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Valuation: Discounted Cash Flow (DCF) Model

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I. Overview of the Discounted Cash Flow (DCF) Model

Overview

What is the DCF

- ◆ **The Discounted Cash Flow (DCF) Model is used to calculate the *present value* of a company or business**

- ◆ Why would you want to calculate the value of company?
 - If you want to take your company public through an IPO (initial public offering) of stock, you would need to know your company's value to determine how many shares of stock you should sell, and at what price you should sell it at

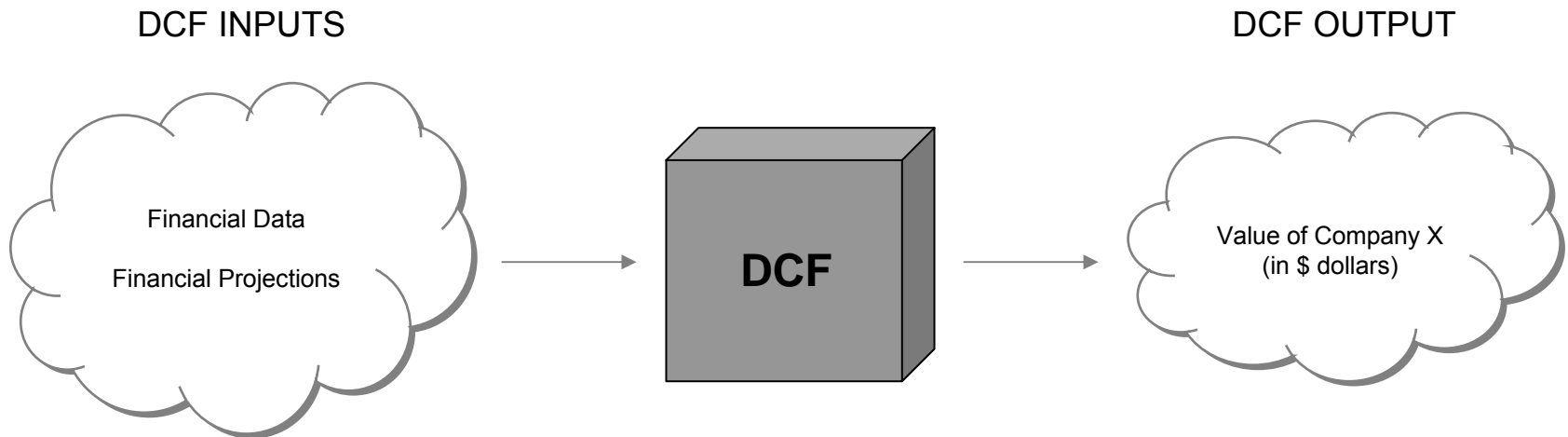
 - If you want to sell your company to a potential buyer, you would want to calculate how much your firm is presently worth to structure the price of the transaction

 - If you wanted to buy a company through acquisition, you would want to calculate the present value of that company to structure the pricing of the deal

Overview

How the Model Flows

- ◆ The DCF takes in available financial data (both historical and projected), makes its own assumptions, and then through a series of calculations, yields the present value of the company in \$ dollars



- ◆ As an example, the yielded result (measured in terms of \$ dollars) can then be used to calculate what the Company's stock price *should* be, given a number of shares the Company wishes to sell, by this equation

$$\frac{\text{Company Value}}{\text{Shares of Stock}} = \text{Per Share Stock Price}$$

Overview

Fundamental Understanding of the DCF

- ◆ The theoretical bases of the DCF
 - “A dollar today is worth more than a dollar ten years from now.” The real purchasing power of a dollar is discounted each year by a specific factor depending on economic and inflationary pressures. How much would a million dollars ten years from now be worth *today*? That is a function of the discount rate
 - The present value of a company (what it is currently worth) is equal to *all* of the company’s *future* cash flows (all of the money it expects to generate in the future), discounted to present day \$ dollars
- ◆ Very literally, this is why it is known as the “Discounted Cash Flow” model – it is projecting the future cash flows of a company and discounting it to present day \$ dollar amounts

Overview

How the DCF Works

- ◆ Based off any available financial data (both historical and projected), the DCF,
 - **First, projects the Company's expected cash flow each year for a finite number of years**
 - **Second, sums all the projected cash flows from the first step**
 - **And lastly, discounts the result from the second step by some rate to yield the value in terms of *present day* \$ dollars**
- ◆ That, in a nutshell, is the core understanding of the DCF model

Overview

Evaluating the DCF as a Method of Valuation

◆ Advantages

- Flexible analysis – adaptable to many different situations and companies, and therefore can almost always be used
- Nicely accounts for changes in estimates/projections about the future

◆ Disadvantages

- Because the calculation is primarily based off *future projections*, it is sensitive to bias and subjectivity, and can therefore be easily manipulated

◆ How the DCF should be used

- It should be used to present a RANGE of values, not a single estimate

◆ Alternatives to the DCF method of valuation

- Comparable Company Analysis, Comparable Transaction Analysis

II. Discounted Cash Flow (DCF) Model

DCF Model

The General DCF Model

$$EV = \sum_{i=0}^N \left[\frac{FCF_i}{(1+d)^i} \right] + \frac{TV}{(1+d)^N}$$

EV: Enterprise Value (value of the company in question)

FCF: Free Cash Flow in year i

d: Discount Rate

i: Year

N: Last projected year

TV: Terminal Value

DCF Model

Steps for Doing a DCF Analysis

- 1) Estimate the Weighted Average Cost of Capital (Cost of Equity & Cost of Debt)
- 2) Project the Free Cash Flows (FCFs)
- 3) Estimate the Terminal Value
- 4) Derive the Enterprise Valuation and EPS

Estimate the Cost of Capital (step one of four)

Weighted Average Cost of Capital

- ◆ The Weighted Average Cost of Capital (WACC) measures the minimum rate of return required to make an investment decision. This is also the discount rate used in the general DCF model (previous page)

$$d = \text{WACC} = K_e * \frac{E}{E + D} + K_d * (1 - T) * \frac{D}{E + D}$$

WACC: Weighted Average Cost of Capital = discount rate (d) for DCF

K_e : Cost of Equity (from CAPM on next page)

K_d : Cost of Debt (current cost of borrowing through debt, average yield to maturity)

E: Market Value of Equity

D: Market Value of Debt

T: Marginal Tax Rate

Estimate the Cost of Capital (step one of four)

Cost of Equity – The Capital Asset Pricing Model (CAPM)

- ♦ The Capital Asset Pricing Model (CAPM) calculates the company's cost of equity – the total return expected by equity investors including dividends and capital appreciation.

$$K_e = r_f + B * (r_m - r_f)$$

K_e :	Cost of Equity (into WACC on previous page)
B :	Company Beta, its volatility relative to the rest of the market <i>If $B = 1$, it is as risky as the overall market.</i> <i>If $B < 1$, it is less risky than the market.</i> <i>If $B > 1$, it is more risky than the market.</i>
r_f :	Risk Free Rate
r_m :	Equity Market Average Return
$r_m - r_f$:	Excess Market Return

Estimate the Cost of Capital (step one of four)

Cost of Debt

- ◆ The cost of debt is the marginal cost of debt after giving effect to the tax shield provided by debt financing

$$K_d = \text{Outstanding Debt} + \text{Marginal Interest Rate}$$

Note: In cases where there is no publicly traded debt, the cost of debt can either be obtained from comparables, or approximated to the Risk-Free-Rate (r_f)

Project the Free Cash Flows (step two of four)

Unlevered Free Cash Flow

- ◆ Leverage in financial terms refers to the tax savings (and therefore cash flow increase) provided by interest payments from Company debt items reported on the income statement
- ◆ Unlevered Free Cash Flow, therefore, refers to the cash flow of a company adjusting out the leverage provided by debt items (interest payments reported on the income statement)

EBITDA

- Depreciation and Amortization

= EBIT

- Taxes (at the marginal tax rate)

= TAX-EFFECTED EBIT

+ Depreciation and Amortization

+/- Change in Deferred Taxes

- Capital Expenditures

+/- Change in Net Working Capital

+/- Change in other Long-term Assets and Liabilities

= **UNLEVERED FREE CASH FLOW**

Estimate the Terminal Value (step three of four)

Two Methods of Calculation

- ◆ The Terminal Value is the value of the business *beyond* the specified forecast period (e.g. the projected value of the company for 30 years into the future)

1) Exit Multiple Method

Terminal Value = what the business would be worth or sold for at the end of the last projected year

Example: Terminal Value = 8.0x EBITDA at the end of year N

2) Perpetuity Growth Method

Terminal Value = Free Cash Flows that grow at a constant rate in perpetuity

$$\text{Terminal Value} = \frac{FCF_N \times (1+g)}{(r + g)}$$

g = nominal perpetual growth rate

r = discount rate

Derive the Enterprise Valuation and EPS (step four of four)

The General DCF Model

$$EV = \sum_{i=0}^{i>N} \left[\frac{FCF_i}{(1+d)^i} \right] + \frac{TV}{(1+d)^N}$$

$$EV - Debt + Cash = EQUITY VALUE$$

$$\frac{EQUITY VALUE}{Diluted Shares} = EPS$$

Note: EPS for an already publicly traded company means “*Earnings Per Share*,” but in this case, where the company has no market valuation, EPS means “*Equity Value Per Share*”

III. Sample DCF

Company X

Discounted Cash Flow Analysis

PRO FORMA SCENARIO

(\$ in millions)

Fiscal Year Ending January 31,	Projected ^(a)	Projected ^(a)					2005 - 2009
	Q4 04	2005	2006	2007	2008	2009	CAGR
Net Sales	\$ 5.9	\$ 37.6	\$ 75.7	\$ 121.9	\$ 158.5	\$ 198.1	51.5%
% Growth		115.7%	101.1%	61.1%	30.0%	25.0%	
EBITDA	(3.2)	(17.2)	4.8	41.4	52.7	65.9	NM
% of Net Sales	(54.4%)	(45.7%)	6.4%	34.0%	33.3%	33.3%	
% Growth		NM	NM	755.5%	27.2%	25.0%	
EBIT	(3.6)	(19.4)	2.2	39.7	51.6	64.4	NM
Less: Cash Taxes @ 33.0% ^(b)	1.2	6.4	(0.7)	(13.1)	(17.0)	(21.3)	
Tax-adjusted EBIT	\$ (2.4)	\$ (13.0)	\$ 1.5	\$ 26.6	\$ 34.5	\$ 43.2	NM
Plus: Depreciation ^(c)	0.5	2.2	2.6	1.8	1.2	1.5	
Depreciation / Net Sales	7.7%	5.8%	3.5%	1.5%	0.7%	0.7%	
Less: Capital Expenditures ^(d)	0.4	(1.6)	(0.6)	(1.1)	(1.4)	(1.7)	NM
Capital Expenditures / Sales	-7.4%	4.3%	0.8%	0.9%	0.9%	0.9%	
Capital Expenditures / Depreciation	-96.2%	73.0%	23.9%	59.3%	117.6%	117.6%	
Less: Change in Working Capital ^(e)	(0.0)	(0.3)	(1.9)	(2.3)	(1.8)	(2.0)	
Change in WC as a % of Change in Sales		(1.0%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)	
Unlevered Free Cash Flow	\$ (1.6)	\$ (12.7)	\$ 1.6	\$ 25.0	\$ 32.5	\$ 40.9	NM
% Growth		NM	NM	1476.3%	30.2%	25.9%	

Discount Rate	15.0%			20.0%			25.0%		
	20.0x	22.5x	25.0x	20.0x	22.5x	25.0x	20.0x	22.5x	25.0x
2010 Earnings ^(f)	\$ 49.6	\$ 49.6	\$ 49.6	\$ 49.6	\$ 49.6	\$ 49.6	\$ 49.6	\$ 49.6	\$ 49.6
Terminal Value	993.0	1,117.1	1,241.2	993.0	1,117.1	1,241.2	993.0	1,117.1	1,241.2
PV of Terminal Value ^(g)	476.7	536.3	595.9	381.3	428.9	476.6	307.7	346.2	384.7
PV of Free Cash Flows ^(g)	42.4	42.4	42.4	33.9	33.9	33.9	27.2	27.2	27.2
Implied Value of Equity	\$ 528.2	\$ 587.8	\$ 647.4	\$ 422.6	\$ 470.2	\$ 517.9	\$ 341.2	\$ 379.6	\$ 418.1
Terminal Value as a % of Equity Value	90.3%	91.2%	92.0%	90.2%	91.2%	92.0%	90.2%	91.2%	92.0%
Implied CF Perpetuity Growth	10.4%	10.9%	11.3%	15.2%	15.8%	16.2%	20.1%	20.6%	21.0%

IV. Additional Resources

Additional Resources

DCF and Related Material

◆ More Documentation on the DCF

- The Vault Career Guide to Finance Interviews (visit <http://www.vault.com>)

◆ Finance Related Documentation

- Research Initiatives Section of Ian Lee's portfolio site (visit <http://users.design.ucla.edu/~ianlee>)