

Discounted Cash Flow: Forecasting Free Cash Flows

Michael R. Roberts

William H. Lawrence Professor of Finance

The Wharton School, University of Pennsylvania

Last Time

Discounted Cash Flow (DCF)

- Forecast drivers

This Time Discounted Cash Flow (DCF)

- Forecasting free cash flows

Forecasting Free Cash Flows

$$\begin{aligned}\text{FCF} = & (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ & + \text{Depreciation} - \text{Capital Expenditures} \\ & - \text{Change in Net Working Capital}\end{aligned}$$

Translate forecast drivers into \$ forecasts

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Revenue Forecasts

Market Forecasts

Initial Market Size (Units, million)

Market Growth Rate

Market Size (Units, million)

(Actual Market Size, Units Mil)

Dell's Market Share

Initial Market Share

Market Share Annual Growth Rate

Market Share

Pricing Strategy

Initial Unit Price (\$/unit)

Bi-Annual Price Increases (\$/unit)

Unit Price (\$/unit)

Year					
0 (F2008)	1	2	3	4	5

1.00					
	2500.00%	128.0%	9.4%	3.5%	
1.0	26.0	59.3	64.9	67.1	
1.0	60.0	116.3	195.4	229.0	

25.00%					
	5.00%	5%	5%	5%	
25.0%	26.3%	27.6%	28.9%	30.4%	

200.00					
	-	49.99	-	49.99	
200.00	200.00	249.99	249.99	299.98	

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Revenue Forecasts

Market Forecasts

Initial Market Size (Units, million)

Market Growth Rate

Market Size (Units, million)

(Actual Market Size, Units Mil)

Dell's Market Share

Initial Market Share

Market Share Annual Growth Rate

Market Share

Pricing Strategy

Initial Unit Price (\$/unit)

Bi-Annual Price Increases (\$/unit)

Unit Price (\$/unit)

Year					
0 (F2008)	1	2	3	4	5

1.00					
	2500.00%	128.0%	9.4%	3.5%	
1.0	26.0	59.3	64.9	67.1	
1.0	60.0	116.3	195.4	229.0	

25.00%					
	5.00%	5%	5%	5%	
25.0%	26.3%	27.6%	28.9%	30.4%	

200.00					
	-	49.99	-	49.99	
200.00	200.00	249.99	249.99	299.98	

$$\text{Revenue} = \text{Market Size} \times \text{Market Share} \times \text{Price}$$

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Revenue Forecasts

Market Forecasts

Initial Market Size (Units, million)

Market Growth Rate

Market Size (Units, million)

(Actual Market Size, Units Mil)

Dell's Market Share

Initial Market Share

Market Share Annual Growth Rate

Market Share

Pricing Strategy

Initial Unit Price (\$/unit)

Bi-Annual Price Increases (\$/unit)

Unit Price (\$/unit)

Year					
0 (F2008)	1	2	3	4	5

1.00					
	2500.00%	128.0%	9.4%	3.5%	
1.0	26.0	59.3	64.9	67.1	
1.0	60.0	116.3	195.4	229.0	

25.00%					
	5.00%	5%	5%	5%	
25.0%	26.3%	27.6%	28.9%	30.4%	

200.00					
	-	49.99	-	49.99	
200.00	200.00	249.99	249.99	299.98	

$$\text{Revenue 1} = 1.0 \times 0.25 \times 200 = 50$$

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Incremental Earnings Forecasts
Sales

Year					
0	1	2	3	4	5
	50.0	1,365.0	4,084.6	4,692.0	6,116.9

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Project Assumptions

Operating Expenses

COGS

COGS / Sales (% Sales)

SG&A

1% of 2008 Company SG&A (\$mil)

SG&A Expense Growth Rate

R&D

R&D Upfront (\$mil)

R&D for Versioning (\$mil)

Year					
0 (F2008)	1	2	3	4	5

80.66%	80.66%	80.66%	80.66%	80.66%	80.66%
--------	--------	--------	--------	--------	--------

69.59

25.00%	25.00%	25.00%	25.00%
--------	--------	--------	--------

200.00

25.00	25.00	25.00	25.00	25.00
-------	-------	-------	-------	-------

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Operating Expenses

COGS

COGS / Sales (% Sales)

SG&A

1% of 2008 Company SG&A (\$mil)

SG&A Expense Growth Rate

R&D

R&D Upfront (\$mil)

R&D for Versioning (\$mil)

Year					
0 (F2008)	1	2	3	4	5

80.66%	80.66%	80.66%	80.66%	80.66%	80.66%
--------	--------	--------	--------	--------	--------

69.59

25.00%	25.00%	25.00%	25.00%
--------	--------	--------	--------

200.00

25.00	25.00	25.00	25.00	25.00
-------	-------	-------	-------	-------

Incremental Earnings Forecasts

Sales

Year					
0	1	2	3	4	5
	50.0	1,365.0	4,084.6	4,692.0	6,116.9

$$\text{COGS} = (\text{COGS} / \text{Sales}) \times \text{Sales}$$

$$\text{Year 1: } 0.8066 \times 50.0 = 40.33$$

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Operating Expenses

COGS

COGS / Sales (% Sales)

SG&A

1% of 2008 Company SG&A (\$mil)

SG&A Expense Growth Rate

R&D

R&D Upfront (\$mil)

R&D for Versioning (\$mil)

Year					
0 (F2008)	1	2	3	4	5

80.66%	80.66%	80.66%	80.66%	80.66%	80.66%
--------	--------	--------	--------	--------	--------

69.59

25.00%	25.00%	25.00%	25.00%
--------	--------	--------	--------

200.00

25.00	25.00	25.00	25.00	25.00
-------	-------	-------	-------	-------

Incremental Earnings Forecasts

Sales

Year					
0	1	2	3	4	5
	50.0	1,365.0	4,084.6	4,692.0	6,116.9

Incremental Earnings Forecasts

COGS

Year					
0	1	2	3	4	5
	40.3	1,101.0	3,294.6	3,784.6	4,933.9

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Project Assumptions

Operating Expenses

COGS

COGS / Sales (% Sales)

SG&A

1% of 2008 Company SG&A (\$mil)

SG&A Expense Growth Rate

R&D

R&D Upfront (\$mil)

R&D for Versioning (\$mil)

	Year					
	0 (F2008)	1	2	3	4	5
COGS / Sales (% Sales)	80.66%	80.66%	80.66%	80.66%	80.66%	80.66%
SG&A		69.59				
SG&A Expense Growth Rate			25.00%	25.00%	25.00%	25.00%
R&D Upfront (\$mil)	200.00					
R&D for Versioning (\$mil)		25.00	25.00	25.00	25.00	25.00

Year 1: SG&A = 1% of '08 SG&A

$$= 0.01 \times \$6,959 = \$69.6$$

Year 2 – 5: SG&A = 25% Annual Growth Rate

$$= \$69.59 \times (1+0.25) = \$87.0$$

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Operating Expenses

COGS

COGS / Sales (% Sales)

SG&A

1% of 2008 Company SG&A (\$mil)

SG&A Expense Growth Rate

R&D

R&D Upfront (\$mil)

R&D for Versioning (\$mil)

Incremental Earnings Forecasts

SG&A

Year					
0 (F2008)	1	2	3	4	5

80.66%	80.66%	80.66%	80.66%	80.66%	80.66%
--------	--------	--------	--------	--------	--------

69.59

25.00%	25.00%	25.00%	25.00%
--------	--------	--------	--------

200.00

25.00	25.00	25.00	25.00	25.00
-------	-------	-------	-------	-------

Year					
0	1	2	3	4	5
	69.6	87.0	108.7	135.9	169.9

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Operating Expenses

COGS

COGS / Sales (% Sales)

SG&A

1% of 2008 Company SG&A (\$mil)

SG&A Expense Growth Rate

R&D

R&D Upfront (\$mil)

R&D for Versioning (\$mil)

Year					
0 (F2008)	1	2	3	4	5

80.66%	80.66%	80.66%	80.66%	80.66%	80.66%
--------	--------	--------	--------	--------	--------

69.59

25.00%	25.00%	25.00%	25.00%
--------	--------	--------	--------

200.00

25.00	25.00	25.00	25.00	25.00
-------	-------	-------	-------	-------

Year					
0	1	2	3	4	5
200.0	25.0	25.0	25.0	25.0	25.0

Incremental Earnings Forecasts

R&D

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Incremental Earnings Forecasts	Year					
	0	1	2	3	4	5
Sales		50.0	1,365.0	4,084.6	4,692.0	6,116.9
COGS		40.3	1,101.0	3,294.6	3,784.6	4,933.9
Gross Profit = (28) - (29)	0.0	9.7	264.0	790.0	907.4	1,183.0
SG&A		69.6	87.0	108.7	135.9	169.9
R&D	200.0	25.0	25.0	25.0	25.0	25.0
EBITDA = (30) - (31) - (32)	-200.0	-84.9	152.0	656.2	746.5	988.1

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Capital Expenditures & PP&E Information

Initial Investment (Fixed Cost, \$mil)

Future Investment (% of initial Investment)

Future Investment (Annual Growth)

Year					
0 (F2008)	1	2	3	4	5
227.70					
	10.0%				
		5.0%	1.0%	1.0%	1.0%

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Capital Expenditures & PP&E Information

Initial Investment (Fixed Cost, \$mil)

Future Investment (% of initial Investment)

Future Investment (Annual Growth)

Year					
0 (F2008)	1	2	3	4	5
227.70					
	10.0%				
		5.0%	1.0%	1.0%	1.0%

Year 0: Initial investment = 227.7

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Capital Expenditures & PP&E Information

Initial Investment (Fixed Cost, \$mil)

Future Investment (% of initial Investment)

Future Investment (Annual Growth)

Year					
0 (F2008)	1	2	3	4	5
227.70	10.0%	5.0%	1.0%	1.0%	1.0%

Year 0: Initial investment = 227.7

Year 1: 10% of initial investment = $0.10 \times \$227.7 = \22.77

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Project Assumptions

Capital Expenditures & PP&E Information

Initial Investment (Fixed Cost, \$mil)

Future Investment (% of initial Investment)

Future Investment (Annual Growth)

Year					
0 (F2008)	1	2	3	4	5
227.70					
	10.0%				
		5.0%	1.0%	1.0%	1.0%

Year 0: Initial investment = 227.7

Year 1: 10% of initial investment = $0.10 \times \$227.7 = \22.77

Year 2: 5% annual growth = $\$22.77 \times (1+0.05) = \23.9

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Capital Expenditures & PP&E Information

Initial Investment (Fixed Cost, \$mil)

Future Investment (% of initial Investment)

Future Investment (Annual Growth)

Year					
0 (F2008)	1	2	3	4	5
227.70	10.0%	5.0%	1.0%	1.0%	1.0%

Year 0: Initial investment = 227.7

Year 1: 10% of initial investment = $0.10 \times \$227.7 = \22.77

Year 2: 5% annual growth = $\$22.77 \times (1+0.05) = \23.9

Year 3-5: 1% annual growth = $\$23.9 \times (1+0.01) = \24.1

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Capital Expenditures & PP&E Information

Initial Investment (Fixed Cost, \$mil)

Future Investment (% of initial Investment)

Future Investment (Annual Growth)

Year					
0 (F2008)	1	2	3	4	5

227.70					
	10.0%				
		5.0%	1.0%	1.0%	1.0%

Capital Expenditure Forecasts

Project CapEx

Year					
0	1	2	3	4	5
227.7	22.8	23.9	24.1	24.4	24.6

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Capital Expenditure Forecasts

Project CapEx

Year					
0	1	2	3	4	5
227.7	22.8	23.9	24.1	24.4	24.6

+

Straight line depreciation over 5 years

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Capital Expenditure Forecasts

Project CapEx

Accumulated CapEx

Depreciation

Year						
	0	1	2	3	4	5
Project CapEx	227.7	22.8	23.9	24.1	24.4	24.6
Accumulated CapEx	227.7	250.5	274.4	298.5	322.9	347.5
Depreciation		45.5	50.1	54.9	59.7	64.6

$$\text{Year 1: } \$227.7 / 5 = \$45.5$$

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Capital Expenditure Forecasts

Project CapEx

Accumulated CapEx

Depreciation

Year						
	0	1	2	3	4	5
Project CapEx	227.7	22.8	23.9	24.1	24.4	24.6
Accumulated CapEx	227.7	250.5	274.4	298.5	322.9	347.5
Depreciation		45.5	50.1	54.9	59.7	64.6

Year 1: $227.7 / 5 = 45.5$

Year 2: $250.5 / 5 = 50.1$

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Capital Expenditure Forecasts

Project CapEx

Accumulated CapEx

Depreciation

Year						
	0	1	2	3	4	5
Project CapEx	227.7	22.8	23.9	24.1	24.4	24.6
Accumulated CapEx	227.7	250.5	274.4	298.5	322.9	347.5
Depreciation		45.5	50.1	54.9	59.7	64.6

What happens to all of that physical capital?

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Capital Expenditure Forecasts

Project CapEx

Accumulated CapEx

Depreciation

Book Value of CapEx

Liquidation Value (LV)

After tax proceeds from asset sale

Year						
	0	1	2	3	4	5
Project CapEx	227.7	22.8	23.9	24.1	24.4	24.6
Accumulated CapEx	227.7	250.5	274.4	298.5	322.9	347.5
Depreciation		45.5	50.1	54.9	59.7	64.6
Book Value of CapEx						72.8
Liquidation Value (LV)						36.4
After tax proceeds from asset sale						45.6

$$\begin{aligned} \text{Book Value} &= \text{Accum CapEx} - \text{Accum Depreciation} \\ &= 347.5 - 274.8 \\ &= 72.8 \end{aligned}$$

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Capital Expenditure Forecasts

Project CapEx

Accumulated CapEx

Depreciation

Book Value of CapEx

Liquidation Value (LV)

After tax proceeds from asset sale

Year						
	0	1	2	3	4	5
Project CapEx	227.7	22.8	23.9	24.1	24.4	24.6
Accumulated CapEx	227.7	250.5	274.4	298.5	322.9	347.5
Depreciation		45.5	50.1	54.9	59.7	64.6
Book Value of CapEx						72.8
Liquidation Value (LV)						36.4
After tax proceeds from asset sale						45.6

$$\begin{aligned} \text{LV} &= \text{Book Value} \times \text{Recovery Rate} \\ &= 72.8 \times 0.50 \\ &= 36.4 \end{aligned}$$

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Capital Expenditure Forecasts

Project CapEx

Accumulated CapEx

Depreciation

Book Value of CapEx

Liquidation Value (LV)

After tax proceeds from asset sale

Year						
	0	1	2	3	4	5
Project CapEx	227.7	22.8	23.9	24.1	24.4	24.6
Accumulated CapEx	227.7	250.5	274.4	298.5	322.9	347.5
Depreciation		45.5	50.1	54.9	59.7	64.6
Book Value of CapEx						72.8
Liquidation Value (LV)						36.4
After tax proceeds from asset sale						45.6

$$\begin{aligned} \text{After-tax proceeds} &= \text{LV} - (\text{LV} - \text{Book Value}) \times \text{Tax Rate} \\ &= 36.4 - (36.4 - 72.8) \times 0.255 \\ &= 45.6 \end{aligned}$$

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Capital Expenditure Forecasts

Project CapEx

Accumulated CapEx

Depreciation

Book Value of CapEx

Liquidation Value (LV)

After tax proceeds from asset sale

Net Project CapEx

Year						
	0	1	2	3	4	5
Project CapEx	227.7	22.8	23.9	24.1	24.4	24.6
Accumulated CapEx	227.7	250.5	274.4	298.5	322.9	347.5
Depreciation		45.5	50.1	54.9	59.7	64.6
Book Value of CapEx						72.8
Liquidation Value (LV)						36.4
After tax proceeds from asset sale						45.6
Net Project CapEx	227.7	22.8	23.9	24.1	24.4	-21.0

Year 5: $24.6 - 45.6 = -21.0$

$$\begin{aligned} \text{FCF} = & (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ & + \text{Depreciation} - \text{Capital Expenditures} \\ & - \text{Change in Net Working Capital} \end{aligned}$$

$$\text{Net Working Capital} = \text{Cash} + \text{Inventory} + \text{AR} - \text{AP}$$

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Project Assumptions

Working Capital Assumptions

Cash Requirements

% of SG&A

% R&D Expenditures

Inventory

Inventory Days (365 x Inventory / COGS)

Excess Inventory liquidation value (% of Inventory Cost)

Accounts Receivable

Days Receivable (365 x Accounts Receivable / Sales)

Accounts Payable

Days Payable (365 x Accounts Payable / COGS)

Year					
0 (F2008)	1	2	3	4	5

50.00%	50%	50%	50%	50%	50%
100.00%	100%	100%	100%	100%	100%

7.58	7.58	7.58	7.58	7.58	7.58
					25.00%

38.49	38.49	38.49	38.49	38.49	38.49
-------	-------	-------	-------	-------	-------

61.54	61.54	61.54	61.54	61.54	61.54
-------	-------	-------	-------	-------	-------

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Project Assumptions

Working Capital Assumptions

Cash Requirements

% of SG&A

% R&D Expenditures

Year					
0 (F2008)	1	2	3	4	5

50.00%	50%	50%	50%	50%	50%
100.00%	100%	100%	100%	100%	100%

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Working Capital Assumptions

Cash Requirements

% of SG&A

% R&D Expenditures

Year					
0 (F2008)	1	2	3	4	5

50.00%	50%	50%	50%	50%	50%
100.00%	100%	100%	100%	100%	100%

Incremental Earnings Forecasts

SG&A

R&D

Year					
0	1	2	3	4	5
	69.6	87.0	108.7	135.9	169.9
200.0	25.0	25.0	25.0	25.0	25.0

Cash for SG&A: 50% of SG&A

Year 1: $0.50 \times \$69.6 = \34.8

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Project Assumptions

Working Capital Assumptions

Cash Requirements

% of SG&A

% R&D Expenditures

Year					
0 (F2008)	1	2	3	4	5

50.00%	50%	50%	50%	50%	50%
100.00%	100%	100%	100%	100%	100%

Incremental Earnings Forecasts

SG&A

R&D

Year					
0	1	2	3	4	5
	69.6	87.0	108.7	135.9	169.9
200.0	25.0	25.0	25.0	25.0	25.0

Cash for SG&A: 50% of SG&A

Year 1: $0.50 \times \$69.6 = \34.8

Cash for R&D: 100% of R&D

Year 1: $1.00 \times \$25.0 = \25.0

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Working Capital Assumptions

Cash Requirements

% of SG&A

% R&D Expenditures

Year					
0 (F2008)	1	2	3	4	5

50.00%	50%	50%	50%	50%	50%
100.00%	100%	100%	100%	100%	100%

Incremental Earnings Forecasts

SG&A

R&D

Year					
0	1	2	3	4	5
	69.6	87.0	108.7	135.9	169.9
200.0	25.0	25.0	25.0	25.0	25.0

Working Capital Forecasts

Cash Requirements - SG&A Funding

Cash Requirements - R&D Funding

Cash

Year					
0	1	2	3	4	5
	34.8	43.5	54.4	68.0	84.9
	25.0	25.0	25.0	25.0	25.0
	59.8	68.5	79.4	93.0	109.9

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Project Assumptions

Inventory

Inventory Days (365 x Inventory / COGS)

Excess Inventory liquidation value (% of Inventory Cost)

Year					
0 (F2008)	1	2	3	4	5
7.58	7.58	7.58	7.58	7.58	7.58
					25.00%

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Inventory

Inventory Days (365 x Inventory / COGS)

Excess Inventory liquidation value (% of Inventory Cost)

Year					
0 (F2008)	1	2	3	4	5
7.58	7.58	7.58	7.58	7.58	7.58
					25.00%

Incremental Earnings Forecasts

COGS

Year					
0	1	2	3	4	5
	40.3	1,101.0	3,294.6	3,784.6	4,933.9

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Inventory

Inventory Days (365 x Inventory / COGS)

Excess Inventory liquidation value (% of Inventory Cost)

Year					
0 (F2008)	1	2	3	4	5
7.58	7.58	7.58	7.58	7.58	7.58
					25.00%

Incremental Earnings Forecasts

COGS

Year					
0	1	2	3	4	5
	40.3	1,101.0	3,294.6	3,784.6	4,933.9

$$\text{Inventory} = \text{Inventory Days} \times \text{COGS} / 365$$

$$\text{Year 1: Inventory} = 7.58 \times \$40.3 / 365 = \$0.837$$

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Project Assumptions

Inventory

Inventory Days (365 x Inventory / COGS)

Excess Inventory liquidation value (% of Inventory Cost)

Year					
0 (F2008)	1	2	3	4	5
7.58	7.58	7.58	7.58	7.58	7.58
					25.00%

Incremental Earnings Forecasts

COGS

Year					
0	1	2	3	4	5
	40.3	1,101.0	3,294.6	3,784.6	4,933.9

Working Capital Forecasts

Inventory

Year					
0	1	2	3	4	5
	0.8	22.9	68.4	78.6	102.5

$$\begin{aligned} \text{FCF} = & (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ & + \text{Depreciation} - \text{Capital Expenditures} \\ & - \text{Change in Net Working Capital} \end{aligned}$$

Working Capital Forecasts

Accounts Receivable

Days Receivable (365 x Accounts Receivable / Sales)

Year						
0	1	2	3	4	5	
38.49	38.49	38.49	38.49	38.49	38.49	38.49

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Working Capital Forecasts

Accounts Receivable

Days Receivable (365 x Accounts Receivable / Sales)

Year						
0	1	2	3	4	5	
38.49	38.49	38.49	38.49	38.49	38.49	

Incremental Earnings Forecasts

Sales

Year						
0	1	2	3	4	5	
	50.0	1,365.0	4,084.6	4,692.0	6,116.9	

$$\text{AR} = \text{AR Days} \times \text{Sales} / 365$$

$$\text{Year 1: AR} = 38.49 \times \$50.0 / 365 = \$5.272$$

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Working Capital Forecasts

Accounts Receivable

Days Receivable (365 x Accounts Receivable / Sales)

Year					
0	1	2	3	4	5
38.49	38.49	38.49	38.49	38.49	38.49

Incremental Earnings Forecasts

Sales

Year					
0	1	2	3	4	5
	50.0	1,365.0	4,084.6	4,692.0	6,116.9

Working Capital Forecasts

Accounts Receivable

Year					
0	1	2	3	4	5
	5.3	143.9	430.7	494.8	645.0

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Working Capital Forecasts

Accounts Payable

Days Payable (365 x Accounts Payable / COGS)

Year					
0	1	2	3	4	5
61.54	61.54	61.54	61.54	61.54	61.54

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Working Capital Forecasts

Accounts Payable

Days Payable (365 x Accounts Payable / COGS)

Year					
0	1	2	3	4	5
61.54	61.54	61.54	61.54	61.54	61.54

Incremental Earnings Forecasts

COGS

Year					
0	1	2	3	4	5
	40.3	1,101.0	3,294.6	3,784.6	4,933.9

$$\text{AP} = \text{AP Days} \times \text{COGS} / 365$$

$$\text{Year 1: AR} = 61.54 \times \$40.3 / 365 = \$6.794$$

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Working Capital Forecasts

Accounts Payable

Days Payable (365 x Accounts Payable / COGS)

Year					
0	1	2	3	4	5
61.54	61.54	61.54	61.54	61.54	61.54

Incremental Earnings Forecasts

COGS

Year					
0	1	2	3	4	5
	40.3	1,101.0	3,294.6	3,784.6	4,933.9

Incremental Earnings Forecasts

Accounts Payable

Year					
0	1	2	3	4	5
	6.8	185.6	555.5	638.1	831.9

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Working Capital Forecasts

Cash Requirements - SG&A Funding
Cash Requirements - R&D Funding
Cash
Inventory
Accounts Receivable
Accounts Payable
Net Working Capital

Year					
0	1	2	3	4	5
	34.8	43.5	54.4	68.0	84.9
	25.0	25.0	25.0	25.0	25.0
	59.8	68.5	79.4	93.0	109.9
	0.8	22.9	68.4	78.6	102.5
	5.3	143.9	430.7	494.8	645.0
	6.8	185.6	555.5	638.1	831.9
0	59.1	49.7	23.0	28.2	25.6

$$\text{Net Working Capital} = \text{Cash} + \text{Inventory} + \text{AR} - \text{AP}$$

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Working Capital Forecasts

Cash Requirements - SG&A Funding
Cash Requirements - R&D Funding
Cash
Inventory
Accounts Receivable
Accounts Payable
Net Working Capital

Year					
0	1	2	3	4	5
	34.8	43.5	54.4	68.0	84.9
	25.0	25.0	25.0	25.0	25.0
	59.8	68.5	79.4	93.0	109.9
	0.8	22.9	68.4	78.6	102.5
	5.3	143.9	430.7	494.8	645.0
	6.8	185.6	555.5	638.1	831.9
0	59.1	49.7	23.0	28.2	25.6

What happens to this working capital?

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Working Capital Forecasts

Cash Requirements - SG&A Funding
 Cash Requirements - R&D Funding
 Cash
 Inventory
 Accounts Receivable
 Accounts Payable
 Net Working Capital
 Recovered NWC at end of Project

Year					
0	1	2	3	4	5
	34.8	43.5	54.4	68.0	84.9
	25.0	25.0	25.0	25.0	25.0
	59.8	68.5	79.4	93.0	109.9
	0.8	22.9	68.4	78.6	102.5
	5.3	143.9	430.7	494.8	645.0
	6.8	185.6	555.5	638.1	831.9
	0	59.1	49.7	23.0	25.6
					51.3

(Most of) it is recovered!

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) + \text{Depreciation} - \text{Capital Expenditures} - \text{Change in Net Working Capital}$$

Working Capital Forecasts

Cash Requirements - SG&A Funding
Cash Requirements - R&D Funding
Cash
Inventory
Accounts Receivable
Accounts Payable
Net Working Capital
Recovered NWC at end of Project

Year					
0	1	2	3	4	5
	34.8	43.5	54.4	68.0	84.9
	25.0	25.0	25.0	25.0	25.0
	59.8	68.5	79.4	93.0	109.9
	0.8	22.9	68.4	78.6	102.5
	5.3	143.9	430.7	494.8	645.0
	6.8	185.6	555.5	638.1	831.9
	0	59.1	49.7	23.0	25.6
					51.3

(Most of) it is recovered!

– Cash – Inventory x Recovery Rate – AR + AP

$$\text{Year 5: } -109.90 - 102.5 \times 0.25 - 645 + 831.9 = 51.375$$

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Working Capital Forecasts	Year					
	0	1	2	3	4	5
Cash Requirements - SG&A Funding		34.8	43.5	54.4	68.0	84.9
Cash Requirements - R&D Funding		25.0	25.0	25.0	25.0	25.0
Cash		59.8	68.5	79.4	93.0	109.9
Inventory		0.8	22.9	68.4	78.6	102.5
Accounts Receivable		5.3	143.9	430.7	494.8	645.0
Accounts Payable		6.8	185.6	555.5	638.1	831.9
Net Working Capital	0	59.1	49.7	23.0	28.2	25.6
Recovered NWC at end of Project						51.3
Change in NWC		59.1	-9.4	-26.6	5.2	48.6

$$\text{Change in NWC} = \Delta\text{NWC} = \text{NWC}(t) - \text{NWC}(t-1)$$

$$\begin{aligned} \text{FCF} = & (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ & + \text{Depreciation} - \text{Capital Expenditures} \\ & - \text{Change in Net Working Capital} \end{aligned}$$

We have all the pieces. Organize into a useful (and familiar) format

(Quasi-) Income Statement

Incremental Earnings Forecasts	Year					
	0	1	2	3	4	5
Sales		50.0	1,365.0	4,084.6	4,692.0	6,116.9
COGS		40.3	1,101.0	3,294.6	3,784.6	4,933.9
<i>Gross Profit = (28) - (29)</i>	0.0	9.7	264.0	790.0	907.4	1,183.0
SG&A		69.6	87.0	108.7	135.9	169.9
R&D	200.0	25.0	25.0	25.0	25.0	25.0
<i>EBITDA = (30) - (31) - (32)</i>	-200.0	-84.9	152.0	656.2	746.5	988.1
Depreciation		45.5	50.1	54.9	59.7	64.6
<i>EBIT = (33) - (34)</i>	-200.0	-130.5	101.9	601.4	686.8	923.5
Taxes	-50.9	-33.2	25.9	153.0	174.8	235.0
<i>NOPAT (35) - (36) (a.k.a. EBIAT, Unlevered Net Income)</i>	-149.1	-97.3	76.0	448.3	512.0	688.5

(Quasi-) Income Statement

Incremental Earnings Forecasts	Year					
	0	1	2	3	4	5
Sales		50.0	1,365.0	4,084.6	4,692.0	6,116.9
COGS		40.3	1,101.0	3,294.6	3,784.6	4,933.9
Gross Profit = (28) - (29)	0.0	9.7	264.0	790.0	907.4	1,183.0
SG&A		69.6	87.0	108.7	135.9	169.9
R&D	200.0	25.0	25.0	25.0	25.0	25.0
EBITDA = (30) - (31) - (32)	-200.0	-84.9	152.0	656.2	746.5	988.1
Depreciation		45.5	50.1	54.9	59.7	64.6
EBIT = (33) - (34)	-200.0	-130.5	101.9	601.4	686.8	923.5
Taxes	-50.9	-33.2	25.9	153.0	174.8	235.0
NOPAT (35) - (36) (a.k.a. EBIAT, Unlevered Net Income)	-149.1	-97.3	76.0	448.3	512.0	688.5

← NOPAT →

$$\begin{aligned}
 \text{FCF} = & (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\
 & + \text{Depreciation} - \text{Capital Expenditures} \\
 & - \text{Change in Net Working Capital}
 \end{aligned}$$

$$\text{FCF} = (\text{Revenue} - \text{Costs} - \text{Depreciation}) \times (1 - t_c) \\ + \text{Depreciation} - \text{Capital Expenditures} \\ - \text{Change in Net Working Capital}$$

Free Cash Flow Forecasts	Year					
	0	1	2	3	4	5
NOPAT (Unlevered Net Income, EBIAT)	-149.1	-97.3	76.0	448.3	512.0	688.5
Depreciation		45.5	50.1	54.9	59.7	64.6
Capital Expenditures	227.7	22.8	23.9	24.1	24.4	-21.0
Changes in NWC		59.1	-9.4	-26.6	5.2	48.6
Free Cash Flows = (38) +(39) - (40) - (41)	-376.8	-133.6	111.6	505.7	542.1	725.5

Other Free Cash Flow Considerations

- Opportunity Costs (Alternative uses of resources)
- Project Externalities (Cannibalization, spillovers,)
- Sunk Costs (Ignore)
- Other non-cash items (E.g., amortization)
- Salvage values (Assets do not disappear)
- Execution Risk (Idiosyncratic)
- Cash flow frequency (Project dependent)

Summary

Lessons

- **Forecasting free cash flows** is a matter of converting our forecast drivers into dollar forecasts
- One of the two basic inputs into a DCF

Coming up next

- Discounted Cash Flow (DCF)
 - Decision Criteria