

Discount rates in drug development

When valuing a biotech company with a discounted cash flows approach (NPV or rNPV), the value is notoriously sensitive to the discount rate. But unfortunately, the standard CAPM does not lend itself to determining discount rates of private biotech companies. Read in this analysis which discount rates valuation professionals use.

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Introduction

The biotechnology industry is known to be capital intensive, associated to a lot of risks, and exhibits long timelines. Consequently, biotech companies need to raise capital several times along their development path and might adopt a licensing strategy. All these events require a thorough valuation.

A survey conducted by BIOSTRAT BIOTECH CONSULTING in early 2010¹ clearly shows that discounted cash flows approaches such as net present value (NPV) and risk-adjusted net present value (rNPV) are the standard valuation methods within the industry; often complemented with a comparables analysis.

In the NPV method we estimate future cash flows and discount them depending on when they should occur. The discount rate should account for the time value of money and for the uncertainty or risk of the cash flows. In the last two decades, the risk-adjusted NPV method (rNPV) – sometimes also referred to as expected NPV (eNPV) – has been developed as an extension of the standard NPV method². In rNPV

valuations, the cash flows are multiplied with the probability that they occur (usually derived from success rates) and are then discounted. While in NPV the development risks are included in the discount rate, in rNPV these risks are addressed with the risk-adjustment of the cash flows. As a consequence, the discount rates for the two methods must be different, even though we value the same company or asset. But how do we determine this discount rate?

For public companies we can make use of the capital asset pricing model (CAPM) and plug statistics, derived from the share price development, into a formula that gives us the cost of capital of that company. In theory, the model also works for private companies; but in reality, biotech companies are either private or their shares are not traded sufficiently to provide reliable statistics. This is all the more disturbing as the inclusion of risks in the discount rate is especially delicate for earlier-stage biotech companies; practitioners strive for a clear guideline on how to determine discount rates for these high-risk companies as the discount rate is one of the most influential parameters.

With this in mind, BIOSTRAT BIOTECH CONSULTING has launched a survey among industry professionals about the discount rates they use depending on the profile of a company and the used valuation method. AVANCE and BIOSTRAT BIOTECH CONSULTING hereby present the results of this survey.

¹ Available under <http://biostrat.dk/financial-valuation-methods-for-biotechnology.pdf>

² For a detailed description of NPV and rNPV, please consult Boris Bogdan and Ralph Villiger, „Valuation in Life Sciences. A Practical Guide“, 3rd edition, Springer Verlag.

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Respondents

Responses from 242 participants of the survey could be used for our analysis. Some participants have skipped the quantitative part and have not been included in this analysis. Moreover, the difference between NPV and rNPV still seems to trouble many professionals. Some respondents did not distinguish between the two methods, and some confounded the names. We have applied utmost care to clearly identify which valuation method – with (rNPV) and without success rates (NPV) – was meant. Finally, we were able to assign each discount rate to a valuation method thanks to the additional questions that have been answered in the survey.

The 242 respondents are widely distributed across the key biotech industry stakeholder groups in biotech/pharma valuations (consultants, bankers, investors, biotech and pharma professionals):

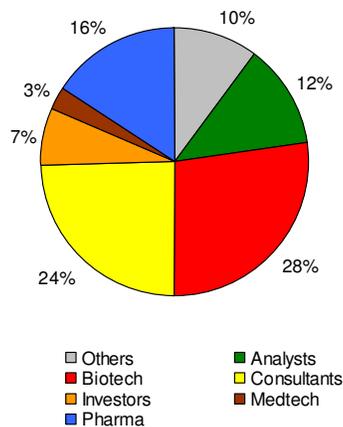


Figure 1: Survey respondents.

88 mentioned that NPV is their primary valuation method as opposed to 105 who said that they primarily used rNPV. 68 responded that valuation is one of their primary tasks. Out of

those, 33 ticked rNPV as their preferred method, and 22 opted for NPV.

Geographically, Europe and the United States are evenly represented:

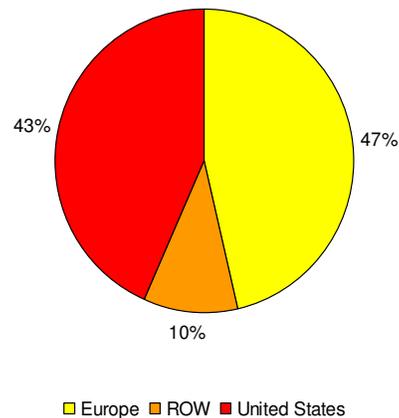


Figure 2: Geographical distribution of respondents.

Example companies

We have presented three example companies; an early-stage company, a mid-stage company, and a late-stage company. The respondents then indicated the discount rate they would use to value each of the companies according to their valuation method of choice (NPV or rNPV). We reproduce the description of the three example companies here once again. All companies are still private and VC funded cancer biotechnology companies which are cash flow negative. The early-stage company has its most advanced product in preclinical phase. The mid-stage company has its lead product already partnered and in phase 2. The late-stage company has a partnered phase 3 product and is expected to go public within the next 2 years.

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Table 1: Example companies.

	Early-stage	Mid-stage	Late-stage
Type of company	Private Biotech		
Phase of lead product	Precl.	P2	P3
Years to market	10	5	2
Disease area	Cancer		
Number of employees	20	100	100
Cash flow negative for	>10y	>5y	>2y
License contracts	no	yes	yes
Funding	VC funded, license revenues if applicable		

Results NPV

First, we present the answers regarding the discount rates used for the NPV method, i.e. the discounted cash flows method that does not include probabilities. In this method, the risk is uniquely considered by the discount rate. In almost all answers, we noticed that earlier-stage companies are discounted more strongly than later-stage companies. This makes sense as the discount rate should also consider the risk, which is doubtlessly higher for earlier-stage companies.

Investors clearly apply the highest discount rates. This is, of course, to their advantage, as they buy into these companies preferably at a low valuation. Medtech professionals use the lowest discount rates. This might also be linked to different risk profiles present in the medtech industry. Pharma professionals even use lower discount rates for later-stage companies. Possibly, pharma companies can absorb the remaining risk in their well diversified portfolio.

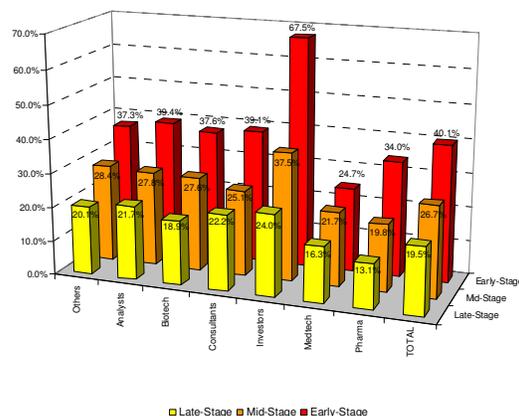


Figure 3: NPV discount rates by profession.

We also analysed the responses with regards to the degree of specialization of the respondents. The two groups were the valuation experts, i.e. professionals whose primary task is valuation, and respondents who indicated that NPV was their primary valuation method.

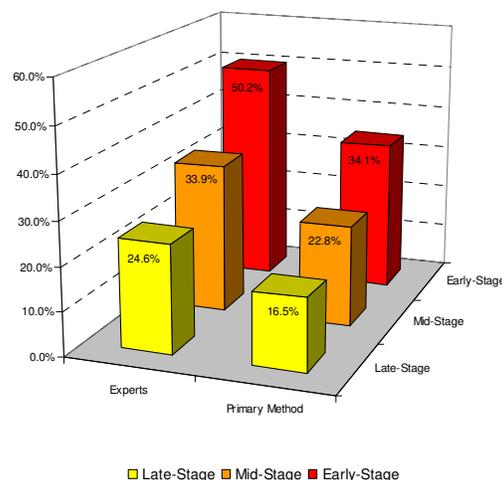


Figure 4: NPV discount rate by specialist groups.

The responses of the NPV users are lower than the overall average discount rates. The valuation experts use higher discount rates.

We cannot determine a significant difference by region. Interest rates might suggest a slightly higher discount rate in the United States, but the survey does not confirm this.

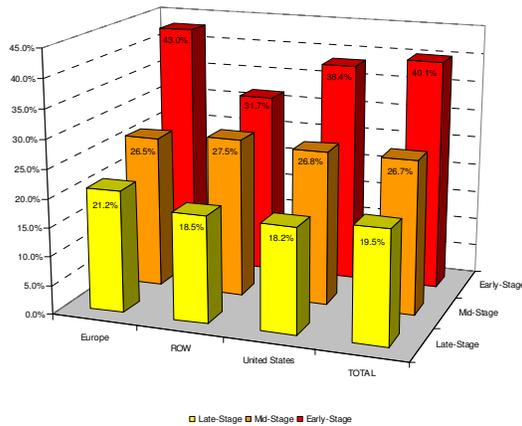


Figure 5: NPV discount rates by region.

While average figures give very reasonable results, we need to mention that the ranges of indicated discount rates are quite large. For early stage companies discount rates between 8% and 100% have been mentioned, for late-stage companies the rates are still between 3% and 65%. But here we also observe a clear trend towards lower discount rates for later-stage companies, even if we look only at the 80% intervals of responses:

Table 2: 80% intervals of NPV discount rates.

Early-stage	15%-70%
Mid-stage	12%-40%
Late-stage	10%-30%

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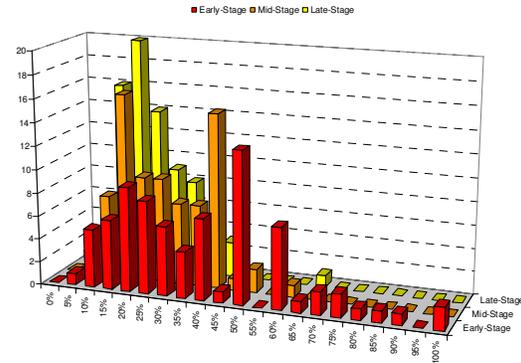


Figure 6: All indicated NPV discount rates.

We need to mention that a subset of 26 of the NPV users have indicated that they adjust the NPV afterwards with a probability that the project reaches commercialization. Their average discount rates are **23.7%, 17.4%, and 14.6%**. These rates are considerably lower than the average NPV discount rates we have displayed above. This makes sense because in this hybrid method between NPV and rNPV, a lot of the project risk is included in the risk adjustment and does not need to be included anymore in the discount rate.

Results rNPV

It is understood that in the rNPV method, all cash flows get adjusted by the probability that they occur. Consequently, a large portion of the risk is already included in this risk-adjustment. We therefore expect lower discount rates for the rNPV method.

Again, we observed that earlier-stage companies are discounted at a higher rate than later-stage companies. Apparently, this means that the success rates are not sufficient to take earlier-stage companies to the same risk level as later-stage companies.

We note a rather stable distribution over all sectors; only medtech exhibits a special case

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with 12% for all companies. This is due to the fact that only one medtech respondent indicated rNPV discount rates. In medtech, the method of choice is clearly NPV. Furthermore, in large companies, often one discount rate is applied over all sorts of investments.

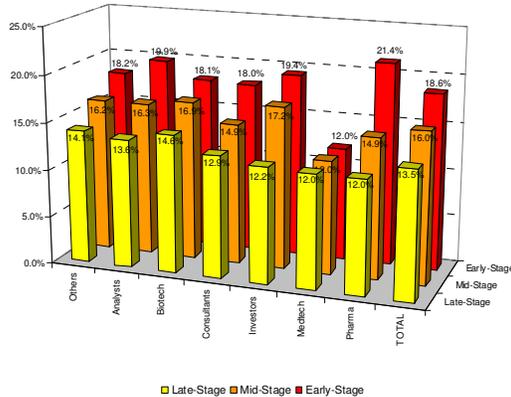


Figure 7: rNPV discount rates by profession.

The average rNPV discount rates of valuation experts and rNPV users are very close.

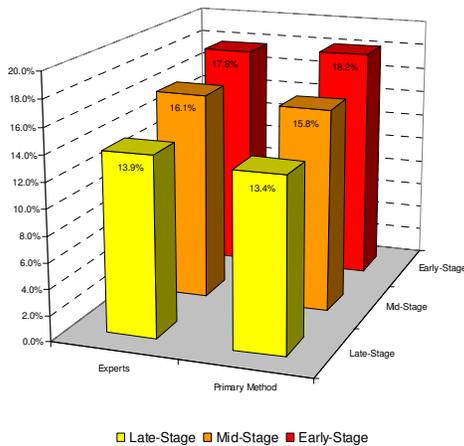


Figure 8: rNPV discount rates by specialist groups.

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For rNPV, we observed a slight difference between the regions. In the United States, the discount rates are always a bit higher, consistent with interest rates. But the trend is not very significant.

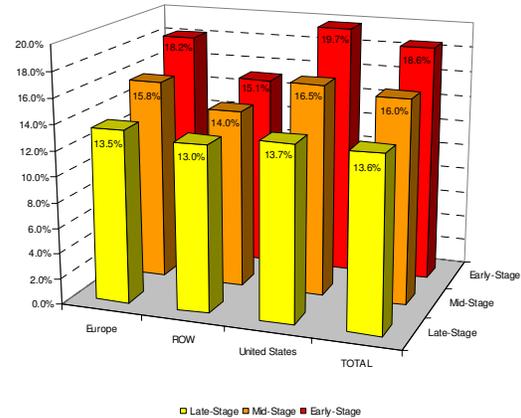


Figure 9: rNPV discount rates by region.

Again, the answers were quite widely distributed, although understandably less than for NPV discount rates which also included different assumptions about the success rates. The 80% intervals give us an already quite reasonable range of the discount rates:

Table 3: 80% intervals of rNPV discount rates.

Early-stage	12%-28%
Mid-stage	10%-22%
Late-stage	9%-20%

Given that the questionnaire remained somewhat vague about the company profiles, we think that these ranges are a very good indication of where rNPV discount rates typically lie.

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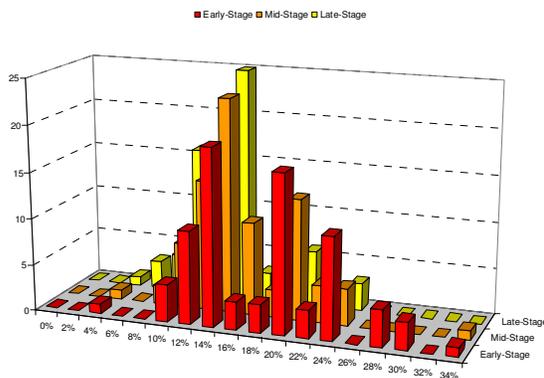


Figure 10: All indicated rNPV discount rates.

Conclusion

The overall picture of the survey conveys a very reasonable picture of the discount rates as they are used for discounted cash flows methods in biotech.

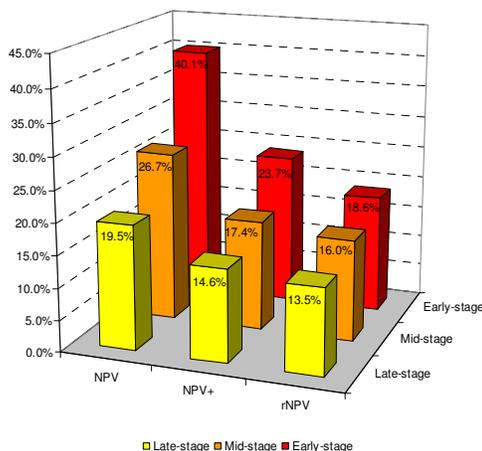


Figure 11: Average results for all discounted cash flows methods.

Earlier-stage companies are always more heavily discounted because they contain more risks. This is even true for rNPV, although the attrition risk is accounted for in a separate way. The range of the discount rates is naturally much larger for NPV where the attrition risk needs to be factored into the discount rate. But there seems to be a certain degree of agreement on the rNPV discount rates; finally rNPV is the standard method within the biotech and pharma community. However, we need to mention that a difference of only 1% can already make a huge difference in value. And moreover, assumptions might also differ for sales, success rates, timelines, and costs. So, even a relatively good match of the discount rates doesn't mean that the value is clearly determined.

The analysis of the responses has revealed that there is still quite a lot of confusion amongst industry practitioners about the names of the various valuation methods. In the context of this survey, we call a discounted cash flows method without success rates, i.e. without risk-adjustment, NPV; a discounted cash flows method which then multiplies the result with a probability is called NPV+; and a discounted cash flows method that risk-adjusts each cash flow with its specific probability is called rNPV. But some talk about rNPV because a high discount rate is also some sort of risk-adjustment in their eyes. Others always mention NPV even though they use rNPV; but they think that in a biotech context it is natural to include success rates in a valuation and this doesn't need to be mentioned additionally.

In view of the absence of a rigorous theory about how to determine the cost of capital for biotech companies, we believe that the results of this survey are a valuable step towards a better understanding of this important parameter.

About Biostrat Biotech Consulting

BIOSTRAT provides strategic decision making services to pharmaceutical, life sciences, and biotech companies. Operating in a highly competitive and one of the most capital and research intensive industries significantly increases the importance for these companies to make the right strategic choices. BIOSTRAT specialises in assisting companies in making strategic decisions with regards to corporate strategy, partnering, licensing, fundraising and M&A. Read more at www.biostrat.dk.

Nicolaj Hoejer Nielsen (nhn@biostrat.dk) is the founder and Managing Director of BIOSTRAT Biotech Consulting. Mr. Nielsen has a background as corporate manager within the biotech industry. Mr. Nielsen holds an MBA from INSEAD and an M.Sc. in Business from Copenhagen Business School and University of Texas. Mr. Nielsen is an Associate Professor at Copenhagen Business School, where he teaches business strategy and strategic marketing on postgraduate courses.

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About Avance

Avance is a company specialised in valuation in life sciences located in Basel, Switzerland. The company serves a wide range of clients around the globe including biotechs, big pharma, hedge funds, investors, banks, and technology transfer offices. Projects include negotiation of license terms, fund raising, and strategic decisions. Our main lines of business are consulting, valuation software, market research, and education. Read more at www.avance.ch.

Ralph Villiger (ralph.villiger@avance.ch) is co-founder and partner of Avance. Ralph holds an MSc in mathematical finance of the University of Oxford and also graduated as mathematical engineer from the Swiss Federal Institute of Technology Lausanne (EPFL). Ralph previously worked in financial risk management and corporate finance. He authored numerous articles on valuation in life sciences in renowned journals and co-authored the book "Valuation in Life Sciences. A Practical Guide", which meanwhile is in its third edition. Ralph teaches at several universities and speaks regularly on international conferences about valuation and licensing.

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