What is Free Cash Flow and how can it be used to value companies?
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Free cash flow (FCF) is the cash flow generated by a firm's operations that is available to pay its financial obligations to those that have provided its funding. These include its equity shareholders and its lenders. This article examines how FCF can be used to value a company. Essentially analysts forecast earnings to a horizon (say 4 years) and then make assumptions regarding earnings and asset growth rates to avoid the impossible task of forecasting to infinity. Operating income is forecasted and free cash flow is simply operating income less the change in net operating assets ($OI_t - \Delta NOA_t$).

The concept of free cash flow can best be explained as a firm-wide application of the net present value (NPV) rule to value a project. Essentially a firm is an evolving bundle of projects that commence and cease at different points in time. If we have an individual project we can easily apply the NPV rule. This usually involves discounting the future cash flows of a project to obtain their present value and then subtracting the cost of an initial outlay or investment (I_t) from this present value. It is a little more complex with a firm. Essentially using the free cash flow method is an attempt to discount the cash flows of all the firm's projects at the same time. The following table serves to illustrate.

Table 1

Time period (t)	1	2	3	4	5	6
Aggregate net cash inflow (C_t)	C_1	C_2	C_3	C_4	C_5	C_6
Cash investment for new projects (I_t)	I_1	I_2	I_3	I_4	I_5	I_6

Here C_t is the aggregate net cash inflows of all the firm's projects which are running during time period t. t = 1, 2, 3, ..6 (see Table 1 above). I_t is the cash investment in new projects made during time period t. Free cash flow for year t is $C_t - I_t$. I_1 represents the new investments made in period 1 and their net cash inflows are included from C_2 onwards if we make the simplifying assumption that cash inflows are deemed to occur at the end of the year in which they actually take place. The firm's life should extend beyond the six year outlined in Table 1. Similarly, the net cash inflows for projects undertaken in time 5 will only occur from time 6 onwards. Essentially all the projects of the firm can be amalgamated as in Table 1. Accordingly, they can be discounted at an appropriate cost of capital to obtain the value of the firm.

Thus part of the challenge in valuing a company is to estimate the future C_t - I_t or FCF, over its future lifetime. Clearly the first task of the analyst is to understand the company's business and strategy. She then uses the financial statements as a means of reflecting and summarising its financial position and its evolution as a result of its strategy. Assuming this analysis is done and earnings are forecast to a reasonable horizon the valuation task then becomes deducing forecasts of C_t - I_t from earnings forecasts. Because of the nature of double entry accounting there are a number of ways in which this can be done.

The simplest, though not necessarily the most popular approach, is to first recognise that operating cash flow or C_t is equal to operating income less operating accruals ($OI_t – OAc_t$). Therefore, $C_t - I_t = (OI_t – OAc_t) – I_t = OI_t – \Delta NOA_t$. Here ΔNOA_t is the change in net operating assets or cash investments plus accruals ($I_t + OAc_t$). Once we have computed free cash flow for each year we can discount it at an appropriate rate to compute the value of the company's operating assets. If the company is unlevered we would use the company's cost of equity to discount the FCF.

The cost of equity is usually estimated from the Capital Asset Pricing Model (CAPM) formula

$$K_e= E(R_i) = R_f + \beta_i\{E(R_m) – R_f\} \quad (1)$$

This equation states that the cost of equity K_e (or expected rate of return) is equal to the risk free rate (R_f) plus a risk premium equal to the firms systematic risk (β_i) by the market risk premium $\{E(R_m) – R_f\}$. Note that the CAPM applies to all assets and not just equity shares.

However, if the company has borrowings the cost of equity will represent both business risk and the financial risk of borrowing. Also the cost of equity will increase as the company increases its leverage. From Modigliani and Miller (MM) proposition 2 we know that the relationship between the cost of equity and leverage is given by the following equation

$$K_e = r_a + (r_a – K_d)D/E \quad (2)$$

Where

K_e is the cost of equity

r_a is the cost of equity of an unlevered firm or the cost of capital representing the business risk of the firm.

K_d is the cost of debt: the interest rate on borrowings

D is the market value of debt

E is the market value of equity

We can rearrange equation (2) to find the appropriate cost of capital for the assets of the company. The re-arranged equation is

$$r_a = WACC = K_e \frac{E}{V} + K_d \frac{D}{V} \quad (3)$$

The formula in equation (3) shows that the unlevered cost of capital for a company is the weighted average of its cost of equity and its cost of debt, therefore it is usually called the Weighted Average cost of capital or WACC. It is the appropriate discount rate for FCF generated by the operating assets of the company which are only susceptible to business risk. It should be really considered the cost of capital for the assets since the label the *weighted* average cost of capital gives rise to the misconception that the WACC changes when the capital structure changes. Provided we have a perfect capital market it stays the same when the capital structure changes in accordance with Modigliani and Miller proposition 1. However, the costs of debt and particularly the cost of equity change. The latter changes in accordance with equation (2) above. Thus a capital structure change will alter some or all of the right hand side of equation (3) so that r_a remains the same.

An alternative approach is to compute the beta of the assets of the firm and use this beta to compute the cost of capital reflecting the business risk of the company. In particular

$$\beta_A = \beta_E \frac{E}{V} + \beta_D \frac{D}{V} \tag{4}$$

β_A is the asset beta

β_E is the equity beta

β_D is the beta of debt.

The remaining notation is as above.

β_A is then used in equation (1), the CAPM, to get the cost of capital for the company's operating assets. Because the cost of capital for the company's assets or operations does not change unless the operations change we estimate the WACC and use it to discount the free cash flows to the operating assets of the company. Theoretically we could compute the free cash flows to equity and to debt and discount these at their appropriate costs to value the company. However, any change in leverage would change the cost of equity and perhaps the cost of debt. Thus our discount rate would have to be changed whenever the capital structure changed. In this regard it should be noted that the weights above are based on market values and not book values. Therefore the capital structure and hence the cost of equity will change over time as the market value of equity changes: even if no additional borrowing is undertaken. For example, a fall in a firm's share price causes its leverage to increase.

For the above reasons most analysts estimate the operating free cash flows and discount these at the cost of capital appropriate to the business risk of the firm. They then subtract the value of the debt from the result to establish the value of equity (E).

The following example which outlines the projected accounts for Alkimos over the next five year serves to illustrate. From year six onward Alkimos will generate a 3% p.a. increase in sales with profit margins remaining constant. Book Value will also grow at 3% giving a constant ROE. The market values Alkimos at €1 billion. Is this a fair valuation based on these projections?

We establish that the risk free rate of interest is 2.775%, the expected market risk premium is 5% and the beta of Alkimos is 1. Using equation (1) we find that the cost of equity is 7.775%. It is clear from the projections in the table below that the interest rate on debt is 4%. We use equation (3) to compute the WACC. Since we know the value of the equity in Alkimos from the market we use this value (€1,000 million) for E and €257.24 as the value of debt (D) and establish that the WACC is 7%.

Table 2: Financial Projections for Alkimos in Millions of Euro

	Present Time 0	1	2	3	4	5
Sales	800.00	864.00	889.92	916.62	944.12	972.44
Operating Income	80.00	86.40	88.99	91.66	94.41	97.24
Interest	10	10.29	9.82	10.11	10.42	10.73
Net Income	70.00	76.11	79.17	81.55	84.00	86.52
Fixed Assets	388.24	399.89	411.88	424.24	436.97	450.08
Net Current Assets	172.00	172.80	177.98	183.32	188.82	194.49
Total Assets	560.24	572.69	589.87	607.56	625.79	644.56
Equity	303.00	327.25	337.07	347.18	357.59	368.32
Debt	257.24	245.44	252.80	260.38	268.20	276.24
Total Capital	560.24	572.69	589.87	607.56	625.79	644.56

An alternative approach is impute the beta of debt from its cost using equation (1) and then employing this value in equation (4) to get the beta for the operations of the firm. This beta is then inserted into the CAPM formula, equation (1), to get the cost of capital for the assets. The beta of debt is = (4-2.775)/5 = 0.245. The beta of the assets is $0.245 * \frac{257.24}{1{,}257.24} + 1 * \frac{1000}{1257.24} = 0.845$. Using this beta in equation (1) we confirm that the cost of capital for the operations of Alkimos is 7%.

From the projections above we estimate the FCF from the operations of Alkimos and discount them at the WACC or cost of capital appropriate to those operating assets. This procedure is outlined in Table 3 on the following page.

Table 3: Valuation of Alkimos

Operating Income	86.40	88.99	91.66	94.41	97.24
ΔNOA	12.45	17.18	17.70	18.23	18.77
FCF	73.95	71.81	73.97	76.18	78.47
Disc. Factor	1.070	1.145	1.225	1.311	1.403
Disc. FCF	69.11	62.72	60.38	58.12	55.95
Cumulative DFCF	69.11	131.84	192.22	250.34	306.28
PV of Terminal Value					1,440.67
Value of Assets					1,746.95
Value of Debt					257.24
Value of Equity					1,489.71

We can see that Alkimos is worth €1.49 billion so it is undervalued by the market. Note the calculation of the present value of the terminal value is computed by first getting the value of FCF from year 6 onwards and then discounting the results back to the present or time 0 $\frac{\mathbf{78.47*(1.03)}/\mathbf{(.07-.03)}}{\mathbf{1.403}}$ = 1,440.67. This is added to the PV of the FCF from years 1 to 5 and then the value of debt is subtracted to give the value of the equity in Alkimos.

But the calculation of WACC and hence the valuation €1.49 billion was done assuming that the value of equity was €1 billion and the D/V ratio was 0.204. These were clearly incorrect assumptions. However, they do not matter since we computed the cost of capital appropriate to the business or operating assets which is not affected by leverage. To check use equation (2) to compute the revised cost of equity implied by the "new" capital structure implied by our valuation of €1.49 billion.

$K_e = .07 + (.07 - .04)\frac{257.24}{1,489.71} = 7.52\%$. The same result is arrived at by computing a revised β for equity from equation (4). This revised β is 0.949 and when inserted equation (1) gives a K_e = 7.52%. If we insert this value into equation (3) along with the revised D/V and E/V values of $\frac{257.24}{1,746.95}$ and $\frac{1,489.11}{1,746.95}$ we will still get a cost of capital of 7% in accordance with MM propositions.

Like all analyses the above is based on assumptions. We are assuming that both the CAPM and Modigliani and Miller propositions 1 and 2 hold. Both of these models are derived assuming perfect capital markets with no taxes and transactions costs. The MM propositions and the CAPM can be adjusted for corporation taxes. This is rarely done for the latter but the cost of debt is routinely adjusted for the corporate tax shield provided in case of the former. However, this adjustment is controversial, because with corporate tax shields additional debt always reduces WACC, so the more a firm borrows the more valuable it is.

This is clearly incorrect so we suspect that something is being omitted from the analysis. One factor that this type of analysis ignores is personal taxes. Even if the personal tax rate on debt and equity income is the same the latter has a personal tax advantage over the former since part of the return to equity (capital gains) can remain unrealised indefinitely leading to a valuable deferment in tax payments. In addition, for many companies in Ireland the corporate tax rate is rather low, there are alternative sources of tax shields (capital allowances) as well as bankruptcy costs. All of these factors serve mitigate if not entirely erode the corporate tax advantage of debt in Ireland.

In any event adjusting for one market imperfection, corporate taxes, while ignoring all others, makes little sense. Similarly, adjusting for every imperfection no matter how insignificant is not cost effective or desirable. An apparently simple method of avoiding any assumptions with respect to taxation would be to compute the FCFs to equity and discount these at the cost of equity. However, this will involve computing the D/V ratio (in market value terms) in each year from the forecast horizon back to the present and using a different cost of equity for each year depending on the D/V ratio in the year in question. While this is feasible and not subject to the assumptions above it is rarely used in practice and not recommended under examination conditions.

Finally, given that Alkimos is profitable and has a low level of leverage it is likely to benefit somewhat from the tax shield of debt. Adjusting K_d for the corporation tax rate gives a revised cost of debt of 3.5% and WACC of 6.9%. Given the uncertainties surrounding estimates of the cost of capital most analysts would have little difficulty in rounding this to 7% as used above.