Click here to see what your answer should look like.

1 Introduction

A variety of skill sets are needed in financial modelling: Accounting, finance, spreadsheet and design skills are all important. The focus in this spreadsheet is on finance - in particular the financial principles underlying financial modelling.

In this spreadsheet you'll find a range of financial modelling problems. The problems are concise - they generally occupy about the same space as the back of an envelope. Even though they are compact the problems will exercise your understanding and application of finance principles.

You solve the problems by designing formulae for cells that have a grey background (as does cell G26 below). A sample problem is shown next.

Problem:- IRR when cash flows grow at a constant rate in perpetuity

An investment of $6m is made today. The investment will generate a dividend of $1.25m in one year's time and dividends threreafter increase at 5.0% per year forever. What is the IRR of this investment?

Investment	[$m]	6
Dividend in first year	[$m]	1.25
Dividend growth rate	[% / yr]	5%
IRR		25.83%

In this spreadsheet blue tag(s) on the left will turn yellow when your answers are correct.

To make the expand [+] and contract [-] icons on the index page work you need to have macros enabled.

Click on the following link for more information about this spreadsheet.

More information

www.tykoh.com

Click here to see what your answer should look like.

The questions on this page cover some core finance topics. Concepts covered here will be useful in more complex questions later in this spreadsheet.

1 Terminal value formula

Financial modelling sometimes requires "terminal values" to be calculated. A terminal value is the value of an ongoing (i.e. perpetual) stream of cash flows. If the cash flows are all the same (or grow by a constant percentage) and are evenly spaced then their total value can be calculated by a simple terminal value formula described below.

In the formula we assume that the first cash flow will occur in one period and its amount then will be "C". Thereafter cash flows will increase by a factor of G per period. Cash flows are discounted at R per period.

Amount of first cash flow to be received	[$m]	C
Per-period growth rate	[%]	G
Per-period discount rate	[%]	R

With these assumptions the value of the ongoing series of cash flows is given by the terminal value formula below.

Value of perpetual annuity described by the above	[$]	C/(R-G)

A cash flow of $2m will be received in one period's time. Thereafter cash flows will be received on an ongoing basis and will increase by 5% per period. If the discount rate is 8% per period what is the terminal value of the cash flows?

Amount of first cash flow to be received	[$m]	2
Per-period growth rate	[%]	5%
Per-period discount rate	[%]	8%

Value of perpetual annuity described by the above	[$m]	66.67

An initial cash flow of $2m is received immediately. Thereafter cash flows will increase by 5% per period. If the discount rate is 8% per period what is the terminal value of the cash flows?

Value of perpetual annuity described by the above	[$m]	72.00

2 Discounting a single cashflow over one period

In the preceding example we discounted an ongoing set of cash flows to a present value. In this section we discount a single cash flow: A cash flow of "C" will occur in one period. We assume the one-period discount rate is R%.

Cash flow	[$]	C
Period period discount rate	[%]	R

The present value of the future cash flow is given by the following formula.

Discounted value of cash flow	[$]	C/(1+R)

A cash flow of $1.8m will occur in one period. The one period discount rate is 5%. What is the discounted or present value?

Cash flow	[$m]	1.8
Per-period discount rate	[%]	5%

Discounted value of cash flow	[$m]	1.714

Alternatively, the PV function can be used to do the calculation. The formula required would be as shown below.

Discounted value of cash flow	[$m]	1.714	<<<	=-PV(L54,1,0,L53)

3 Discounting cash flows + terminal value

A series of cash flows must be discounted to present value. Cash flows are shown below on row 77. Cash flows are shown explicitly for periods 1 - 7. After period 7 cash flows continue in perpetuity and each cash flow is 5% greater than the preceding.

Discount rates vary over time. Each discount rate is a 'one-period' discount rate. For example, the discount rate for period 4 (in cell O76), gives the rate at which the cash flow at the end of period 4 should be discounted to give the value of the cash flow at the beginning of the period.

For each period find the value at the beginning of that period of all following cash flows. The first number in the series will be the present value of all of the cash flows.

Period	[yr]	1	2	3	4	5	6	7
One-period discount rate	[%]	6.00%	6.50%	6.60%	7.00%	7.50%	8.00%	8.50%
Cash flow	[$m]	1.00	1.10	1.20	1.30	1.35	1.40	1.44

Terminal growth rate	[%]	5%

Value at beginning of period of all following cash flows	[$m]	33.36	34.36	35.49	36.63	37.90	39.39	41.14

4 Internal rate of return

The internal rate of return of a set of cash flows can be defined as the discount rate that makes the present value of those cash flows zero.

Period	[yr]	1	2	3	4	5
Cash flow	[$m]	-100	23	56	77	20

Find the internal rate of return (IRR) of the cash flows above.

IRR	[%]	26%

Show that discounting the cash flows above at the internal rate of return gives a net present value of zero.

NPV @ IRR	[$m]	0.00

5 Calculating present value on a nominal basis

The discount rate in cell M104 and the cash flows on row 107 are expressed on a nominal basis. Nominal means not inflation adjusted. Calculate the NPV.

Nominal discount rate	[%]	4.50%

Period	[yr]		1	2	3	4	5
Nominal cash flow	[$m]		-360	110	140	150	150
NPV using nominal discount rate	[$m]	125.07					

6 Calculating an inflation index

This question continues from the preceding one. Yearly inflation is 1.20%. On row 118 calculate an inflation index (relative to a starting value of 1). On row 119 calculate real (i.e. inflation-adjusted) cash flows.

Inflation rate per year	[%]	1.20%

Period	[yr]		1	2	3	4	5
Inflation index	[#]	1.000	1.0120	1.0241	1.0364	1.0489	1.0615
Real (inflation-adjusted) cash flow	[$m]		-355.731	107.407	135.079	143.011	141.315

7 Calculating a real discount rate

Using the nominal discount rate in cell M104 and the inflation rate in cell M115 calculate in cell M126 the real (inflation-adjusted) discount rate.

Real discount rate	[%]	3.26%	<- Note - This is not simply the nominal discount rate less the inflation rate.

8 Calculating NPV on a real (inflation-adjusted) basis

Discount the real cash flows you calculated using the real discount rate to obtain the NPV of the real cash flows. The NPV of the real cash flows discounted at the real rate should equal the NPV of the nominal cash flows discounted at the nominal rate.

NPV using real values	[$m]	125.07	<- Note - This is the same on real and nominal bases (if the correct real discount rate is used).

9 Calculating IRR on nominal and inflation-adjusted bases

Calculate the IRRs of the nominal and real cash flows. You should find that the margin between these does NOT (in general) equal the inflation rate.

IRR of nominal cash flows	[%]	18.33%
IRR of real cash flows	[%]	16.93%
Difference between IRR on nominal and real bases	[%]	1.40%
Inflation rate	[%]	1.20%

Note that the IRR on a real basis does not equal the IRR on a nominal basis less inflation.

Click here to see what your answer should look like.

Following are questions introducing discounted cash flow (DCF) and economic profit (EVA) methodologies.

1 Discounted cash flow

A firm has a growth rate of 3%.p.a: Each year capital, capital expenditure and free cash flows grow by 3%. The firm's cost of capital is 8% and its after-tax return on invested capital is 7%.

Growth rate	[%]	3%
Cost of capital	[%]	8%
After-tax return on invested capital	[%]	7%

Calculate CAPEX (capital expenditure), FCFF (free cash flow to the firm) and the firm's discounted cash flow (DCF) value. The FCFF terminal value in cell M27 should show the value at the end of period 4 of all cash flows to be received in periods 5 through to perpetuity.

Cash flows occur at the end of periods. The DCF firm value in cell I29 is the value as at the beginning of period 1 (or, equivalently, as at the end of period 0).

DCF valuation

Period	[yr]	0	1	2	3	4
Invested capital	[$m]		100.00	103.00	106.09	109.27
Net operating profit after tax	[$m]		7.00	7.21	7.43	7.65
CAPEX	[$m]		3.00	3.09	3.18	3.28
FCFF	[$m]		4.00	4.12	4.24	4.37
FCFF terminal value	[$m]		-	-	-	90.04
FCFF + terminal value	[$m]		4.00	4.12	4.24	94.41
DCF firm value	[$m]	80.00				

2 Economic profit

Economic profit / value added is calculated by multiplying invested capital by return on capital less the cost of capital. Calculate economic value added for each year and determine the net present value of all economic value added.

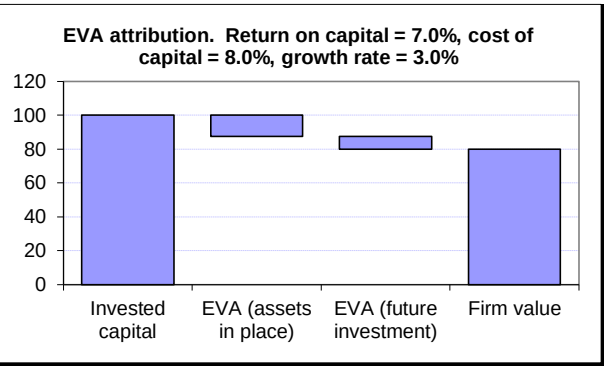
Economic value added

Period	[yr]	1	2	3	4
Economic value added (EVA)	[$m]	(1.00)	(1.03)	(1.06)	(1.09)
Terminal value of EVA	[$m]	-	-	-	(22.51)
EVA + terminal value	[$m]	(1.00)	(1.03)	(1.06)	(23.60)
NPV of EVA + terminal value	[$m]	(20.00)			

Summarise invested capital, EVA due to assets in place and EVA due to future investments. Reconcile those against the DCF valuation from earlier.

Economic value added summary

Invested capital	100.00
EVA due to assets in place	(12.50)
EVA due to future investments	(7.50)
Firm value	80.00



Click here to see what your answer should look like.

Some problems that appear difficult or intractable can be solved more easily if re-framed in an appropriate way. This sheet contains examples of such problems. Solutions require careful design of the "chain of logic" in the underlying calculations. Some simple algebra (no more than high-school level) may be required.

1 Meeting two objectives concurrently

Capital is comprised of debt and equity. Calculate debt and equity so that the debt / equity ratio is 35% and total capital is $100.

Debt / Equity ratio	[%]	35%
Debt	[$m]	25.93
Equity	[$m]	74.07
Capital (Debt + Equity)	[$m]	100.00

2 Meeting several objectives concurrently

This is an extension of the preceding problem. Two policies are to be set: 1) Dividend payout policy, and 2) borrowing policy. Policy settings are required to meet two constraints 1) The debt / equity ratio must meet certain targets, and 2) capital growth must also meet targets.

Determine an investing policy to meet debt / equity and growth rate targets. The debt / equity targets are given on row 32. Growth rate targets are given on row 33. A growth rate target of, say, 6% in period 1 means that the capital in period 2 should be 6% greater than in period 1.

In the section below dividends should be represented as negative numbers (since they are outgoing cash). Net borrowings should be represented as positive numbers (since they are incoming cash).

Period	**[yr]**	**1**	**2**	**3**	**4**	**5**	**6**
Debt / Equity ratio	[%]	30%	35%	40%	42%	40%	38%
Growth rate of capital	[%]	6%	5%	4%	3%	2%	1%
Net income	[$m]	50.00	55.00	60.00	61.00	62.00	
Debt	[$m]	23.08	27.48	31.80	34.24	34.06	
Equity	[$m]	76.92	78.52	79.50	81.52	85.16	
Capital	[$m]	100.00	106.00	111.30	115.75	119.22	
Investing cash flows							
Dividends	[$m]	(48.40)	(54.02)	(57.98)	(57.36)	(59.04)	
Borrowings	[$m]	4.40	4.32	2.44	(0.17)	(0.58)	

Workspace (not really needed though)

3 Resolving circular references

Two formulae are shown below. The first formula expresses the K_e - the cost of equity - in terms of four other parameters. One of those parameters is E - the market value of equity. The second formula expresses E - the market value of equity - in terms of three other parameters. One of those parameters is K_e - the cost of equity.

Formulae
$K_e = K_u + D/E \times (K_u - K_d)$
$E = FCFE / (K_e - g)$

There is a circular relationship between the cost of equity and the market value of equity: Cost of equity depends on the market value of equity, and the market value of equity depends on the cost of equity.

Restructure the formulae to resolve the circular references. Then determine the cost of equity and the market value of equity in cells K73 and K74.

Term	Symbol	Units	Amount
Market value of debt	D	[$]	20.00
Free cash flow to equity	FCFE	[$]	35.00
Cost of debt	K_d	[%]	6.00%
Growth rate	g	[%]	3.00%
Unlevered cost of equity	K_u	[%]	11.00%
Cost of equity	K_e	[%]	11.24%
Market value of equity	E	[$]	425.00

4 Induction

In some problems an "nth" (last) result is known and an inductive method can be used to calculate the n-1th, n-2nd, n-3rd and so on. Following is an example.

The formula below gives the market value of equity in a 5th (terminal) year. The formula assumes free cash flows will continue indefinitely into the future after year 5. In the formula E_5 is the market value of equity in the fifth year, FCFE is free cash flow, K_e is cost of equity and g is the growth rate in perpetuity.

$E_5=FCFE_5/(Ke_5 - g)$

The formula below defines the market values of equity in years prior to the terminal year. Each formula for year "m" refers to the following year "m+1".

$E_m=(E_{m+1} + FCFE_m)/(1+Ke_m)$

Use the above formulae to calculate the market value of equity at the beginning of period 1. Try to make your formulae consistent across years.

Growth rate of free cash flows in terminal phase	g	[%]	3%

Term	Symbol	Units					
Period		[yr]	1	2	3	4	5
Terminal period		[0/1]	0	0	0	0	1
Cost of equity [one-period discount rate]	Ke	[%]	11%	12%	13%	14%	15%
Free cash flow to equity	FCFE	[$m]	30.0	35.0	40.0	45.0	50.0
Market value of equity	E	[$m]	371.9	382.8	393.8	405.0	416.7

Click here to see what your answer should look like.

Interest rates and costs of capital can vary over time - they can have a "term structure". The questions on this page relate to term structure.

1 Multiple discount rates

Rows 18 and 19 below show cash flows in a lease. Cash flows in periods 1 - 6 (inclusive) are lease payments. The lease ends in period 7 and at that time the underlying asset is sold for its estimated residual value. There is no lease payment made in the final period.

Calculate the present value of the lease. Lease payments should be discounted at the rate shown in cell L15. Discount the final - riskier - asset sale at the higher discount rate shown in cell L16.

Discount rate of lease payments in periods 1 - 6	[%]	6%
Discount rate of asset sale in period 7	[%]	11%

Period	[yr]	1	2	3	4	5	6	7
Cash flow	[$m]	(0.23)	(0.23)	(0.23)	(0.23)	(0.23)	(0.23)	1.20

Present value of lease cash flows	[$m]	(0.55)

What would the value of the lease be if the final cash flow in cell R19 included a lease payment? (Assume the figure shown in that cell is the net of the lease payment and asset sale).

Present value of lease cash flows	[$m]	(0.60)

In solving this problem wouldn't it be better to model the lease cash flows on two separate rows - one row for payments and another for the asset sale? That way the individual streams could easily be discounted at their own rates.

That's true - that would be a better solution. The reason the problem has been structured this way is as a lead-in to following problems. Those problems involve not one or two discount rates but many and we look for solutions that can cope with multiple discount rates without requiring separate rows for each rate.

2 Term structure of discount rates

Discount rates have a term structure shown on rows 41 and 42. Each period has its own discount rate. Calculate the present values of the cash flows shown on row 43 by discounting each future cash flow by its corresponding discount rate. Also calculate the total present value.

Period	[yr]	1	2	3	4	5	6	7
Discount rate [annual effective from beginning of period 1 to end of period "n"]	[%]	6.0%	6.0%	6.5%	6.6%	7.0%	8.0%	9.0%
Cash flow	[$m]	(0.23)	(0.23)	(0.23)	(0.23)	(0.23)	(0.23)	1.20
Present value of individual cash flows	[$m]	(0.22)	(0.20)	(0.19)	(0.18)	(0.16)	(0.14)	0.66
Total present value	[$m]	(0.44)						

3 Term structure of discount rates - using an array

Consider the discount rate term structure shown below on rows 53 and 54. Calculate the present value of the cash flows shown on row 55. You'll probably need to use an array to solve this problem.

Period	[yr]	1	2	3	4	5	6	7
Discount rate	[%]	6.0%	6.0%	6.5%	6.6%	7.0%	8.0%	8.5%
Cash flow	[$m]	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	2.10

Total present value	[$m]	0.33

Click here to see what your answer should look like.

The capital asset pricing model (CAPM) relates the expected-or-required return on an asset in terms of a number of drivers: The risk free rate, the asset's risk, market return, market risk and the correlation between the asset returns and market returns.

Beta is can be defined as the asset's risk divided by the market's risk and multiplied by the correlation between the asset's returns and the market's returns.

In spreadsheets risk can be calculated using the STDEV function and correlation by the CORREL function.

1 Calculation of Beta

The table below shows weekly asset and market prices. Calculate returns, risks and correlations and from those calculate beta and the expected return / cost of capital.

Market and asset price data

Week	Market price [$]	Market return [%]	Asset price [$]	Asset return [%]
0	103.19		104.16	
1	104.00	0.78%	107.28	2.99%
2	107.23	3.11%	118.40	10.37%
3	106.88	-0.33%	119.54	0.96%
4	108.95	1.93%	114.18	-4.48%
5	108.53	-0.38%	120.36	5.41%
6	109.52	0.91%	112.37	-6.64%
7	108.46	-0.97%	108.09	-3.80%
8	110.10	1.50%	113.33	4.85%
9	102.76	-6.66%	103.22	-8.93%
10	101.05	-1.66%	98.99	-4.09%
11	99.65	-1.39%	98.42	-0.58%
12	101.98	2.34%	100.89	2.51%
13	98.25	-3.65%	90.04	-10.76%
14	96.17	-2.12%	88.55	-1.65%
15	96.54	0.39%	88.94	0.44%
16	97.54	1.03%	86.55	-2.69%
17	98.54	1.03%	92.15	6.47%
18	100.74	2.23%	93.32	1.27%
19	102.50	1.74%	101.37	8.62%
20	101.12	-1.34%	101.02	-0.34%
21	99.26	-1.84%	94.06	-6.89%

Risk / standard deviation is usually expressed on an annualised basis. To convert a weekly standard deviation to a yearly one multiply the weekly standard deviation by the square root of the number of weeks in a year.

2 Market and asset risk

Risk free rate	[%]	3.6%	
Market return	[%]	9.0%	
Riskiness of market (annualised standard deviation)	[%]	16.6%	<< =STDEV(G22:G42)*SQRT(52)
Riskiness of asset (annualised standard deviation)	[%]	40.8%	

	D	E	F	G	H	I	J	K	L	M
55	3	Market and asset correlation								
56										
57		Correlation of asset with market	[%]	68.5%	<<	=CORREL(G22:G42,G22:I42)*SQRT(52)				
58										
59	4	Beta								
60										
61		Beta	[#]	1.69	<<	=G57*G53/G52				
62										
63	5	Cost of capital								
64										
65		Cost of capital	[%]	12.7%	<<	=risk free rate + (market return - risk free rate) * beta				
66										
67	6	Net present value								
68										
69		*The table below shows free cash flows expected from the asset. The first will be received in one year's*								
70		*time. Using the cost of captial above find the present values of the asset's cash flows.*								
71										
72		Period	[yr]	1	2	3	4	5	6	
73		Asset free cash flow	[$m]	15.00	15.30	15.61	15.92	16.24	16.56	
74		NPV	[$m]	63.06						
75										
76										
77										
78										

Click here to see what your answer should look like.

The questions on this page relate to a valuing a firm in a "steady-state" where growth, leverage, tax and return on capital do not change from year to year. Steady state scenarios are often used in the terminal phase of discounted cash flow (DCF) models.

The table below on the left shows assumptions to be used in a DCF valuation. The table below on the right shows formulae that are useful in performing the valuation. The symbols used in the formula are defined in various rows in column E.

Assumptions	Symbol	Units	Value
Unlevered cost of equity	K_u	[%]	10%
Pre-tax cost of debt	K_d	[%]	6%
Growth rate	g	[%]	3%
Tax rate	t	[%]	30%
Return on capital	ROC	[%]	12%
Depreciation rate		[%]	5%
Debt / equity ratio		[%]	25%

Formulae
EBIT x (1 - t) = C x ROC
FCFE = (EBIT - I) x (1 - t) + Depn - CAPEX + Δ_d
FCFD = -Δ_d + (1 - t) * I
FCFF = FCFE + FCFD
S = D x (K_u - K_d)
K_e = (K_u - S x g / FCFE) / (1 - S / FCFE)

Consider the assumptions shown above. Calculate the book values of debt and equity in cells G23 and G24 below. Their ratio should be in accord with the debt/equity ratio in cell G16

1 Balance sheet

Debt	D	[$m]	20.00
Equity	E	[$m]	80.00
Assets	C	[$m]	100.00

Calculate the components of the income statement below. The first calculation will need to be for earnings before interest and taxes (EBIT). Once EBIT is known then EBITDA (earnings before interest, taxes, depreciation and amortisation) and the other sections can be determined.

2 Income statement

EBITDA		[$m]	22.14
(Depreciation)	Depn	[$m]	(5.00)
EBIT	EBIT	[$m]	17.14
(Interest)	I	[$m]	(1.20)
EBT		[$m]	15.94
(Tax)		[$m]	(4.78)
Net profit		[$m]	11.16

Calculate the cash flow from operations. A non-cash item (depreciation) was deducted in calculating net income. That deduction needs to be reversed to obtain the cash flow from operations.

3 Cash flow statement

Cash flow from operations			
Net profit		[$m]	11.16
Plus depreciation		[$m]	5.00
Cash flow from operations		[$m]	16.16

Calculate the cash flow from financing. There are two components here: Dividends (outgoing) and net borrowing (incoming - in this case). Both of these are driven by the growth assumption. Both equity and debt in the next period should be the current periods' increased by the growth factor.

Cash flow from financing			
Dividends		[$m]	(8.76)
Net borrowing	Δ_d	[$m]	0.60
Cash flow from financing		[$m]	(8.16)

Calculate capital expenditure (CAPEX). This has two components: Replacement CAPEX (i.e. expenditures to "make up" for depreciation) plus growth CAPEX.

Cash flow from investing			
Replacement CAPEX		[$m]	(5.00)
Growth CAPEX		[$m]	(3.00)
Total CAPEX	CAPEX	[$m]	(8.00)
Other investments		[$m]	-
Cash flow from investing		[$m]	(8.00)

Generate the statement of changes in equity. Retained earnings will be previous retained earnings (none) plus net income less dividends paid.

4 Statement of changes in equity

Opening equity	[$m]	80.00
Retained earnings	[$m]	2.40
Closing equity	[$m]	82.40

Calculate free cash flows to equity, to debt and to the firm (equity + debt).

5 Free cash flows

Free cash flow to equity	FCFE	[$m]	8.76
Free cash flow to debt	FCFD	[$m]	0.24
Free cash flow to the firm	FCFF	[$m]	9.00

The preceding sections describe the firm from a "book" or accounting perspective. Next analyse the firm from a "market value" perspective.

If the firm were solely financed by equity then the 'unlevered' equity discount rate in cell G10 should be used to discount equity cash flows. However, the firm is partly financed by debt. Debt financing increases the volatility and risk of equity cash flows because interest payments must be made in both good years and bad years.

Calculate the risky / leveraged cost of equity below. Use two of the formulae (for S and K_e) from the formula box on the top of this page.

6 Levered cost of equity

Unlevered cost of equity		[%]	10.00%
Dollar spread between K_u & K_d	S	[$m]	0.80
Levered cost of equity	K_e	[%]	10.70%

Using terminal value formulae and appropriate discount rates determine the market values of debt and equity.

7 Market values

Market value of equity	[$m]	113.71
Market value of debt	[$m]	20.00
Market value of firm	[$m]	133.71

Summarise below the book values of debt and equity. How do they compare with market values? When would they be the same? When would they be greater? When would they be less?

8 Book values

Book value of equity	[$m]	80.00
Book value of debt	[$m]	20.00
Book value of firm	[$m]	100.00

Calculate the weighted average cost of capital (WACC). Do this twice: Once using market value weights for debt and equity, and again with book value weights.

9 WACC

WACC (on market value basis)	[%]	9.73%
WACC (on book value basis)	[%]	9.40%

Using the free cash flow to the firm (in cell G85) and the WACC you have just calculated determine the market value of the firm (use a terminal value formula). Do this twice - once using the market-value-weighted WACC, and again using the book-value-weighted WACC. Which gives the correct answer?

10 Market value reconciliation

Market value of firm (using market value weighted WACC)	[$m]	133.71
Market value of firm (using book value weighted WACC)	[$m]	140.56

Find the P/E and Enterprise value / EBITDA ratios.

11 Ratios

P/E ratio	[#]	7.17
Enterprise value / EBITDA	[#]	6.04

Summarise below the returns on capital and equity.

	C	D	E	F	G	H	I	J	K	L	M	N
146	12	**Returns**										
147												
148		Return on capital		[%]	12.0%							
149		Return on equity		[%]	14.0%							
150												
151												
155												
156												

Click here to see what your answer should look like.

This page is a progression from the preceding page which considered only a steady-state scenario. Here we allow assumptions to vary over time: So leverage, cost of capital, growth, return on capital etc all have a term structure. Aside from that, the calculations needed on this page are very similar to those on the preceding page.

Generally, you will need to "work backwards" from the terminal state. Try to make your formulae "copy-and-pastable" i.e. uniform across each row.

Induction example

Period		**[yr]**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Terminal year		[0/1]	0	0	0	0	0	0	1
Assumptions									
Unlevered cost of equity	K_u	[%]	10%	10%	10%	10%	10%	10%	10%
Pre-tax cost of debt	K_d	[%]	6%	6%	6%	6%	6%	6%	6%
Growth rate	g	[%]	9%	8%	7%	6%	5%	4%	4%
Tax rate	t	[%]	30%	30%	30%	30%	30%	30%	30%
Return on capital	ROC	[%]	15%	14%	13%	12%	11%	10%	10%
Depreciation rate		[%]	5%	5%	5%	5%	5%	5%	5%
Debt / equity ratio		[%]	35%	32%	29%	26%	23%	20%	20%

1 Balance sheet

Debt	D	[$m]	25.93	26.42	26.46	25.99	24.97	23.37	24.30
Equity	E	[$m]	74.07	82.58	91.26	99.97	108.55	116.83	121.50
Assets	C	[$m]	100.00	109.00	117.72	125.96	133.52	140.19	145.80
Debt / Equity ratio check		[%]	35%	32%	29%	26%	23%	20%	20%
Growth rate check		[%]	9%	8%	7%	6%	5%	4%	

2 Income statement

EBITDA		[$m]	26.43	27.25	27.75	27.89	27.66	27.04	28.12
(Depreciation)	Depn	[$m]	(5.00)	(5.45)	(5.89)	(6.30)	(6.68)	(7.01)	(7.29)
EBIT	EBIT	[$m]	21.43	21.80	21.86	21.59	20.98	20.03	20.83
(Interest)	I	[$m]	(1.56)	(1.59)	(1.59)	(1.56)	(1.50)	(1.40)	(1.46)
EBT		[$m]	19.87	20.21	20.27	20.03	19.48	18.63	19.37
(Tax)		[$m]	(5.96)	(6.06)	(6.08)	(6.01)	(5.85)	(5.59)	(5.81)
Net profit		[$m]	13.91	14.15	14.19	14.02	13.64	13.04	13.56

3 Cash flow statement

Cash flow from operations									
Net profit		[$m]	13.91	14.15	14.19	14.02	13.64	13.04	13.56
Plus depreciation		[$m]	5.00	5.45	5.89	6.30	6.68	7.01	7.29
Cash flow from operations		[$m]	18.91	19.60	20.08	20.32	20.31	20.05	20.85
Cash flow from financing									
Dividends		[$m]	(5.41)	(5.47)	(5.48)	(5.44)	(5.36)	(8.36)	(8.70)
Net borrowing	Δ_d	[$m]	0.50	0.04	(0.47)	(1.03)	(1.60)	0.93	0.97
Cash flow from financing		[$m]	(4.91)	(5.43)	(5.95)	(6.47)	(6.96)	(7.43)	(7.73)
Cash flow from investing									
Replacement CAPEX		[$m]	(5.00)	(5.45)	(5.89)	(6.30)	(6.68)	(7.01)	(7.29)
Growth CAPEX		[$m]	(9.00)	(8.72)	(8.24)	(7.56)	(6.68)	(5.61)	(5.83)
Total CAPEX	CAPEX	[$m]	(14.00)	(14.17)	(14.13)	(13.86)	(13.35)	(12.62)	(13.12)
Other investments		[$m]	-	-	-	-	-	-	-
Cash flow from investing		[$m]	(14.00)	(14.17)	(14.13)	(13.86)	(13.35)	(12.62)	(13.12)

4 Statement of changes in equity

Opening equity		[$m]	74.07	82.58	91.26	99.97	108.55	116.83	121.50
Retained earnings		[$m]	8.50	8.68	8.71	8.58	8.28	4.67	4.86
Closing equity		[$m]	82.58	91.26	99.97	108.55	116.83	121.50	126.36

5 Free cash flows

Free cash flow to equity	FCFE	[$m]	5.41	5.47	5.48	5.44	5.36	8.36	8.70
Free cash flow to debt	FCFD	[$m]	0.59	1.07	1.58	2.12	2.65	0.05	0.05
Free cash flow to the firm	FCFF	[$m]	6.00	6.54	7.06	7.56	8.01	8.41	8.75

	I	J	K	L	M	N	O	P	Q	R	S	T
75	6	**Levered cost of equity**										
76												
77		Unlevered cost of equity		[%]	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	
78		Dollar spread between K_u & K_d	S	[$m]	1.04	1.06	1.06	1.04	1.00	0.93	0.97	
79		Levered cost of equity	K_e	[%]	11.11%	11.07%	11.02%	10.95%	10.86%	10.75%	10.75%	
80												
81	7	**Market values**										
82												
83		Market value of equity		[$m]	93.55	98.53	103.98	109.95	116.55	123.84	128.79	
84		Market value of debt		[$m]	25.93	26.42	26.46	25.99	24.97	23.37	24.30	
85		Market value of firm		[$m]	119.48	124.96	130.44	135.94	141.51	147.20	153.09	
86												
87	8	**Book values**										
88												
89		Book value of equity		[$m]	74.07	82.58	91.26	99.97	108.55	116.83	121.50	
90		Book value of debt		[$m]	25.93	26.42	26.46	25.99	24.97	23.37	24.30	
91		Book value of firm		[$m]	100.00	109.00	117.72	125.96	133.52	140.19	145.80	
92												
93	9	**WACC**										
94												
95		WACC		[%]	9.61%	9.62%	9.63%	9.66%	9.68%	9.71%	9.71%	
96												
97	10	**Ratios**										
98												
99		P/E ratio		[#]	5.32	5.84	6.43	7.13	7.96	8.96	8.96	
100		Enterprise value / EBITDA		[#]	4.52	4.59	4.70	4.87	5.12	5.44	5.44	
101												
102	11	**Returns**										
103												
104		Return on capital		[%]	15.0%	14.0%	13.0%	12.0%	11.0%	10.0%	10.0%	
105		Return on equity		[%]	18.8%	17.1%	15.6%	14.0%	12.6%	11.2%	11.2%	
106												
107	12	**Economic value added**										
108												
109		*EVA per unit capital and no growth*		[#]	0.56	0.46	0.35	0.24	0.14	0.03	0.00	
110		EVA due to assets in place		[$m]	56.10	49.64	41.12	30.58	18.17	4.12	0.38	
111		EVA due to growth assets		[$m]	(36.62)	(33.68)	(28.40)	(20.60)	(10.17)	2.89	6.91	
112		Economic value added		[$m]	19.48	15.96	12.72	9.98	7.99	7.01	7.29	
113												
114	13	**EVA / DCF reconciliation**										
115												
116		Invested assets [IA]		[$m]	100.00	109.00	117.72	125.96	133.52	140.19	145.80	
117		EVA		[$m]	19.48	15.96	12.72	9.98	7.99	7.01	7.29	
118		Total		[$m]	119.48	124.96	130.44	135.94	141.51	147.20	153.09	
119		DCF market value of firm		[$m]	119.48	124.96	130.44	135.94	141.51	147.20	153.09	
120		Check IA + EVA = DCF		[ok/check]	**ok**	**ok**	**ok**	**ok**	**ok**	**ok**	**ok**	
121												
122												
123												
124												

Click here to see what your answer should look like.

The questions on this page are about working with IRR: Calculating, targeting, tiering, etc.

1 Share of free cash flow to achieve a target IRR

Investors are required to provide capital in the first two years of a project according to the schedule shown on row 11 below.

Period	[yr]	**1**	**2**	**3**	**4**	**5**
Capital contributed	[$m]	(50.00)	(40.00)	-	-	-
Free cash flow	[$m]	-	-	40.00	70.00	120.00

In subsequent years the project yields the free cash flows shown above on row 12. What proportion of free cash flows (as a fixed percentage) should the investors receive to achieve an IRR of 30% over the lifetime of the project?

Target IRR	[%]	30%

Proportion of free cash flows	[%]	83%

Generate a schedule of cash flows for the project above showing capital contributed and free cash flows. The free cash flows should be those shown earlier on row 12 scaled by the proportion you calculated in cell L20.

Period	[yr]	1	2	3	4	5
Project cash	[$m]	(50.00)	(40.00)	33.12	57.96	99.36

Calculate the IRR of the cash flows above and show the IRR matches the target IRR in cell L18.

IRR	[%]	30%

2 Calculating IRR tenor

Investors are required to provide capital in the first two years of a project according to the schedule shown on row 39 below.

Period	[yr]	1	2	3	4	5	6	7
Equity contributed	[$m]	(50.00)	(40.00)	-	-	-	-	-
Free cash flow	[$m]	-	-	40.00	70.00	70.00	70.00	120.00

In subsequent years the project yields the free cash flows shown above on row 40.

Investors are entitled to dividends equal to 80% of the free cash flows until they achieve an IRR of 20%. Thereafter they have no further claim on free cash flows. Calculate the dividends investors receive. [They will receive 80% for a number of years, less than 80% on a final year and 0% thereafter.] Show investing and dividend cash flows below.

Dividend payout ratio	[%]	80%
Target IRR	[%]	20%

Workspace

Period	[yr]	1	2	3	4	5	6	7
Investor cash flow	[$m]	(50.00)	(40.00)	32.00	56.00	56.00	4.22	-

Calculate the investors' IRR and confirm it matches the target IRR in cell L50.

Investor IRR	[%]	20%

3 IRR waterfall

A project begins in year 0 and finishes in year 4. Two partners contribute capital in year 0 as shown below in cells M72:M73. Cash available for distribution to the partners at the end of the project in year 4 is $60m.

Partner A - capital	[$m]	35.00
Partner B - capital	[$m]	2.00
Cash to distribute	[$m]	60.00

The cash distribution is split between the partners on an "IRR waterfall" basis. In cells L85:L88 below calculate the distributions in year 4 that would be required to achieve the project IRRs listed in cells J85:J88.

In cells O85:Q88 calculate the profit split between the two partners. You'll need to calculate the contribution at each IRR tier.

		Hurdles			**Split**		
IRR	Cash flow in year 0	Cash flow in year 4	Partner A split	Partner B split	Partner A	Partner B	Project
8.0%	(37.00)	50.34	100%	0%	13.34	-	13.34
10.0%	(37.00)	54.17	75%	25%	2.88	0.96	3.83
12.0%	(37.00)	58.22	60%	40%	2.43	1.62	4.05
12.5%	(37.00)	59.27	50%	50%	0.89	0.89	1.78

Profit	[$ 000's]	19.53	3.47	23.00
Equity	[$ 000's]	35.00	2.00	37.00
Total	[$ 000's]	54.53	5.47	60.00

In cells R99:R101 calculate the IRRs due to the individual partners and to the project overall. When you have done that the chart below will show the IRR split as a function of the cash available for distribution.

Project cash flows

Period	[yr]	0	1	2	3	4	IRRs
Partner A cash flows	[$ 000's]	(35.00)	0.00	0.00	0.00	54.53	11.72%
Partner B cash flows	[$ 000's]	(2.00)	0.00	0.00	0.00	5.47	28.59%
Project cash flows	[$ 000's]	(37.00)	0.00	0.00	0.00	60.00	12.85%

4 Two IRRs

The following set of cashflows have two IRRs. Find both the lower and the higher IRR.

Period	[yr]	1	2	3
Cash flow	[$ 000's]	699.30	(1,678.32)	1,000.00

Lower IRR	[%]	10%
Higher IRR	[%]	30%

5 IRR when cash flows grow at a constant rate in perpetuity

An investment of $6m is made. The investment will generate a dividend of $1.25m in the first year and dividends threreafter increase at 5.0% forever. What is the IRR of this investment?

Investment	[$m]	6
Dividend in first year	[$m]	1.25
Dividend growth rate	[% / yr]	5%
IRR		25.83%

Click here to see what your answer should look like.

The questions on this page relate to "sculpting" various profiles of cash flows.

1 Reserving for a future need #1

Two projects are to be developed: Project Alpha will require an expenditure of $2m per year in years 4 through 6 (inclusive) and Project Beta will require $3m per year in years 5 through 7 (inclusive). Before the first project begins a reserve account has to accumulate sufficient funds to service the two projects in the subsquent years. To achieve this a fixed amount will be deposited into the reserve account in years 1 through 3 (inclusive).

So - in years 1 through 3 deposits will be made into the reserve account. In years 4 through 7 cash will be withdrawn as required. The reserve account earns 5% interest paid yearly in arrears. Cash flows always occur on the last day of the year in this order: 1) Interest on the reserve account calculated and credited, 2) deposit (if any) made and 3) withdrawal (if any) made. There is to be a zero cash balance in the reserve account after the last withdrawal has been made.

Interest earned on reserve account	[%]	5.00%

Year	[yr]	1	2	3	4	5	6	7
Opening balance	[$m]		4.196	8.601	13.227	11.889	7.483	2.857
Deposit	[$m]	4.196	4.196	4.196				
Interest earned	[$m]		0.210	0.430	0.661	0.594	0.374	0.143
Project Alpha cost	[$m]	-	-	-	(2.0)	(2.0)	(2.0)	-
Project Beta cost	[$m]	-	-	-	-	(3.0)	(3.0)	(3.0)
Closing balance	[$m]	4.196	8.601	13.227	11.889	7.483	2.857	-

Workspace

2 Reserving for a future need #2

In the preceding question the deposits were all the same size. In this exercise the deposits have to be of varying sizes - 20% of the total deposits must be made in the first year, 30% in the second and 50% in the third. Revise your model accordingly.

Interest earned on reserve account	[%]	5.00%

Year		1	2	3	4	5	6	7
Deposit profile	[%]	20%	30%	50%				
Opening balance	[$m]		2.555	6.515	13.227	11.889	7.483	2.857
Deposit	[$m]	2.555	3.832	6.387				
Interest earned	[$m]		0.128	0.326	0.661	0.594	0.374	0.143
Project Alpha cost	[$m]	-	-	-	(2.0)	(2.0)	(2.0)	-
Project Beta cost	[$m]	-	-	-	-	(3.0)	(3.0)	(3.0)
Closing balance	[$m]	2.555	6.515	13.227	11.889	7.483	2.857	-

Workspace

3 Paying down a loan according to a repayment profile

A loan has an initial principal of 500,000 and must be repaid over 6 years. Loan payments must be made according to the schedule shown on row 75. If T is the total paid over the six years then 10% of T must be made in year 1, 15% in year 2, and so on.

Interest is paid in arrears and payments occur at the end of each year. Calculate the principal and interest payments needed to pay down the loan according to the repayment schedule. Use negative

numbers to represent interest and principal payments and use positive numbers to represent the principal balance.

Principal	[$]	500,000
Interest rate	[%]	6%

Period	[yr]	1	2	3	4	5	6
Repayment schedule	[%]	10%	15%	20%	20%	25%	10%

Period	[yr]	1	2	3	4	5	6
Opening principal	[$]	500,000	468,385	404,066	305,080	200,155	58,127
Principal repaid	[$]	(31,615)	(64,319)	(98,986)	(104,925)	(142,028)	(58,127)
Interest paid	[$]	(30,000)	(28,103)	(24,244)	(18,305)	(12,009)	(3,488)
Total payment	[$]	(61,615)	(92,422)	(123,230)	(123,230)	(154,037)	(61,615)
Closing principal	[$]	468,385	404,066	305,080	200,155	58,127	(0)

Workspace

4 Paying down a loan with capitalised interest

A loan is to be paid off in equal instalments. There are seven payment periods during which instalments can be made. There is an optional grace period at the start of the loan during which no principal or interest payments need be made. During this grace period interest is capitalised and added to the outstanding principal.

Calculate the principal and interest payments for the loan. Use negative numbers to represent interest and principal payments and use positive numbers to represent capitalised interest and the principal balance.

Interest rate	[%]	5%
Opening Principal	[$m]	100
Number Capitalisation Pe	[#]	2
Term	[yrs]	7

Year	[yr]	1	2	3	4	5	6	7
Interest								
Interest Payment	[$m]	-	-	(5.51)	(4.51)	(3.47)	(2.37)	(1.21)
Principal								
Opening principal	[$m]	100.00	105.00	110.25	90.30	69.35	47.35	24.25
Capitalised interest	[$m]	5.00	5.25	-	-	-	-	-
Principal payment	[$m]	-	-	(19.95)	(20.95)	(22.00)	(23.10)	(24.25)
Closing principal	[$m]	105.00	110.25	90.30	69.35	47.35	24.25	0.00

Workspace

Click here to see what your answer should look like.

The questions on this page relate to statistical measures of expected value and standard deviation.

1 Expected value of a distribution

A wind farm has a maximum output of 600 Megawatts. It generates maximum output when the wind speed is above a certain threshold. At lower wind speeds the farm has a lower ouput. At very high wind speeds the farm cannot operate and is off-line. At very low speeds the farm is also off-line.

The table below on rows 20 to 44 lists probabilities that the wind will be a certain speed on a given day. The probabilities are shown in column E. The power outputs corresponding to each wind speed are shown in column F. Daily wind speeds are independent of each other.

Wind distribtion "shape" parameters	
α	0.178
λ	10
k	1.5

Wind farm generating profile

Wind speed [m/s]	Probability of wind speed [%]	Power output at given wind speed [MW]
0.00	8.56%	0
2.00	13.80%	0
4.00	14.82%	11
6.00	13.94%	38
8.00	12.10%	91
10.00	9.93%	178
12.00	7.78%	307
14.00	5.87%	488
16.00	4.28%	600
18.00	3.03%	600
20.00	2.08%	600
22.00	1.40%	600
24.00	0.92%	600
26.00	0.59%	0
28.00	0.37%	0
30.00	0.23%	0
32.00	0.14%	0
34.00	0.08%	0
36.00	0.05%	0
38.00	0.03%	0
40.00	0.02%	0
42.00	0.01%	0

Workspace

Calculate the expected (i.e. mean / average) wind speed

Expected wind speed	[m/s]	8.03

Calculate the power ouput at the expected wind speed (use linear interpolation)

Power output at expected wind speed	[MW]	92.22

Workspace

Calculate the expected power ouput. (Note - this is not the same as the power output at the expected speed).

Expected power ouput	[MW]	158.44

Asuming electricity can be sold at a price of $55 per Megawatt-hour what is the expected revenue over 365 days?

Expected revenue over 365 days.	[$m]	76.34

2 Standard deviation of a distribution

The standard deviation of the windfarm power output is a measure of its riskiness with respect to wind speed distributions. Calculate the standard deviation of daily revenues.

Standard deviation of daily revenues	[$]	58,149

Calculate the standard deviation of yearly revenues (assuming daily power outputs are independent of each other).

Standard deviation of yearly revenues	[$m]	1.11

3 Two envelope problem

This fairly abstract modelling problem illustrates the occasional challenges of integrating language, logic and mathematics.

Two sealed envelopes each contain sums of money. You are given one of the envelopes. You are then told the other envelope contains either twice as much or half as much as yours (with equal probability). If X represents the value of your envelope what is the expected value of the other envelope?

A	2 X
B	1.5 X
C	1.25 X
D	1 X

Answer: C

You have the opportunity to swap envelopes. Do you swap? You can do a web search on "Two envelope paradox" for analyses of this problem.

Click here to see what your answer should look like.

The questions on this page relate to cash flows denominated in currencies other than the local currency and also to inflation and real and nominal discount rates.

1 Forward foreign exchange rates

A company will receive foreign and domestic currency cash flows according to the schedule shown in the table below. The first cash flow will be received in one year.

Cash flows

Period	[yr]	1	2	3	4	5
Australian Dollars	[$AUD m]	56	45	23	23	23
Great Britain Pounds	[£ m]	30	30	50	50	50
Japanese Yen	[Y m]	867	850	800	800	800
United States Dollars	[$USD m]	80	80	80	80	80

The table below shows spot (i.e. current) foreign exchange rates relative to United States Dollars. The rates are shown in cells I27:I30. The figure for each currency shows the number of units of that currency that can be purchased with one United States Dollar.

The table below also shows risk free rates on a nominal basis for each currency. [Nominal means not inflation adjusted.] The risk free rates are shown in cells K27:K30.

Rates

Country	*Spot FX rate (vs $USD)*	*Inflation rate*	*Risk free rate (nominal)*	*Risk margin (nominal)*
Australian Dollar	0.98002	2.90%	3.50%	3.00%
Great Britain Pounds	0.63024	2.60%	0.50%	3.01%
Japanese Yen	78.43771	-0.40%	0.00%	3.02%
United States Dollars	1.00000	1.40%	0.25%	3.03%

Calulate future (forward) fx rates. Do that on the following basis: Two investing strategies should yield the same return: 1) Buy one unit of domestic currency and earn interest at the domestic risk free rate for one period, 2) Buy one unit of domestic currency, immediately convert it into a foreign currency at the spot rate, earn the foreign risk free rate for one period, and - last - convert the foreign currency holding plus earned interest back to the domestic currency at the then-prevailing spot rate.

Future FX rates

Period	[yr]		1	2	3	4	5
Australia	[#]	0.9800	1.0118	1.0446	1.0785	1.1134	1.1495
Great Britain	[#]	0.63024	0.6318	0.6334	0.6350	0.6366	0.6381
Japan	[#]	78.43771	78.2421	78.0470	77.8524	77.6582	77.4646
United States	[#]	1.00000	1.0000	1.0000	1.0000	1.0000	1.0000

2 Discount factors across currencies

Calculate discount factors needed to present-value future cash flows. The cash flows are assumed to be risky so the risk margins listed above in cells L27:L30 should be added to the corresponding risk free rates.

Discount factors

Period	[yr]	1	2	3	4	5
Australia	[#]	1.0650	1.1342	1.2079	1.2865	1.3701
Great Britain	[#]	1.0351	1.0714	1.1090	1.1480	1.1883
Japan	[#]	1.0302	1.0613	1.0934	1.1264	1.1604
United States	[#]	1.0328	1.0667	1.1017	1.1378	1.1751

3 Present-valuing currency cash flows

Calculate the present values of the cash flows in their respective currencies.

PV of cash flows in domestic currency

Period	[yr]	1	2	3	4	5
Australia	[$AUD m]	52.58	39.67	19.04	17.88	16.79
Great Britain	[£ m]	28.98	28.00	45.08	43.56	42.08
Japan	[Y m]	841.58	800.90	731.69	710.24	689.42
United States	[$USD m]	77.46	75.00	72.62	70.31	68.08

4 Converting risky foreign cash flows to a reference / domestic currency

Calculate the present $USD value of all of the cash flows.

PV of cash flows in $USD

Period	[yr]		1	2	3	4	5
Australia	[$USD m]		51.97	37.98	17.66	16.06	14.60
Great Britain	[$USD m]		45.87	44.21	71.00	68.42	65.94
Japan	[$USD m]		10.76	10.26	9.40	9.15	8.90
United States	[$USD m]		77.46	75.00	72.62	70.31	68.08
Total	[$USD m]		186.06	167.45	170.67	163.94	157.52
NPV	[$USD m]	845.64					

5 Inflation adjusting currency cash flows

Calculate real (inflation-adjusted) cash flows for each currency.

Real cash flows in domestic currency

Period	[yr]	1	2	3	4	5
Australia	[$AUD m]	54.42	42.50	21.11	20.51	19.94
Great Britain	[£ m]	29.24	28.50	46.29	45.12	43.98
Japan	[Y m]	870.48	856.84	809.68	812.93	816.19
United States	[$USD m]	78.90	77.81	76.73	75.67	74.63

6 Calculating real risk-free and risky rates

Calculate each currencies real risk free rate and each cash flows real risk margin. Hint: The present value of real cash flows discounted at the real discount rate is equal to the present value of nominal cash flows discounted at the nominal discount rate.

Rates

Country	*Risk free rate (nominal)*	*Inflation rate*	*Currency risk free rate (real)*	*Cash flow risk margin (real)*
Australian Dollar	3.50%	2.90%	0.58%	2.92%
Great Britain Pounds	0.50%	2.60%	-2.05%	2.93%
Japanese Yen	0.00%	-0.40%	0.40%	3.03%
United States Dollars	0.25%	1.40%	-1.13%	2.99%

Workspace

Click here to see what your answer should look like.

The questions on this page relate to some ratios used in financial modelling.

1 Debt service coverage ratio

The debt service coverage ratio (DSCR) is the cash flow available for debt service (CFADS) in a period divided by the principal and interest payments due in that period.

Period	[yr]	1	2	3	4	5	6	7
CFADS	[$m]	2.50	2.60	2.65	2.70	2.77	2.80	2.80
Debt principal due	[$m]	0.48	0.51	0.54	0.57	0.60	0.64	0.68
Debt interest due	[$m]	0.24	0.21	0.18	0.15	0.11	0.08	0.04
DSCR	[#]	3.49	3.63	3.70	3.77	3.87	3.91	3.91

2 Loan life coverage ratio

The loan life coverage ratio (LLCR) is the present value of all future cash flows available for debt service (CFADS) divided by the current outstanding debt. The following example shows a calculation for LLCR.

CFADS is shown below on row 39. Row 37 shows discount rates needed to present-value the CFADS. In this example the discount rates are 'one-period' rates: They are the rates needed to discount a cash flow at the end of each period back to the start of that period.

For example, consider the discount rate for year 4 shown in cell P37. That discount rate is 6.5%. That means a cash flow occurring at the end of year 4 must be discounted at 6.5% to give the value of that cash flow at the beginning of year 4.

Row 38 calculates a 'running' or compounded discount factor by applying each period's discount rate in turn. Row 39 lists the CFADS. Row 40 calculates the present value of each CFADS by discounting each CFADS by the corresponding discount factor.

Cell L43 calculates the LLCR by dividing the present value of the CFADS (ie. the sum of the discounted values) by the current outstanding debt.

Period	[yr]	0	1	2	3	4	5	6
One period discount rate	[%]		5.0%	5.5%	6.0%	6.5%	7.0%	7.2%
Discount factor	[#]	1.0000	1.0500	1.1078	1.1742	1.2505	1.3381	1.4344
CFADS	[$m]		6.50	5.50	5.70	6.70	6.00	5.70
Discounted CFADS	[$m]		6.19	4.97	4.85	5.36	4.48	3.97
Present value of CFADS	[$m]	29.83						
Outstanding debt at period end	[$m]	20.10						
LLCR	[#]	1.48						

Calculate the loan life coverage ratios for the scenario shown below. You need to be very clear about the meaning of the discount rates shown on row 52: The discount rate for year 4, say, will apply for year 4 irrespective of how many years in the future year 4 is.

So - whether year 4 is one, two, three or four years ahead - use the year 4 discount rate to discount over that year.

Period	[yr]	0	1	2	3	4	5	6
One period discount rate	[%]		5.0%	5.5%	6.0%	6.5%	7.0%	7.2%
Discount factor	[#]	1.0000	1.0500	1.1078	1.1742	1.2505	1.3381	1.4344
CFADS	[$m]		6.50	5.50	5.70	6.70	6.00	5.70
Discounted CFADS	[$m]	-	6.19	4.97	4.85	5.36	4.48	3.97
Present value of CFADS	[$m]	29.83	24.82	20.68	16.22	10.58	5.32	-
Outstanding debt at period end	[$m]	20.10	15.87	13.44	10.21	7.03	3.47	-
LLCR	[#]	1.48	1.56	1.54	1.59	1.50	1.53	-

Workspace (not really needed though)

Click here to see what your answer should look like.

Financial models that perform forecasting typically divide forecasts into phases - often a detailed near/medium-term section is followed by a "steady-state" longer term one. The following model comprises four phases: Pre-upgrade, upgrade, post-upgrade and steady-state or terminal.

Real estate holdings (A - E) yield rental incomes. Some of the holdings will be refurbished and after refurbishment will give increased rental incomes. During refurbishment, however, no rental income will be received. A model is required to forecast rental income and costs.

The table below contains data your model will use. Cells M19:M23 list the area in square meters of holdings A - E. Cells N19:N23 give the initial rent (per square meter per quarter) of each holding.

Cells O19:O23 give the growth per quarter (pre refurbishment) in rent per square meter. Cells P19:P23 give the rent per square meter per quarter in the first quarter after refurbishment. Cells Q19:Q23 give the growth per quarter (after refurbishment) in rent per square meter.

	Area (m^2)	Initial rent / m^2 / qtr	Growth per qtr in rent / m^2 (pre refurbish)	Rent / m^2 / qtr (after refurbish)	Growth per qtr n rent / m2 (after refurbish)	Lease ends in qtr (#)	Refurbish starts in qtr (#)	Refurbish periods (qtrs)	Refurbishment cost / m^2	Lease break cost ($)
A	100	200	0.25%	300	1.00%	4	1	2	1,200	100,000
B	200	150	0.50%	200	1.00%	2	3	3	750	30,000
C	200	150	0.25%	225	1.25%	5	-	6	2,000	20,000
D	100	200	0.60%	300	2.00%	2	4	2	1,200	50,000
E	150	150	0.75%	250	1.40%	3	3	2	300	30,000

The holdings are all currently leased. Cells R19:R23 lists the quarters in which each lease ends. Cells S19:S23 give the quarters in which refurbishment will start. If the start quarter is given as zero then no refurbishment will be done.

If refurbishment starts before a lease ends then a lease break cost must be paid. This is a one-off fee paid in the quarter in which refurbishment begins. Lease break costs are detailed in cells V19:V23.

Cells T19:T23 give the number of quarters required to complete refurbishment (if refurbishment is to be done). Cells U19:U23 give the refurbishment cost per square meter. Refurbishment costs are spread out evenly over the term of the refurbishment.

Calculate the rental, refurbishment and net cash flows below. Also calculate net present values of the cash flows. Assume that cash flows continue into perpetuity growing at the same rate as in the final period of the model.

1 Generate phase flags

In the section below indicate with a 0 or 1 whether refurbishing will occur. Use 1 to indicate refurbishing will occur and 0 to indicate it won't.

Refurbishing (10 = not refurbishing, 1 = refurbishing)

Quarter	[#]	**1**	**2**	**3**	**4**	**5**	**6**	**7**
A	[0/1]	1	1	-	-	-	-	-
B	[0/1]	-	-	1	1	1	-	-
C	[0/1]	-	-	-	-	-	-	-
D	[0/1]	-	-	-	1	1	-	-
E	[0/1]	-	-	1	1	-	-	-

2 Calculate growth rates

In the area below calculate the growth rate per quarter in rent per square meter. During refurbishing no rent will be received and growth rates then will be zero.

Growth rate per qtr in rent / m^2

A	[%]	0.00%	0.00%	1.00%	1.00%	1.00%	1.00%	1.00%
B	[%]	0.50%	0.50%	0.00%	0.00%	0.00%	1.00%	1.00%
C	[%]	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%	0.25%
D	[%]	0.60%	0.60%	0.60%	0.00%	0.00%	2.00%	2.00%
E	[%]	0.75%	0.75%	0.00%	0.00%	1.40%	1.40%	1.40%

3 Calculate income #1

In the area below calculate the rental income per square meter per quarter.

Rental income / m^2 / qtr

A	[/m^2 / qtr]	-	-	300.0	303.0	306.0	309.1	312.2
B	[/m^2 / qtr]	150.0	150.8	-	-	-	200.0	202.0
C	[/m^2 / qtr]	150.0	150.4	150.8	151.1	151.5	225.0	225.6
D	[/m^2 / qtr]	200.0	201.2	202.4	-	-	300.0	306.0
E	[/m^2 / qtr]	150.0	151.1	-	-	250.0	253.5	257.0

4 Calculate income #2

In the area below calculate the rental income in thousands of dollars per quarter.

Rental income [000's / qtr]

A	[000's / qtr]	-	-	30.0	30.3	30.6	30.9	31.2
B	[000's / qtr]	30.0	30.2	-	-	-	40.0	40.4
C	[000's / qtr]	30.0	30.1	30.2	30.2	30.3	45.0	45.1
D	[000's / qtr]	20.0	20.1	20.2	-	-	30.0	30.6
E	[000's / qtr]	22.5	22.7	-	-	37.5	38.0	38.6

5 Calculate upgrade cost

In the area below calculate the cost of refurbishing. That cost is spread evenly over the number of periods required for the refurbishment.

Refurbishing cost [000's / qtr] [Numbers in this section should be negative.]

A	[000's / qtr]	(60.0)	(60.0)	-	-	-	-	-
B	[000's / qtr]	-	-	(50.0)	(50.0)	(50.0)	-	-
C	[000's / qtr]	-	-	-	-	-	-	-
D	[000's / qtr]	-	-	-	(60.0)	(60.0)	-	-
E	[000's / qtr]	-	-	(22.5)	(22.5)	-	-	-

6 Calculate break fee

In the area below calculate the lease break cost. The break cost must be paid if refurbishment begins before the end of the lease. If a break fee is paid it is paid in full when refurbishment begins.

Lease break cost [000's] [Numbers in this section should be negative.]

A	[000's]	(100.0)	-	-	-	-	-	-
B	[000's]	-	-	-	-	-	-	-
C	[000's]	-	-	-	-	-	-	-
D	[000's]	-	-	-	-	-	-	-
E	[000's]	-	-	(30.0)	-	-	-	-

7 Calculate net cash flow and NPV

Calculate net cash flows and NPVs of the cash flows. The terminal value in column V should represent the value at the beginning of period 8 of cash flows in period 8 and continuing to perpetuity. Bear in mind that cashflows grow at individual rates.

Discount rate (per quarter):	5%

Net cash flow & NPV

Period	[qtr]	NPV	Net cash flow 1	2	3	4	5	6	7	Terminal value 8 +
A	[000's]	357.0	(160.0)	(60.0)	30.0	30.3	30.6	30.9	31.2	655.6
B	[000's]	565.2	30.0	30.2	(50.0)	(50.0)	(50.0)	40.0	40.4	848.4
C	[000's]	837.4	30.0	30.1	30.2	30.2	30.3	45.0	45.1	947.4
D	[000's]	437.5	20.0	20.1	20.2	(60.0)	(60.0)	30.0	30.6	642.6
E	[000's]	611.3	22.5	22.7	(52.5)	(22.5)	37.5	38.0	38.6	809.7

Total	[000's]	2,808.4

Click here to see what your answer should look like.

Financial models sometimes have to do "lookups" of data and assumptions. The following is such a model.

A model is required to forecast business volumes and associated resourcing costs. Resources comprise two classes of employees - "A" and "B". When business volumes increase staffing also needs to increase to support the greater volume.

The table below shows the number of "A" and "B" staff required for various volumes of business. For example, if business volumes are between 10 (in cell O13) and 12 (in cell O12) then 5 "A" staff and 7 "B" staff are required to support that level of business.

Staff resourcing requirements					
For business volume from:	$m	0	10	12	20
to:	$m	10 -	12 -	20 -	40 -
Number "A" staff required:	[#]	4	5	6	7
Number "B" staff required:	[#]	6	7	9	11

The table below shows the initial costs per year of each class of staff.

Initial per-staff yearly costs		
"A" staff initial cost per year per person	[$ 000's]	80
"B" staff initial cost per year per person	[$ 000's]	90

The table below shows the percentage growth per year in per-staff costs.

Growth rate in per-staff costs		
"A" staff	[% / yr]	10%
"B" staff	[% / yr]	5%

The table below shows assumptions about the yearly rate of growth in business volume.

Business growth assumptions						
Year	[yr]	2013	2014	2015	2016	2017
Growth	[%]	10%	15%	20%	25%	30%

The business volume in the prior period (i.e. the period before the first period to be modelled) is given in cell N38 below.

Business volume in prior period		
Business volume in prior period	[$m]	10

The intervals (in months) between forecast dates is listed below in cell N42.

Date intervals	[months]	6

The model below is required to forecast business volumes and staff numbers and costs.

1 Dates and events

In the section below calculate period start and end dates. Also generate "flags" (0 or 1) that indicate whether a period is the first in the year or the last in the year.

Period starts	[Date]	1/01/2013	1/07/2013	1/01/2014	1/07/2014	1/01/2015	1/07/2015	1/01/2016	1/07/2016	1/01/2017
Period ends	[Date]	30/06/2013	31/12/2013	30/06/2014	31/12/2014	30/06/2015	31/12/2015	30/06/2016	31/12/2016	30/06/2017
Is first period in year	[0/1]	1	0	1	0	1	0	1	0	1
Is last period in year	[0/1]	0	1	0	1	0	1	0	1	0

2 Growth and volume

In the section below calculate yearly business growth and per-period growth. Also calculate business volumes.

Yearly business growth	[%]	10%	10%	15%	15%	20%	20%	25%	25%	30%
Growth this period	[%]	4.88%	4.88%	7.24%	7.24%	9.54%	9.54%	11.80%	11.80%	14.02%
Business volume	[units]	10.49	11.00	11.80	12.65	13.86	15.18	16.97	18.98	21.63

3 Resource requirements

Determine the number of staff required to support the business volumes calculated above.

Number staff - class A	[#]	5.0	5.0	5.0	6.0	6.0	6.0	6.0	6.0	6.5
Number staff - class B	[#]	7.0	7.0	7.0	9.0	9.0	9.0	9.0	9.0	11.0

4 Resource costs

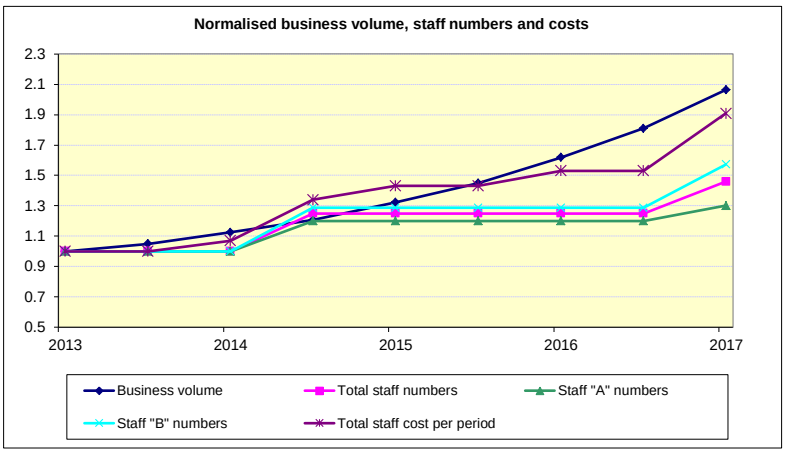
Calculate the cost of staff - both per-person and collectively. Bear in mind that staff salaries escalate in the first period of each new year. Also calculate the total staff costs for each year. The total should be reported only in the last period in each year - other periods should show zero for the staff cost.

Cost per staff - class A	[$ 000's/yr]	80.00	80.00	88.00	88.00	96.80	96.80	106.48	106.48	117.13
Cost per staff - class B	[$ 000's/yr]	90.00	90.00	94.50	94.50	99.23	99.23	104.19	104.19	109.40
Cost of Staff - class A	[$ 000's/period]	200.00	200.00	220.00	264.00	290.40	290.40	319.44	319.44	380.67
Cost of Staff - class B	[$ 000's/period]	315.00	315.00	330.75	425.25	446.51	446.51	468.84	468.84	601.68
Total staff cost for year	[$ 000's]	-	1,030.00	-	1,240.00	-	1,473.83	-	1,576.56	-

5 Normalised growth

Calculate normalised volumes, numbers and costs. Normalised figures should be scaled so that initial values are all 1.

Business volume	[$m]	1.000	1.049	1.125	1.206	1.321	1.447	1.618	1.809	2.063
Total staff numbers	[#]	1.000	1.000	1.000	1.250	1.250	1.250	1.250	1.250	1.458
Staff "A" numbers	[#]	1.000	1.000	1.000	1.200	1.200	1.200	1.200	1.200	1.300
Staff "B" numbers	[#]	1.000	1.000	1.000	1.286	1.286	1.286	1.286	1.286	1.571
Total staff cost per period	[$ 000's]	1.000	1.000	1.069	1.338	1.431	1.431	1.531	1.531	1.907



Click here to see what your answer should look like.

Project finance models are often concerned with determining the present value and internal rate of return of projects and also with prioritising claims against project cash flows. Following is a basic project finance model that illustrates some of these concepts.

The assumptions section below lists various inputs and assumptions the model is required to use.

Assumptions		
Tax rate	[%]	35%
Interest on cash balance	[%]	5%
Minimum cash balance	[$m]	50
Dividend payout ratio	[%]	75%
Interest paid on outstanding debt	[%]	7%
Discount rate for NPV	[%]	20%
Discount rate for LLCR	[%]	17%
Terminal year	[yr]	7
Debt in terminal year	[$m]	100
EV / EBITDA ratio in terminal year	[#]	5

The section below shows periods in the life of the model. Periods 1 through 7 are modelled. At the end of the last period we assume the project is sold at a certain EV / EBITDA multiple. At that time outstanding debt should have been amortised down to the value shown in cell M18 in the assumptions section above.

Debt should be amortised in credit-foncier style (i.e. equal payments but varying principal and interest proportions). Debt repayments should be set so the the current outstanding debt will be amortised to the target debt value by the end of the last model period. Assume payments are at the end of each period and interest in paid in arrears.

Period	**[yr]**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Amortising periods left	[yr]		7	6	5	4	3	2	1
Tax rate	[%]		35%	35%	35%	35%	35%	35%	35%

1 Income statement

In the section below put formulae to complete the income statement. Some items will depend on parameters yet-to-be-determined. For example, interest revenue on cash balances depends on cash balance - which is yet to be determined.

Period	[yr]	0	1	2	3	4	5	6	7
Operating revenue	[$m]		230.0	236.9	244.0	251.3	258.9	266.6	274.6
Operating expense	[$m]		(50.0)	(51.5)	(53.0)	(54.6)	(56.3)	(58.0)	(59.7)
Interest revenue	[$m]		2.5	3.7	3.7	3.8	3.9	3.8	3.8
Interest paid	[$m]		(15.8)	(15.4)	(14.3)	(13.3)	(12.4)	(10.7)	(8.9)
Depreciation	[$m]		(8.00)	(8.24)	(8.49)	(8.74)	(9.00)	(9.27)	(9.55)
Profit before tax	[$m]		158.8	165.4	171.9	178.4	185.1	192.5	200.3
Tax	[$m]		(55.6)	(57.9)	(60.2)	(62.5)	(64.8)	(67.4)	(70.1)
NPAT	[$m]		103.2	107.5	111.7	116.0	120.3	125.1	130.2

Cashflow statement

2 Operating revenues

In the section below put formulae to calculate cashflow from operations.

Total operating revenues	[$m]		230.0	236.9	244.0	251.3	258.9	266.6	274.6
Operating expenses									
Total operating expenses	[$m]		(50.0)	(51.5)	(53.0)	(54.6)	(56.3)	(58.0)	(59.7)
Net working capital movement	[$m]		(1.50)	(1.55)	2.00	(1.64)	(1.69)	(1.74)	(1.79)
Cashflow from operations	[$m]		178.5	183.9	193.0	195.1	200.9	206.9	213.1

3 Capital expenditure

In the section below calculate capital expenditures

Replacement CAPEX	[$m]		(3.00)	(3.09)	(3.18)	(3.28)	(3.38)	(3.48)	(3.58)
Growth CAPEX	[$m]		(21.00)	(21.63)	(22.28)	(22.95)	(23.64)	(24.34)	(25.08)
Total capital expenditure	[$m]		(24.0)	(24.7)	(25.5)	(26.2)	(27.0)	(27.8)	(28.7)

4 Funding

The schedule of equity and debt raisings is shown below. Calculate each period's total funding.

Debt funding	[$m]		10.00	0.0	5.00	7.00	0.0	0.0	0.0
Equity funding	[$m]		12.00	0.0	0.0	0.0	0.0	0.0	0.0
Total funding	[$m]		22.0	0.0	5.0	7.0	0.0	0.0	0.0

5 Cashflow available for debt service

In the section below calculate cashflow available for debt service.

Cashflow from operations	[$m]		178.5	183.9	193.0	195.1	200.9	206.9	213.1
Capital expenditure	[$m]		(24.0)	(24.7)	(25.5)	(26.2)	(27.0)	(27.8)	(28.7)
Interest earned	[$m]		2.5	3.7	3.7	3.8	3.9	3.8	3.8
Cashflow from funding	[$m]		22.0	0.0	5.00	7.00	0.0	0.0	0.0
Tax payable	[$m]		(55.6)	(57.9)	(60.2)	(62.5)	(64.8)	(67.4)	(70.1)
Cashflow available for debt service	[$m]		123.4	104.9	116.0	117.2	113.0	115.5	118.2

6 Cashflow available for equity

In the section below calculate cashflow available for equity

Cashflow available for debt service	[$m]		123.4	104.9	116.0	117.2	113.0	115.5	118.2
Debt interest payable	[$m]		(15.8)	(15.4)	(14.3)	(13.3)	(12.4)	(10.7)	(8.9)
Debt amortised	[$m]		(14.4)	(16.9)	(18.0)	(20.4)	(24.0)	(25.7)	(27.5)
Cashflow available for equity	[$m]		93.2	72.6	83.7	83.4	76.6	79.1	81.8

7 Net cash flow

In the section below calculate net cash flow. Note that distributions to equity have yet to be calculated so their values are currently unresolved.

Cashflow available for equity	[$m]		93.2	72.6	83.7	83.4	76.6	79.1	81.8
Distributions	[$m]		(69.9)	(72.0)	(80.8)	(82.8)	(78.1)	(78.9)	(81.0)
Net cash flow	[$m]		23.3	0.7	2.9	0.7	(1.6)	0.2	0.7

8 Distribution waterfall

In the section below calculate cashflow available for distribution to equity holders. The actual amount of the distribution is to be the payout ratio times the amount available. Note, however, that cash post-distribution cannot be less than the minimum cash balance listed in the assumptions section.

Payout ratio	[%]		75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%
Post funding cashflow	[$m]		93.2	72.6	83.7	83.4	76.6	79.1	81.8
Opening cash balance	[$m]		50.0	73.3	74.0	76.9	77.6	76.0	76.3
(Minimum cash balance)	[$m]		(50.0)	(50.0)	(50.0)	(50.0)	(50.0)	(50.0)	(50.0)
Cashflow available for distribution	[$m]		93.2	95.9	107.7	110.4	104.2	105.1	108.1
Distribution (+ve)	[$m]		69.9	72.0	80.8	82.8	78.1	78.9	81.0

9 Terminal value calculations

In the section below assume the project is sold at the EV / EBITDA ratio given in the assumptions section. Assume this occurs at the end of the final model year and after distributions for that year have been received by the equity holders. Calculate the net present value of the stream of distributions plus the final sale.

Is terminal value year	[0/1]		0	0	0	0	0	0	1
EBITDA	[$m]		180.0	185.4	191.0	196.7	202.6	208.7	214.9
Terminal value	[$m]		0	0	0	0	0	0	974.6
Distribution + terminal value	[$m]		69.9	72.0	80.8	82.8	78.1	78.9	1,055.7

10 Net present value

Calculate the project's net present value (to equity)

NPV	[$m]	547.3

11 Internal rate of return

Calculate the equity holders' internal rate of return

IRR cashflows		(500.0)	69.9	72.0	80.8	82.8	78.1	78.9	1,055.7
IRR	[%]	22.1%							

12 Debt service

In the section below calculate principal and interest payments on debt

Debt interest payable	[$m]		(15.8)	(15.4)	(14.3)	(13.3)	(12.4)	(10.7)	(8.9)
Debt amortised	[$m]		(14.4)	(16.9)	(18.0)	(20.4)	(24.0)	(25.7)	(27.5)
Total debt service	[$m]		(30.2)	(32.3)	(32.3)	(33.8)	(36.4)	(36.4)	(36.4)

13 Ratios

Calculate below the debt service ratio and loan life coverage ratio

Debt service coverage ratio (DSCR)	[#]		4.1	3.2	3.6	3.5	3.1	3.2	3.2
Loan life coverage ratio (LLCR)	[#]		3.5	3.3	3.3	3.3	3.2	3.2	3.2

14 Cash account

In the section below track cash balances and interest revenue.

Interest on cash balances	[%]		5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Opening balance	[$m]		50.0	73.3	74.0	76.9	77.6	76.0	76.3
Cashflow available	[$m]		93.2	72.6	83.7	83.4	76.6	79.1	81.8
Distributions	[$m]		(69.9)	(72.0)	(80.8)	(82.8)	(78.1)	(78.9)	(81.0)
Closing balance	[$m]	50.0	73.3	74.0	76.9	77.6	76.0	76.3	77.0
Interest	[$m]		2.5	3.7	3.7	3.8	3.9	3.8	3.8

15 Balance sheet

Model the balance sheet below

Cash	[$m]	50.0	73.3	74.0	76.9	77.6	76.0	76.3	77.0
Net working capital	[$m]	5.0	6.5	8.0	6.0	7.7	9.4	11.1	12.9
Fixed assets at cost	[$m]	770.0	794.0	818.7	844.2	870.4	897.4	925.2	953.9
Accumulated depreciation	[$m]	(100.0)	(108.0)	(116.2)	(124.7)	(133.5)	(142.5)	(151.7)	(161.3)
Total assets	[$m]	725.0	765.8	784.5	802.4	822.2	840.4	860.9	882.5
Debt	[$m]	225.0	220.6	203.7	190.7	177.2	153.2	127.5	100.0
Equity	[$m]	500.0	512.0	512.0	512.0	512.0	512.0	512.0	512.0
Retained earnings	[$m]	0	33.3	68.8	99.8	133.0	175.1	221.4	270.5
Total liabilities	[$m]	725.0	765.8	784.5	802.4	822.2	840.4	860.9	882.5
Check	[ok/check]		ok	ok	ok	ok	ok	ok	ok

Sources and uses of funds

16 Sources of funds

In the section below calculate a breakdown of sources of funds

Operating revenue	[$m]	230.0	236.9	244.0	251.3	258.9	266.6	274.6
Decrease in working capital	[$m]	0	0	2.0	0	0	0	0
Interest revenue	[$m]	2.5	3.7	3.7	3.8	3.9	3.8	3.8
Debt funding	[$m]	10.0	0	5.0	7.0	0	0	0
Equity funding	[$m]	12.0	0	0	0	0	0	0
Negative net cash flow	[$m]	0	0	0	0	1.6	0	0
Total sources of funds	[$m]	254.5	240.6	254.7	262.2	264.3	270.4	278.4

17 Uses of funds

In the section below calculate a breakdown of uses of funds

Operating expenses	[$m]	50.0	51.5	53.0	54.6	56.3	58.0	59.7
Increase in working capital	[$m]	1.5	1.5	0	1.6	1.7	1.7	1.8
Tax payable	[$m]	55.6	57.9	60.2	62.5	64.8	67.4	70.1
Capital expenditure	[$m]	24.0	24.7	25.5	26.2	27.0	27.8	28.7
Interest paid	[$m]	15.8	15.4	14.3	13.3	12.4	10.7	8.9
Debt amortised	[$m]	14.4	16.9	18.0	20.4	24.0	25.7	27.5
Distributions	[$m]	69.9	72.0	80.8	82.8	78.1	78.9	81.0
Positive net cash flow	[$m]	23.3	0.7	2.9	0.7	0	0.2	0.7
Total uses of funds	[$m]	254.5	240.6	254.7	262.2	264.3	270.4	278.4
Check	[ok/check]	ok	ok	ok	ok	ok	ok	ok