CHARTA LEARNING · LESSON NOTES

Free cash flow valuation

Equity Investments

1 A story: three companies, three futures

- Utility: steady growth, no change expected
- Bicycle maker: boom, then a settling
- Software firm: very fast, then a slow fade
- The growth path picks the model

IN THE LESSON

- Picture three companies.
- The first is a water utility.
- It has grown at a gentle pace for thirty years and will do the same for the next thirty.
- The second is a maker of electric bicycles.
- Orders are booming, but the boom will fade in a few years as rivals arrive.
- The third is a young software firm.
- It is growing very fast today, but nobody believes that can last, so its growth will come down slowly over a long stretch.
- Same question for all three: what are they worth?
- The answer depends on a single thing, the path growth takes.
- A model that ignores the path gives a precise answer to the wrong question.

2 Match the model to the path

One stage is the last box alone; two stages are both

High growth, year by year → Stable growth for ever

Three stages

Very high growth → Declining growth → Stable growth

IN THE LESSON

- Here are the paths as two rows.
- Read each row from left to right as time passing.
- Start with the last box of the top row, on its own.
- That is the utility.
- It sits in one stable stage, so a single growing perpetuity describes it, and extra stages would only add guesses.
- The whole top row is the bicycle maker.
- It has a spell of high growth with a visible end, then a stable stage.
- We forecast the first stage year by year, then switch to a perpetuity.
- The bottom row is the software firm.
- Its growth is far above what any business can keep for ever, and it will not drop all at once, so we add a middle stage, a transition, that brings growth down gradually.

3 The single stage model

$V_0 = FCF_1 \div (r - g)$
needs $g < r$

Next year's flow	Cash flow expected in year one
Required return (r)	Rate the claimants require
Growth rate (g)	Steady yearly growth
Value today	What it is worth now

IN THE LESSON

- Here is the simplest model.
- The value today equals next year's free cash flow, divided by the discount rate minus the growth rate.
- Let's take the terms.
- Free cash flow is the cash left after the business has paid for the investment it needs to keep growing.
- We will meet two kinds, free cash flow to the firm, for all providers of capital, and free cash flow to equity, for shareholders alone.
- The discount rate is the return the claimants require.
- The growth rate is how fast the flow rises each year for ever.
- The rule is that growth must be below the discount rate.
- If it is not, the formula breaks and gives nonsense.

4 Example 1: the water utility, one stage

FCFE now 2.00, g = 3%, r = 9%

Next year's flow	2.00 × 1.03	**$2.06**
Gap r − g	9% − 3%	**6%**
Value today	2.06 ÷ 0.06	**$34.33**
If g were 4%	2.08 ÷ 0.05	**$41.60**
Change from one point	41.60 ÷ 34.33 − 1	**+21%**

IN THE LESSON

- Example one.
- Marlow Water has just produced free cash flow to equity of two dollars a share.
- Growth is steady at three per cent, and shareholders require nine per cent.
- First, next year's flow is two dollars times one point zero three, which is two dollars six cents.
- Second, the gap between required return and growth is six per cent.
- Third, divide two point zero six by zero point zero six, and the value is thirty four dollars thirty three.
- Now see how touchy it is.
- Raise growth to four per cent and next year's flow becomes two dollars eight cents over a gap of five per cent.
- That gives forty one dollars sixty, up by a fifth, from one point of growth.

5 Two stages and three stages

- Two stages: forecast, then a perpetuity
- Three stages: forecast, fade, then a perpetuity
- Value the last stage at the end of the one before
- The last stage must be sustainable for ever

IN THE LESSON

- Now the longer paths.
- A two stage model has a high growth stage, forecast one year at a time, and then a second stage that is a growing perpetuity.
- We value the perpetuity at the end of the first stage, then discount that lump back to today along with the yearly flows.
- A three stage model adds a transition.
- Growth falls step by step, perhaps from twenty five per cent to eleven, before settling at its long run rate.
- Choose two stages when growth ends in a clear step, and three when it fades.
- In both, the last stage must be one a company could keep for ever.

6 Growth over time: the three stages drawn

Chart: Growth rate vs Years from now

- Stage one
- Transition
- Stable

IN THE LESSON

- Here is the three stage path as a picture.
- Time runs along the bottom, in years from now.
- Growth rate is up the side.
- The left part of the line is flat and high.
- That is stage one, where we forecast each year.
- Then the line slopes down.
- That is the transition, where growth fades year by year.
- Finally the line goes flat again, but low.
- That is the stable stage, which carries on for ever.
- The two dashed lines mark where one stage ends and the next begins.
- A two stage company has the same picture without the slope: high, then a drop, then low.
- A one stage company is just the low flat line.

7 Example 2: the bicycle maker, two stages

FCFE now 1.50; 15% for 3 years, then 4%; r = 10%

FCFE, years 1 to 3	1.725, 1.984, 2.281	
Terminal value, year 3	2.281 × 1.04 ÷ 0.06	**$39.54**
PV of years 1 to 3	at 10%	**$4.92**
PV of terminal value	$39.54 \div 1.10^3$	**$29.71**
Two stage value	4.92 + 29.71	**$34.63**

Single stage at 4%: 1.56 ÷ 0.06 = $26.00, 25% too low

IN THE LESSON

- Example two.
- Spoke Cycles has free cash flow to equity of one dollar fifty a share.
- It will grow fifteen per cent a year for three years, then four per cent for ever.
- Shareholders require ten per cent.
- Step one, the flows: one dollar seventy three, one ninety eight and two twenty eight.
- Step two, the terminal value at year three uses the year four flow.
- Two twenty eight times one point zero four, divided by six per cent, is thirty nine fifty four.
- Step three, add the present values: the yearly flows are worth four ninety two, and the terminal value brought back three years is twenty nine seventy.
- The total is thirty four sixty three.
- A single stage at four per cent says only twenty six dollars.

8 Example 3: the software firm, three stages

FCFE now 1.00; growth 25%, 25%, 18%, 11%, then 4%; r = 11%

PV of years 1 and 2	high growth stage	**$2.39**
PV of years 3 and 4	transition stage	**$2.70**
Terminal value, year 4	2.047 × 1.04 ÷ 0.07	**$30.41**
PV of terminal value	$30.41 \div 1.11^4$	**$20.03**
Three stage value	2.39 + 2.70 + 20.03	**$25.12**

Single stage at 4% on today's flow: 1.04 ÷ 0.07 = $14.86

IN THE LESSON

- Example three.
- Lumen Apps has free cash flow to equity of one dollar a share.
- Growth is twenty five per cent in years one and two, eighteen in year three and eleven in year four, then four per cent for ever.
- The required return is eleven per cent.
- The flows are one twenty five, one fifty six, one eighty four and two oh five.
- The first two years are worth two thirty nine today, and the transition years add two seventy.
- The terminal value at year four is two oh five times one point zero four over seven per cent, which is thirty dollars forty.
- Brought back four years, it is twenty dollars three.
- The total is twenty five dollars twelve.
- Skipping the fade would badly mislead us.

9 Grow the flow, or grow its parts

- Grow the flow itself, or sales and margins
- Building blocks suit a story about the business
- Trap: one stage for a firm about to change
- Ask what the next ten years look like first

IN THE LESSON

- One more choice.
- Growth can be applied to the free cash flow itself, or to its building blocks: sales, profit margin and the investment needed.
- Using the building blocks is usually better when the story is about the business, such as sales doubling while margins improve, because cash flow can swing wildly when investment is lumpy.
- Now the exam trap.
- A company about to change sharply, for example one that will lose a big contract or will start a big expansion, cannot be valued with a single stage model from today's numbers.
- Today's growth is not the path.
- Always ask first what the next ten years look like, then pick the stages to match.

10 Whose cash flow, and whose value?

- FCFF: cash for lenders and owners together
- FCFE: cash for the shareholders alone
- FCFF gives the whole house, FCFE your share
- Rate and final steps follow from the choice

IN THE LESSON

- Now to estimate what a firm is worth.
- Think of buying a house with a mortgage.
- The house has a total value.
- You, the owner, hold only what is left after the bank is repaid.
- Companies work the same way.
- Free cash flow to the firm is the cash available to everyone who funds the business, lenders and shareholders together.
- Free cash flow to equity is the cash left for shareholders alone, after the lenders have been paid.
- So the first one values the whole house and the second one values your share of it.
- Which rate and what you subtract at the end follow from that choice, and mixing them up is the classic mistake.

11 Two routes to the value of the shares

From FCFF

Discount at the WACC → Firm value → Subtract debt, preferred

From FCFE

Discount at return on equity → Equity value → Divide by shares

IN THE LESSON

- Here are the two routes side by side.
- In the top row we start from the cash flow to the firm.
- We discount it at the weighted average cost of capital, which the analysts spell W A C C.
- That blends what lenders and shareholders each require.
- The result is the value of the firm, and since lenders have a claim on that, we subtract the market value of debt, and of any preferred shares, to reach equity.
- The bottom row starts from the cash flow to equity.
- We discount at the required return on equity, and the answer is already the equity value.
- There is nothing left to subtract.
- Either way, we end by dividing by the shares.

12 Valuing a firm from FCFF

Equity = PV(forecast) + PV(terminal) + cash − debt − preferred

PV of forecast flows	Years in the forecast
Terminal value	Value beyond the horizon
Surplus cash	Added: not in the flows
Debt, preferred	Taken off: lenders first
Equity value	What shareholders own

IN THE LESSON

- Here is the recipe for the firm.
- Discount each forecast flow at the weighted average cost of capital.
- Add a terminal value at the horizon, also discounted back.
- That sum is the operating value of the firm.
- Add surplus cash and other non operating assets, because the flows do not include them.
- Then subtract the market value of debt, and of preferred shares if there are any, to reach the equity value.
- Divide by the number of shares for the value per share.
- Let's name the terms.
- The present value of the forecast flows and the terminal value make up the operating value.
- Debt and preferred shares come off.
- Cash goes on.

13 Example 4: valuing a firm from FCFF

FCFF $140m, 150m, 160m; g = 3.5%; WACC 8.5%; cash 40; debt 900; 80m shares

PV of years 1 to 3	at 8.5%	**$381.7m**
PV of terminal value	$3{,}312 \div 1.085^3$	**$2,593.0m**
Add cash, subtract debt	+ 40 − 900	**$2,114.7m**
Equity per share	2,114.7 ÷ 80	**$26.43**
Forgetting the debt	3,014.7 ÷ 80	**$37.68**

Forgetting the debt overstates the value by 43%

IN THE LESSON

- Example four.
- Northgate Foods has forecast free cash flow to the firm of one hundred and forty, one hundred and fifty, and one hundred and sixty million dollars.
- After year three it grows at three and a half per cent.
- The weighted average cost of capital is eight and a half per cent.
- It holds forty million of surplus cash, owes nine hundred million at market value, and has eighty million shares.
- The three years are worth three hundred and eighty two million today.
- The terminal value is one sixty times one point zero three five over five per cent, which is three thousand three hundred and twelve, worth two thousand five hundred and ninety three today.
- Add cash, subtract debt, and equity is two thousand one hundred and fifteen million.
- Per share, that is twenty six dollars forty three.

14 Example 5: the same job from FCFE

FCFE per share 2.40, 2.52, 2.64; g = 3%; r = 9%

PV of years 1 to 3	at 9%	**$6.36**
Terminal value, year 3	$2.64 \times 1.03 \div 0.06$	**$45.32**
PV of terminal value	$45.32 \div 1.09^3$	**$35.00**
Equity value per share	6.36 + 35.00	**$41.36**
Wrongly deducting debt	41.36 − 6.00	**$35.36**

FCFE already comes after the lenders: do not subtract debt

IN THE LESSON

- Example five, from the shareholders' side.
- Harlow Goods has free cash flow to equity per share of two dollars forty, two fifty two and two sixty four in years one to three, then growth of three per cent for ever.
- The required return on equity is nine per cent.
- The three years are worth six dollars thirty six today.
- The terminal value is two sixty four times one point zero three, over six per cent, which is forty five dollars thirty two.
- Brought back three years, it is thirty five dollars.
- The total is forty one dollars thirty six a share.
- Debt per share is six dollars, but it is already reflected, because lenders were paid before this cash flow was struck.
- Subtract it again and you would wrongly get thirty five thirty six.

15 Keep the pieces consistent

- Rates match claimants: WACC for FCFF, r for FCFE
- Nominal flows with nominal rates
- Add surplus cash; subtract debt and preferred
- FCFE valuation: never subtract debt again

IN THE LESSON

- Three rules keep the valuation honest.
- First, rates match claimants.
- Flows to the whole firm go with the weighted average cost of capital.
- Flows to equity go with the required return on equity.
- Second, currencies and inflation match.
- Nominal flows, which include inflation, need nominal rates.
- Real flows need real rates.
- Never mix them.
- Third, count every asset once.
- Surplus cash and investments the business does not use are not in the operating flows, so you add them.
- Preferred shares are a claim ahead of the ordinary shareholders, so you subtract them in an F C F F valuation.
- Run through those three checks before you trust any answer.

16 The rest of the story

- Terminal value stands for all years after the forecast
- Usually more than half of the total value
- Method one: constant growth from then on
- Method two: a multiple of a horizon figure

IN THE LESSON

- Every forecast has to stop somewhere.
- You might forecast five years in detail, but the company does not close on the last day of year five.
- The terminal value is the stand in for everything that happens after the forecast ends, and it is usually the largest slice of the answer, often well over half.
- There are two ways to build it.
- One assumes stable growth from then on and uses the growing perpetuity formula.
- The other applies a multiple, such as price to earnings, to a figure forecast for the horizon year.
- We will do both.
- The first rests on your assumptions.
- The second rests on what the market pays today for similar companies.

17 Terminal value by constant growth

$TV_n = FCF_{n+1} \div (r - g)$ where $FCF_{n+1} = FCF_n \times (1 + g)$

Terminal value (TV)	Value at the end of year n
Flow in year n+1	Flow in the year after
Discount rate	WACC or return on equity
Stable growth (g)	Growth that can last for ever

IN THE LESSON

- Here is the first method.
- The terminal value at the end of year n equals the free cash flow in year n plus one, divided by the discount rate minus the stable growth rate.
- Look at the numerator closely.
- It is the flow for the year after the horizon, not the flow in the horizon year.
- This is the formula for a growing perpetuity, which values a stream starting one year ahead.
- So take the final forecast flow and multiply it by one plus g.
- For a firm flow, use the weighted average cost of capital.
- For an equity flow, use the required return on equity.
- The result is a value at year n, so it must still be discounted back.

18 Example 6: two ways to the terminal value

Year 5: FCFE 3.00, EPS 4.50; r = 10%; g = 4%; peer P/E 12

By growth	3.00 × 1.04 ÷ 0.06	**$52.00**
Slip: year 5 flow as is	3.00 ÷ 0.06	**$50.00**
By multiple	12 × 4.50	**$54.00**
P/E implied by growth	52.00 ÷ 4.50	**11.6**
Present value of the two	÷ 1.10^5	**$32.29, $33.53**

The growth method needs next year's flow in the numerator

IN THE LESSON

- Example six.
- An analyst forecasts five years for Tidewater Shipping.
- In year five, free cash flow to equity is three dollars a share and earnings per share is four fifty.
- The required return is ten per cent and stable growth is four.
- Peers trade on a price to earnings ratio of twelve.
- By growth: three times one point zero four is three twelve, divided by six per cent, is fifty two dollars.
- The common slip uses three instead, and gets only fifty.
- By multiple: twelve times four fifty is fifty four.
- The multiple implies a price to earnings of eleven point six when we use fifty two, so the two methods are close.
- Discounted five years, they are thirty two twenty nine and thirty three fifty three.

19 One point of growth, a big swing

Terminal value at year 5 ($)

g = 3%	**44.14**
g = 4%	**52.00**
g = 5%	**63.00**
P/E 12	**54.00**

Required return 10%; year 5 FCFE 3.00; EPS 4.50

IN THE LESSON

- Look at how touchy the terminal value is.
- These bars show the value at year five for Tidewater.
- The first three use the growth method with a required return of ten per cent, at growth of three, four and five per cent.
- At three per cent the value is forty four dollars fourteen.
- At four it is fifty two.
- At five it is sixty three.
- One point of growth moves the answer by a sixth or a fifth.
- The last bar is the multiple method, at fifty four.
- Notice it sits near the middle bar.
- When methods agree, we feel better.
- When they differ widely, it is a question to answer, not a rounding error.

20 Example 7: is the growth rate sustainable?

NOPAT next year 120; g = 4%; ROIC 10%; WACC 9%

Reinvestment rate	g ÷ ROIC = 4% ÷ 10%	**40%**
FCFF in year n+1	120 × (1 − 0.40)	**$72m**
Consistent terminal value	72 ÷ 0.05	**$1,440m**
Ignoring reinvestment	120 ÷ 0.05	**$2,400m**
Overstatement	2,400 ÷ 1,440 − 1	**+67%**

IN THE LESSON

- Example seven.
- A growth rate in the terminal value is a promise that the business can keep it.
- First, it should not be higher than the long run growth of the economy in nominal terms.
- Second, the investment must be consistent with it.
- A company grows only by reinvesting.
- Growth equals the reinvestment rate times the return on invested capital.
- Suppose net operating profit after tax next year is one hundred and twenty million, growth is four per cent, and the return on new capital is ten per cent.
- Reinvestment must be forty per cent.
- Free cash flow to the firm is seventy two million.
- At nine per cent, the terminal value is one thousand four hundred and forty.
- Ignoring reinvestment gives two thousand four hundred.

21 Mistakes to avoid so far

- 1. Too few stages for a firm in transition
- 2. Growth at or above the discount rate
- 3. Terminal flow: year n + 1, not year n
- 4. Debt: off FCFF value, never off FCFE value
- 5. Terminal value not discounted back from year n

IN THE LESSON

- Time to pause on the mistakes that cost marks.
- One.
- Using too few stages.
- A firm about to change sharply cannot be valued with one stage from today's numbers.
- Two.
- Growth above the discount rate.
- The formula needs growth below the rate, and a stable stage growing faster than the economy for ever is not believable.
- Three.
- Using the flow in year n instead of year n plus one in the terminal value.
- Four.
- Subtracting debt from an equity cash flow valuation, or forgetting to subtract it from a firm valuation.
- Five.
- Forgetting to discount the terminal value back from the horizon.
- A terminal value sits at year n, not today.

22 From a value to a verdict

- Compare intrinsic value per share with the price
- Value above price: undervalued
- Value below price: overvalued
- The gap must beat the uncertainty in the inputs

IN THE LESSON

- Now the payoff.
- A valuation is only useful if it leads to a decision.
- Imagine you are selling a car.
- A friend values it at ten thousand, but a buyer offers eight.
- If you trust your friend, the offer is too low.
- If you trust the market, perhaps your friend is hopeful.
- The same logic applies to shares.
- Once the model gives intrinsic value per share, you compare it with the market price.
- Value above price suggests the share is undervalued, a possible buy.
- Value below price suggests it is overvalued.
- But the gap only matters if it is bigger than the error in your inputs, and that is where most of the thinking is done.

23 The value per share and the rule

Value per share = (Firm value − Debt) ÷ Shares compare with price

Firm value	Value of every claim
Less debt	Market value of debt
Shares	Shares outstanding
Value per share	Intrinsic value per share
Market price	Where the share trades

IN THE LESSON

- Here is the final step with a firm model.
- The value per share equals firm value minus debt, divided by the number of shares.
- Then compare that with the market price.
- If the value is above the price, the share looks undervalued.
- If it is below, it looks overvalued.
- If they are close, treat it as fairly valued.
- The term to watch is debt.
- Firm value belongs to every provider of capital, so dividing it by shares without taking off the lenders' claim treats their money as shareholders' money.
- That makes nearly every share look like a bargain.
- Always ask whether your flow is a firm flow or an equity flow before you divide.

24 Example 8: a verdict from an FCFF model

FCFF next year $75m, g = 4%, WACC 9%; debt $450m; 50m shares; price $22.00

Firm value	75 ÷ (0.09 − 0.04)	**$1,500m**
Equity value	1,500 − 450	**$1,050m**
Value per share	1,050 ÷ 50	**$21.00**
Against the price	21.00 ÷ 22.00 − 1	**−4.5%**
Careless: no debt taken off	1,500 ÷ 50	**$30.00**

Careless version looks 36% undervalued: a false buy signal

IN THE LESSON

- Example eight.
- Quillon Retail has free cash flow to the firm next year of seventy five million dollars, growing at four per cent for ever.
- The weighted average cost of capital is nine per cent.
- Debt is four hundred and fifty million at market value, there are fifty million shares, and the price is twenty two dollars.
- Firm value is seventy five divided by five per cent, which is one thousand five hundred million.
- Take off debt, and equity is one thousand and fifty million.
- Per share, that is twenty one dollars.
- Against a price of twenty two, the share looks about five per cent overvalued.
- The careless version divides fifteen hundred by fifty and gets thirty dollars, which would look thirty six per cent undervalued.

25 A verdict that depends on the WACC

Value per share ($)

WACC 8.5%	**24.33**
WACC 9.0%	**21.00**
WACC 9.5%	**18.27**
Price	**22.00**

FCFF 75m, g = 4%, debt 450m, 50m shares

IN THE LESSON

- Now stress test the verdict.
- These bars show the value per share for Quillon at three weighted average costs of capital, beside the share price.
- With a rate of eight and a half per cent the value is twenty four dollars thirty three, above the price.
- At nine per cent it is twenty one, a little below.
- At nine and a half per cent it is eighteen twenty seven, well below.
- The last bar is the price of twenty two.
- So half a point lower flips the verdict to undervalued, while half a point higher makes it look even more overvalued.
- The four and a half per cent gap we found is smaller than that swing.
- A sensible analyst would call Quillon about fairly valued, not overvalued.

26 A checklist before you give a verdict

Before saying buy or sell

Check	Question
Cash flow type	Firm or equity? Debt step?
Stress test	Move r and g half a point
Reinvestment	Does capex support growth?
The gap	Bigger than the shake?

IN THE LESSON

- Here is the checklist, in order.
- First, is the cash flow a firm flow or an equity flow, and have you matched the rate and the debt step?
- Second, shake the discount rate and the stable growth rate by a reasonable amount, perhaps half a point, and see whether the verdict survives.
- Third, check the forecast makes sense: growth needs reinvestment, so a high growth forecast with little capital spending overstates value.
- Fourth, compare the gap with the shake.
- A gap smaller than the shake is not a signal.
- Fifth, give the verdict in words: undervalued, overvalued or about fair, and say how sure you are.

27 Recap: from path to verdict

Five steps in a free cash flow valuation

Choose the model	One, two or three stages
Value it	FCFF to WACC; FCFE to r
Terminal value	Flow in year n+1, back to today
Verdict	Value per share against price
Stress test	Move r and g before you decide

IN THE LESSON

- Let's pull it together.
- Choose the model by the growth path: one stage for a mature firm, two for a boom that ends, three when growth fades.
- Value the firm by discounting its flows.
- For a firm flow use the weighted average cost of capital, then subtract debt and preferred shares and add surplus cash.
- For an equity flow use the required return on equity, and subtract nothing.
- Build the terminal value from the flow in year n plus one, keep growth sustainable and the reinvestment consistent, and discount it back.
- Then compare value per share with the price, and stress test the inputs before you call a share over or undervalued.

28 Try three quick questions

1. FCFE model gives equity value 900m; debt is 200m. Subtract debt?
   Answer: No: FCFE is already after the lenders. Equity = 900m.
2. Final flow 80, g = 3%, r = 8%. Terminal value?
   Answer: 80 × 1.03 ÷ 0.05 = 1,648.
3. Value $21.00 against price $22.00. Clearly overvalued?
   Answer: No: a small gap can vanish with a half point change in r or g.

IN THE LESSON

- Now try three quick questions yourself.
- Pause after each one.
- Question one.
- A free cash flow to equity model gives an equity value of nine hundred million, and the company has two hundred million of debt.
- Should we subtract the debt?
- The answer is no.
- Free cash flow to equity already comes after the lenders, so the nine hundred million is the equity value.
- Question two.
- The final forecast flow is eighty, growth is three per cent, and the rate is eight per cent.
- What is the terminal value?
- Eighty times one point zero three is eighty two point four, divided by five per cent, is one thousand six hundred and forty eight.
- Question three.
- The model value is twenty one dollars and the price is twenty two.
- Is the share clearly overvalued?
- No, because a half point change in the rate could flip the verdict.