Valuation theory

William Mann

EMORY
GOIZUETA BUSINESS SCHOOL

DCF valuation of any investment

Investments are worth the present value of expected future cash flows:

$$P = \frac{CF_1}{1+r} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} \ldots$$

- These cash flows are **expected values**: They average over every possible scenario for the future, and may grow forever.
- The DCF value is a finite number, provided the long-run average growth of cash flows is less than the required rate of return r.
- Discount rates should represent the "opportunity cost of capital," which means, the average return you would get from the next-best investment that features the same level of risk.

DCF valuation of a growing perpetuity

We can’t reliably forecast every future cash flow.
To apply this framework, we need to simplify it.

One approach is to make a good guess about the long-run growth rate of cash flows, call it g , and use it to forecast the future values:

$$P = \frac{CF_1}{1+r} + \frac{CF_1 \times (1+g)}{(1+r)^2} + \frac{CF_1 \times (1+g)^2}{(1+r)^3} + \ldots$$

Using the *growing perpetuity formula*, this magically simplifies to

$$P = \frac{CF_1}{r-g}$$

Most people blend these approaches: Forecast a few years, then bundle the rest into a “terminal value” using the formula above.

Application: Risk-free bond valuation by DCF (see p.446)

A risk-free bond delivers a fixed coupon for a number of periods T, then a large principal repayment at the end. Its DCF valuation is

$$P = \text{Coupon} \times \underbrace{\frac{1}{r_f}\left[1 - \frac{1}{(1+r_f)^T}\right]}_{\text{Annuity factor}} + \text{Principal} \times \underbrace{\frac{1}{(1+r_f)^T}}_{\text{PV factor}}$$

The “annuity factor” is the PV of a perpetuity starting today, minus another starting from T, using the formula from above with $g = 0$.

In practice, Treasuries are regarded as the only risk-free security, and their prices are easy to look up. So this formula is mainly used to *back out* the risk-free rate, in order to use it for other purposes. You fill in the rest of the information in the formula, and then find the value of r_f that makes the formula match the actual price at which the Treasury is currently trading.

Risky bond valuation by DCF (see p.468-470)

There are two ways to adapt the prior slide to *risky* bonds:

- The first approach is to apply the DCF framework directly:
  Replace “Coupon” and “Principal” with expected values. Replace r_f with a higher rate r_D that reflects the risk premium.
- The second approach is more common in practice:
  Leave “Coupon” and “Principal” equal to their promised values, but replace r_f with y, the yield to maturity on the bond.
- The yield to maturity on a bond is even higher than r_D. It is *defined* as the rate that gives us the right answer above.
  It is not directly comparable to other investment returns (except for risk-free bonds, in which case $y = r_f$).

Either approach is correct in principle, but they are easily confused.

Equity valuation based on discounting future dividends

- A company's stock is a claim to the dividends that it will pay.
- Applying the "growing perpetuity" formula from earlier,

$$P_{\text{stock}} = \frac{\text{Div}_1}{r_E - g_{\text{Div}}}$$

- This is called the constant-growth dividend discount model, or sometimes the Gordon growth model.
- It is not meant as a precise valuation, but a rough guide.
- r_E is the discount rate for the stock's dividends.
- g_{Div} is the long-run average growth rate of those dividends.

Equity valuation based on free cash flows to equity (FCFE)

- It's difficult to forecast exactly when dividends will be paid.
- Different idea: Forecast the profits available to pay dividends.
  - Assume the company will pay these profits out eventually, and will manage them responsibly in the meantime, enough that we can ignore the time value involved.
- Value stocks by forecasting free cash flows to equity (FCFE).
  - FCFE are based on earnings, with adjustments (next slide).
  - The point is to focus on the firm's profits instead of payout.
- Closely related approaches: residual-income, value-added.

Free cash flows to equity: Textbook formulas

To calculate the free cash flow to equity in any year, we combine textbook formulas (18.9) and (18.10) to get

$$FCFE = \underbrace{EBIT \times (1 - \tau_c) + \text{Dep.} - \text{Cap. ex} - \text{Increase in NWC}}_{\text{Free cash flow to firm (FCFF)}}$$
$$- \underbrace{\text{Interest expense} \times (1 - \tau_c) + \text{Increase in net debt}}_{\text{Payments to/from lenders and bondholders}}$$

Intrinsic value of the firm's equity based on future FCFEs:

$$\text{Market capitalization} = \frac{FCFE_1}{1 + r_E} + \frac{FCFE_2}{(1 + r_E)^2} + \dots$$

In a constant-growth model:

$$\text{Market capitalization} = \frac{FCFE_1}{r_E - g}$$

Equity valuation based on free cash flow to firm (FCFF)

- Finally, we can also abstract from borrowing decisions.
- The second line in the FCFE formula is its own set of cash flows.
  Their PV should equal the value of the firm's net debt today.
- So focus on the first line, free cash flows to the firm (FCFF).
  - Easiest to forecast because they depend only on operations.
  - Sometimes also called unlevered free cash flows, UFCF.
  - Their present value is the firm's enterprise value, which in turn is equal to market capitalization plus net debt.
- You discount FCFF at a special rate rWACC , which is:
  - a weighted average of discount rates for debt and equity,
  - adjusted for the fact that interest payments are tax-deductible.

Free cash flow to firm: Textbook formulas

Free cash flow to the firm in any year: Textbook formula (18.9).

$$FCFF = EBIT \times (1 - \tau_c) \ + \ \text{Dep.} \ - \ \text{Cap. ex} \ - \ \text{Increase in NWC}$$

$$\text{Enterprise value} \quad = \quad \frac{FCFF_1}{1 + r_{WACC}} \quad + \quad \frac{FCFF_2}{(1 + r_{WACC})^2} \quad + \quad \ldots$$

In a constant-growth model:

$$\text{Enterprise value} \quad = \quad \frac{FCFF_1}{r_{WACC} - g_{FCFF}}$$

Market capitalization = Enterprise value − net debt.

Growth and value stocks

- Analysts often compare "growth" stocks and "value" stocks.
- Exact definitions vary, but the general idea is always the same:
    - Divide market cap by some number from financial statements.
    - Stocks with high values of this ratio are called “growth stocks.”
    - Stocks with low values are called “value stocks.”
- These labels are meant to suggest investment strategies:
    - High ratios suggest growth in future dividends.
    - Low ratios look like a cheap buying opportunity.
- ...but don’t take this too seriously. They are just labels.

Example: Market-to-book ratio

Recall that market value of equity is usually greater than book value.

- Their ratio gives us the market-to-book ratio (MB for short).
- For example, at the end of 2018, Microsoft's book value of equity was $92bn, while its market capitalization was $770bn.
- Its market-to-book ratio was 770/92 = 8.37.
- At the same time, Kohl's had book value of equity $5.5bn, market capitalization of $12bn. So Kohl's MB ratio was 2.2.

Price-to-book is another name for the same thing.

Note that you get the same ratios if you use per-share numbers.

Book-to-market (BM), or book-to-price, just divides the other way:
BM for MSFT was 92/770 = 0.12, BM for Kohl's was 5.5/12 = 0.46

Price-earnings and price-dividend ratios

The price-to-earnings ratio (PE) is similar to MB:

- Market capitalization divided by the firm's earnings;
- or, share price divided by earnings per share.

Price-dividend (PD) uses dividends instead of earnings.

- Closely linked to PE, because dividends and earnings have to add up to the same number over in the long run.

Textbook section 18.4 provides some data and figures.

Like the MB ratio, can use these for relative comparisons across firms.

But unlike MB, these ratios are also meaningful on their own: they are connected with DCF valuation. See below...

DCF and valuation ratios

The formula $P = \frac{CF_1}{r-g}$ can be rearranged as

$$\frac{P}{CF_1} = \frac{1}{r-g}$$

The left side looks like a valuation multiple:

Depending on the setting, could be P/E, EV/EBITDA, etc.

The formula gives us perspective on what affects these multiples, and, how big of an effect we could expect from changing r or g .

Dividend discount model and P/D ratio

In the dividend discount model, the P/D ratio is equal to

$$P_{\text{stock}} = \frac{1}{r_E - g_{Div}}$$

Illustration:

- Suppose the discount rate for a company's dividends is $r_E = 8\%$, and its future dividends will grow at $g_{Div} = 3\%$.
- Then its P/D ratio is $\frac{1}{0.08-0.03} = 20$, a typical value.
- If we forecast $1 of dividends per share in the upcoming year, then each share is worth $20 today.

These formulas are very simple, but they can help us get some perspective on what matters for stock prices...

Using the dividend discount model to understand stocks

Example 1: *Short-run* events do not affect stock prices much.

- Suppose next year's profit and dividend forecasts fall by 25%.
  But, suppose everyone expects things to then return to normal.

- What happens to the stock price from the previous slide? plus $0.75 of dividends expected by the end of the year,

    - At the end of the year, the stock price will be:

$$\$1 \times \frac{1.03}{.08 - .03} = \$20.60$$

    - The value of the stock today is that $20.60,

discounted once:

$$\frac{\$20.60 + \$0.75}{1.08} = \$19.77$$

- So there is a 25% drop in this year's profits, but only 1% drop in stock price.

Conclusion: The *near-term future* is only a small part of a stock's total value.

Using the dividend discount model to understand stocks

Example 2: *Long-run growth* affects stock prices tremendously.

- Suppose the company in the original example is on track this year to pay its \$1 dividend per share.
- But some event today shrinks the long-run forecast of dividend growth to 2.5%.
- The slower growth rate will not be obvious right away.
- But the stock price *today* falls from \$20 to $\frac{\$1}{0.08-0.025} = \$18.18$.
- A bigger drop than the prior slide, with no obvious cause today.

Conclusion: Even if stock prices make sense, they can be hard to explain.