain to both parties. Typical risks are related to unforeseen incidents in technical feasibility and the costs of product innovations, to the size and growth of sales markets, to the reaction of

[2] Even though this view has recently been challenged by Kaplan, Sensoy and Strömberg (2008), management quality and post investment entrepreneurial behavior still remains a key issue in venture capital investing.

competitors upon the product's introduction etc. On the contrary prospects may be huge once a portfolio firm shows the potential to establish an absolutely new market such as firms like eBay or Google. Additionally, consider the financial effect of FDA approval for a newly developed drug against cancer. Another source of external impact is the financial market's condition at the time of the exit. Cumming and MacIntosh (2003) find that market receptivity at the time of the exit strongly affects exit channels. With significantly different return expectations for initial public offerings versus buy backs and secondary sales uncertainties about the exit market conditions are a major source of concern for the investor. These influences may be even more pronounced under the possibility of entrepreneurial moral hazard. Given unfavorable market conditions, the founder's share in the firm becomes less valuable and he might be inclined to work less hard.[3] Therefore, it is reasonable to assume that risks of moral hazard increase with market downturns as argued in Dessein (2005), where external uncertainty will make monitoring efforts more costly. On the contrary, favorable market conditions may lead to increasing entrepreneurial efforts which in turn will reduce monitoring costs and increase firm value.

There may be firm risks and strengths that are not exclusively related to internal or external factors. This is particularly given in situations where the venture entails the development of a highly complex technology or a business strategy in a volatile environment and the venture's success critically depends on the entrepreneur's skills. First of all, the more complex the underlying innovation, the more complex it is to find a proper valuation benchmark for this firm. For this reason risks of adverse selection will increase with the firm's execution uncertainty. Second, contractual incompleteness gives rise to potential post-contractual disputes about the business strategy and exposes the venture capital investor to the risks associated with hold-up problems. The latter is of special

[3] This argumentation follows Casamatta (2003), where entrepreneurial effort is driven by expected returns in the good and in the bad state of the world.

concern to the investor in cases in which the entrepreneur's human capital is particularly valuable to the product or technology development because the entrepreneur can credibly threaten to leave. The hold-up problem addressed in Hart and Moore (1994) is therefore likely to be greater in entrepreneurial firms with severe complexity. But unlike an internal risk, the agency problem associated in this category arises out of potential moral hazard in combination with the complex business strategy. Therefore, risks and strengths related to the business strategy and the product or technology development are decisive for a smooth execution of the venture contract.

Hypotheses development

Kaplan and Strömberg (2004) relate these three risk and strength categories to distinctive features of venture capital contracts. Because financial contracts will never be complete, it is also straightforward to assume that different types of agency risks and firm prospects will have a different impact on the valuation of venture capital backed firms. Additionally, we argue that the relation between firm agency risks and prospects differs for the three distinctive categories presented in the last section. Although all three categories are closely intertwined and are difficult to disentangle in reality our sample provides some insight into the relative importance of the respective categories in each investment. To know about the relative importance of each risk and strength category is of severe importance to founders and investors alike. From an entrepreneur's point of view our analysis shows the value relevance of firm risks and strengths disentangling effects he will be able to influence, such as the management team, from effects he won't be able to influence, such as the market environment. To know about the value of a complete management team may therefore help to shape the entrepreneurial team even prior to the search for potential investors.

Additionally our approach allows for a more differentiated pricing of venture capital backed firms.

Internal risks and strengths

Within the last section we argued that internal uncertainties arise because the entrepreneur is better informed than the venture capitalist. In the sense of Jensen and Meckling (1976) costs related to informational asymmetry are the sum of monitoring expenditures by the principal, bonding expenditures by the agent and the residual loss. From the venture capitalist's perspective only monitoring costs and the residual loss are relevant. Primarily, firm risk expectations will increase both factors while the notion of an internal strength should lower monitoring and residual loss expectation. Lerner (1995) reports that monitoring costs for venture capitalists are substantial given the costs associated with frequent portfolio firm visits and intensive operational involvement. The rational venture capitalist will invest in monitoring activities as long as the monitoring costs will be outweighed by an increase in his financial claim's market value. As a result agency problems will remain unresolved to some degree and the corresponding reduction in the firm's market value creates the residual loss. Both, monitoring expenditures and the residual loss will lower the venture capitalist's expected return and consequently the market value of his financial claims. Therefore, it is straightforward to assume that both factors, monitoring costs and residual loss, will be related to his expectations about the firm's risk and strength. Whereas agency theory does not provide any clear-cut predictions about the relationship between the degree of agency risks and the associated agency costs it seems reasonable that agency costs will tend to increase with the severity of perceived internal risks. On the contrary, agency costs will be reduced given that the founding team owns reliable skills, a proven track record or the venture capitalist faces an experienced co-investor. Such positive

deal characteristics will lower the need for monitoring and thereby reduce residual losses. Still, given the investor's informational disadvantage, and entailed monitoring costs to keep the company on track, we should expect internal risks to have a stronger impact on valuation than internal strengths. To some extend, this view has already been expressed by Brennan and Kraus (1987) who state that rational investors will assume a worst case scenario due to the presence of adverse selection risk. The following hypothesis sums up the above discussion:

H_RS1: Internal risks (strengths) lead to lower (higher) values of the venture capitalist's financial claim. The negative impact of internal risks is stronger than the positive influence of internal strengths.

External risks and strengths

Venture capitalists hold equity like claims in their portfolio firms with substantial upside and downside potential. In this context standard capital market theory predicts that external uncertainty will affect the value of the investor's financial claim only to the extent that it is non-diversifiable. Given that the typical venture capital firm's portfolio size is rather small a substantial part of idiosyncratic risks remain in the overall portfolio risk profile as discussed by Jones and Rhodes-Kropf (2004). Moreover, costly monitoring may be positively related to external uncertainty. But, as the venture has real option features we expect that external factors that are assessed as strengths have a stronger impact on the value than those that are marked as risks. This leads to our second hypothesis:

H_RS2: External factors that are assessed as strengths lead to significant higher pre-money values whereas external risks (negatively) affect valuation to a lesser degree.

Execution risk and strengths

With respect to execution risks and strengths, Kaplan and Strömberg (2004) find a negative relation with the presence of typical contractual terms such as contingent compensation and venture capitalist's control and liquidation rights. Instead founder vesting provisions are frequently used to mitigate the hold-up problem. As far as these provisions cannot resolve the hold-up problem perfectly execution risks will have a negative impact on the value of the venture capitalist's financial claim. Execution strengths, by contrast, can be interpreted that hold-up problems are of minor concern to the investor. Execution strengths, therefore, are expected to lead to higher pre-money valuations.

H_RS3: Execution risks (strengths) have a negative (positive) impact on the value of venture capitalist's financial claims.

Within the last section, we argued why expected agency problems might be important in venture valuation. However, expected agency perceptions are primarily individual investor's assumptions. They may depend on the investor's experience but also on recent success, general risk awareness, his opinion on market and industry developments, actual fund liquidity and portfolio constitution. From an entrepreneur's point of view, he cannot accurately predict whether the potential investor assumes his business as extremely risky or rather assumes huge prospects of success. The negotiating of firm values is therefore subject to severe uncertainty. Still, besides assumptions about risks and prospects, there are several qualitative but observable factors that are seen to influence venture capital investments.

2.2 Non-financial information

Inderst and Müller (2004) show, that capital market characteristics affect the value of high technology companies disregarding their fundamental values. With growing capital supply, competition for target firms increases and with that investors' bargaining powers decrease as documented in Gompers and Lerner (2000). As fund inflows into the venture capital industry vary significantly with time, venture valuations might therefore be subject to economic cycles.

Chan, Lakonishok and Sougiannis (2001) argue that the valuation of high technology firms is especially challenging. Due to the innovativeness of the technology, benchmark firm valuations are often missing and therefore estimating firm value becomes more uncertain. Additionally, those firms often possess only negligible physical assets. Given that financial statements are weak at reporting intellectual assets, for high research and development (R&D) intensive firms reliable audited accounting information is less relevant. Facing higher uncertainty for these firms, it might be that investors use risk discounts in the valuations of technology firms.

Chan et al. (1997) explore the value of alliances for publicly listed firms. They find that firms entering into strategic alliances exhibit superior operating performance relative to their industry peers. This might be even more important with regard to venture financing. Cooperation partners play two significant roles. First, there is a certification effect. The willingness to cooperate with the newly founded venture shows interest in the underlying innovation. Thereby, the existence of a cooperation partner verifies potential market acceptance. Second, especially cooperation partners out of the venture's industry might play significant roles in overcoming product development barriers. Entering a strategic cooperation with a large and well established industry player might help to get access to

their resources and expertise. For these reasons the existence of cooperation partners should increase firm values.

While in general accounting information is seen to be of less use to capture the strengths of young and innovative technology firms, for public equity markets Deng, Lev and Narin (1999) find that the number of patents filed by a company increases its market to book ratio as well as stock return performance. With regard to venture capital, Lerner (1994b) finds that the number of patents is positively related to pre-money values for biotechnology firms. To some kind, awarded patents possess certification effects as an external patent institution assumes the underlying innovation to be unique and protectable. Additionally, given that awarded patents protect against firm substitution, they will help to defy market position. The existence of patents thereby provides a verifiable proxy for potential investors with regard to intellectual property protection. Therefore, we would expect that a firm's number of patents increases firm value. While this holds true for life science and medical related industries, this is not necessarily the case in other industries such as software firms where legal protection of intellectual assets might be more complicated. In these industries prototypes by contrast to patents are often used to monitor project development. Although it is not yet a patent protected asset and often does not possess any liquidation value, it is a clear hindsight of firm development and indicates opportunities of product development. Regarding this line of reasoning, the existence of prototypes might therefore increase firm values.

Cumming (2005) and Kaplan and Strömberg (2003) document the impact of firm maturity on financial contracting. While Timmons (1990) reports failure rates of 40% within the first year after foundation, default rates for entrepreneurial firms decline with growing firm age as addressed in Stinchcombe's concept of the liability of newness, Stinchcombe (1965). As firm maturity proxies we use firm age and the round number in

which the firm receives financing. Both are observable variables. We assume certification effects from round numbers with regard to uncertainty. While firms in their first round of financing are riskiest, follow up investments become less risky due to the growing track record. The same holds true for firm age. Therefore, we assume higher pre-money values for more mature firms.

Manigart et al. (2002) argue that venture capital investors might pursue other than purely financial goals depending on the goals and preferences of their backers. They find that the required return investors expect of their investments is depending on investor types. For this reason it is straightforward to assume that investor governance might also influence venture valuations. For corporate backers, next to investment returns, important project outcomes might include innovation, knowledge transfer and other synergies. Thus, we assume that they are in general willing to pay for strategic synergies which will result in higher pre-money values. However, as addressed in Hellmann (2002), there may be situations, in which corporate investors are able to provide superior support than purely financial investors. In that case, given the non-financial investment of support, it may also be that corporate investors are rewarded with lower pre-money values.

Within the last section we argued that qualitative but observable information may have influence on venture backed firm values. We subsume our assumptions in hypothesis two.

H_NFS: Equity values rise with the number of patents, prototypes, cooperation partners, fund inflows and firm age.

While the venture capital literature focuses primarily on non-financial information, historical accounting information is a key input in standard valuation models, Damodaran (2002) and Koller, Goedhart and Wessels (2005).

2.3 Financial statement information

Although financial history is often short and sometimes not existent, recent accounting research, Hand (2005) and Armstrong, Davila and Foster (2006), finds that historical financial statement information is also highly relevant in explaining pre-money values of venture capital backed firms. Within their analysis, they focus primarily on three balance sheet items: cash, noncash assets and long term debt and the main components of the income statement which are revenues and capital expenditures.

Demers and Lev (2001) analyze the role of cash-burn rates, the pace at which non profitable technology firms invest money, for the value of publicly listed internet firms. They find cash-burn rates in relation to actual cash holdings affect firm values negatively. Within their argumentation, cash proxies a liquidity reserve. The higher actual cash reserves, the longer the firm may sustain cost intensive product development periods. Therefore, especially in venture capital financing cash levels may be a severe concern for investors.

Next to the liquidity argument of cash reserves, noncash assets, defined as total assets minus cash assets, are, taken together with cash assets, an observable proxy for firm size. According to the standard valuation framework of enterprise value to total assets ratio and in line with Hand (2005) we therefore assume that firms with higher total assets will receive higher pre-money valuations. By contrast, long term debt obligations are assumed to reduce pre-money values as they are corporate liabilities that have to be settled once they are due. Finally, Hand (2005) and Armstrong, Davila and Foster (2006) argue that R&D

expenditures are value increasing as they can be regarded as investments into the innovation.

Summing up, we assume that financial statement information is relevant in explaining entrepreneurial firm values. Most financial statement variables ought to have identically impact in public and private equity markets. Thereby cash holdings and noncash assets should increase firm value while long term debt and selling, general and administrative expense (SG&A) decrease value. Contrary to public equity markets, research and development expenditures may be seen as investments and are therefore regarded as value enhancing.

H_FS: Equity values rise (fall) with higher cash, revenues, total assets and R&D expenditures (long term debt and SG&A).

3. Data

3.1 Sample origination

Our analysis is based on 294 venture capital financing rounds by 339 different venture capital investors. Due to syndication this sample covers 1059 individual investments. We use a hand-collected data set from Kreditanstalt fuer Wiederaufbau (KfW) which is the largest promotional bank in Germany and also supports the financing of innovative firms. Owing to the sensitive nature of the analyzed data in this project we went into a research cooperation agreement with KfW to guarantee that all analyzed data will be collected strictly anonymously and considered confidential. Within the venture capital program, entitled as ERP Start Fund, KfW invests as co-investor into technology firms on a pari passu approach, i.e. on the same conditions as the lead investor. To apply for KfW co-financing, venture capital investors provide all relevant internal documents regarding the

investment opportunity. As a minimum, these are: complete due diligence concerning management team, product, technology and innovation, legal issues, market, competition, business strategy, historical financial statements, valuation, invested amount, planned exit scenario, risks and strengths and external surveys. All internal documents regarding the investment decision which are: explanation of the technology, market and competition analysis, expectations about market volume, potential market shares and patent situation. Founders' resumes and founders' qualification appraisals, articles of association, shareholders' agreements, by-laws and cooperation contracts. Based on these documents we were able to follow the complete investment process of the involved venture capital investments.

3.2 Sample selection issues

In this section we address potential selection biases of our sample. First of all we only see investments in which Kreditanstalt fuer Wiederaufbau participated as co-investor. Therefore, our sample might be biased towards deals for which the lead investor strives to share his investment with KfW as syndication partner. However, with regard to this argument we find that on average, 72% off all transactions are syndicated (not considering KfW) and four investors syndicate on average within each of the 294 analyzed transactions. Therefore, we assume that our sample is not biased towards KfW as a co-investor. Second, KfW only acts as a co-investor if the investment opportunity is primarily based in Germany. Thus our sample could be biased towards firms with headquarters in Germany. Still, within our analysis we primarily focus on the pricing of venture backed firms by their investors. Lead investors in our sample are not reduced to German investors. We find several among them from the United States, Europe and the Middle East. Therefore, we assume that a selection bias towards German innovative firms does not bias our results on the value

relevance of financial information, non-financial information and investors' risk and strength perceptions.

Overall we acknowledge that the sample is somewhat selected and the extent of any bias is unknown. Still considering the obvious biases mentioned above we do not see any major issues impairing our research question.

3.3 Data description

Our data comprises information about 294 venture capital investments in 168 innovative firms between January 1999 and May 2008. The details of these transactions are given in Table 1.

----Please insert Table 1 approximately here----

Panel A indicates that out of the 294 investments, 195 had cooperation partners, i.e. the funded firm already possessed a partner to cooperate in product development, research activity or market entry.

Panel B reports individual firm information. On average firms are 38 months old by the time of financing and posses about 6 patents. The median age of exactly three years shows that the firms within our sample are mainly early stage investments.

Panel C reveals the number of deals by year. Out of the 294 investments, the majority of deals (214) took place following the year 2004. For this reason our analysis is one of the rare opportunities to analyze investments after the new economy downturn.

Panel D shows that the industry range targeted by venture capital investors is rather focused. We distinguish between life science (biotech and medicine technology) firms, internet and telecommunication, traditional high technology companies, industrial manufacturing

companies and other industries. While the investment focus clearly lies on life science firms (139) there are also several traditional high technology companies (65) producing lasers and optoelectronic equipment.

Panel E reports worldwide yearly inflows in million Euros into venture capital funds for the time period January 1999 until May 2008 as reported by Thomson Venture Economics. What can be seen is the variation over time. With commitments of 170 EUR bn. in 2000 the fund inflows decline to 16 EUR bn. in 2003. We use this information to construct a variable ww_fund_inflows. For each transaction date ww_fund_inflows measures aggregated worldwide fund inflows over the preceding four quarters.

Table 2 summarizes median financial statement and valuation data by investment round. Panel A gives an overview of the financing round distribution.

----Please insert Table 2 approximately here----

On average the start up firms received the second round of financing. Compared to other studies, such as Hand (2005) and Armstrong, Davila and Foster (2006), the observed firms are younger and smaller and therefore represent a typical venture capital portfolio as reported in Kaplan and Strömberg (2003).

Panel B reports median pre- and post-money values on a round to round basis. Pre-money values steadily increase beginning with a median of 1.9 Mio. EUR for first round investments and a median of 8.5 Mio. EUR for rounds higher than four. Still, the agreed pre-money values vary significantly within all investment rounds. Even for controlling for extreme outliers, that is taking the 90% decile – the 10% decile, we find a significant range of pre-money values of 6.5 million EUR within round one and up to 12 million EUR within rounds larger than three. For further evidence of the significant difference in determined pre-

money values, Figure 1 reports the range of values by investment round and key industries. Median post-money values by round vary from 2.9 Mio. EUR up to 12.7 Mio. EUR.

Panel C reports median founder's and lead investor's equity share distributions by round. Overall, the founding team owns 53% of the venture backed firm. However, their share decrease steadily, as the firm becomes more valuable. Owning 70% of all shares in investment round one, the founders' equity shares decrease to 24% in rounds higher than four. Still, by that time, their shares are worth about 3.1 million EUR. For further evidence, Figure 2 gives an overview of post-money firm value and entrepreneurial share distribution by round. By contrast, the lead venture capitalist's stake does not increase with the pace of entrepreneurial shares decrease. Lead investors hold median shares of 19% in round one, 20% in round three and 32% in rounds larger than four. This shows that early lead investors primarily care about anti dilution. When additional capital is raised in rounds two or three, new co-investors finance the additional amounts, while the first round investors only increase capital in those amounts to retain their equity stakes.

Panel D reports financial statement information per round. For each investment, we obtain data from the previous year's financial statement. First of all it is noteworthy that 51 out of the 294 investments were done without any historical financial statements available. Of course, the majority of cases in which financial statements are not available take place within the first two rounds (49). In one deal, the lead venture capitalist did not rely on financial information within round five as the underlying firm was subject to recent merger activity.[4] We observe a pattern for increasing median values for almost all financial statement items except net income which becomes increasingly negative from round to round.

[4] The inclusion or exclusion of this transaction from the analysis does not quantitatively influence our results.

In line with Kaplan and Strömberg (2004), we base our analysis on agency risks on the internal due diligence and investment memoranda provided by the venture capital investors. These investment memoranda are most often a document prepared by the lead investor's investment manager to inform senior management about the investment opportunity. Analyzing those documents, we note whether specific categories were named as firm risks and strengths. Table 3 gives an overview of the risks and opportunities associated with our sample. All reported factors are dummy variables that become one, once the specific characteristic was named within the investment proposal.

----Please insert Table 3 approximately here----

Panel A reports internal investment characteristics investors explicitly mentioned within the investment recommendation. We distinguish between management quality, previous management performance, financial structure/funding, co-investors and the actual portfolio fit. Column one reports the frequency investors mentioned these factors as risks. Column two reports the times investors mentioned these factors as strengths.[5] With regard to non diversifiable internal factors, management quality is a major concern for most investments. In 126 out of the 294 investments, the investor mentioned risks with regard to management quality. Exemplary comments are the lack of business experience or strong dependencies on one key founder. On the opposite, management quality is also a major issue in evaluation start-up's opportunities. In 73% of all investments, investors mentioned management quality as favorable. A typical assessment is: "Management team is fully established. The CSO is one of the world's leading researchers on that topic. CEO and CFO are both financially committed and have very good business contacts." Additionally, we find that management

[5] Deviating from Kaplan and Strömberg (2004) we do not report internal risk/strength with regard to valuation. Including investor's valuation assessment might lead to problems of endogeneity.

risk and strength evaluations are mostly independent from each other. By way of example we do find that investors evaluate the scientific strength of the founders as positive, still argue that the team misses an experienced CFO. Previous performance is cited as a risk in 12% and as a reason to invest in about 41%. Exemplary risks of previous performance are: “Founding team missed milestones in previous round”, or “Management delivers liquidity status too late and incomplete”. As a reason to invest investors see factors like having a serial entrepreneur on board or that the firm is in schedule with the business plan from the previous round. Funding is mentioned as problematic in about 16% of all investments. A typical concern is illiquidity: “Have to find new co-investor before break even is reached”. As a reason to invest, funding is only mentioned in 7% of all investments, e.g. “financial structure ensures downside protection in case of bankruptcy event”. Finally, the role of co-investors and general portfolio fit is addressed. Only 9 out of the 294 investment recommendations cite co-investors as a threat. An exemplary evaluation is: “There are substantial frictions among existing investors”. In about 15% co-investors are seen as a reason to invest, often when corporate co-investors possess extensive product and technology knowledge. Six times investors mentioned risks of portfolio fit. This was the case when they thought themselves not that experienced in the specific industry. In 9% investors mentioned positive effects of portfolio fit, mostly when they were well experienced within the industry. To construct the aggregate variables internal risk and internal strength, we calculate the mean over the five dummy variables management quality, previous performance, funding, co-investors and portfolio fit.

Panel B reports external factors that investors mentioned within the investment recommendation. Market size was seen as threat in only 18%. A typical example is: “unsure about market potential as there is no market yet”. By contrast, 63% of all proposals deemed the market as potentially large and underdeveloped. Risks of competition seem to be a major threat in venture capital investing as almost 70% of all investment proposals refer to

them. Less often (44%) the opportunity of non existent competition is highlighted. Firm strengths with regard to the likelihood of customer adoption are mentioned in about 44%. First order entry or positive customer feedbacks on prototypes are typical examples. Risks of customer adoption are noted in 34%. Finally, positive financial market conditions with regard to refinancing or a scheduled exit are noted in about 30%. Risks by financial markets seem to be less severe. They are mentioned in only 13 proposals, e.g. “extremely difficult to find follow on financing for early biotech firms right now”. We construct the aggregate variables external risk and strength by calculating the mean over the four dummy variables market size, competition, customer acceptance and financial markets.

Panel C reports factors that relate to execution difficulties and opportunities of product development and the business strategy. With regard to product development, investors name missing proof of concept or potential obstacles in about 58%. Product strengths are noted in 87%. Finally, the implemented business strategy is seen almost as often as a risk (40%) as it is seen as strength (32%). Exemplary arguments are: “The expansion into middle east markets guarantees first mover effects” or “Growth strategy hinders quality improvement”. To construct the aggregate variable execution risk/strength, we calculate the mean over the two dummy variables product development and business strategy.

Overall it is noteworthy that we face significantly more reasons to invest (1305) than risks associated with the investment (881). This is naturally the case as we only observe positive investment recommendations. Still, we do not believe that our sample suffers from any form of selection bias as without a positive investment recommendation, venture backed firms do not possess any positive net present value.

Table 4 presents pairwise correlations across our explanatory variables.

---Please insert Table 4 approximately here----

All explanatory financial variables are log transformed according to $\log_e[Z+1]$ from the most recent fiscal year immediately prior to the valuation date.[6] To construct the aggregate variables internal, external and execution risks and strengths, we calculate the mean over the dummy variables shown in Table 3. Round reveals the actual financing round. Prototype is a dummy variable that becomes one if the portfolio firm possessed a prototype at the time of investment. Cooperation partner shows whether the firm already had a strategic cooperation by the time of the investment. Corporate lead investor is a dummy variable for corporate lead investors. Age denotes firm's age in months and patents the number of awarded patents by the time of the investment. ww_fund_inflows measures world wide fund inflows into the venture capital industry in EUR mil. within the four quarters prior to the investment date. This information is taken from Thomson Venture Economics Database. We find rather strong positive correlation for all financial statement variables. This result is not surprising, as expenses intuitively rise with growing firm size.

Except for the correlation between noncash assets and R&D and SG&A and noncash assets, none of these correlations exceed 0.6. These results suggest that the explanatory variables are not likely to be redundant. In addition, as Judge et al. (1985) suggest that correlation coefficients should be considered harmful if they exceed 0.8, there seem to be no problems regarding multicollinearity. Nevertheless, for additional robustness we conduct the variance inflation factor test (VIF) based on the regression of an explanatory variable on all other explanatory variables (not reported). As a result collinearity does not appear to be a serious

[6] We add one to each observation, as we face several pre-revenue or zero patent firms. For these firms it would not be possible to calculate the log of zero.

problem in interpreting the regression. None of the VIF coefficients exceeds values larger than six.

4. Explaining venture valuations

Many papers have studied the role of agency risk in venture capital contracting. Sapienza and Gupta (1994), Gompers (1995), Kaplan and Strömberg (2003 and 2004) and Cumming (2005) analyze venture capital investments and find that agency risks influence security selection, the use of covenants, syndication, monitoring and staging. Still, agency risk effects on venture valuations have never been considered explicitly.

Hand (2005) and Armstrong, Davila and Foster (2006) find that hard factors, i.e. financial statements and observable non-financial information, such as patents, is able to explain a significant share of variation in pre-money valuations. However, their analysis is detached from agency risks influences due to data limitations as stated by Hand (2005). Their variables thereby provide a well grounded framework, in which to analyze the influence of agency risk expectations on the valuation of young and innovative firms. Within our analysis we revisit value relevance by combining venture capital and accounting theory. That is, we explicitly take into account the role of agency risk expectations that are directly mentioned within investors' due diligence documentation, controlling for financial statement and non-financial information. To assess these influences, we use a log-linear model according to equation one.[7]

$$LnPREMV_i = \alpha + \sum_b \theta_b LnFS_{bi} + \sum_c \Psi_c LnNFS_{ci} + \sum_d \zeta_d \frac{1}{n} Risk_{di} + \sum_e \zeta_e \frac{1}{n} Strength_{ei} + \varepsilon_i \qquad (1)$$

[7] Using a log-linear model provides a more outlier robust framework than linear models and is the standard within the venture valuation literature, used in Lerner (1994a), Gompers and Lerner (2000) or Hand (2005).

Where LnPREMV is the natural log of firm i's pre-money value. LnFS is the natural log of all financial statement information. LnNFS represents the natural log of our qualitative and observable variables. Finally, we analyze impact of internal risk and strength assessment. Table 5 provides regression results of our multivariate analysis. All results are reported using robust standard errors clustered on the firm level, Peterson (2008). Model I to IV report results restricted to those 226 observations, where financial statement information was available. In Model V and VI financial statement information is not required extending the sample to 273 observations. We drop 21 observations due to missing valuation data.

---Please insert Table 5 approximately here----

Model I shows the explanatory power of financial statement information. All explanatory financial variables are log transformed according to $\log_e[Z+1]$ from the most recent fiscal year immediately prior to the valuation date.[8] We do find that a significant share of variation in venture valuations (R^2=40%) is explained by historical accounting information. The two balance sheet asset variables, cash and noncash assets, that is total assets minus cash, have the predicted sign (according to *H_FS*) and are statistically significant. Long term debt has the predicted negative effect on pre-money valuations but remains statistically insignificant which is in line with Armstrong, Davila and Foster (2006). In line with Hand (2005) we do not find significant value relevance of historical revenues. R&D expenses have a weakly significant positive impact on venture valuations. While investors deem R&D expense as innovation investments, rather than costs, non investment expenses such as selling general and administrative expenses reduce firm value.

[8] We add one to each observation, as we face several pre-revenue or zero patent firms. For these firms it would not be possible to calculate the log of zero.

Model II reports, according to hypotheses *H_NFS* and *H_RS*, value relevance of non-financial information and direct measures of agency risk and investment strength. In line with the particular importance of these factors within the venture capital literature, non-financial information has a larger impact on valuations (R^2=53%) than accounting information. Compared to investment rounds larger than four, valuations within financing rounds one to three are significantly lower. Of course, this is the more severe the smaller the round number. Next to investment rounds we control for industry variations. Compared to manufacturing firms, investors pay higher prices for firms within the life science industries. This is counterintuitive since technology firms might exhibit higher valuation risks as argued by Noe and Rebello (1996). Still, many investors specialize on technology investments and have a huge routine in technology investing. For this reason dealing with life science firms might therefore be no additional threat to them. We do not find that the existence of prototypes significantly increases venture valuations. Additionally, the firm age variable does not have a significant impact. Thereby getting older does not have additionally explanatory power given the round number of the investment. Reputation effects due to existing cooperation partners have a statistically significant and economically large impact on entrepreneurial valuations. Firms that possessed a cooperation partnership by the time of the investment had an enterprise value 38% higher than firms without established partners. The same relation holds true for the number of issued patents. While previous work, Lerner (1994b), finds that patents are value relevant for biotechnology firms, the same holds true for our sample of various industry types. With regard to investor governance, we find a negative impact of the corporate investor dummy on venture valuations. This result contradicts previous findings for the biotechnology industry, Lerner (1994a) and Hand (2005), in which corporate investors paid higher prices due to synergy effects. Still, analyzing hundreds of investment proposals, we find that corporate lead

investors often mention their superior management and technical support abilities. Being mostly major international corporations, corporate lead investors are often able to provide better supporting activities than purely financially interested investors. From an entrepreneur's point of view to associate with corporate investors may therefore be attractive. This view is supported in Hellmann (2002). Given a situation in which the captive investor sees the entrepreneurial firm as a technology complement, the entrepreneur might be inclined to favor corporate investors over purely financial investors due to superior support activities. This could result in lower prices as argued in Hsu (2004). To analyze the role of market influence on venture valuations, for each deal we calculate the worldwide fund inflows into venture capital over the last four quarters immediately prior to the investment. Controlling for investor's market assessment within the agency risk section, we do find that increasing fund inflows increase venture valuation. Still, this relation is statistically insignificant. This result might indicate that investors care about the market situation and price the perceived market development within their risk and strength assessment.[9]

Finally, we analyze the role of investors' directly mentioned risk and strength assessments. With regard to agency risks, we find the expected (compare *H_RS1*) strong and significant impact of internal risk assessments on round valuations. For each additional risk investors mention within the investment proposal, the firm's equity value drops by 22% (-1.091/5).[10] The effects of investors' external and execution risk perception are statistically insignificant. With regard to investment prospects we find support for *H_RS1*. Performing a Wald-test, we find the coefficient for external strengths (0.93) is significantly lower than for external risk (1.091). For both, external and execution strength, we find an economically

[9] Within Model IV we will show that not controlling for investor's agency risk expectations, i.e. dropping the variables internal, external and execution risk/strength, previous fund inflows significantly increase entrepreneurial firm valuations.

[10] Internal risk $\in$ [0, 0.2, 0.4, 0.6, 0.8, 1] is the average of the five dummy variables denoted in Table 3, Panel A, column one.

huge and statistically significant influence on firm valuation. This supports *H_RS2*, that external strength will be more important for the valuation of young and innovative firms than external risk. Finally, we do find mixed results for hypothesis *H_RS3*. While execution strength has a significant impact on venture valuations, execution risk is only of minor importance. Overall, we acknowledge the pronounced importance of opportunity assessments:

For each additional internal strength investors name within the investment proposal, the firm's pre-money value increases by 19% (0.926/5).[11] The recognition of each additional external opportunity, such as market size, no competition, likely customer adoption and financial market situation, yield to an increase in pre-money value of 33% (1.317/4).[12] Finally an increase in perceived opportunities of product development or business strategy success increases firm value by 27% (0.547/2).[13]

Model III reports the results of the full model according to equation one on those 226 observations where firms already had historical financial statement information at the time of the investment. Even taking into account non-financial information and investors' opportunity perceptions, financial statement information remains relevant in explaining venture valuations. The additional inclusion of financial statement information increases the total adjusted R^2 by ten percentage points compared to Model II. The two balance sheet asset variables cash and noncash assets remain statistically significant and the significance of long term debt increases. By contrast, we find the statistical significance of R&D expenditures reduced. Most likely as those effects are also captured within the number of patents issued, which also becomes less significant. Otherwise, the value relevance of non-

[11] Internal strength $\in$ [0, 0.2, 0.4, 0.6, 0.8, 1] is the average of the five dummy variables denoted in Table 3, Panel A, column two.
[12] External strength $\in$ [0, 0.25, 0.5, 0.75, 1] is the average of the four dummy variables denoted in Table 3, Panel B, column two.
[13] Execution strength $\in$ [0, 0.5, 1] is the average of the two dummy variables denoted in Table 3, Panel C, column two.

financial information, taking into account the full model remains unchanged from Model II. Investors' assessments also remain unchanged from introducing financial statement information. Being able to explain 63% of all variation within venture backed pre-money values, the model shows that venture capitalists are able to identify relevant value drivers and price firms accordingly.

However, from an entrepreneur's point of view it is difficult to assume which factors influence the investor's assessment on agency risk and upside potential. To address value drivers which are immediately observable also for entrepreneurs and outside investors, Model IV relies only on externally observable information. Ignoring the investor's agency risk and strength expectation reduces the explanatory power severely. The adjusted R^2 drops from 63% to 51%. Otherwise, relying only on externally observable factors can especially help founders to assess their firms' values. In line with Model I and Model III firm's cash reserves play an important role in explaining venture valuations. Additionally, increasing long term debt and non R&D related expenses reduce firm values. Within the non-financial variables round and industry dummies are significant in line with the previous models. The strong impact of fund inflows once agency risk expectations are ignored, that is dropping the variables internal, external and execution risks/strengths, reveals the importance of market characteristics as argued by Inderst and Müller (2004). The result shows that investors care about the market situation and price the perceived market development within their risk and strength assessments. Overall, Model IV confirms, that while entrepreneurs and outside co-investors do face less transparency in venture valuations, a severe amount of uncertainty can be reduced simply taking into account externally verifiable financial and non-financial qualitative information.

Model V extends on Model IV by taking into account all observations. For this reason we ignore financial statement availability. This increases the sample by 47 observations where financial statements were not yet available at the time of the investment. Even disregarding financial statements, 37% of variation in pre-money valuations can be explained by qualitative observable information. The key value drivers remain unchanged to Model IV despite that the economic impact of awarded patents increases in the absence of financial statement information.

Model VI adds investors' assessments to non-financial variables still ignoring financial statements. The significant increase in adjusted R^2 (+18 percentage points) shows the importance of professional judgment within venture valuations. Even not taking into account financial statement information, 55% of all variability can be explained within Model VI.

5. Valuation errors

Within the empirical section we established the influence of three different information types on the assessment of pre-money values of venture backed firms: financial statements, non-financial information and investors' assumptions about firm risk and strength. While the explanation content of pre-money valuations rises with the inclusion of each additional type of information it is yet unclear whether the use of additional information will lead to more accurate valuations. To analyze the precision of different valuation models a standard approach in corporate finance studies is to compare model implied valuation errors. Prior studies generally reported valuation accuracy based on logarithmic errors, such as in Kaplan and Ruback (1995) or absolute relative percentage errors as in Francis, Olsson and Oswald (2000). For comparison, we report both error measures in Table 6.

---Please insert Table 6 approximately here----

Column one reports absolute log errors. Absolute log errors are defined as the ratio of the model estimated pre-money value to the pre-money value assessed in the actual investment. Column two reports absolute percentage errors. Absolute percentage error is the absolute difference between actual and model predicted pre-money value, scaled by the actual pre-money value. Panel A reports median in sample errors for the three major models analyzed in Table 5. Model I, the financial statement model, is based on Table 5, Model I using only the most recent financial statement information to predict pre-money values for venture backed firms. This approach yields median absolute log errors of 49% and median absolute percentage errors of 46%. Model II, additionally includes non-financial information and is based on Table 5, Model IV. The additional information set of non-financial but observable data yields to more accurate predictions, reducing median valuation errors about 7 percentage points. Model III additionally adds investors' risk and opportunity assumptions and yields to lowest median valuation errors of 37% for absolute log measures and 36% for absolute percentage errors. Of course, these error measures are strictly in sample and should be considered with care. Therefore, Panel B reports median out of sample valuation errors. That is, we used the first 100 observations within the years 1999 until 2005 to estimate the three different regression models. Based on these regressions, we performed out of sample pre-money predictions for the 126 transactions happening post 2005. Model I shows the results for the financial statement model. Compared to in sample results, median valuation errors increase resulting in 56% for absolute log errors. Still, this result shows that using only financial statement data venture capital investors are able to get an indicative pre-money value of a potential portfolio firm. Additionally, including non-financial observable variables, Model II, yields to moderately more accurate predictions producing out of sample valuation errors of 54%. The effect of adding agency risk and strength assessments is

shown in Model III. Compared to Model I and Model II there is a significant increase in accuracy resulting in median valuation errors of less than 40%. This result shows that for venture capital investors, the pricing of young and innovative firms is not a guess at all.

6. Robustness regressions

Within the empirical section, we divided our sample into 226 and 273 observations based on whether accounting information was considered or not. We found, that even not considering accounting information (sample of 273 observations) the regression model was able to explain a significant share of variation in assessed pre-money values. This approach may be questioned as we cannot assume that venture capitalists did not use financial statement information within their analysis. Therefore, we redo our analysis using the sample of 47 firm observations where accounting data was not available at the time of the investment. To cope with the decreased number of observations we exclude dummy variables for minor industries and rounds. Additionally, we exclude several insignificant explanatory variables. Table 7 reports our results for the 47 observations where accounting information was not available at the time of the investment.

---Please insert Table 7 approximately here----

Model I reports the results of non-financial information and corresponds to Table 5, Model V. Reducing the sample to 47 observations does not primarily change the results. Especially the explanatory power of 39% remains within comparable levels, although the only statistically significant value drivers are fund inflows and firm age. Model II adds on Model I taking into account risk and strength assumptions. With regard to the assessment of prospects, we find again a strong and significant impact on firm valuations. The results for agency risks do not remain that robust. None of the coefficients remains significant and in

two cases prefixes change. Still, the overall explainability of firm value variation remains unchanged yielding an adjusted R^2 of 68%.

7. Summary and Conclusion

In this study, we analyze the value drivers relevant for the pricing of venture capital backed firms. For this purpose, we consider the impact of direct measures related to agency risk and investment opportunities, financial statements and non-financial information on entrepreneurial firm valuation. Using a unique hand-collected data set of 294 venture capital investments by 339 investors our results are as follows:

First and foremost, investment strength and agency risk perceptions are the most pronounced factors in venture valuations. Investors impose risk discounts on internal risks of adverse selection, external market risks and due to business complexity. These effects are economically large. E.g. for each additional internal risk factor that investors mention within the investment proposal, the firm's equity value drops by 22%. On the other hand, venture valuations are primarily driven by the perceived upside potential. Thus, firm values rise remarkably once investors detect investment strengths. With each additional internal strength noted in the investment proposal, valuations rise by 19%. Noting business strategy or product development as strengths increases the pre-money firm value by 27%. We conclude that those factors often analyzed in theoretical models with regard to financial contracting also influence venture valuations.

Second, although expertise and judgment play an important role within the valuation of innovative firms, there are several externally observable value drivers. In case financial statement information is available, cash reserves are an important value driver. Additionally, investors price R&D expenditures as investments resulting in positive effects while day-to-day business costs (SG&A) have the expected negative impact. With regard to

non-financial value drivers we find that entrepreneurs may increase venture valuations significantly by engaging into cooperation agreements. We find that investors are willing to pay a premium up to 46% for firms with cooperation partners. Therefore, based on our findings, entrepreneurs and external co-investor alike are able to get an indicative evaluation of firm value drivers.

Our results show that even given the high uncertainty investors face in the financing of young and innovative firms, value determination is not a guess. Based on a simple valuation model using financial statements, non-financial data and investors' risk and strength assessments, start-up firms may be valued with out of sample errors less than 40%. This is only moderately more inaccurate than valuation errors for mature firms in public equity markets.

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Appendix

Table 1: Summary statistics

Panel A:						**N**				
# Investments						294				
# Individual firms						168				
# Investments given portfolio firms had cooperation partner						195				
Panel B: Portfolio firm data					**Mean**		**Median**			
Age (months)					38		36			
Number of patents					6		2			
Panel C: Valuation dates										
Year	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Obs.	3	15	12	13	11	25	56	80	74	5
Panel D: Portfolio firm's industry										
	Life Science		**Internet**		**Telecom**		**Traditional high technology**		**Industry**	**Other**
Obs.	139		59		17		65		10	4
Panel E: Market data	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Worldwide vc fund inflows (EUR mil.)	75,384	170,051	68,332	18,574	15,853	24,003	39,433	47,109	50,719	22,207

This table reports summary statistics for 294 venture capital investments between 1999 and 2008 in 168 different firms. Investments given portfolio firms had cooperation partner counts all 195 investments in which the funded venture already had a strategic cooperation agreement. Panel B reports firm age in months and the number of patents funded firms possessed at the time of the investment. Panel C reports the distribution of valuation dates by year. Panel D reports industry type distribution. Panel E reports yearly worldwide fund inflows in million of Euros into the venture capital industry between January 1999 until May 2008 as reported by Thomson Venture Economics Database.

Table 2: Financial summary statistics by financing round

Panel A: Distribution of financing rounds						
Round	**Total**	**Round 1**	**Round 2**	**Round 3**	**Round 4**	**Round >=5**
Obs.	294	85	114	62	23	10
Panel B: Valuations by round in 1000 EUR						
Pre-money value (Median)	3,000	1,855	2,294	4,500	6,026	8,500
Pre-money value (Min)	149	149	398	355	1,950	3,468
Pre-money value (Max)	33,800	15,800	20,000	32,000	33,800	27,000
Post-money value (Median)	4,500	2,903	3,420	6,180	7,661	12,700
Panel C: Share distribution						
Lead investor equity share	0.20	0.19	0.18	0.20	0.25	0.32
Founder team equity share	0.53	0.70	0.54	0.39	0.33	0.24
Panel D: Financial information by round						
Obs. with no financial statements	51	41	8	1	0	1
Balance sheet data in 1000 EUR						
Cash	47	0	63	156	227	202
Total assets	520	25	544	1,291	3,114	3,305
Long term debt	0	0	0	0	0	79
Income statement data in 1000 EUR						
Sales	95	0	30	228	187	254
Net income	-302	-44	-238	-556	-1,454	-1,832
R&D expenditures	237	4	141	483	726	1,111
SG&A expenditures	393	0	218	634	1,323	1,529

This table reports summary statistics of financial statement information and valuations in 294 venture capital investments in the time 1999 and 2008. Panel A gives an overview of the firm observations by investment round. Panel B reports the median, minimal and maximum pre-money value and the median post-money value by round in 1000 EUR. Panel C reports founder team's equity shares and lead investor's shares by investment round. Panel D reports financial statement information by round. Obs. with no financial statements shows the number of investments that were financed while the firms did not have any historical financial statements at the time of the investment. Cash reports firms' median amount of cash by round in 1000 EUR, documented within the last financial statement before the transaction. Total assets reports firms' median amount of cash by round in 1000 EUR, documented within the last financial statement before the transaction. Long term debt reports firms' median amount of debt by round in 1000 EUR, documented within the last financial statement before the transaction. Sales reports firms' median sales by round in 1000 EUR, documented within the last income statement before the transaction. Net income reports firms' median net income by round in 1000 EUR, documented within the last income statement before the transaction. R&D expenditures report firms' median R&D expenditures by round in 1000 EUR, documented within the last income statement before the transaction. SG&A expenditures report firms' median SG&A expenditures by round in 1000 EUR, documented within the last income statement before the transaction.

Table 3: Investment strengths and risks

Factors	Investor's risk assessment		Investor's strength assessment	
	Total sample N=294			
	N	%	N	%
Panel A: Internal factors				
# Management quality	126	42.86%	215	73.13%
# Previous performance	36	12.24%	121	41.16%
# Funding	47	15.99%	21	7.14%
# Co-Investors	9	3.06%	44	14.97%
# Portfolio fit	6	2.04%	26	8.84%
Panel B: External factors				
# Market size and growth	52	17.69%	185	62.93%
# Competition	204	69.39%	129	43.88%
# Customer acceptance	100	34.01%	129	43.88%
# Financial markets and exit conditions	13	4.42%	87	29.59%
Panel C: Execution factors				
# Product or technology development	171	58.16%	255	86.73%
# Business strategy or model	117	39.80%	93	31.63%

This table reports explicitly mentioned investment strengths and risks of 294 venture capital investments by 339 investors. Investments were made between 1999 and 2008. Column one reports investor's risk assessments. It shows the number of times, investors noted internal, external and execution factors as investment risks. Column two reports investor's strength assessments. It shows the number of times, investors noted internal, external and execution factors as investment strengths. All denoted factors (within internal, external, execution) are dummy variables that become one, once the venture capital investor noted them explicitly as firm risks or strengths. Panel A reports internal factors. Management quality reveals the number of times, investors named management quality as a reason to invest or as investment risk. Previous performance is a dummy variable that becomes one, once the management's or firm's performance until the investment was named as risk or strength. Funding reveals whether investors noted financial structure as risk or strength. Co-Investors reports whether syndication partner were named as risk or strength in the investment proposal. Portfolio fit shows risk/strength appraisal with regard to the actual portfolio structure and costs of monitoring. Panel B reports dummy variables that investors noted with regard to external factors. Markets size counts the number of times investors named the market as risk or reason to invest. Competition counts risks and strengths related to competition. Customer acceptance counts whether customer demand was named within the risk/strength assessment. Financial markets counts the number of times investors saw reasons to invest or threats related to exit conditions. Panel C shows execution factors. Risk/strengths of product development are denoted in the dummy variable product or technology development. Business strategy reveals the number times investors saw business strategy as risk and reason to invest.

Table 4: Pairwise correlation between estimation variables

Panel A	**Ln (1 + cash)**	**Ln (1 + noncash assets)**	**Ln (1+ long term debt)**	**Ln (1 + revenue)**	**Ln (1+ R&D expense)**	**Ln (1+ SG&A expense)**
Ln (1 + cash)	1					
Ln (1 + noncash assets)	0.29	1				
Ln (1+ long term debt)	-0.30	0.29	1			
Ln (1 + revenue)	0.03	0.55	0.33	1		
Ln (1+ R&D expense)	0.32	0.71	0.22	0.43	1	
Ln (1+ SG&A expense)	0.26	0.65	0.13	0.54	0.55	1
Internal risks	-0.16	0.02	0.15	0.02	-0.02	0.02
External risks	-0.06	-0.09	-0.04	-0.09	-0.23	-0.06
Execution risks	-0.01	-0.06	0.03	0.03	0.01	-0.05
Internal strengths	0.12	0.07	-0.08	0.05	0.10	-0.05
External strengths	0.21	0.08	-0.14	-0.07	0.17	0.00
Execution strengths	0.08	0.12	0.10	0.05	0.23	0.11
Round	0.35	0.53	0.16	0.34	0.52	0.38
Prototype	0.08	0.29	0.05	0.29	0.20	0.27
Ln (1 + age)	0.21	0.59	0.23	0.47	0.54	0.50
Cooperation partner	0.08	0.16	0.10	0.13	0.16	0.08
Ln (1 + number of patents)	0.32	0.32	-0.05	0.09	0.34	0.18
Corporate lead investor	-0.11	0.02	-0.02	0.05	-0.01	0.00
Ln (1 + ww_fund_inflows)	-0.10	-0.15	0.05	-0.04	-0.14	-0.13

This table provides the pairwise correlation between the explanatory variables. All accounting variables are based on the most recent financial statement immediately prior to the investment. Financial variables are log transformed according to $\log_e[Z+1]$. Cash represents firm i's cash reserves. Noncash assets are calculated as (total assets - cash). Firm i's revenues, expenditures are taken from the most recent income statement. Internal risks is the average of the dummy variables for the presence of management quality risk, questionable performance risk, financial structure risk, negative influence of other investors, and portfolio fit risk. External risks is the average of the dummy variables for the presence of market risk, competition risk, customer acceptance risk, and financial markets / exit risk. Execution risks is the average of the dummy variables for product development risk and business strategy risk. Internal strengths is the average of the dummy variables for the presence of management quality strength, previous achievements, financial structure strength, positive influence of other investors, and portfolio fit opportunities. External strengths is the average of the dummy variables for the presence of good market conditions, competition advantages, customer acceptance, and financial markets / exit strengths. Execution strengths is the average of the dummy variables for product development strengths and business strategy strength. Round is the number of the investment round. Prototype is a binary variable. Prototype is set to one if firm i has a product prototype developed by the time of the investment. Age denotes firm i's age in months at the time of the investment. Corporate lead investor indicates whether the lead investor is a corporate investor. ww_fund_inflows measure worldwide fund inflows in EUR mil. into venture capital within the four quarters prior to the investment. This information is taken from Thomson Venture Economics Database. Correlation coefficients larger than the absolute value of 0.12 are significant at the 5% level.

Panel B	**Internal risks**	**External risks**	**Execution risks**	**Internal strengths**	**External strengths**	**Execution strengths**
Internal risks	1					
External risks	-0.08	1				
Execution risks	-0.25	0.05	1			
Internal strengths	-0.20	-0.10	0.06	1		
External strengths	-0.03	-0.16	-0.05	0.12	1	
Execution strengths	-0.08	-0.10	-0.08	-0.06	0.07	1
Round	0.02	-0.09	-0.10	0.08	0.25	0.07
Prototype	-0.04	-0.01	-0.05	0.09	0.08	0.09
Ln (1 + age)	0.00	-0.12	-0.08	0.09	0.17	0.16
Cooperation partner	0.02	-0.21	-0.01	0.13	0.13	0.06
Ln (1 + number of patents)	0.00	-0.15	-0.12	-0.03	0.29	0.20
Corporate lead investor	-0.02	0.05	-0.02	0.09	0.01	0.03
Ln (1 + ww_fund_inflows)	0.10	-0.01	-0.15	0.07	0.03	0.03

This table provides the pairwise correlation between the explanatory variables. Financial variables are log transformed according to $\log_e[Z+1]$. Internal risks is the average of the dummy variables for the presence of management quality risk, questionable performance risk, financial structure risk, negative influence of other investors, and portfolio fit risk. External risks is the average of the dummy variables for the presence of market risk, competition risk, customer acceptance risk, and financial markets / exit risk. Execution risks is the average of the dummy variables for product development risk and business strategy risk. Internal strengths is the average of the dummy variables for the presence of management quality strength, previous achievements, financial structure strength, positive influence of other investors, and portfolio fit opportunities. External strengths is the average of the dummy variables for the presence of good market conditions, competition advantages, customer acceptance, and financial markets / exit strengths. Execution strengths is the average of the dummy variables for product development strengths and business strategy strength. Round is the number of the investment round. Prototype is a binary variable. Prototype is set to one if firm i has a product prototype developed by the time of the investment. Age denotes firm i's age in months at the time of the investment. Corporate lead investor indicates whether the lead investor is a corporate investor. ww_fund_inflows measure worldwide fund inflows in EUR mil. into venture capital within the four quarters prior to the investment. This information is taken from Thomson Venture Economics Database. Correlation coefficients larger than the absolute value of 0.12 are significant at the 5% level.

Panel C	**Round**	**Prototype**	**Ln (1 + age)**	**Cooperation partner**	**Ln (1 + number of patents)**	**Corporate lead investor**	**Ln (1 + ww_fund_inflows)**
Round	1						
Prototype	0.22	1					
Ln (1 + age)	0.53	0.20	1				
Cooperation partner	0.11	0.08	0.22	1			
Ln (1 + number of patents)	0.30	0.12	0.24	0.22	1		
Corporate lead investor	0.02	0.01	0.11	0.09	-0.02	1	
Ln (1 + ww_fund_inflows)	-0.07	0.06	-0.16	0.06	-0.07	0.12	1

This table provides the pairwise correlation between the explanatory variables. Financial variables are log transformed according to $\log_e[Z+1]$. Round is the number of the investment round. Prototype is a binary variable. Prototype is set to one if firm i has a product prototype developed by the time of the investment. Age denotes firm i's age in months at the time of the investment. Corporate lead investor indicates whether the lead investor is a corporate investor. ww_fund_inflows measure worldwide fund inflows in EUR mil. into venture capital within the four quarters prior to the investment. This information is taken from Thomson Venture Economics Database. Correlation coefficients larger than the absolute value of 0.12 are significant at the 5% level.

Table 5: Venture valuation regressions

	Exp.	Model I		Model II		Model III	
	Sign	Coeff	t	Coeff	t	Coeff	t
Constant		10.385	20.801***	12.284	7.262***	9.063	6.301***
Financial statement data							
Ln (1 + cash)	+	0.169	6.030***			0.117	5.015***
Ln (1 + noncash assets)	+	0.122	2.039**			0.110	2.543**
Ln (1+ long term debt)	-	-0.047	-1.596			-0.047	-2.191**
Ln (1 + revenue)	+	0.013	1.101			0.017	1.539
Ln (R&D expense)	+	0.163	1.877*			0.057	0.86
Ln (SG&A expense)	-	-0.074	-2.711***			-0.040	-1.679*
Non-financial information							
Dummy round 1	-			-1.057	-4.227***	-0.603	-2.553**
Dummy round 2	-			-0.759	-3.648***	-0.672	-3.872***
Dummy round 3	-			-0.507	-2.911***	-0.600	-3.965***
Dummy round 4	-			-0.260	-1.455	-0.457	-3.002***
Life science	+/-			0.249	1.536	0.206	1.596
Internet	+/-			0.483	2.548**	0.346	2.024**
Telecommunications	+/-			0.309	1.276	0.132	0.647
Traditional high technology	+/-			0.109	0.663	0.160	1.238
Prototype	+			0.059	0.48	0.036	0.343
Ln (1 + age)	+			-0.036	-0.387	-0.096	-1.188
Cooperation partner	+			0.382	3.010***	0.320	3.106***
Ln (1 + number of patents)	+			0.223	3.126***	0.118	1.725*
Corporate lead investor	+/-			-0.453	-1.674*	-0.270	-1.209
Ln (1 + ww_fund_inflows)	+			0.161	1.147	0.219	1.768*
Risk and strength assessment							
Internal risks	-			-1.091	-3.154***	-0.802	-2.713***
External risks	-			-0.104	-0.441	-0.007	-0.035
Execution risks	-			-0.161	-0.934	-0.203	-1.345
Internal strengths	+			0.926	2.680***	0.729	2.435**
External strengths	+			1.317	5.543***	1.272	5.657***
Execution strengths	+			0.547	3.449***	0.559	3.691***
No. of obs.			226		226		226
Adj. R^2			0.40		0.53		0.63
Prob.			0.00		0.00		0.00
Wald-coefficient test							
Internal risks > Internal strengths			-		0.00		0.00

This table presents OLS-regression estimates of the determinants of pre-money values in 294 venture capital investments. We drop 21 observations due to missing valuation data. Additionally in Model I-IV we drop 47 observations due to missing financial statements. Investments were made between 1999 and 2008. The dependent variable is the natural log of firm i's pre-money equity value. Model I explanatory variables include financial statement variables taken from the most recent financial statement immediately prior to the investment round. All financial statement variables Z are log-transformed according to $\log_e(Z+1)$. Cash represents firm i's cash reserves given in the most recent balance sheet. Noncash assets are calculated as (total assets - cash). Long term debt reports the value of long term liabilities reported in the most recent balance sheet. Firm i's revenues and expenditures are taken from the most recent income statement. Model II reports results for non-financial information and risk and strength assessments. Dummy round 1, 2, 3 and 4 report round effects relative to investment rounds higher than five. Additionally we include dummy variables for different industry types. Life science combines medicine technology and biotechnology firms. We further control for internet, telecommunications and traditional high technology firms in relation to the omitted industry types manufacturing and other industries. Prototype is a binary variable. Prototype is set to one if firm i has a product prototype developed by the time of the investment. Age denotes firm i's age in months at the time of the investment. Corporate lead investor indicates whether the lead investor is a corporate investor. Cooperation partner indicates whether firm i had a cooperation partner at the time of the investment. Number of patents counts the number of patents firm i owns at the time of the investment. ww_fund_inflows measures worldwide fund inflows into the venture capital industry within the four quarters prior to the investment in EUR mil. This information is taken from Thomson Venture Economics Database. Internal risks is the average of the dummy variables for the presence of management quality risk, questionable performance risk, financial structure risk, negative influence of other investors, and portfolio fit risk. External risks is the average of the dummy variables for the presence of market risk, competition risk, customer acceptance risk, and financial markets / exit risk. Execution risks is the average of the dummy variables for product development risk and business strategy risk. Internal strengths is the average of the dummy variables for the presence of management quality strength, previous achievements, financial structure strength, positive influence of other investors, and portfolio fit opportunities. External strengths is the average of the dummy variables for the presence of good market conditions, competition advantages, customer acceptance, and financial markets / exit strengths. Execution strengths is the average of the dummy variables for product development strengths and business strategy strength. Model III reports results for non-financial information and risk and strength assessments controlling for financial information. T-statistics are reported using robust standard errors clustered at the firm level. The Wald coefficient test reports whether the absolute coefficient for internal risks is significantly larger than the coefficient for internal strengths. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Venture valuation regressions

	Exp.	Model IV		Model V		Model VI	
	Sign	Coeff	t	Coeff	t	Coeff	t
Constant		7.941	5.117***	10.322	8.131***	10.973	9.182***
Financial statement data							
Ln (1 + cash)	+	0.142	5.396***				
Ln (1 + noncash assets)	+	0.091	1.705*				
Ln (1+ long term debt)	-	-0.059	-2.365**				
Ln (1 + revenue)	+	0.005	0.423				
Ln (R&D expense)	+	0.106	1.25				
Ln (SG&A expense)	-	-0.057	-2.215**				
Non-financial information							
Dummy round 1	-	-0.760	-3.187***	-1.216	-4.053***	-1.030	-4.642***
Dummy round 2	-	-0.797	-4.291***	-0.882	-3.393***	-0.748	-3.993***
Dummy round 3	-	-0.686	-4.589***	-0.634	-2.695***	-0.543	-3.292***
Dummy round 4	-	-0.544	-3.341***	-0.380	-1.612	-0.277	-1.626
Life science	+/-	0.341	2.124**	0.507	3.277***	0.298	1.859*
Internet	+/-	0.504	2.509**	0.670	3.593***	0.433	2.446**
Telecommunications	+/-	0.555	2.550**	0.842	4.325***	0.320	1.553
Traditional high technology	+/-	0.227	1.333	0.291	1.62	0.206	1.173
Prototype	+	0.122	0.982	0.153	1.164	0.052	0.475
Ln (1 + age)	+	0.010	0.11	0.064	0.962	0.005	0.084
Cooperation partner	+	0.387	3.420***	0.458	3.874***	0.362	3.126***
Ln (1 + number of patents)	+	0.176	2.366**	0.277	3.582***	0.188	2.780***
Corporate lead investor	+/-	-0.138	-0.636	-0.320	-1.281	-0.444	-1.912*
Ln (1 + ww_fund_inflows)	+	0.332	2.601**	0.375	3.525***	0.259	2.605**
Agency assessment							
Internal risks	-					-0.836	-2.794***
External risks	-					-0.066	-0.3
Execution risks	-					-0.164	-1.144
Internal strengths	+					1.110	3.889***
External strengths	+					1.439	6.684***
Execution strengths	+					0.548	3.665***
No. of obs.			226		273		273
Adj. R^2			0.51		0.37		0.55
Prob.			0.00		0.00		0.00

This table presents OLS-regression estimates of the determinants of pre-money values in 294 venture capital investments. We drop 21 observations due to missing valuation data. Additionally in Model I-IV we drop 47 observations due to missing financial statements. Investments were made between 1999 and 2008. The dependent variable is the natural log of firm i's pre-money equity value. Model IV explanatory variables include financial statement variables taken from the most recent financial statement immediately prior to the investment round and non-financial information. All financial statement variables Z are log-transformed according to $\log_e(Z+1)$. Cash represents firm i's cash reserves given in the most recent financial statement. Noncash assets are calculated as (total assets - cash). Firm i's revenues and expenditures are taken from the most recent income statement. Model II reports results for non-financial information and risk and strength assessments. Dummy round 1, 2, 3 and 4 report round effects relative to investment rounds higher than five. Additionally we include dummy variables for different industry types. Life science combines medicine technology and biotechnology firms. We further control for internet, telecommunications and traditional high technology firms in relation to the omitted industry types manufacturing and other industries. Prototype is a binary variable. Prototype is set to one if firm i has a product prototype developed by the time of the investment. Age denotes firm i's age in months at the time of the investment. Corporate lead investor indicates whether the lead investor is a corporate investor. Cooperation partner indicates whether firm i had a cooperation partner at the time of the investment. Number of patents counts the number of patents firm i owns at the time of the investment. ww_fund_inflows measures worldwide fund inflows into the venture capital industry within the four quarters prior to the investment in EUR mil. This information is taken from Thomson Venture Economics Database. For Model V and VI we add 47 observations where financial statement information was not available. Model V reports results for non-financial information on the complete sample of 273 observations where valuation data was available. Model VI extends Model V on investor's risk and strength assessments. Internal risks is the average of the dummy variables for the presence of management quality risk, questionable performance risk, financial structure risk, negative influence of other investors, and portfolio fit risk. External risks is the average of the dummy variables for the presence of market risk, competition risk, customer acceptance risk, and financial markets / exit risk. Execution risks is the average of the dummy variables for product development risk and business strategy risk. Internal strengths is the average of the dummy variables for the presence of management quality strength, previous achievements, financial structure strength, positive influence of other investors, and portfolio fit opportunities. External strengths is the average of the dummy variables for the presence of good market conditions, competition advantages, customer acceptance, and financial markets / exit strengths. Execution strengths is the average of the dummy variables for product development strengths and business strategy strength. T-statistics are reported using robust standard errors clustered at the firm level. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: Valuation errors

		abs log error	abs percentage error
Panel A: In sample, 226 observations [1999-2008]			
I	Financial statement model	48.79%	45.78%
II	Financial statement + non-financial model	40.34%	40.47%
III	Full model	37.38%	35.52%
Panel B: Out of sample, 126 observations [2006-2008]			
I	Financial statement model	56.30%	50.02%
II	Financial statement + non-financial model	54.15%	49.17%
III	Full model	39.25%	35.52%

This table reports the distribution of valuation errors for the three different valuation approaches. Column one reports absolute log errors, defined as the absolute logarithm of the ratio of the estimated value to the actually assessed pre-money value. Column two reports median absolute percentage error, defined as the absolute difference between actual and model predicted pre-money value, scaled by the actual pre-money value. Panel A reports median in sample valuation errors. The financial statement model is based on Table 5, Model I using only financial statement information. The financial and non-financial statement and qualitative information model is based on Table 5, Model IV using financial statement and non-financial information. The full model is based on Table 5, Model III using financial statement, non-financial information and investor's risk and strength assessments. Panel B reports out of sample results. That is we used the first 100 observations within the years 1999 and 2005 to calibrate the regression model. Based on this regression result we predicted the pre-money values for the 126 transactions post 2005.

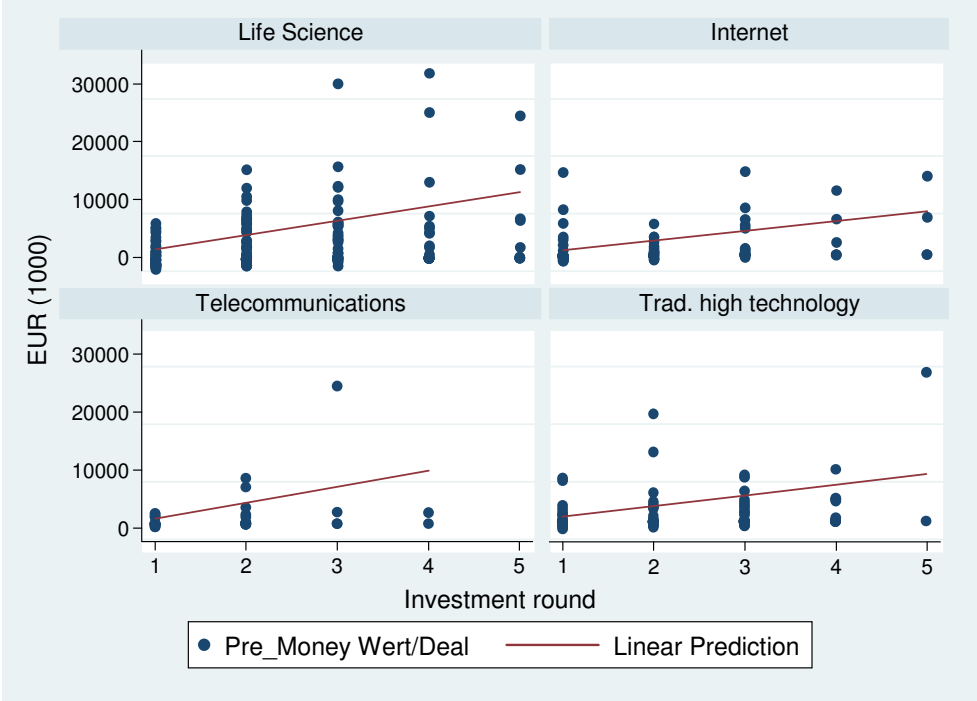
Table 7: Robustness regression

	Exp.	Model I		Model II	
	Sign	Coeff	t	Coeff	
Constant		5.330	2.921***	6.176	4.117***
Non-financial information					
Dummy round 1	-	0.051	0.133	-0.113	-0.498
Life science	+/-	-0.326	-1.154	-0.149	-0.595
Ln (1 + age)	+	0.306	2.726***	0.126	1.313
Cooperation partner	+	0.291	1.132	0.375	1.777*
Ln (1 + number of patents)	+	0.288	1.623	0.051	0.353
Ln (1 + ww_fund_inflows)	+	0.767	4.732***	0.612	4.167***
Risk and strength assessment					
Internal risks	-			1.035	1.308
External risks	-			-0.086	-0.153
Execution risks	-			-0.204	-0.754
Internal strengths	+			1.771	2.533**
External strengths	+			1.717	3.753***
Execution strengths	+			0.127	0.357
No. of obs.		47		47	
Adj. R^2		0.39		0.68	
Prob.		0.00		0.00	

This table presents OLS-regression estimates of the determinants of pre-money values in 47 venture capital investments. These 47 observations are a subsample out of the 273 investments for which accounting data was not available at the time of investment. Investments were made between 1999 and 2008. The dependent variable is the natural log of firm i's pre-money equity value. Model I explanatory variables include non-financial information: That is a dummy variable for first round investments and a dummy variable for life science industry firms. Age denotes firm i's age in months at the time of the investment. Number of patents counts the number of patents firm i owns at the time of the investment. Cooperation partner indicates whether firm i had a cooperation partner at the time of the investment. Number of patents counts the number of patents firm i owns at the time of the investment. ww_fund_inflows measures worldwide fund inflows into the venture capital industry within the four quarters prior to the investment in EUR mil. This information is taken from Thomson Venture Economics Database. Model II extends Model I on investor's risk and strength as-assessments. Internal risks is the average of the dummy variables for the presence of management quality risk, questionable performance risk, financial structure risk, negative influence of other investors, and portfolio fit risk. External risks is the average of the dummy variables for the presence of market risk, competition risk, customer acceptance risk, and financial markets / exit risk. Execution risks is the average of the dummy variables for product development risk and business strategy risk. Internal strengths is the average of the dummy variables for the presence of management quality strength, previous achievements, financial structure strength, positive influence of other investors, and portfolio fit opportunities. External strengths is the average of the dummy variables for the presence of good market conditions, competition advantages, customer acceptance, and financial markets / exit strengths. Execution strengths is the average of the dummy variables for product development strengths and business strategy strength. T-statistics are reported using robust standard errors clustered at the firm level. * significant at 10%; ** significant at 5%; *** significant at 1%

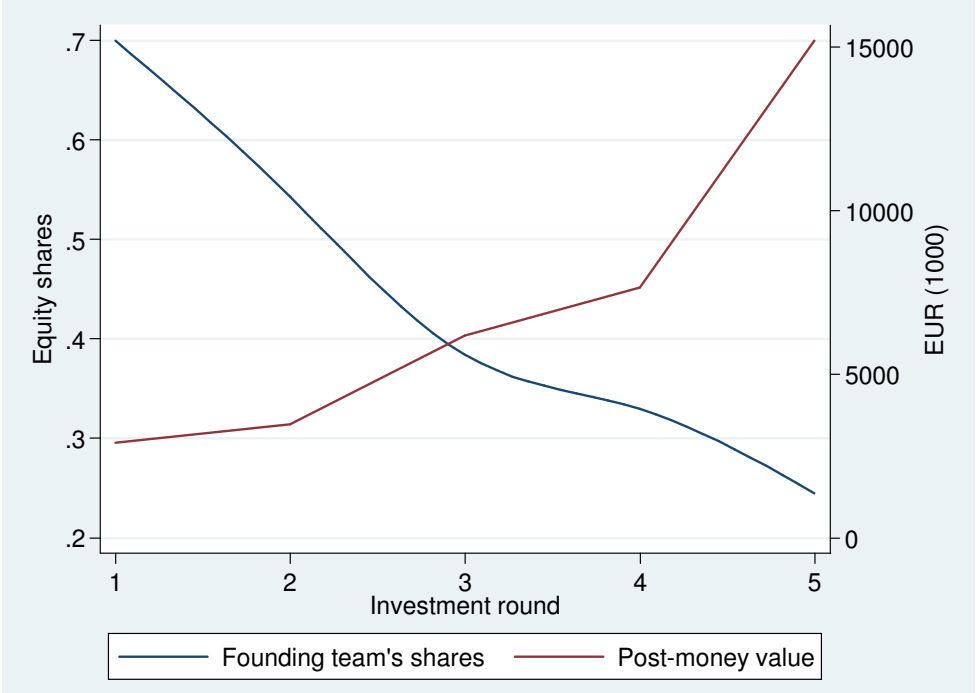
Figures

Figure 1: Firm value distribution by round



This figure reports firm value distributions within the major industry classifications life science, internet, telecommunications and traditional high technology by investment round.

Figure 2: Development of firm value and founder's share by round



This figure reports the median of the total founding team's equity shares and post-money values by investment round.