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Corporate Finance in Life Sciences

Terminal value, or how to get to an arbitrary value.

Discounted cash flows valuation in textbooks assumes two periods of business operations: a first period, for which the cash flows are estimated up to a certain time horizon, and a second period, beyond that time horizon, where the cash flows are assumed to be stable or to constantly grow. Mathematically we can express the second period very easily in the following way:

$$V_T = \frac{CF_T}{r-g},$$

where V_T is the terminal value, T the time horizon, CF_T the cash flow at T, r the discount rate and g the growth rate. The value of the company or project is then calculated as follows:

$$V = \sum_{i=0}^{T-1} \frac{CF_i}{(1+r)^i} + \frac{V_T}{(1+r)^T}.$$

Many renown and self-proclaimed experts say that the terminal value can be of extreme importance for the value of a company. Rappaport (1985) reports that the terminal value is 50% to 80% of the total company value. Copeland, Koller, and Murrin (1994) even quantify the contribution of the terminal value to the company value at 125% for high tech companies (they chose a time horizon of 8 years). This means that by the end of the chosen time horizon the company has not even earned all the money it has spent until then. Until then the company would be an unprofitable adventure. So, the cash flows that actually make the company worthwhile to invest in, i.e. the ones beyond the time horizon of the valuation, are crudely summarised in the terminal value. In other words, the overwhelming part of the company value is made up by cash flows that have not been estimated, but that should happen because the company is assumed to have reached a stable state by the end of the time horizon. How these stable cash flows are composed year after year and what it takes to sustain them is left in the dark. The terminal value is based on the assumption that somehow the company is able to maintain – or even increase in the case of a growth rate – its earnings.

We think it is completely unrealistic to assume that a company, especially a company in the field of drug development, reaches a stable state after 8 or even 20 years. First, in the case of an international pharmaceutical company, probably the prototype of what could be assumed a stable company in the drug development industry, this approach would make any cash flow estimation obsolete. Why should the company in 5 years be any more stable than today? Second, if we assume a biotech company, who has a lead drug in late stage development, its future depends heavily on the success of that project. If the project fails the company might even have problems to fund its other projects, while if the project becomes an economic success, the company can grow and expand its pipeline either with acquisitions, licensing, or increased R&D activity. Third, the terminal value only assumes that the future cash flows are stable, but it does not verify whether the conditions are given for this stability. Imagine a company with one project on the market and with an empty pipeline. It is impossible to have a stable revenue stream without replacing the product once it is off-patent. People using terminal value run the danger to blindly assume that somehow – they do not know exactly how – the company is able to replace its commercial products. They should always verify whether the R&D expenses and the projects in the pipeline are suited for this. Fourth, very similarly, assume a company with one important drug that generates most of the revenues of the company. The companies might face problems replacing that product (e.g. former Serono with Rebif, Lundbeck with Citalopram, Pfizer with Lipitor). If the time horizon is chosen such that the product is still patent protected when applying the terminal value, we implicitly assume that the company is able to replace the revenue stream stemming from that project. This should actually be a conclusion of the valuation process, not an assumption. In figure 1 all risk-adjusted cash flows are displayed stemming from Serono's pipeline in 2005.

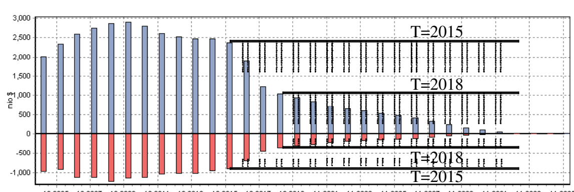

Figure 1: risk-adjusted cash flows of Serono's pipeline in 2005, estimated by Avance in ri:val.

At the time we did not think that Serono's pipeline could compensate the loss of Rebif's and Gonal F's revenues once they loose patent protection. As the figure displays, there is a big difference if we assume the terminal value in 2015 or in 2018. This sensitivity to the choice of the time horizon T is of course non-sense and should be hint enough to look for a different method.

We therefore advocate for a much more comprehensible method. Instead of assuming stable or growing cash flows we assume a stable or growing R&D activity, the pipeline feed rate. The company each year spends a certain amount on early-stage R&D, which in return yields a number of preclinical projects. These projects can be in any stage, the R&D costs must simply account for the costs the company spends for projects prior to that stage. Looking at the historical R&D output of the company and the budgeted R&D expenses we are able to estimate a feed rate, i.e. how many new projects the company can feed into its pipeline every year. We can even assume various feed rates. Assume a company specialised in different disease areas like CNS, inflammation, and metabolic diseases. We could say that the company can generate 1-2 preclinical CNS projects each year, 1 inflammation project, and 1 metabolic project every second year. We then define a prototype project for each feed rate with cautiously estimated parameters. It is unrealistic to assume that every project will become a blockbuster, we therefore recommend to use average or even median sales estimates. As a final step we then include these not-yet identified project into our valuation: Each year the company has to spend money for pre-preclinical R&D and generates in return new standard projects according to the feed rates.

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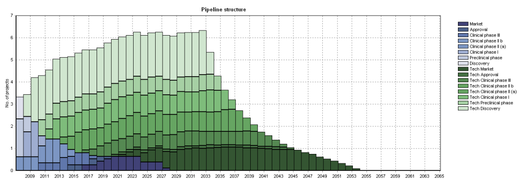

Figure 2: Average pipeline structure of a biotech company over time, generated with ri:val.

Figure 2 displays the mechanism of the feed rate. The currently identified projects represent the current pipeline and are coloured in blue. Different shades of blue correspond to projects in different phases. Naturally a project moves to a darker shade of blue with time, but only with a given probability. Therefore the pipeline of the currently identified projects (in blue) naturally dries out. In figure 2 we see that each year one project in discovery phase is added to (or fed into) the pipeline. This discovery phase lasts two years before the project can move to preclinical phase. Therefore we observe from the second year onwards always two projects in discovery. All projects that will be generated in the future are displayed in green shades, according to their stages. We see that the stable phase only starts somewhere between 2023 and 2030. Figure 3 displays the cash flows of the same company. Again green are revenues that stem from not-yet identified projects. We see nicely how and at what level they replace the current pipeline.

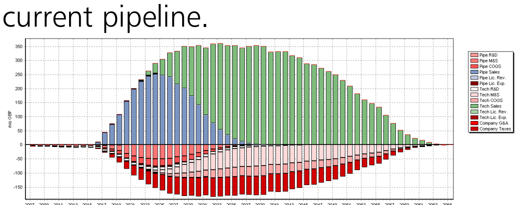

Figure 3: Risk-adjusted cash flows including feed projects, generated with ri:val.

In the year 2028 the cash flows start being stable. If we were to use terminal value, we would therefore need to estimate cash flows for 20 years for the displayed kind of company. In both figures we can see a decay at the right hand side. This is because we only fed over the next 25 years projects into the pipeline, as displayed in figure 3.

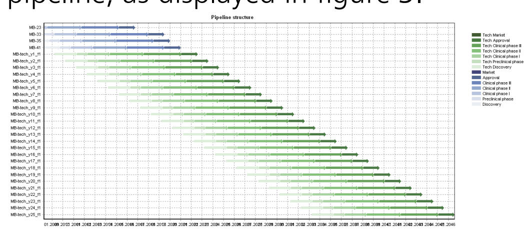

Figure 4: Development plan of company, generated with ri:val.

The ideas of the feed rate and the terminal value are close to each other, both try to capture the value of the company from activities that lie beyond our horizon of estimation. But while terminal value sets a point in time as horizon, the feed rate assumes that this horizon is the current pipeline. All projects are valued in full, and projects that are not initiated or identified so far belong to the feed rate.

As discussed the terminal value relies on some rather vague assumptions of stability that are rarely checked – and also rarely fulfilled. The feed rate approach relies on much more tangible input parameters like prototype project, early R&D expenses, and research output (feed rate). It is a much easier task to estimate these parameters, where we can also use the track record of a company. By the way, BD&L can also be assumed as a feed rate. A pharmaceutical company can in-license each year 4 IND projects; this corresponds to a feed rate of 4.

It is clear that for earlier stage companies the value of the not-yet identified projects is more important, because most of their revenues will stem from this kind of projects. Nevertheless one should remain realistic in attributing value to things that are not there. In the displayed example the feed projects altogether make up 20% of the company value. Expanding the feed to more than 25 years has virtually no influence, because these additional discovery projects, which have for its early stage a small value anyway, get discounted for another 25 years ($(1+20\%)^{-25}=1\%$). In contrast, the terminal value can be as high as 500% of the value of the present pipeline dazzling investors and creating unrealistic return expectations.