Discounted Cash Flow: Decision Making

Q: How should we make financial decisions?

Q: Which actions create value?

A: Those in which the benefits exceed the costs…

Q: What if costs and benefits arrive at different times?

A: Compare *PV*(Benefits) to *PV*(Costs)

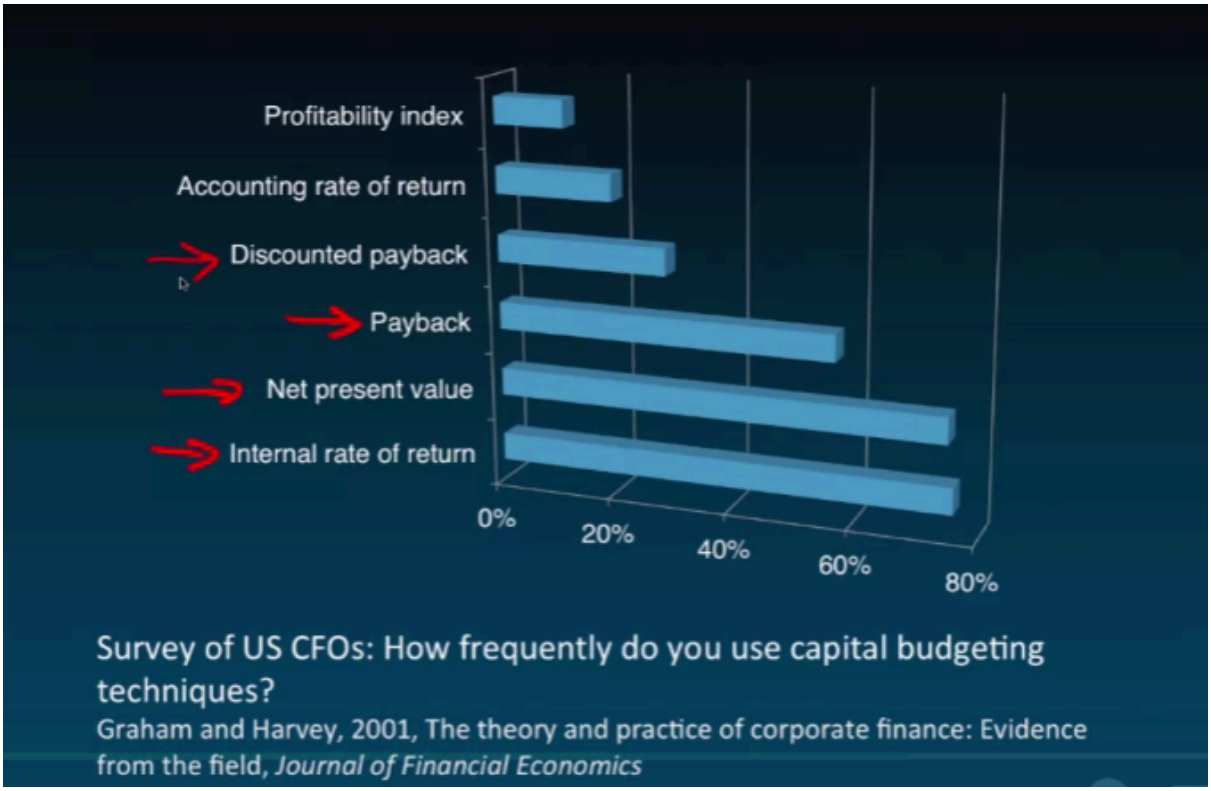
Lesson: The NPV Decision Rule says accept all projects with a positive NPV and reject all projects with a negative NPV

$$NPV = PV(\text{Benefits}) - PV(\text{Costs})$$

Net Present Value >0

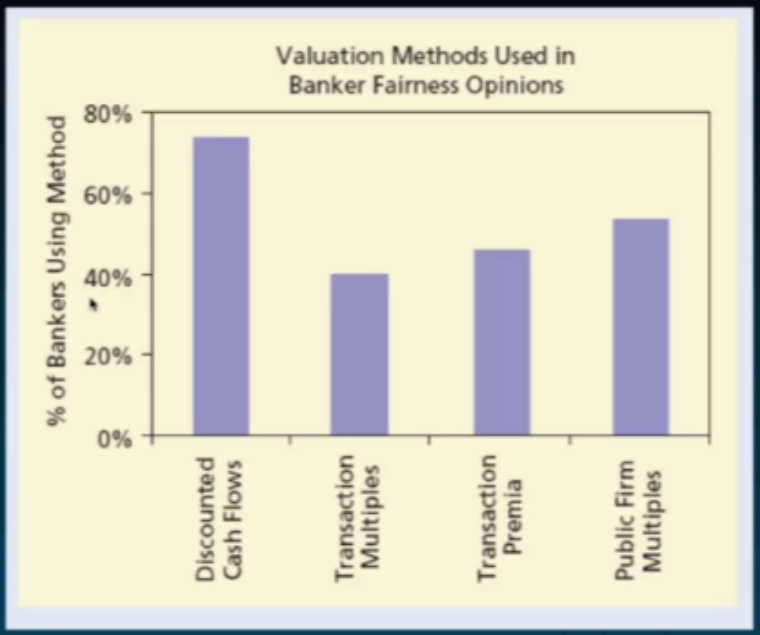
$$= FCF_0 + \frac{FCF_1}{(1+R)} + \frac{FCF_2}{(1+R)^2} + \ldots + \frac{FCF_T}{(1+R)^T}$$

F: free

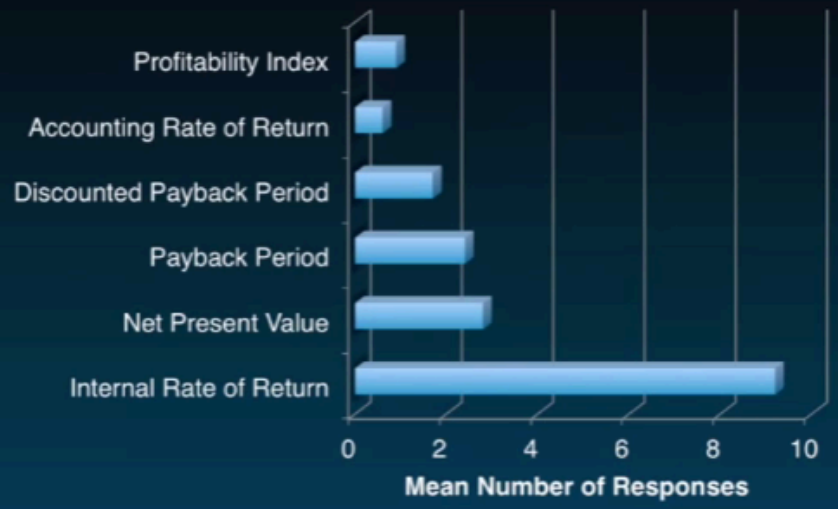


Survey of US CFOs: How frequently do you use capital budgeting techniques?

Graham and Harvey, 2001, The theory and practice of corporate finance: Evidence from the field, *Journal of Financial Economics*



How Investment Bankers Value Companies (Source: page 145 in Graham, Smart, Megginson, 2010)



Which criterion do you use to evaluate an investment?

What do Private Equity Firms Say they Do? (Paul Gompers, Steve Kaplan, and Vladimir Mukharlyamov)

Recall: Two components to NPV

1. Free Cash Flows
2. Discount Rate

FCF = (Revenue – Costs – Depreciation) x (1 – t_c)
+ Depreciation – Capital Expenditures
– Change in Net Working Capital

Lesson: FCF is the cash flow that can be distributed to the financial claimants (e.g., debt and equity) of the project or company

FCF = (Revenue – Costs – Depreciation) x (1 – t_C)
+ Depreciation – Capital Expenditures
– Change in Net Working Capital

Lesson: FCF is **not** the same as accounting cash flow from the statement of cash flows (SCF) but we can derive FCF from the SCF.

FCF = (Revenue – Costs – Depreciation) x (1 – t_C)
+ Depreciation – Capital Expenditures
– Change in Net Working Capital

Lesson: FCF is more precisely unlevered free cash flow to distinguish it from free cash flow to equity (FCFE) or levered free cash flow.

FCFE = (Revenue – Costs – Depreciation) x (1 – t_C)
+ Depreciation – Capital Expenditures
– Change in Net Working Capital
– Interest x (1 – t_C)
+ Net Borrowing

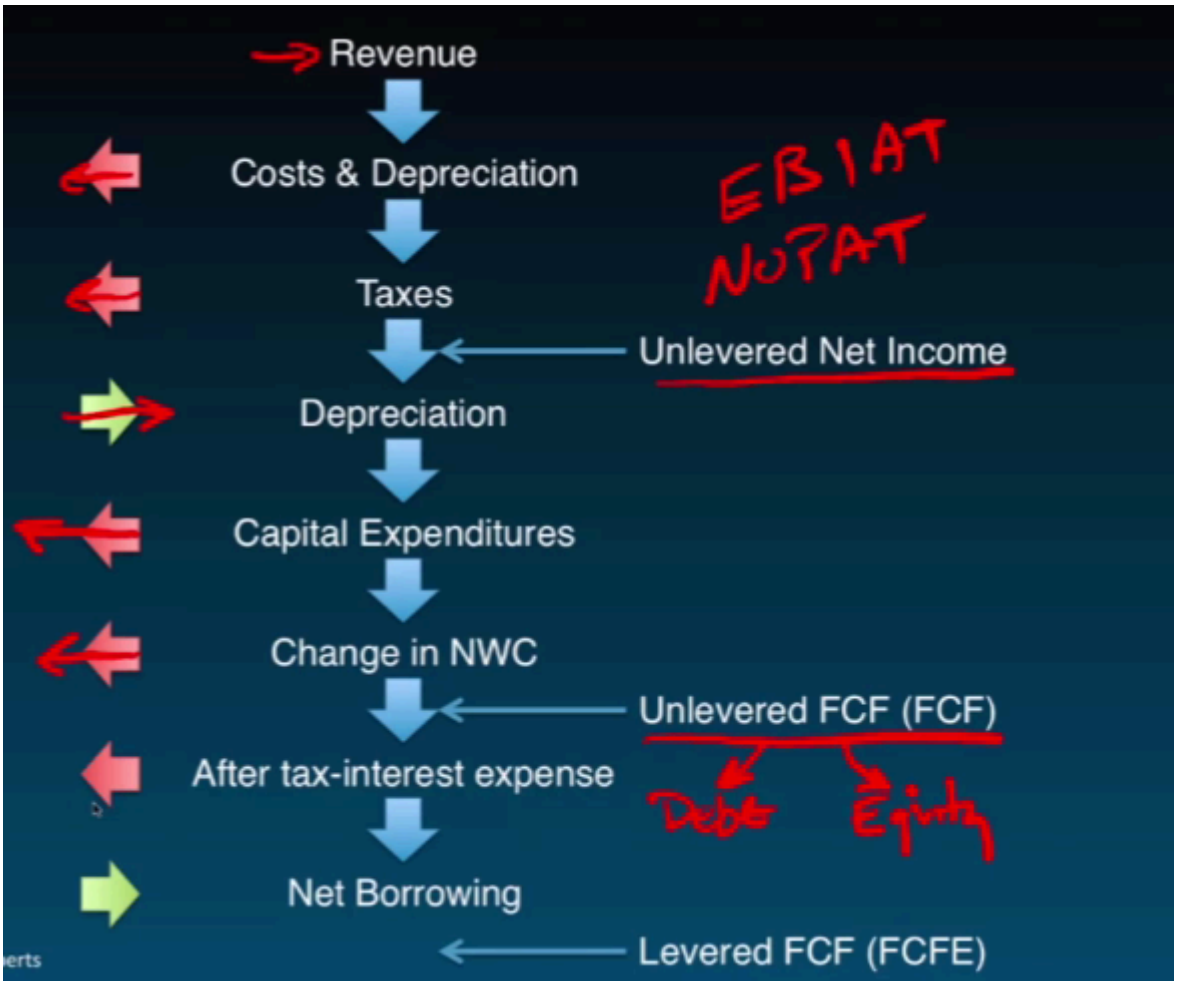
FCFE = FCF – Interest x (1 – t_C) + Net Borrowing

Lesson: FCFE is residual cash flow left over after **all** of the project's requirements have been satisfied, implications accounted for, *and* all debt financing has been satisfied

FCFE = FCF – Interest x (1 – t_C) + Net Borrowing

Lesson: FCFE is the cash flow that can be distributed to the shareholders (i.e., equity) of the project or company

Lesson: FCFE is more precisely levered free cash flow because it is affected by the choice of leverage (i.e., debt)



Should I sell this tablet

FCF = (Revenue – Costs – Depreciation) x (1 – t_c)
+ Depreciation – Capital Expenditures
– Change in Net Working Capital

Revenue = Market Size x Market Share x Price

Project Assumptions	Year 0 (F2008)	1	2	3	4	5
Revenue Forecasts						
Market Forecasts						
Initial Market Size (Units, million)		1.00				
Market Growth Rate			2500.00%	128.0%	9.4%	3.5%
Market Size (Units, million)		1.0	26.0	59.3	64.9	67.1
(Actual Market Size, Units Mil)		1.0	60.0	116.3	195.4	229.0
Corp Market Share						
Initial Market Share		25.00%				
Market Share Annual Growth Rate			5.00%	5%	5%	5%
Market Share		25.0%	26.3%	27.6%	28.9%	30.4%
Pricing Strategy						
Initial Unit Price ($/unit)		200.00				
Bi-Annual Price Increases ($/unit)			-	49.99	-	49.99
Unit Price ($/unit)		200.00	200.00	249.99	249.99	299.98

Costs = R&D Expenditures

Project Assumptions	Year 0 (F2008)	1	2	3	4	5
Operating Expenses						
COGS						
COGS / Sales (% Sales)	80.66%	80.66%	80.66%	80.66%	80.66%	80.66%
SG&A						
1% of 2008 Company SG&A ($mil)		69.59				
SG&A Expense Growth Rate			25.00%	25.00%	25.00%	25.00%
R&D						
R&D Upfront ($mil)	200.00					
R&D for Versioning ($mil)		25.00	25.00	25.00	25.00	25.00

Capital Expenditures

Project Assumptions	Year 0 (F2008)	1	2	3	4	5
Capital Expenditures & PP&E Information						
Initial Investment (Fixed Cost, $mil)	227.70					
Future Investment (% of initial Investment)		10.0%				
Future Investment (Annual Growth)			5.0%	1.0%	1.0%	1.0%

Depreciation

Project Assumptions	Year 0 (F2008)	1	2	3	4	5
Capital Expenditures & PP&E Information						
Initial Investment (Fixed Cost, $mil)	227.70					
Future Investment (% of initial Investment)		10.0%				
Future Investment (Annual Growth)			5.0%	1.0%	1.0%	1.0%
PP&E Liquidation Value	50.00%	50.0%	50.0%	50.0%	50.0%	50.0%
PP&E life for depreciation (Years)	5.00	5	5	5	5	5

*Straight line depreciation

Net Working Capital = Cash + Inventory + AR – AP

Taxes

We want the marginal tax rate (MTR)

=

Tax rate on additional $ of earnings

25.5%

This is Nonsense!

~~This is Nonsense!~~

Impossible to make accurate forecasts!

Lesson: Point of DCF is to focus discussion and analysis on relevant issues

Lesson: Successful valuation (i.e., decision making) depends critically on input from non-finance personnel

2. Compute internal rate of return

The internal rate of return (IRR) of a project is the one discount rate such that the net present value of the project's free cash flows equals zero.

2. Compute internal rate of return

$$NPV = \frac{-\$376.8}{(1+IRR)^0} + \frac{-\$133.6}{(1+IRR)^1} + \frac{\$111.6}{(1+IRR)^2} + \frac{\$505.7}{(1+IRR)^3} + \frac{\$542.1}{(1+IRR)^4} + \frac{\$725.5}{(1+IRR)^5}$$

$$\Rightarrow IRR = 43.7\%$$

The promised return on investing in the project is 43.7% > 12% (hurdle rate) → undertake the project

Lesson: The IRR Rule says accept all projects whose $IRR > R$, reject all projects whose $IRR < R$

r: discount rate

Break Even Analysis finds the parameter value that sets the NPV of the project equal to zero holding fixed all other parameters

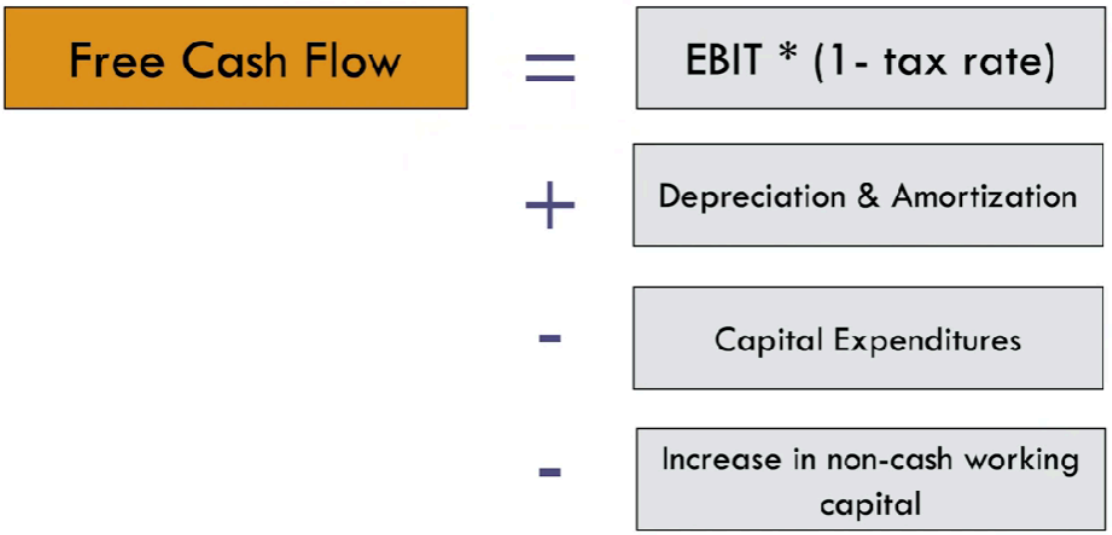
DISCOUNTED CASH FLOW STEPS

Press Esc to exit full screen

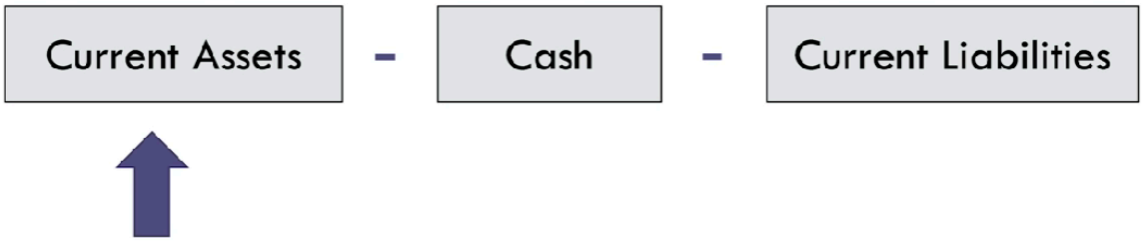
1. Forecast the Free Cash Flow
2. Calculate the Weighted Average Cost of Capital
3. Calculate the Terminal Value
4. Discount the Free Cash Flow and Terminal Value
5. Calculate the implied share price

FCF: Cash flow available to both debt and equity holders after the business pays for everything it needs to continue operating

FREE CASH FLOW FORMULA



NON-CASH WORKING CAPITAL FORMULA

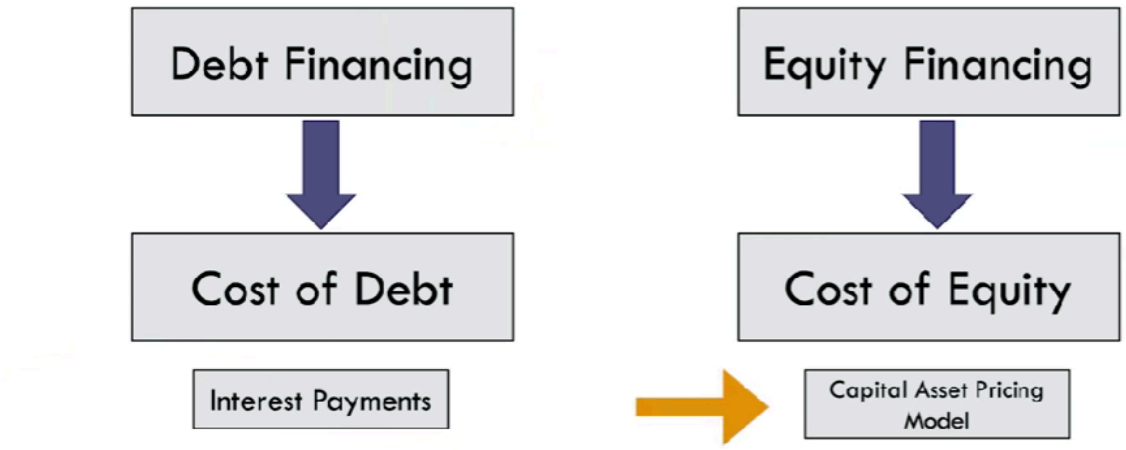


Calculate the FCF	
Assumptions	
EBIT	150
Tax Rate %	25%
Depreciation	15
Amortization	20
CapEx	50
Non-cash Working Capital (inc) / dec	(12)

Free Cash Flow	
EBIT	150
Tax	(38)
D&A	35
CapEx	(50)
Non-cash Working Capital (inc) / dec	(12)
Free Cash Flow	**86**

Project the FCF until they reach a steady state (usually 5-10 years

WEIGHTED AVERAGE COST OF CAPITAL



Beta: stock's volatility in relation to the market (like the S&P 500), where the market has a beta of 1

CAPITAL ASSET PRICING MODEL

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f)$$

$E(R_i)$ = Expected Return

R_f = Risk-free rate

β_i = Beta

$E(R_m)$ = Expected market return

WEIGHTED AVERAGE COST OF CAPITAL

$$WACC = \frac{E}{E+D} * R_E + \frac{D}{E+D} * R_D * (1-T)$$

E = Equity

D = Debt

R_E = Cost of Equity (the CAPM)

R_D = Cost of Debt

WACC Calculation	
Equity value	175
Debt value	150
Cost of Debt	5%
Tax rate	30%
10y Treasury	2%
Beta	1.3
Market Return	8%
Cost of Equity	10%
E / D +E	54%
D / D+E	46%
WACC	**6.9%**

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f)$$

$$WACC = \frac{E}{E+D} * R_E + \frac{D}{E+D} * R_D * (1-T)$$

Terminal Value: Value of the business after the forecasted period

TERMINAL VALUE

Perpetuity Growth

$$TV = \frac{(FCF_n \cdot (1+g))}{(WACC - g)}$$

FCF_n = FCF final forecast year

g = Growth rate

Exit Multiple

TV = Financial Metric x Trading Multiple

(Example: EBITDA x 5)

Financial Metric example = EBITDA

Trading Multiple example = Enterprise Value / EBITDA

Terminal Value Calculation

Assumptions	
WACC	10%
Growth rate	2.50%
EV/EBITDA Multiple	7.00x

Period	*0*	*1*	*2*	*3*	*4*	*5*
EBITDA		100	125	135	140	142
FCF		50	60	65	70	72

Perpertuity Growth TV	984.0
EV/ EBITDA TV	994.0
Average	989.0

TV = Financial Metric x Trading Multiple
(Example: EBITDA x 5)

$$TV = \frac{\left(FCF_n \cdot (1+g)\right)}{(WACC - g)}$$

Discounting Cash Flows

Assumption	
WACC	8%

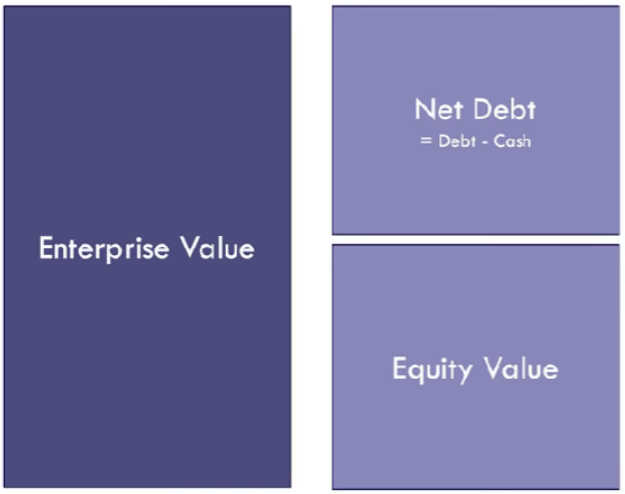
Period	*0*	*1*	*2*	*3*	*4*	*5*
FCF		100	100	100	100	100
Terminal Value						800
Discount factor		0.93	0.87	0.80	0.75	0.70
PV of FCF		93.0	86.5	80.5	74.9	69.7
PV of TV						557.2

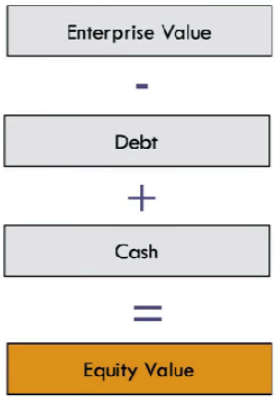
Enterprise Value

$$Discount\ Factor = \frac{1}{(1+r)^n}$$

$$DCF = \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \cdots + \frac{CF_n}{(1+r)^n}$$

ENTERPRISE VALUE TO EQUITY VALUE





Enterprise Value to Equity Value	
Enterprise Value	2500
Cash	50
Marketable Securities	250
Short term debt	350
Long term debt	1200
Equity Value	**1250**
Shares Outstanding	150
Share Price	**8.33**