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Valuation of Early Stage High-tech Start-up Companies

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ABSTRACT

Valuating start-ups, especially at early stages, is a challenge given the lack of historical data and many uncertain factors about the future. This article presents a methodology for the valuation of early stage start-ups that we have proven in practice. The risk linked to a start-up is expressed through an individual beta coefficient as important component of the discounting factor within a discounted cash flow (DCF) valuation based on the data in a business plan. Core of this methodology is the development of an evaluation framework for the individual adjustment of the beta coefficient that is applicable to early stage start-ups. This was shown by applying the methodology to 16 early stage start-ups in the fields of biotechnology, nanotechnology, medical technology and clean technology, which provided an easy-to-handle and comprehensible comparison of different investment options for early stage investors.

JEL Classifications: *G32, M13*

Keywords: *business valuation; discounted cash flow method; capitalisation rate; beta coefficient; venture capital; business angels*

I. INTRODUCTION

The valuation of a start-up is a central matter to both investors and founders (Cumming and Dai, 2011; Hsu, 2004; Engel and Keilbach, 2007; Hochberg et al., 2010; Gompers et al., 2010). Generally, the valuation of a company is more difficult the younger the company is, given the lack of historical data and uncertainty about many elements that could influence its development (Peemöller et al., 2001). The absence of sound forecasted cash flows and growth rate of a company or the determination of the cost of capital are some of the main criticisms against the discounted cash flow (DCF) method for early stage start-ups (Achleitner and Nathusius, 2004; Moyen et al., 1996; Vinturela and Erickson, 2004). An easy method of evaluation from the investor perspective, which is both easy-to-handle and accepted among practitioners, is necessary to better manage negotiations between investors and founders (Achleitner and Nathusius, 2003; Armstrong et al., 2006; Paul et al., 2007).

This article presents a methodology for the valuation of early stage high-tech start-ups based on the information of a business plan and additional discussions with the founders or the management team. Starting with the future cash flows from the business plan of a start-up, a DCF valuation gives the company value. The new aspect is that the beta coefficient as important component of the discount factor, which is one of the most significant parameters within the DCF valuation, is discussed and adjusted according to the capital asset pricing model (CAPM). The focus on the beta coefficient representing the individual risks of start-ups and its individual adjustment can provide an important simplification in assessing investment possibilities. The methodology was applied and validated for 16 start-ups in Germany and Switzerland.

II. THEORETICAL BACKGROUD

A. Early Stage Investments

Madill et al. (2005), following the findings of Harrison and Mason (1992), identified aspects that differentiate business angels (BA) as early stage investors from other investors. The magnitude of their investments is smaller and earlier in time, when the so-called "equity gap" is most significant. As a comparison, venture capitalists (VCs) invest only 1% of the value of their investments in the seed stage (5% of the deals), 18% in the start-up stage and the rest is provided to expand the company (Meyer, 2006). According to Sohl (2007), BAs do not only look for more opportunities but also invest 16 times as often as typical VCs do. Of other opinion are Mason and Harrison (1994), who showed that generally BAs invest in fewer deals than VCs. In contrast to VCs, who look for investments which may produce higher returns, BAs do not have the monetary capacity to diversify their investments, so instead adopt a less risky strategy, which leads to fewer "home runs" but also to fewer deals with a complete loss (Benjamin and Margulis, 1996). Mason and Harrison (2002b) discovered that compared to VCs, BAs have a fewer proportion of investments in which they lose money, but in turn a significantly higher proportion of their investments either break-even or generate only modest returns.

BAs help to bridge the financial gap in the high-risk early stage phase, in that, having been financed by BAs the credibility of the company raises in the eyes of

potential partners and increases the chances of the company receiving further investment, so they (Maunula, 2006). In doing so, they complement larger VC companies, especially with regard to the size of the investment, the value added in the investment phases and the flow of deals (Madill, et al., 2005). Mason and Harrison (2002a) have noticed that BAs are, in general, looking for more investment opportunities, mainly because most of the proposals they receive do not coincide with their investment criteria. For example, in the industry and technology sector, the company stage or the location may not fulfil their conditions. Many investors do not possess the necessary technical knowledge required for investing in high-tech areas: BAs as well as VCs choose to invest in specific sectors where they have acquired technological and market knowledge, previous experience and a strong network (Mason, 2006; Murray, 1999; Van Osnabrugge and Robinson, 2000). Finding a good opportunity takes much effort and results in high search costs, because of a lack of access to academic researchers and a long selection process (Mason and Harrison, 1992; Mason and Harrison, 1995). How investors base their decisions on different frameworks is deeply investigated by many scholars (Fried and Hisrich, 1994; Mason and Harrison, 1996a; Paul, et al., 2004; Zheng, et al., 2010; Van Osnabrugge, 2000). Besides aspects like financial risks or the business-plan of the company, the involved VCs in turn have a considerable influence on the attraction of further external funds in later stages. As outlined in an empirical study by Chang (2004), the better the reputations of participating VCs and other strategic partners of the start-up were, the more money it could raise. In their analysis of Initial Public Offerings (IPOs), Megginson and Weiss (1991) found that the reputation of an experienced VC may communicate unobserved qualities about the company to the capital market, which leads to an increase of the market value of the company.

B. Valuation of Early Stage Start-ups

Accordingly to Elnathan et al. (2010), there is a general scarcity in research about experts' valuations of private companies. More specifically, there is an insufficiency not only in the research about the determinants of valuations in private equity (Cumming and Dai, 2011), but also especially about BAs and their investment decisions (Paul et al., 2007). Some scholars have addressed some issues, from general considerations to the identification of the factors that investors consider when evaluating a company.

The first issue addressed is how start-up evaluations might not depend on start-up characteristics only, but also on those of the investors. Gompers and Lerner (2000) show that market conditions impact VC valuations with regard to the value of the closed VC deals. Specifically, they assume that under perfect market conditions inflows of money into VCs funds should not be related to a change in the valuation of private companies. It is shown, that high inflows lower the standards of a valuation and rises dramatically when the inflows cease. Hochberg et al. (2010) explain how the density of the VC market and the level of networking affect valuations of newly founded companies. Cumming and Dai (2011) present empirical evidence on how VCs' reputation, size, and limited attention impact their bargaining power and consequently valuations in addition to venture quality and market conditions.

The second issue addressed is information asymmetry, which becomes critical when investors try to evaluate companies based on the information they are provided by the founders or able to collect (Binks et al., 1992). Sanders and Boivie (2004) explain how information asymmetry can lead to opportunistic behaviour in form of adverse selection (i.e. hidden information) and moral hazard (i.e., hidden actions). For this reason, investors struggle to get valuable and reliable information. To reduce such an uncertainty, investors should rely on a set of observable indicators, such as corporate governance mechanisms, even though it might only be feasible when the company has enough history. Zheng et al. (2010) focus on two kinds of information that influence investor evaluations: internally generated information on the start-up's innovative capability and externally verifiable information on the start-up's inter-company network attributes. The study is based on the idea that company capabilities are heterogeneous among the market participants and hence lead to different company performance (Teece et al., 1997; Cockburn et al., 2000).

The third issue addressed is how the evaluation process develops. Maxwell et al. (2011) argue that investment decisions are made according to two stages, a first selection stage or screening in which investors determine, if the company will be further considered or rejected, and a second in which a more thorough evaluation and a negotiation will lead to a potential deal between investor and entrepreneur. Mason and Harrison (2002) emphasize that focusing on such a process of selection can lead to higher chances of a successful investment. Other studies have identified more stages in the process, e.g., a three-stage model by Amatucci and Sohl (2004) and more comprehensive approaches with eight stages by Van Osnabrugge and Robinson (2000) and Haines et al. (2003).

The fourth issue concerns which characteristics of a start-up the investors take into consideration when evaluating. Generally, both BAs and VCs agree that the entrepreneur itself and the management team are the two factors that mostly influence their involvement in a financing deal (MacMillan et al., 1987; Van Osnabrugge and Robinson, 2000; Van Osnabrugge, 2000). A good resume of VCs investment determinants was done by Hsu (2007), who finds that various characteristics of founders are important determinants in VC evaluations: prior experience in founding, both human capital (e.g., training and prior professional experience) and social capital (e.g., social skills and charisma) of the start-up's founders are all positively correlated with higher evaluations. Consistent with this is that the higher the similarity between the profile of a VC and the profile of a start-up team in terms of their educational background and professional experience, the more favourable the evaluation by the venture capitalist will be (Franke et al., 2006).

C. Valuation Criteria

Few studies have, however, been done on the difference between VCs and BAs in respect of their evaluation of qualitative aspects. BAs perform less professional due diligence than VCs, invest more opportunistically, rely more on instincts and do not calculate internal rates of return (Van Osnabrugge and Robinson, 2000; Sudek, 2006). Sudek (2006) also argues that most of the literature up to 2006 was concerned with VCs evaluations, while specific research on BAs investment evaluations is rare. Nonetheless, some scholars have tried to list a series of factors that BAs seem to

consider when evaluating a start-up. Feeney et al. (1999) focused on the decision stage of investments and determined that the criteria on which the assessment of the company is mostly based are entrepreneur's abilities and track record. Mason and Harrison (1996b) agreed with that and also added the fact of how marketing strategy and financial projection were of core importance.

Van Osnabrugge and Robinson (2000) ranked the 27 most significant criteria for European angels, where enthusiasm of the entrepreneur and his trustworthiness were found to be ranked first and second, and sales potential of the product and expertise of the entrepreneur third and fourth. Sudek (2006) did a comparable study on U.S. angels with different results. Trustworthiness came first, management team second, enthusiasm third and potential exit routes fourth. When only considering the criterion management team, its passion and perceived sense of survivability were ranked first and second, coachability third and last were the experience of the advisor and the team. Maxwell et al. (2011) expose an overview of previous research on investment criteria without rankings, which we summarise as follows: Mason and Stark (2004) identified the importance of financial numbers and other straightforward, verifiable factors, such as sales, evidence of marketplace and size as well as patent protection. Skills, experience, track record, personality of the entrepreneur and of the management team are factors of human capital that are emphasised by various authors (Sørensen, 2007; Haines et al., 2003; Mason and Stark, 2004; Zhang, 2011). Feeney et al. (1999) also add more subjective personality characteristics, like honesty and integrity.

The opinion of Maxwell et al. (2011) that such a long list of criteria might confuse researchers, investors and entrepreneurs can easily find support. Landström (1998) suggests the possibility that investors vary their decision making criteria as the process unfolds over time. Maxwell et al. (2011) build on that and express concerns, supported by previous literature, that such criteria might be biased while the investor is trying to recollect the procedure used when evaluating a company. They also argue that opposed to this list of characteristics, behavioural decision research has clearly shown how investors in practice often tend to use cognitive shortcuts known as heuristics, which lead to the use of a smaller number of criteria to evaluate the company only in the case when they present values above or below a determined threshold. For such a reason, Maxwell et al. (2011) provide a list of specific criteria based on previous research that is also suited as an elimination-by-aspects heuristic which investors can follow to easily reject the majority of opportunities: adoption, product status, protectability, customer engagement, route to market, market potential, relevant experience and financial model.

D. Valuation Methods

Besides qualitative considerations, investors often rely on more quantitative methods to achieve a clearer comparison among investment opportunities. Fernández (2007) divides evaluation methods into six different groups: balance sheet, income statement, mixed (goodwill), cash flow discounting, value creation and options. Engel (2003) structures the same evaluation methods into two main groups. The first group includes classical methods, which can be applied independently from the objectives of the evaluation, while the second is better suited for specific conditions related to VC financing. Achleitner and Nathusius (2003) further subdivide these two main groups:

the first subcategory of the classical methods includes fundamental analytical and market oriented methods. Fundamental analytical methods, based on data of a single company, can be further divided into single and comprehensive evaluation methods. Single evaluation methods sum up in a single number the various assets a company presently owns. When looking at the comprehensive evaluation methods, we have the widely diffused DCF method, the income method and the real option method (Ballwieser, 2001; Leuner, 1998; Festel et al., 2009). The second subcategory of the classical methods considers market oriented methods that compare factors among similar companies in a determined peer group, like, e.g., the initial public offering (IPO) or the recent acquisition methods. The second main group concerns the situation specific methods, which are subdivided into two approaches: first, rules of thumb, mostly favoured by BAs but only suited as a complement to other methods, and second, comprehensive evaluation methods, like the VC method and the first Chicago method (Engel, 2003; Amis et al., 2003; Amis and Stevenson, 2001).

Although some criticism has been raised throughout the years (Moyen et al., 1996), many have identified the DCF method as the most dominant in practice (Jennergren, 2008; Jiménez and Pascual, 2008), and according to Vinturella and Erickson (2004) and Fernández (2007) it is also the most conceptually correct. The DCF method is based on the idea that the present value of a company is given by the capacity of generating positive future cash flows (Achleitner and Nathusius, 2003; Fernandez, 2002). A common feature of this class of methods is the discount of the future cash flows by the required rate of return, which expresses the risk related to such payments. The discount rate has to reflect, in the most realistic way, the costs of capital of the company. DCF methods can be subdivided into more specific methods. If the balance sheet shows equity and debt, the adjusted present value (APV) method, the weighted average cost of capital (WACC) method and the total cash flow (TCF) method are relevant. The term "equity methods" is applied, if only equity is used as reference capital. Fernández (2004a) furthermore subdivides the DCF methods into ten different approaches, which differ in the chosen type of cash flows or in the appropriate discount rate. There are different opinions regarding the time horizon to be considered in the DCF methods. Vinturella and Erickson (2004) and Jennergren (2008) provide a model based on the assumption that a company evaluation using a DCF method should not stop at the first period of 10-15 years, in which the free cash flow is derived from operations of the company, but also a post-horizon period, which provides a continuing value of the company under the assumption that it grows at constant and sustainable rate after the first explicit forecasted period.

E. Discount Factor

It is important to note that usually high tech start-ups are completely financed through equity, which means that the cost of capital equals the cost of equity. The value of the forecasted cash flows has to be discounted by a discount factor to obtain the present value. The discount factor expresses the required return of the employed equity by the investor and at the same time reflects the costs of capital for the start-up. The literature contemplates different methods related to the capital market, from the arbitrage pricing theory to the regression model, in which a risk premium is calculated.

In the CAPM, individual systematic risk related to a company is expressed through a so-called beta coefficient, a measure of risk relative to a peer group (Vinturella and Erickson, 2004). The beta coefficient has a significant impact on the capital costs, as the CAPM equation shows (Fernández, 2004b; Ai and Brockett, 2008; Womack and Zhang, 2003):

$$E(R_i) = R_f + \beta_i[E(R_m) - R_f]$$

where: $E(R_i)$ is the expected return on the capital for asset i, R_f is the risk-free interest rate that is usually derived from the yield of high-quality government bonds, $E(R_m)$ is the expected return of the market, $[E(R_m)-R_f]$ is the expected market risk premium, and β_i is the sensitivity of the expected excess returns from asset i to the expected excess market returns, or also

$$\beta_i = \frac{Cov(R_i, R_m)}{\sigma^2(R_m)}$$

with $Cov(R_i,R_m)$) as the covariance between the return of the market and the return of the asset i, and $\sigma^2(R_m)$ as the variance of the return of the market.

In these definitions it is important to note, that one underlying assumption of the CAPM is that the required market risk premium is equal to the expected market risk premium (Fernández, 2004b).

A beta could be derived from either accounting history or a sensibility analysis based on the forecasted cash flows. Fernández (2004a) proposes, for example, different kinds of betas based on financial factors (leveraged, asset, etc.). Start-ups usually lack such an accounting history and the estimation of variability in future market earnings might also become problematic, making these propositions hard to translate in practice.

Especially for the valuation of small companies, the CAPM model of Sharpe (1964) and Lintner (1965) leads to an abnormal description of the expected returns (Banz, 1981). Based on the CAPM model, Fama and French (1992) developed an extended model that specifically addresses the risks related to the size and value. In consequence, they included a "size premium" to compensate investments in companies with a relatively small market capitalisation and a "value premium" to encounter the risk related to high book-to-market values (Fama and French, 2012; Womack and Zhang, 2003). In contrast to the expansion by adding size and value parameters to the CAPM, the valuation approach introduced in this article is based on the basic form of CAPM and the specific risks of the start-up is taken into account by an adjusted beta factor. In practice, when investors conduct a company valuation they seldom use these models: only a quarter of VCs utilise the CAPM to determine the risk premium (Achleitner, et al., 2004). To determine the final discount factor, investors often use deduction values according to their return expectations and perceived risk (Sahlman and Scherlis, 1987).

III. VALUATION METHODOLOGY

A. Definition and Adjustment of the Basic Beta Coefficient

Important parameters are the risk-free rate and the market risk premium, which are needed to determine the capital costs or the discount rate, respectively, to be used in the CAPM. To determine the risk-free rate we chose the rates of government bonds and treasury securities before the financial market crisis started: a ten-year German Government Bond yielded a return of 4.126% as per September 1st, 2008 (Bloomberg, 2013). For the market risk premium 5.5% was chosen (Fernández et al., 2013). The company tax rate of 35% based on earnings before interest and taxes (EBIT) was given by the German Institute of Certified Public Accountants (Institut der Wirtschaftsprüfer, 2002).

As discussed earlier, the beta coefficient for early stage start-ups cannot be derived from past values or by comparison with companies of a peer group. The rate of return expected by investors in early stage investments and the average capitalisation rate is 39.5% (Achleitner et al., 2004). Using the CAPM to calculate the cost of equity for start-up companies in early stages based on a risk-free interest rate of 4.126% and a market risk premium of 5.5% yields a basic beta coefficient of 6.4 to cover the required return on equity for VC companies. The calculated basic beta coefficient is suitable for high-tech start-ups, for example in the biotech, nanotech or clean-tech areas with high technology and market risk. For start-ups with a lower business risk, such as in the services or trade sector, a lower basic beta coefficient is justified. For comparison, public companies in a mature stage usually have a beta between 0.5 and 2.

This general basic beta coefficient of 6.4 for early stage high-tech start-ups has to be adjusted for each individual start-up based on the risk profile. We developed a standardised assessment scheme for the adjustment of the beta coefficient. The assessment scheme is used for the standardised determination of a premium or a discount to the beta coefficient depending on the risk profile, associated with the start-up, based on information from the business plan and additional discussions with the founders or the management team. It contains all the relevant categories such as technology, products, implementation, organisation and financial aspects and can be easily applied by an experienced investor after the reading of a typical business plan.

B. Application and Validation of the Methodology

The evaluation methodology was applied to 16 start-ups whose complete business plans were available (Figure 1). Start-ups were chosen from areas with similar risk profiles, such as biotechnology, cleantech and nanotechnology (Table 1). Only companies with a limited range of initial corporate values were considered: such values stated in the business plans span between 1.2 and 4.1 million Euros.

We developed a simple Excel model in the form of a basic DCF calculation with which the adjusted corporate values can be calculated. For this purpose the relevant figures from the business plans, such as revenue projections and costs, are transferred into the model and the final corporate value can be calculated using the adjusted beta coefficient. As shown in Table 2, the adjustment of the beta coefficient is based on various categories, considering technological, organisational, financial and other characteristics each with related subcategories. Depending on its specific influence on the risk, each subcategory can lead to a positive or negative impact on the compensation that a potential investor requires and hence a corresponding adjustment of the beta coefficient is necessary. These beta adjustments are then cumulated and result in a beta coefficient for the specific start-up. By using the CAPM, the derived

beta coefficient is then applied for the start-up being valued to estimate the required return, which, in turn, is a decisive input parameter for the company valuation using a DCF approach.

Figure 1
Steps for the application and validation of the technology after the development

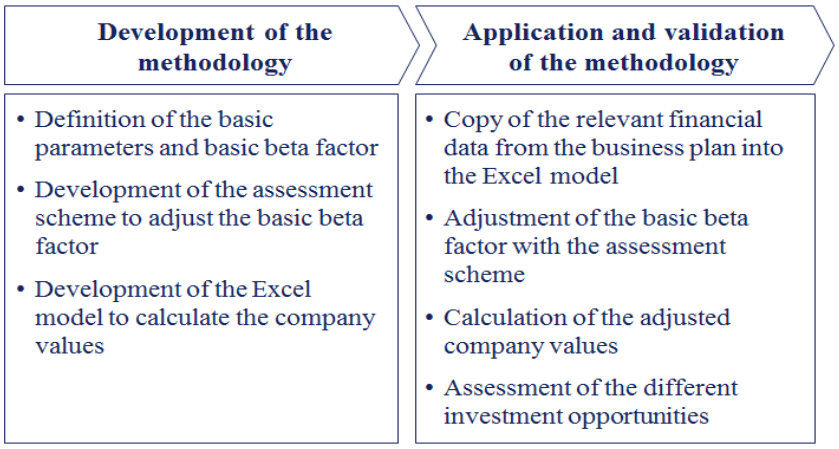

Table 1
Results of the evaluation of the selected start-ups*

Nr.	Sector	Country	Initial company value [mn Euro]	Adjustment of the beta coefficient	Adjusted beta coefficient	Adjusted discount rate	Adjusted company value [mn Euro]
1	Biotech	Switzerland	1.3	3.0	9.6	0.55	0.6
2	Biotech	Germany	1.3	7.5	14.1	0.79	0.2
3	Biotech	Germany	1.8	-3.5	3.1	0.21	7.6
4	Cleantech	Switzerland	2.1	-1.0	5.6	0.34	3.2
5	Cleantech	Germany	2.3	-2.5	4.1	0.26	5.9
6	Nanotech	Germany	2.4	3.0	9.6	0.55	1.0
7	Biotech	Germany	2.5	4.5	11.1	0.63	0.7
8	Biotech	Germany	2.5	-0.5	6.1	0.36	2.9
9	Medtech	Germany	2.6	5.5	12.1	0.68	0.6
10	Cleantech	Germany	2.9	-4.0	2.6	0.18	16.5
11	Cleantech	Germany	3.1	3.5	10.1	0.58	1.0
12	Nanotech	Germany	3.2	3.0	9.6	0.55	1.4
13	Cleantech	Germany	3.2	2.5	9.1	0.52	1.5
14	Biotech	Germany	3.3	-0.5	6.1	0.36	3.7
15	Biotech	Germany	3.5	-1.0	5.6	0.34	4.8
16	Biotech	Switzerland	4.5	2.5	9.1	0.52	2.0

* The initial company value is always calculated with the basic beta coefficient 6.6.

Table 2

Assessment scheme of one of the start-ups to adjust the basic beta coefficient

Category	Subcategory	Adjustment of the beta coefficient					Result
		+1	+0,5	0	-0.5	-1	
Technology	Maturity of technology	Technology still in initial experimental phase	**Technology successful on a laboratory scale**	Technology successful in pilot plant	Technology successful in demo plant	Technology successful in technical application	**0.5**
	Advantages compared to competitive technologies	No advantages identified	Advantages not clearly identifiable	Costs or quality advantages identifiable	**Costs and quality advantages identifiable**	Significant costs and quality advantages identifiable	**-0.5**
	Reputation of scientist	**No reputation**	Poor reputation	Moderate reputation	Good reputation	Very good reputation	**1.0**
	Patent protection	No patent application	**First patent application filed**	Basic patent close to being granted	Basic patent granted	Extensive portfolio of granted patents	**0.5**
Products	Product benefits	Product benefits not identifiable	**Product benefits not clearly identifiable**	Product benefits clearly identifiable	Product benefits confirmed by first clients	Product benefits confirmed by numerous clients	**0.5**
	Unique selling proposition	Unique selling proposition not identifiable	**Unique selling proposition not clearly identifiable**	Unique selling proposition clearly identifiable	Unique selling proposition confirmed by first clients	Unique selling proposition confirmed by numerous clients	**0.5**
	Scalability	Very low scalability	**Low scalability**	Moderate scalability	High scalability	Very high scalability	**0.5**
	Competition	Currently strong competition	**Potentially strong competition**	Moderate competition	Low competition	Long-term low competition	**0.5**
Implementation	Business plan	**Business plan unjustifiable**	Business plan with open questions	Business plan plausible	Business plan occasionally proven	Business plan frequently proven	**1.0**
	Technical development plan	Technical development plan unjustifiable	**Technical development plan difficult to justify**	Technical development plan justifiable	Technical development plan likely to be feasible	Technical development plan very likely to be feasible	**0.5**
	Marketing plan	Marketing plan unjustifiable	Marketing plan difficult to justify	**Marketing plan justifiable**	Marketing plan likely to be feasible	Marketing plan very likely to be feasible	**0.0**
	Business development plan	Business development plan unjustifiable	Business development plan difficult to justify	**Business development plan justifiable**	Business development plan likely to be feasible	Business development plan very likely to be feasible	**0.0**
Organisation	Competences of the management team	Management team with major flaws	**Management team with some flaws**	Management team is complete	Management team is complete and competent	Management team is complete and very competent	**0.5**
	Headquarters location	Headquarters location problematic	Headquarters location can be improved	Headquarters location is fine	**Headquarters location has advantages**	Headquarters location has many advantages	**-0.5**
	Competences of advisory board	Very low level of competences of advisory board/ consultants	Low level of competences of advisory board/ consultants	**Moderate level of competences of advisory board/ consultants**	High level of competences of advisory board/ consultants	Very high level of competences of advisory board/ consultants	**0.0**
	Process efficiency	Process inefficient	Process not very efficient	**Process efficient**	Process very efficient	Process exceptionally efficient	**0.0**
Finances	Sales plan	Sales plan unjustifiable	**Sales plan difficult to justify**	Sales plan justifiable	Sales plan conservative	Sales plan very conservative	**0.5**
	Costs plan	**Costs plan unjustifiable**	Costs plan difficult to justify	Costs plan justifiable	Costs plan conservative	Costs plan very conservative	**1.0**
	Profitability	Fundamentally low profitability	Risk of low profitability	**Average profitability**	Currently high profitability	Fundamentally high profitability	**0.0**
	Liquidity plan	**Financial resources for next year are not secured**	Financial resources for next year are secured	Financial resources for next 2 years are secured	Financial resources for next 3 years are secured	Financial resources for next 4 years are secured	**1.0**
							7.5

In Table 2, such an evaluation scheme is exemplified for one of the start-ups and the adjustments, highlighted in bold, demonstrate the drivers and rationale behind the determination of the beta coefficient. This specific assessment increased the start-up's specific beta coefficient to 7.5 points, mainly because of a lack of international reputation of the responsible scientist, the unclear and inconsistent business model and cost planning and the not secured funding for the next year. In addition, the technology worked, so far, only at laboratory scale, only an initial patent application existed, product benefits and unique selling points were not clear, there was strong competition, the management team showed some gaps, and sales planning calculations were difficult to explain. As for factors to lower the risk and to decrease the beta coefficient, only cost and quality advantages compared to competitive technologies were identified.

Table 1 shows a compilation of all start-ups rated with the initial company values calculated based on the basic beta coefficient 6.4 (it is important to note that these company values were calculated with our Excel model based on the sales and cost date from the business plans), the increases or reductions of the beta coefficient, the adjusted beta coefficients and the adjusted company values. We obtained a much more differentiated picture with the assessment of investment opportunities based on the adjusted beta coefficients and corporate values. The bandwidth was from 0.2 to 15.2 million Euros compared with the spectrum of corporate values in the business plans of 1.2 to 4.1 million Euros. With its higher discriminatory power, the new range of values serves an early stage investor as better indication about the company's actual value compared to the data from the business plan. Above all, it is an objective comparison of different investment opportunities mainly based on existing business plans. A comparison with the company values which were shown by the founders in the business plans was not done, as such company values had not been calculated in most of the business plans.

IV. CONCLUSION

The discount rate, which corresponds to the capitalisation rate as the required return on equity reflects the capital costs of start-ups. To determine the capitalisation rate, the characteristics of young technology companies have to be taken into account. In investment negotiations, given the great importance of company evaluations for the negotiations between entrepreneurs and investors, it is advisable to prepare it thoroughly with accepted valuation methods in which all possible risks are taken into account. The beta coefficient is of central importance as an expression of the investor perceived or suspected risks. In negotiations, the founding team shows the risk as low as possible and therefore wants to propose a low beta and reasonable costs of equity with regard to the valuation. Our method is applicable to any early stage start-up and facilitates a better comparison among companies. It can help to bring the negotiations between entrepreneurs and investors regarding the company value to an objective basis, avoiding a focus of the discussion on unnecessary details and the loss of a holistic view.

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