FORECASTING AND VALUATION OF ENTERPRISE CASH FLOWS

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1. Overview

A decision to invest in a stock proceeds in two major steps – estimating value and assessing why market value differs from estimated value. This spreadsheet implements both these steps.

In the first step, the spreadsheet estimates enterprise value using the discounted enterprise cash flow valuation model (DCF) and then subtracts the existing net financial liabilities to derive equity value. The model rests on enterprise cash flow drivers identified in the FSA1 spreadsheet – growth, margins, and net enterprise asset intensity.

Although forecasts of future net financial liabilities are not needed to derive equity value, they are needed for two other reasons: (i) to compare model forecasts to analyst forecasts, which are only available for net income if one is using public databases, and (ii) to compute widely used relative valuation metrics such as the price to forward earnings ratio and price to forward dividends ratio.

Therefore, in the second step, the spreadsheet supplements the DCF model with forecasts of leverage and interest rates to forecast net income and dividends. This step aids in identifying the potential causes for deviation between estimated value and market value by allowing one to compare model forecasts to analyst net income forecasts, and to compare the firm's forward price to earnings ratio, price to book ratio, and price to forward dividends ratio to its peers.

1.1. Enterprise activities: The discounted enterprise cash flows model (DCF)

The DCF model is implemented as follows: [Inputs to be forecasted are in ***bold green italics***.]

- Forecast enterprise cash flows

  - Enterprise cash flows = enterprise profit after tax – change in net enterprise assets

  - The three drivers of enterprise cash flows are (1) sales revenue and its subsequent growth; (2) after tax enterprise profit margin; (3) net enterprise asset intensity as measured by the ratio of net enterprise assets to sales.

    - $\text{Sales}_{t+1} = \text{Sales}_t * (1 + \textit{forecasted sales growth})$

    - $\text{Enterprise profit after tax}_{t+1} = \text{sales}_{t+1} * \textit{forecasted enterprise profit margin after tax}$

    - $\text{Net enterprise assets}_{t+1} = \textit{forecasted net enterprise asset intensity} * \text{sales}_{t+1}$

  - It forecasts growth, margins, and asset intensity for an explicit horizon. It assumes that these inputs are constant beyond the explicit horizon.

- Enterprise value = present value of forecasted enterprise cash flows discounted at the enterprise cost of capital (***wacc***).

- Equity value = enterprise value – existing net financial liabilities. Existing net financial liabilities suffice; forecasts of future financial liabilities are not needed.

Enterprise value Value of net enterprise assets = PV of enterprise cash flows	Value of financial liabilities – Value of financial assets
	Value of equity

1.2.   Financial activities: Net income, dividends, and book value of equity

This part of the spreadsheet proceeds as follows:

- Derive financial statements
    - Net financial liabilities = *forecasted ratio of net financial liabilities to net enterprise assets* * net enterprise assets

    - Net financial expense after tax = *forecasted net financial expense rate after tax* * net financial liabilities

    - Net income = enterprise profit after tax – net financial expense after tax

    - Net distributions = contributions from equity holders – distributions to equity holders = enterprise cash flows – net financial expense after tax + change in net financial liabilities

    - Ending equity = Beginning equity + net income – net distributions
        - Check: Equity = Net enterprise assets – Net financial liabilities

- Derive relative valuation metrics: It computes three key relative valuation metrics: price to book ratio, price to forward earnings ratio, and price to forward dividends ratio.

- Infer cost of equity: If one uses a subjective wacc or industry wacc, then it is useful to know the cost of equity implied by the assumed wacc and estimated value. Accordingly, the spreadsheet infers the cost of equity from wacc and leverage so that it can be compared with alternative measures of cost of equity.

1.3.   Enterprise cost of capital or weighted-average cost of capital (wacc)

The spreadsheet needs wacc as an input to discount enterprise cash flows. The spreadsheet does not specify how wacc should be derived. One can use industry wacc or a subjective measure of wacc.

Textbooks derive wacc using a company's equity beta, leverage, and risk-free rate as follows:

$$\text{wacc} = \frac{\text{MV of NFL * Net interest rate, after tax}}{\text{MV of NFL + MV of E}} + \frac{\text{MV of E * } r_e}{\text{MV of NFL + MV of E}}$$

This expression is the genesis of the term wacc because it is the weighted average of r_e and cost of NFL. This expression provides a way of inferring wacc from r_e and cost of NFL.

The weighted average formula applies to negative leverage as well. The net interest rate after tax should be the interest rate on net financial assets after tax. When this rate is close to zero, the first term in the wacc formula drops out and the wacc formula reduces to the following:

$$\text{wacc} = \frac{\text{MV of equity}}{\text{MV of equity - NFA}} \text{ x } r_e$$

As a practical matter, one can estimate wacc as follows:

1.   Go to the latest balance sheet and derive NFL; NFL is negative if FA > FL. Assume that the market value of NFL equals its book value. You can also get the market value of NFL from some finance websites such as Bloomberg.

2.   Estimate the interest rate, after tax.

3.   Go to any finance website (CapitalIQ, Yahoo, Bloomberg) and look up MktCap = 'E'

4.   Estimate cost of equity using the CAPM equation $r_e = r_f + \beta (r_m - r_f)$

    4.1.   Risk-free rate is typically assumed to be the 10-year Treasury rate.

4.2. Go to the finance websites and look up the firm's β.

4.3. Analysts typically assume that the market risk premium $(r_m - r_f)$ is in the range between 4%-7%. Estimates of market risk premia are available from surveys of market participants.

5. Use the wacc formula

One should not view wacc as the dependent variable and r_e and cost of NFL as the independent variables. To appreciate how r_e depends on wacc, it helps if one recasts the above wacc equation as follows:

r_e = wacc + (wacc – Net interest rate, after tax) * (MV of net financial liabilities/MV of equity)

wacc depends on the risk-free rate and enterprise risk while r_e depends on wacc and risk due to leverage. Under Modigliani-Miller assumptions, wacc does not depend on leverage. Increasing leverage has two effects: (i) it may increase net interest rate if there is an increase in default risk. (ii) it always increases the r_e because of increase in volatility of returns to equity holders even if there is no change in default risk.

Alternatively, one can estimate wacc by first calculating "unlevered beta" and then using it in CAPM.

Specifically,

▪ Calculate "unlevered β" = β * (E/(NFL+E)) where NFL and E are as above.

▪ Calculate wacc = r_{nd} + "unlevered β"* $(r_m - r_{nd})$ where r_{nd} is the after-tax cost of NFL.

1.4. Relative valuation: Forward P/E, Price to Book, and Dividend Yield

For relative valuation, investors often compare the firm's equity value to its earnings, book values, and dividends. Changes in these ratios across time and across firms can be attributed to changes in perceived risk, expected growth, or mispricing.

1.4.1. Forward P_0/E_1

▪ P/E ratio depends on risk and growth in earnings. It also depends on interest rates.

▪ The benchmark P/E is $1/r_e$.

▪ The inverse of P/E is often referred to as (forward) earnings yield.

▪ As a statistical benchmark, over the long haul as a crude average, P/E approximates 15.

1.4.2. Price to Book Ratio [P_0/B_0]

▪ P/B ratio depends on risk, growth, and return on equity

▪ P/B = Price/Earnings * Earnings/Book value = P/E * ROE

▪ The benchmark P/B is 1.

▪ Conceptual benchmark applies if the expected ROE equals r_e

▪ Because of accounting conservatism, P/B is rarely less than one and typically has a multiple of 2-4 times

▪ By extension, ROE often seems quite large (in excess of 20 %)

1.4.3. Forward dividend yield ratio or Div_1/P_0

▪ The dividend may refer to either the current or forward dividend

▪ There is NO benchmark

▪ Many firms do not pay dividends, nor do they plan to do so in the foreseeable future

- As a statistical average, yield ratios tend to be 3-4% with a significant variation across firms and time periods
- The yield ratio depends on risk and growth in dividends

1.5.   Estimated and actual values: Explaining the difference

P_0 = estimated value

M_0 = actual market value

e_1 = estimated earnings
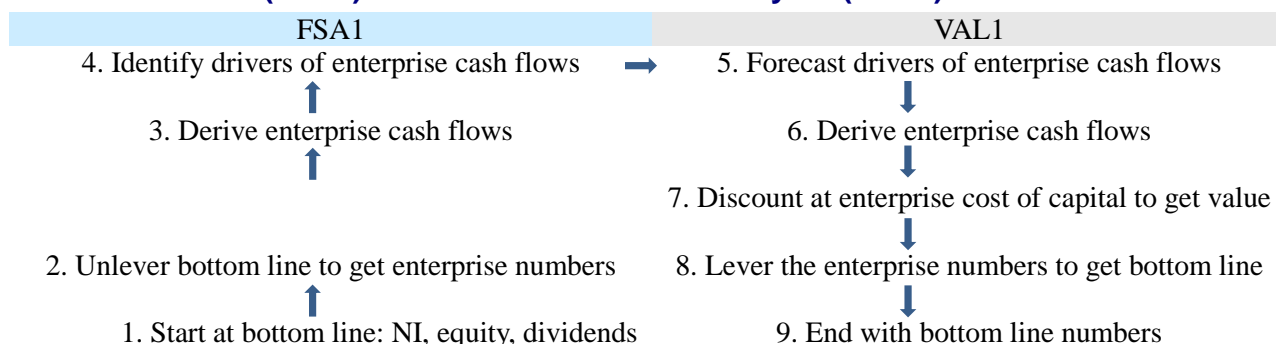
f_1 = analyst forecast of forthcoming earnings

$$P_0 - M_0 = (e_1 - f_1) * \frac{M_0}{f_1} + (\frac{P_0}{e_1} - \frac{M_0}{f_1}) * e_1$$
$$\text{Term 1} \qquad\qquad \text{Term 2}$$

Difference in values = Differences in earnings forecasts * Forward PE ratio as per analyst forecasts + Differences in forward PE ratios * earnings forecast

Term 1 picks up the effect of forward earnings optimism. As discussed in VAL3, one can further decompose the earnings optimism is sales optimism and margin optimism.

Term2 picks up the effect of optimism regarding growth and risk (approximately, optimism regarding the difference between wacc and growth).

1.6.   Valuation (VAL1) is financial statement analysis (FSA1) in reverse

FSA1	VAL1
4. Identify drivers of enterprise cash flows ⟶	5. Forecast drivers of enterprise cash flows
↑	↓
3. Derive enterprise cash flows	6. Derive enterprise cash flows
↑	↓
	7. Discount at enterprise cost of capital to get value
	↓
2. Unlever bottom line to get enterprise numbers	8. Lever the enterprise numbers to get bottom line
↑	↓
1. Start at bottom line: NI, equity, dividends	9. End with bottom line numbers

2.   Detailed steps to be read along with the spreadsheet

2.1.   Enterprise activities: Forecast sales

1.   Historical data: Current year sales

2.   The income statement starts with current year sales.

3.   Forecast: Sales growth

4.   Sales = Previous year's sales * (1 + growth)

2.2.   Enterprise activities: Forecast enterprise profit margin after tax

5.   Forecast: After-tax enterprise profit margin

6.   Enterprise profit after tax = Sales * After-tax enterprise margin

2.3. Enterprise activities: Forecast net enterprise assets needed to sustain sales

7. Historical data: Net enterprise assets for the current year

8. The balance sheet starts with net enterprise assets for the current year.

9. Forecast: Ending net enterprise assets are forecasted as a percent of sales.

10. Ending net enterprise assets = Ending net enterprise assets as % of sales * Sales

   10.1. After tax ROIC = Enterprise profit margin after tax divided by net enterprise assets as % of sales

2.4. Enterprise cash flows

11. Start with enterprise profit after tax because enterprise cash flows equal enterprise profit after tax if no investment is needed in net enterprise assets.

12. Subtract the change in net enterprise assets

13. Enterprise cash flows = Enterprise profit after tax - Change in net enterprise assets

   13.1. Enterprise cash flows do not depend on financial activities such as the level of net financial liabilities and the net financial expense rate.

2.5. Valuation

14. Start with enterprise cash flows derived earlier.

15. Compute the growth rate in enterprise cash flows.

16. Input: Enterprise cost of capital (aka wacc) is assumed constant for all years.

17. Make sure that the enterprise cash flows reach terminal growth before computing terminal value. Terminal value is computed at the end of Year 5 because the enterprise cash flows reach terminal growth only after that year. The formula is $C_5*(1+g)/(wacc-g)$ or $C_6/(wacc - g)$.

18. Enterprise value = PV of enterprise cash flows until Year 5 + PV of terminal value

19. Historical data: Initial ending net financial liabilities.

20. Subtract net financial liabilities.

21. Equity value = Enterprise value – Net financial liabilities

2.5.1. Key enterprise valuation ratios

22. Enterprise cash flow yield: Next period enterprise cash flows/Current enterprise value

23. Price to book ratio: Current enterprise value/Current net enterprise assets

24. Price to earnings ratio: Current enterprise value/Next period enterprise profit after tax

2.6. Financial activities: Principal and interest flows to net financial liabilities

25. Start the income statement with enterprise profit after tax derived above.

26. Start the balance sheet with net enterprise assets derived above.

27. Start the cash flow statement with enterprise cash flows derived above.

28. Net financial liabilities at the end of the current year appear on the balance sheet.

29. Forecast: Target ratio of net financial liabilities to net enterprise assets

   29.1. Instead of specifying net financial liabilities to equity ratio, we specify net financial liabilities to net enterprise assets ratio. Specifying the net liabilities to equity ratio leads to messy iterations

because equity depends on net interest expense, which depends on net financial liabilities, which, in turn, depend on equity.

29.2. The target ratio of net financial liabilities to net enterprise assets ratio can be negative if the firm intends to hold financial assets in excess of financial liabilities as per its financial policy.

30. Forecasted net financial liabilities = (net financial liabilities/net enterprise assets) * net enterprise assets

31. Forecast: Net financial expense rate, after tax

32. Net financial expense, after tax = Previous ending net financial liabilities * net financial expense rate, after tax

33. Net financial expense payments, after tax = net financial expense, after tax

34. Change in net financial liabilities is a financial cash flow.

2.7. Financial activities: Equity flows

35. The remaining cash flow is distributed to shareholders

35.1. Note that the distributions to shareholders are not a constant percentage of net income. If they were constant, the ratio of net financial liabilities to net enterprise assets will not be constant.

36. Net income = Enterprise profit after tax – Net financial expense, after tax

37. Historical: Equity at the end of Y0 = Net enterprise assets – Net financial liabilities.

38. Ending equity = Previous ending equity + net income – distributions to shareholders

39. Check A – L – E = 0.

2.7.1. Key valuation ratios

40. Dividend yield: Next period dividend/Current equity value

41. Price to book ratio: Current equity value/Current book value

42. Price to earnings ratio: Current equity value/Next period earnings [a.k.a. forthcoming earnings]

2.8. Inferring cost of equity

If one used firm's cost of equity to derive wacc, then this step is indeed redundant. However, in many instances, we assume that the firm's wacc is the same as its competitors, or we use a subjective estimate of wacc. In these cases, it is useful to know the cost of equity implied by wacc and leverage.

43. See the equation for cost of equity (r_e) specified earlier.

43.1. r_e generally varies across time if leverage based on market values changes. Even if NFL/book value of equity is kept constant, as is the case in this model, the ratio of NFL to market value of equity changes over time. Thus, r_e varies across time.

43.2. Therefore, you cannot discount distributions to shareholders at the current r_e to derive the current equity value.

3. Questions addressed by the spreadsheet: Summary

Equity analysis rests on understanding the implications of enterprise cash flows forecasted. To that effect, the spreadsheet concerns the following questions.

1. How do the forecasted enterprise drivers differ from those computed in the past in FSA1 and FSA2?

2. How do your forecasts differ from those available from the analysts? Analysts usually provide forecasts of sales and net income.

3. How does the estimated forward P/E differ from the actual forward P/E? Forward P/E depends primarily on the difference between wacc and growth beyond the horizon.

4. How do the differences between your forecasts and analyst forecasts explain the difference between your estimate of value and market value? Which differences matter the most?

5. Are the conclusions sensitive to the forecasts of financial activities?