8

Discounted cash flow valuation

As introduced in Section 6.1 above, discounted cash flow models estimate the value of a company (or contract or project) from discounting expected future cash flows from the company to the time of valuation – i.e., estimating the net available cash flow at specific points in time and then using the risk-adjusted cost of capital over the time periods to estimate its value today:

Table 8.1 Basic structure of company cash flows

Dates	t_a	t_b	t_c	T
Time periods	*First*	*Second*	*Third*	*Stable*
Revenues (+)				
Costs (cash) (–)				
Taxes (–)				
Investments (–/+)				
Free Cash flow				

Table 8.1 shows the basic structure of cash flows for valuing a company, a matrix including the analyst's best estimates for each cash flow category displayed in the left column for each future date. The time-unit is typically set in *years*, and t_n denotes n years into the future. Estimated annual cash flows are assumed to fall on these dates, since the benefits of specifying more frequent cash flows usually are limited. The time *periods* like from t_a until t_b are included since they are particularly important if one assumes

significant staged changes over time, e.g., from an increasing ESG impact on the company. In general, it is only necessary to specify the number of time periods for which one has relevant and significant information. For example, in a case where one has reliable information regarding the government's plans to gradually phase in costly regulations over time, e.g., emission taxes increased in three stages over 10 years, then each stage may represent a separate time period in the cash flow structure. Even the best analyst cannot credibly forecast far into the future, and thus after time *T* one needs to specify the expected steady cash flows for the continuation value.

Cash flows may be defined differently, depending on the scope of the valuation. The standard approach is to assume *Free cash flow* to the whole firm – i.e. what the firm, and its assets, produces, and which value may be afterwards split between lenders and shareholders. An alternative is to deduct interests and instalments to lenders from the cash flow to get to *Equity cash flow* – i.e., what shareholders would receive after all other claimants have been serviced. How to estimate cash flows reflecting ESG matters is covered below.

The actual valuation of these cash flows is done by discounting them to today, effectively finding their value given their riskiness and how far out in the future they are. Assuming *r* as the alternative cost of capital (see the discussion in Section 8.2), the discounting is done using Equation 1 for each cash flow and adding the discounted (=present) values to get to the total value:

Equation 1

$$PV\left(FCF_n\right)=\frac{FCF_n}{\left(1+r\right)^n}$$

The value of all cash flows from time *T* and onwards into infinity, also called the continuation value, requires first valuing them at time *T* and then discounting this value to today. The future value at time *T* could either be valued using the 'Gordon's' formula, Equation 2, or a multiple of expected earnings, cash flow or assets, at that time:

Equation 2

$$PV_T\left(FCF_n\right) = \frac{FCF_{T+1}}{r-g}$$

where g represents perpetual growth rate in steady state.[12] The value of these cash flows today is then calculated as:

Equation 3

$$PV_0\left(PV_T\left(FCF_T\right)\right) = \frac{PV_T(FCF_T)}{\left(1+r\right)^T}$$

Finally, assuming that one has valued the free cash flow to the firm, one then needs to deduct any debt, and add any additional sources of value such as tax subsidies or optionality.

We discuss all valuation elements and how to include the ESG dimensions below.

8.1 Cash flow estimation

Each cash flow element, as illustrated in Table 8.1 – i.e. revenues, cash-costs, investments and taxes – is generally estimated from a company's own recent history, with reference to its peers, or based on specific information regarding verifiable business prospects. These estimations usually take a major share of an analyst's time, and it's beyond the scope of this guide to specify all of the possible techniques used.

In a valuation recognizing ESG dimensions, one also needs to do an additional assessment of how the ESG issues that are *material* in the specific case are expected to impact any of these cash flow items. This assessment should be focused on the overall materiality assessment discussed above. ESG issues commonly vary by industry, and the industry-specific topics and related questions raised in the first part above are natural starting points for the analysis. Across any of these questions the same analytical approach applies.

[12] When there is increasing awareness that there are fundamental limits to growth based on availability of resources and total externalities on the globe, the need to set a moderate g is more relevant than ever.

- How is the future of the company going to be different from the past? Should the future be estimated over a longer horizon and/or are there valid reasons for predicting several distinct stages of development?
- How is the case different from its peers, and will it develop towards them or vice versa? What is a fair set of assumptions for the steady state cash-flows?
- Is there specific and reliable information regarding significant external changes in policies, regulations, public opinion, competitive pressure, best practices etc., that are applicable to the forecasts?
- For the material issues, what are relevant and reliably comparable metrics (ratios, scales, indicators etc.) that may be applied in the adjustment of cash flow items. For each of these metrics, what are the current and expected levels?
- For each material issue: Does it represent changed costs, changed risk, changed capex and/or a different revenue development? Even if it is challenging, one needs to draw a conclusion about this to make the approach useful for a proper revision of the cash flow estimates.

8.2 Cost of capital

As argued in Section 6.2.2, calculations of the cost of capital (the denominator in the DCF valuation approach) should only take systematic risk into consideration. For adjustments related to firm-specific risk, we refer to Section 9.3.

8.2.1 Standard inputs for estimating cost of capital

For valuation purposes, the cost of capital is most often calculated using the Weighted Average Cost of Capital (WACC) method, which takes into account the firm's leverage, its cost of debt, and its cost of equity according to the formula:

Equation 4

$$r_{wacc} = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D \left(1 - t_c\right)$$

where E represents the firm's equity, D represents the firm's debt, both at market values, r_E and r_D the cost of equity and the cost of debt, respectively, and t_c the corporate tax rate.

Alternatives to the WACC method are the Adjusted Present Value (APV) method and the Free cash flow to Equity (FCFE) method. Although the approaches differ in how leverage is considered when discounting cash flows, all three methods require an estimation of the equity cost of capital to calculate firm value.

8.2.2 Systematic risk adjustments – β

The β-risk of a firm is usually estimated using observed equity βs of the firm, its peers and its industry, and then de-leveraging these to get to asset *beta*s. As these necessarily are estimated from historical data, the issue is whether the beta-risk may be different going forward due to ESG dimensions? In efficient markets, it is also necessary to assess whether market prices and implicit risk-assessments (β-risk) have already captured these dimensions in the most recent reference period.

As mentioned in Section 6.1, most analysts use the Capital Asset Pricing Model (CAPM) to estimate a firm's *ex-ante* cost of equity capital (Pinto et al., 2019). In the CAPM world, market risk (systematic risk) is the only priced risk factor. The CAPM formula relates a firm's market risk (β) to the returns of an individual stock:

Equation 5

$$ER_i = R_f + \beta_i \left(ER_M - R_f \right)$$

where ER_i represents the expected return of stock i, R_f represents the risk-free rate, and $(ER_M - R_f)$ represents the market risk premium. Importantly, assets will only be correctly priced if markets are efficient (Markowitz & Todd, 2000). The Arbitrage Pricing Theory (APT) (Ross, 1976) has less restrictive assumptions, and relates stock returns to several "risk factors" – e.g. (Fama & French, 1993), (Carhart, 1997).

Determining whether a stock is *ex-post* correctly priced (i.e., whether the observed returns correspond to the systematic risk to which investors

are exposed) is therefore largely dependent on which model is used. Several academic papers show that firms with higher ESG scores have higher returns than what traditional asset pricing models would predict:

- A value-weighted portfolio of the "100 Best Companies to Work for in America" earned an annual four-factor alpha of 3.5% from 1984 to 2009, and 2.1% above industry benchmarks (Edmans, 2011).
- Socially Responsible Investing (SRI) leads to superior performance that cannot be explained by differences in market sensitivity, investment style, or industry specific factors (Derwall, Guenster, Bauer, & Koedijk, 2005), (Statman & Glushkov, 2009), (Kempf & Osthoff, 2007).

This evidence is in line with the findings described in Section 6.2.2, since a lower *ex-post* cost of capital is consistent with valuations being higher than expected *ex-ante*, given a certain level of risk. However, and in apparent contradiction, firms with lower ESG scores (stocks excluded by environmental screens and "sin stocks" are also shown to have higher returns than what traditional asset pricing models would predict (Chava, 2010), (Hong & Kacperczyk, 2009)).

The fact that sorting stocks based on ESG scores leads to different returns – than traditional asset pricing models would predict – can be caused by two distinct channels.

1. Markets are inefficient, and investors do not base their decisions on the full set of information regarding ESG issues.
2. The models used to calculate expected returns are incorrect, possibly because they ignore the existence of an "ESG risk-factor" (systematic).

These two channels have distinct consequences for ESG-related cost of capital adjustments. If the reason for the mispricing is market inefficiency, one can argue that such inefficiency will decrease over time, as firms start reporting more on ESG issues, and investors start collecting more information about these issues. If that is the case, a cost of capital adjustment may not be warranted, particularly if investors have a long-term investment horizon. However, if the reason for the mispricing is the existence of

a systematic risk factor distinct from CAPM's market risk (β), then investors should use an asset pricing model that takes a firm's exposure to that risk factor into consideration. Importantly, the two channels may both play a role in the current observed mispricing.

The existing academic literature is far from conclusive with respect to the existence of an ESG risk factor. Below are two examples of papers that argue for and against this channel.

- ESG attributes may be relevant to firm value, but they are not efficiently incorporated into prices. There is no evidence that abnormal returns are compensation for risk (Mănescu, 2011).
- There is existence of an ESG risk premium within global equity portfolios both geographically and longitudinally (Pollard, Sherwood, & Klobus, 2018).

A possible solution to this problem would be to gather information on ESG scores and returns of a firm's peers and industry, in order to determine the possible existence of a systematic risk factor and track the development of this factor over time. In an actual valuation this is less relevant, since both markets are in transition and the research in this field is inconclusive. The pragmatic approach is to use a CAPM-based cost of capital.

8.3 Firm value, equity value and past liabilities

One final issue is how to incorporate *known* past liabilities, such as underfunded pension plans or the decommissioning of power plants, into the valuation. For example, ENBW, the German energy producer, has (unfunded) pension provision of 7.65 bn. Euro and provisions for the dismantling of power plants of 5.86 bn. Euro in the balance sheet. ENBW reports the (estimated) present value of these obligations, so they should be treated similar to debt in the calculation of the equity value by deducting the book value of the assets from firm value.

We will discuss the valuation[13] of uncertain obligations in more detail in Sections 9.3 and 9.4.

[13] See the ENBW case in the appendix.