

DISCOUNTED CASH FLOW: CONCEPT AND MODEL

Marcin Siwicki
New Member Education

Overview

Stock's current price reflects the total value of the company forever

Project the future free cash flows

- Cash that company generates after the money required for its operations and asset base
- Allows company to pursue opportunities to enhance shareholder value

Discount these cash flows by the weighed average cost of capital - the cost of financing the company

Key concepts covered in lecture : Free Cash Flows, Capital Structure, CAPM, WACC, Terminal Value

DCF Analysis									
(\$ in millions of US dollars)									
	Historical				Projected				
Fiscal Year Ending: 12/31	2004	2005	2006	2007	2008	2009	2010	2011	2012
Operating Income	\$8.0	\$7.0	\$100.3	\$214.7	\$303.9	\$298.4	\$298.7	\$286.6	\$261.6
Taxes	(1.0)	(0.9)	(4.8)	(7.7)	(9.1)	(11.9)	(11.9)	(11.5)	(10.5)
Depreciation and Amortization	12.0	14.5	56.6	127.2	193.4	182.4	191.6	194.9	197.6
Decreases (Increases) in Working Capital	(1.0)	(1.8)	(40.0)	(74.5)	(134.2)	-	(0.6)	(0.5)	(0.4)
Capital Expenditures	(110.0)	(121.6)	(828.9)	(2,321.2)	(331.5)	(27.6)	(281.8)	(252.2)	(220.9)
Free Cash Flows	(92.0)	(102.9)	(716.8)	(2,061.5)	22.5	441.2	196.0	217.3	227.4
Free Cash Flows Already Received	-	-	-	-	-	-	-	-	-
Discounted Free Cash Flows					20.9	381.8	157.8	162.8	158.5

Free Cash Flow

Represents cash the firm is able to generate after laying out the money required for its asset base

Allows company to pursue ways to enhance shareholder value

Cash is needed to develop products, make acquisitions, pay dividends, reduce debt

Should be noted that negative FCF is not necessarily bad – could mean that firm is making large investments, if these investments earn a high return then the firm's strategy could pay off

Two main methods to calculate FCF:

- Working Capital methods
- Statement of Cash Flows Method

Working Capital

Net Income
+ D/A
- Capital Expenditures
- Increases in Working Capital
FCF

Statement of Cash Flows

Cash Flow From Operations
- Capital Expenditures
FCF

Working Capital

Represents operating liquidity – the capital available to run the business

Positive working capital is required to ensure that a firm is able to continue operations and satisfy debt obligations

In general, companies with more WC will be more successful since they will be able to fund and expand their operations

Calculation

Current Assets
- Cash
- ST Investments
Total WC Assets
Current Liabilities
- Short Term Debt
- Current Portion Long Term Debt
Total WC Liabilities
Total WC Assets
- Total WC Liabilities
Working Capital

Capital Structure

The capital structure of a company is essential to calculating WACC

Since WACC is a weighted average of the costs of equity and debt, knowing what the proportions are is necessary

Ideally, you are given a target capital structure that you are aiming for, unfortunately that is not the case in TBC

To find capital structure we use the book value of debt and the market value of equity – added these make up the total capitalization of the firm. Debt is commonly viewed as loans and bonds

The capital structure is then just a measurement of what percentage of the assets of a company where financed through debt and what percentage through equity

Cost of Debt

The cost of debt in the TBC model is based off the firm's credit rating, as well as the risk free rate

The credit rating can be used as an indicator for the cost of debt by providing a debt premium over the risk free rate that the firm's corporate bonds trade at

In reality, you would use a Bloomberg terminal to pull the relevant data on the bonds with the longest maturity the firm has

Capital Asset Pricing Model – Cost of Equity

To determine the cost of equity for the firm – or the cost of financing the company through equity - we use CAPM

The inputs include the risk free rate, the firm's observable beta, and the expected return for the market

The risk free rate is the appropriate treasury bond (either 10 or 30 year)

The firm's beta is pulled from any financial website (although if it does not make sense conceptually, it should be recalculated)

Expected market return is something that is projected by the analyst based on historical market returns

Weighted Average Cost of Capital

The end result of our efforts – the cost of financing the firm through a combination of debt and equity

We use the cost of debt and the cost of equity, weighted respectively by their proportions in capital structure, and accounting for tax

This final value gives us the cost of the firm's financing the undertaking new projects etc

It will also serve as the discount rate for our future cash flows

Capital Asset Pricing Model

The rate of return on a stock should be dependent upon the risk free rate of return, the markets return, and the stock's tendency to follow the market

This is to say that equity investors expect a rate of return on their investment to be a function of how closely a stock follows the broader market; those with higher betas, should have higher rates of return

For more interest, consult papers by Sharpe & Litner, and a revised CAPM by Fischer Black

CAPM follows several main assumptions

- No transaction costs
- Assets are all tradable and infinitely divisible
- No taxes
- No individual can affect security prices
- Decisions are made solely in terms of expected returns and variances
- Unlimited short sales and borrowing and lending at the risk free rate
- Homogenous expectations – same views on expected return and risk

Given these assumptions, it can be clear why CAPM doesn't hold up empirically

If the model is right there should be linear relationships between returns and betas, and the only variable that should explain return is beta

However, in reality the relationship between return and beta is weak, and that other variables (size, price/book) explain differences in return better

Cost of Equity

Normally, there is a risk premium that you are given as an analyst. For our DCF valuations in TBC, we rely on using the risk free rate in combination with the expected market return to calculate our risk premium.

$$R_e = r_f + \beta \underbrace{(E(r_m) - r_f)}_{\text{market risk premium}} \quad \text{where: } r_f \text{ is the risk free rate}$$

β is the firms equity beta

As mentioned, the beta should be pulled from either Yahoo! Finance, Bloomberg, or any other data site that is reputable. If their calculations or the beta doesn't make sense (i.e. negative beta), consider reevaluating the computation through either regression analysis or through the normally accepted equation for beta

The risk free rate is the yield on the US treasury bond. However, when evaluating a foreign company it may be appropriate to use the representative government bond for that country. However, the risk will be higher, so the rate will be higher. This is because even Russia defaulted on its bonds, and caused the hedge fund LTCM to lose money and this, compounded with other factors, brought Wall Street to its knees in 1998-1999

WACC

Below is the WACC equation, along with the necessary inputs

$$\text{WACC} = R_e \left[\frac{\text{Market Value of Equity}}{\text{Total Capital}} \right] + R_d \left[\frac{\text{Book Value of Debt}}{\text{Total Capital}} \right] (1 - \tau)$$

where: R_e is the cost of equity

R_d is the cost of debt

τ is the effective tax rate

The book value of debt should be the sum of Short Term Debt, Current Portion of Long Term Debt, Long Term Debt, less Cash
However, the TBC DCF template will calculate the book value based off the input you give it

Growth Rate

As previously mentioned, the FCFs are forecasted out for each individual year for the next five years. However, this is not enough to value the company, since it will most likely be existent for longer than that. Forecasting for each individual year for the rest of the firm's existence is not a viable idea either

To account for this we need to set a terminal growth rate, one that the firm's growth will converge to and continue for into perpetuity. The DCF valuation is very sensitive to this figure.

There are multiple ways to check your terminal growth rate, two are discussed here:

Value of Perpetuity Relative to Total Value

One method is to see what the Present Value of the Perpetual Cash Flows (Terminal Value) is relative to the Present Value of Total Cash Flows.

If this ratio of $PV(TV)/PV(Total)$ is above 65-75%, your terminal growth rate should definitely be reconsidered.

High growth companies (tech, biotech, etc) might indeed have a value for this ratio that is quite high. This is because they do not have much incoming cash flow now, and it is expected that they will in the future as their product takes off

Comparing Trading Multiples

A commonly used method for double-checking growth rates used on the Street is comparing the trading multiples in the future, and the trading multiples of the company now

To do this we take the last forecasted EBITDA and roll it forward one year by using the terminal growth rate

We then divide the Terminal Value by this rolled EBITDA and find the implied forward multiple

We then compare to the current multiple (Firm Value/EBITDA)

Growth Rate

The commonly accepted method for determining a growth rate is to begin with the expected inflation rate, and alter this figure based on the firm's factors, macroeconomic factors, industry factors, etc. For example, a firm that specializes in hardcopy yellow pages will most likely have a negative terminal growth rate as that particular industry as a whole in decline.

Actual or forecasted nominal GDP will yield a number that is too high, since GDP includes productivity, population, market share gains, along with inflation. However, if FCF are growing and have grown at the rate of nominal GDP in the past, and we believe it will continue to do so in the future, this might be okay

Calibrate for your business and industry, will the pricing grow faster or slower than inflation 10 years out in perpetuity?

You will typically have a 2-4% number

One input to think about is the *organic* growth rate of earnings (or if stable: revenue) for the last 10 years

We're seeking a level of stability, where margins, market share are stable and productivity gains are almost zero

Value of Perpetuity Relative to Total Value

Present Value of Forecasted Cash Flows:	\$ 929.86
Present Value of Perpetual Cash Flows:	\$ 3,747.76
Present Value of Total Cash Flows	\$ 4,677.61
PV(Perpetuity)/PV(Total)	80.12%

Comparing Trading Multiples

EBITDA	\$ 459.18
Rolled	\$ 463.77
Terminal Value	\$ 4,934.37
Forward Multiple	10.64
2007 EBITDA	\$ 461.87
2007 Firm Value	\$ 3,169.36
Multiple	6.86

Terminal Value

The terminal value gives us a value of the company beyond the years forecasted in the model based on the terminal growth rate figure

The denominator (WACC-g) discounts this future value in terms of dollars of the last year forecasted

This means the TV value will be discounted by the same factor as the last forecasts

Equation

$$TV = \frac{FCF_{\text{last year}} (1 + g)}{WACC - g}$$

$$PV(TV) = \frac{\left[\frac{FCF_{\text{last year}} (1 + g)}{WACC - g} \right]}{(1 + WACC)^N}$$

Discounting

We discount cash flows because of the notion that a dollar today is not the same as a dollar tomorrow

Because discounting is compounded, the cash flows further away from the present, even if they are all equal, are worth relatively less in present terms

Investments that have higher risk will also usually have higher discount rates. Since the discount rate can be thought of as the required return to make the investment attractive (in terms of yields on bonds), investors require a higher return for their higher risk, hence the discount rate ends up being higher

Your discount rate should never be below that of r_f since treasury bonds or bills are considered the safest investment that could be made, since as mentioned, it is unlikely that the U.S. Government will default

Tax Rate

We use the effective tax rate that the company provides in the notes of its quarterly and annual filings

Sometimes, they forecast expectations for what their tax rate in the future should be, this should be taken into account for the valuation – it can sometimes be found in the transcript for their earnings calls

Forecasting

We start off with growth and then tailor it down for each year until it converges to a low number

Often, a few years out will be forecasted or released by the company in an earnings call. If they have a solid track record of meeting this, it may be safe to use

Terminal Shares Outstanding

Amount of shares the company will have left outstanding at the end of the DCF's period

Base this off of the firm's history with share buybacks, and secondary offerings to determine the ballpark for this figure

It will not affect the present value of the DCF, but it will affect the price per share figure

Last Twelve Months (LTM)

Found using the latest report and then plugging it into the stub and previous stub columns

This calculates the change in the previous twelve months and is what we should be using to value the company

Ideally, these figures are what is used for the comparables analysis as well – to compare apples to apples

Putting It All Together

After appropriate forecasting and terminal assumptions, we discount the values of the future cash flows accordingly with WACC. We then sum these values together to gain the intrinsic value of the company

Since we are looking for equity value we must now subtract the firms debt (since bondholders have seniority) and add back cash as this is available to shareholders (in the form of dividends or stock repurchases)

We then take this total value, and divide by the terminal number of shares outstanding.

This provides us with an estimate of what the true stock price of the company should be. Our DCF model provides a range as well as the potential upside and downside multiples

Remember, the DCF is not everything. Trading comparables are equally important. In the industry there are multiple valuation techniques including the DCF, trading comparables, and transaction comparables