IB Interview Guide, Module 4: Valuation and DCF Analysis

Table of Contents:

Overview & Key Rules of Thumb

If you've already read and understood the guides and lessons on Present Value and IRR, Accounting, and Equity Value and Enterprise Value, this guide will be straightforward.

The main difference is that this guide is about the **real-life applications** of those topics, not the theory behind them.

This section **ties together all these concepts** to create something that is useful in real life: An integrated valuation model for a company.

It goes back to **Implied vs. Current Value:** Is a company undervalued, overvalued, or valued appropriately?

With an Excel-based valuation, you can answer that question and then use the results to advise a client or invest your money.

Key Rule #1: The Big Idea Behind DCF Analysis and Valuation

We've continually referenced this formula:

Company Value = Cash Flow / (Discount Rate – Cash Flow Growth Rate), where Cash Flow Growth Rate < Discount Rate.

If a company's Discount Rate and Cash Flow Growth Rate *stay the same forever*, then it should be worth the amount predicted by this formula.

But that is never true in real life.

A company may grow quickly in its early days, but then slow down as it gets bigger and more mature.

And a company's Discount Rate might be very high early on, but then drop to a much lower level as its risk and potential returns both decline.

Since the Discount Rate and Cash Flow Growth Rate change over time, valuation is more complicated than this simple formula.

There are two main ways to reflect this reality more accurately:

1. Project a company's cash flows, and possibly its Discount Rate, **in detail** in the near term – the next 5, 10, or 15 years. And then assume that its Cash Flow Growth Rate and Discount Rate stay the same after that in the **Terminal Period**, and value the company in

that period using the formula above. Discount the values from both periods and add them together.

2. Use **valuation multiples** for the company's near-term financial results – the next year or two – and don't rely on cash flow projections at all. Remember that valuation multiples are **shorthand** for cash flow-based valuation, assuming you've picked appropriate peer companies.

Method #1 is called the **Discounted Cash Flow (DCF) Analysis**, and it's the most *theoretically* correct way to value a company.

For example, you might project a company's cash flows over the next 10 years, and conclude that their Present Value is $1,200 at a Discount Rate of 10% and that the Present Value of the cash flows in its Terminal Period is $1,500.

Based on that, the company's Implied Value is $2,700.

Since you're valuing a company based on its cash flows, as opposed to external factors like other companies, this method is often called **intrinsic valuation**.

Method #2 is known as **relative valuation**. To use it, you have to collect sets of "comparable" companies and M&A transactions, calculate their valuation multiples, and then apply those multiples to the company you're valuing.

For example, similar companies in the sector trade at EV / EBITDA multiples of between 10x and 12x.

Your company has an EBITDA of $200, so its Implied Enterprise Value *should*, therefore, be between $2,000 and $2,400.

There are other methodologies as well, but these are the most important ones.

Once you've valued a company using both relative and intrinsic valuation, you can see how its **Implied Value** compares with its **Current Value**.

For example, maybe the company's Current Enterprise Value is $2,000.

But based on the analysis above – a DCF that produced an Implied Value of $2,700, and comparable companies that showed an Implied Value between $2,000 and $2,400, the company seems **undervalued**.

As an investment banker advising this company, you might use this analysis to tell the Board of Directors the price they might get if they decide to sell the company.

If you're an investor at a private equity firm or hedge fund, you might use this information to conclude that the company is undervalued and that it could be a good investment if its stock price increases.

Return to Top.

Key Rule #2: DCF – How to Project Free Cash Flow

The first step in a DCF analysis is to project the company's cash flows in the **explicit forecast period**.

"Explicit forecast period" usually means the next 5-10 years, but it could mean 15-20+ years, depending on the company and industry.

As you know from the guide(s) to valuation metrics and multiples, there are different types of "cash flow": Free Cash Flow, Levered Free Cash Flow, and Unlevered Free Cash Flow.

You should use Unlevered Free Cash Flow in pretty much all DCF analyses.

That means that you need to project the following items:

1. Revenue.
2. COGS and Operating Expenses.
3. Taxes.
4. Depreciation & Amortization (and *sometimes* other recurring, non-cash add-backs).
5. The Change in Working Capital.
6. Capital Expenditures.

You ignore huge chunks of the company's Income Statement and Cash Flow Statement, including Net Interest Expense, Other Income / (Expense), *most* of the non-cash adjustments, the entire Cash Flow from Financing section, and most of the Cash Flow from Investing section.

You ignore them because those items are non-recurring or relate only to *specific* investor groups rather than all investors.

Unlevered FCF represents the company's recurring business cash flow that is available to ALL investors.

You might remember that we previously defined Unlevered FCF this way:

- **Unlevered Free Cash Flow:** NOPAT + Non-Cash Adjustments and Change in Working Capital from CFS – CapEx.

NOPAT corresponds to items #1, #2, and #3 above (Revenue, COGS and Operating Expenses, and Taxes), and the Change in Working Capital and CapEx correspond to items #5 and #6 above.

We do **not** include all the "Non-Cash Adjustments" – just Depreciation & Amortization and not much else.

There are 2 reasons for that:

1) Most of these non-cash adjustments, aside from D&A, are **non-recurring** (e.g., Gains and Losses, Impairments, and Write-Downs). And when you *project* Free Cash Flow, you ignore these non-recurring items.

2) And stock-based compensation, the other common, recurring item in this section, is **NOT** a real non-cash expense and should **not** be added back to calculate FCF. And, per the definition above, it relates only to a *specific* investor group (Equity investors).

SBC is **not** a non-cash expense in the same way D&A is because it **creates additional shares** and dilutes the existing investors.

Think about it like this: Let's say you have a house worth $10 million, and you pay someone to manage it for you.

Instead of paying him a cash salary of $100,000 per year over 5 years, you award him a 1% ownership stake in the house each year. By the end, he owns 5% of the house.

If you decide to sell the house after 5 years, you'll receive only $9.5 million – not $10.0 million – because someone else owns a portion of it.

Sure, you haven't paid this person a cash salary, but he still **costs you money** because he has reduced your ownership in the house!

It's the same with Stock-Based Compensation: If you add it back as a non-cash expense, you're getting a "free lunch" because you're not reflecting the cash payouts associated with it, nor are you reflecting the additional shares that get created.

The main non-cash adjustment that *doesn't* fit into the guidelines above is **Deferred Taxes**.

You *can* include it, but it should decrease as book vs. cash-tax timing differences reverse.

So, if Deferred Taxes initially represent 20% of total Income Taxes, they shouldn't stay at 20% throughout the entire forecast period; they should drop to a much lower percentage, such as 3-5%, by the end.

Here's what **we will project** and what **we won't project** for Steel Dynamics, starting with the Income Statement:

Net sales			
Unrelated parties	$ 7,407,233	$ 8,481,567	$ 7,087,101
Related parties	187,178	274,385	285,823
Total net sales	7,594,411	8,755,952	7,372,924
Costs of goods sold	6,862,693	7,789,741	6,653,780
Gross profit	731,718	966,211	719,144
Selling, general and administrative expenses	327,626	316,214	272,777
Profit sharing	23,064	42,126	27,764
Amortization of intangible assets	25,312	27,551	31,770
Asset impairment charges	428,500	260,000	308
Operating income (loss)	(72,784)	320,320	386,525
Interest expense, net of capitalized interest	153,950	137,263	127,728
Other (income) expense, net	15,383	18,254	(4,033)
Income (loss) before income taxes	(242,117)	164,803	262,830
Income tax expense (benefit)	(96,947)	73,153	99,314
Net income (loss)	(145,170)	91,650	163,516
Net loss attributable to noncontrolling interests	14,859	65,374	25,798
Net income (loss) attributable to Steel Dynamics, Inc.	$ (130,311)	$ 157,024	$ 189,314

You always need to project all of these items (Revenue, COGS, and OpEx), but note that Amortization and Depreciation are often *embedded* within other line items such as COGS.

Don't project this! Impairments, Write-Downs, Gains/Losses, etc. are all non-recurring.

These items shouldn't be a part of *Unlevered* FCF since they relate to debt investors and non-core-business Assets.

You do project Taxes in Unlevered FCF, but they are based on EBIT, not Pre-Tax Income.

And then on the Cash Flow Statement:

Operating activities:			
Net income (loss)	$ (145,170)	$ 91,650	$ 163,516
Adjustments to reconcile net income (loss) to net cash provided by operating activities:			
Depreciation and amortization	294,595	263,325	230,928
Impairment charges	428,500	260,000	308
Equity-based compensation	22,604	14,016	15,504
Deferred income taxes	(99,323)	(25,042)	30,737
Loss on disposal of assets	9,763	5,561	1,082
Changes in certain assets and liabilities:			
Accounts receivable	311,302	(2,191)	(78,237)
Inventories	488,003	68,730	(108,025)
Other assets	3,284	3,064	13,705
Accounts payable	(227,092)	(76,141)	40,141
Income taxes receivable/payable	12,706	(22,086)	(12,494)
Accrued expenses	(60,689)	36,686	15,010
Net cash provided by operating activities	1,038,483	617,572	312,175

Use NOPAT rather than Net Income.

You always project D&A.

Leave these out; non-recurring or not "real" non-cash expenses.

You can project Deferred Income Taxes, but make them decrease over time.

Leave this out; non-recurring.

Include all these Working Capital line items.

You leave out most of the Cash Flow from Investing and Cash Flow from Financing sections, with one exception:

Investing activities:			
Purchases of property, plant and equipment	(114,501)	(111,785)	(186,843)
Proceeds from maturities of short-term commercial paper, net	—	—	31,520
Acquisition of business, net of cash acquired	(45,000)	(1,669,449)	—
Other investing activities	9,874	33,967	2,478
Net cash used in investing activities	(149,627)	(1,747,267)	(152,845)
Financing activities:			
Issuance of current and long-term debt	207,930	1,822,096	423,965
Repayments of current and long-term debt	(612,534)	(635,578)	(517,978)
Proceeds from exercise of stock options, including related tax effect	10,781	32,307	37,508
Contributions from noncontrolling investors	—	5,418	17,860
Distributions to noncontrolling investors	(1,187)	(743)	(439)
Dividends paid	(127,569)	(105,379)	(94,812)
Debt issuance costs	(608)	(22,219)	(6,195)
Net cash provided by (used in) financing activities	(523,187)	1,095,902	(140,091)

Always project CapEx.

These items are all non-recurring, so leave them out.

These items are all either non-recurring or related to *just* Debt or *just* Equity investors, so you exclude this entire section of the CFS when projecting Unlevered FCF.

How to Make the Projections

Once you've decided **what to include** and **what to exclude**, you make the actual projections for Unlevered FCF.

This process depends on the company's industry and business segments, but here are the general set of steps to follow:

1) Project Revenue.

You could use several approaches to project revenue depending on how much time you have and how much detail you need:

1. Simple % Growth Rate (e.g., assume that revenue grows at 5% per year).
2. Units Sold * Average Selling Price (e.g., assume the company sells 1,000 widgets for $10 each).
3. Market Share * Market Size (e.g., assume the company captures 10% of a $1 billion market).

You must be able to **justify your numbers**, which means that methods #2 and #3 are better if you have the time to use them.

We used method #2 for Steel Dynamics:

Steel Dynamics Inc. - Revenue and Expenses:	Units:	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
						Projected					
Net Sales by Segment:											
Steel Operations:	$ M	$ 5,725.6	$ 6,390.7	$ 7,074.7	$ 7,758.2	$ 8,505.8	$ 9,237.1	$ 10,079.3	$ 10,583.2	$ 11,006.6	$ 11,336.8
Metals Recycling Operations:	$ M	2,266.7	2,317.4	2,540.3	2,777.4	2,965.4	3,162.2	3,368.1	3,469.1	3,538.5	3,609.3
Steel Fabrication Operations:	$ M	729.4	793.5	855.2	921.7	984.0	1,050.4	1,110.7	1,166.2	1,212.9	1,249.3
Other Segments:	$ M	346.3	377.5	411.5	444.4	479.9	513.5	544.4	571.6	594.4	612.3
Inter-Company Eliminations:	$ M	(1,352.0)	(1,473.0)	(1,622.5)	(1,774.5)	(1,928.6)	(2,081.9)	(2,251.8)	(2,354.3)	(2,438.1)	(2,506.0)
Total Consolidated Sales:	$ M	**$ 7,716.0**	**$ 8,406.2**	**$ 9,259.3**	**$ 10,127.2**	**$ 11,006.6**	**$ 11,881.3**	**$ 12,850.7**	**$ 13,435.9**	**$ 13,914.3**	**$ 14,301.6**
Annual Growth Rate:	%	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*	*7.9%*	*8.2%*	*4.6%*	*3.6%*	*2.8%*
Total Shipments by Segment:											
Steel Operations:	K Tons	9,161.0	9,985.5	10,884.1	11,754.9	12,695.3	13,583.9	14,399.0	15,118.9	15,723.7	16,195.4
Metals Recycling Operations:	K Tons	5,964.9	6,263.2	6,513.7	6,774.3	6,977.5	7,186.8	7,402.4	7,624.5	7,777.0	7,932.5
Steel Fabrication Operations:	K Tons	532.4	575.0	615.3	658.4	697.9	739.7	776.7	815.6	848.2	873.6
Total Consolidated Shipments:	K Tons	**15,658.3**	**16,823.7**	**18,013.1**	**19,187.5**	**20,370.6**	**21,510.5**	**22,578.1**	**23,559.0**	**24,348.8**	**25,001.5**
Annual Growth Rate:	%	*8.0%*	*7.4%*	*7.1%*	*6.5%*	*6.2%*	*5.6%*	*5.0%*	*4.3%*	*3.4%*	*2.7%*
Shipment Growth Rates by Segment:											
Steel Operations:	%	10.0%	9.0%	9.0%	8.0%	8.0%	7.0%	6.0%	5.0%	4.0%	3.0%
Metals Recycling Operations:	%	5.0%	5.0%	4.0%	4.0%	3.0%	3.0%	3.0%	3.0%	2.0%	2.0%
Steel Fabrication Operations:	%	8.0%	8.0%	7.0%	7.0%	6.0%	6.0%	5.0%	5.0%	4.0%	3.0%
Average Sales Price Per Ton:											
Steel Operations:	$ 000 / Ton	625.0	640.0	650.0	660.0	670.0	680.0	700.0	700.0	700.0	700.0
Metals Recycling Operations:	$ 000 / Ton	380.0	370.0	390.0	410.0	425.0	440.0	455.0	455.0	455.0	455.0
Steel Fabrication Operations:	$ 000 / Ton	1,370.0	1,380.0	1,390.0	1,400.0	1,410.0	1,420.0	1,430.0	1,430.0	1,430.0	1,430.0
Other Segments Sales Growth:	%	10.0%	9.0%	9.0%	8.0%	8.0%	7.0%	6.0%	5.0%	4.0%	3.0%
Inter-Company Eliminations % Revenue:	%	14.9%	14.9%	14.9%	14.9%	14.9%	14.9%	14.9%	14.9%	14.9%	14.9%

We assumed that the company ships a certain amount of steel in each segment and sells each ton for a certain dollar amount. These figures keep changing until revenue growth decreases to a much lower level by the end of Year 10 (FY 25 here).

2) Assume an Operating (EBIT) Margin or Project COGS and OpEx.

Similar to step #1, you could make this part simple or complex depending on the time and resources available.

The **simplest** approach is to make the company's Operating Income, or EBIT, a percentage of revenue and to make it grow or decline or over time to reflect business trends.

But you could also project expenses based on individual employees and major categories like rent and marketing, and make everything grow at different rates.

For Steel Dynamics, we kept it relatively simple and projected Operating Margins by Segment:

Steel Dynamics Inc. - Revenue and Expenses:	Units:	Projected FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
Net Sales by Segment:											
Steel Operations:	$ M	$ 5,725.6	$ 6,390.7	$ 7,074.7	$ 7,758.2	$ 8,505.8	$ 9,237.1	$ 10,079.3	$ 10,583.2	$ 11,006.6	$ 11,336.8
Metals Recycling Operations:	$ M	2,266.7	2,317.4	2,540.3	2,777.4	2,965.4	3,162.2	3,368.1	3,469.1	3,538.5	3,609.3
Steel Fabrication Operations:	$ M	729.4	793.5	855.2	921.7	984.0	1,050.4	1,110.7	1,166.2	1,212.9	1,249.3
Other Segments:	$ M	346.3	377.5	411.5	444.4	479.9	513.5	544.4	571.6	594.4	612.3
Inter-Company Eliminations:	$ M	(1,352.0)	(1,473.0)	(1,622.5)	(1,774.5)	(1,928.6)	(2,081.9)	(2,251.8)	(2,354.3)	(2,438.1)	(2,506.0)
Total Consolidated Sales:	$ M	**$ 7,716.0**	**$ 8,406.2**	**$ 9,259.3**	**$ 10,127.2**	**$ 11,006.6**	**$ 11,881.3**	**$ 12,850.7**	**$ 13,435.9**	**$ 13,914.3**	**$ 14,301.6**
Annual Growth Rate:	%	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*	*7.9%*	*8.2%*	*4.6%*	*3.6%*	*2.8%*
Operating Income by Segment:											
Steel Operations:	$ M	429.4	511.3	601.3	698.2	808.1	923.7	1,007.9	1,058.3	1,100.7	1,133.7
Metals Recycling Operations:	$ M	(11.3)	(11.6)	-	-	14.8	15.8	33.7	34.7	35.4	36.1
Steel Fabrication Operations:	$ M	127.7	142.8	162.5	175.1	196.8	210.1	222.1	233.2	242.6	249.9
Other & Intracompany:	$ M	(166.3)	(181.3)	(197.6)	(213.4)	(230.5)	(246.6)	(261.4)	(274.5)	(285.4)	(294.0)
Operating Margin by Segment:											
Steel Operations:	%	7.5%	8.0%	8.5%	9.0%	9.5%	10.0%	10.0%	10.0%	10.0%	10.0%
Metals Recycling Operations:	%	(0.5%)	(0.5%)	–	–	0.5%	0.5%	1.0%	1.0%	1.0%	1.0%
Steel Fabrication Operations:	%	17.5%	18.0%	19.0%	19.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%
Other & Intracompany:	%	(48.0%)	(48.0%)	(48.0%)	(48.0%)	(48.0%)	(48.0%)	(48.0%)	(48.0%)	(48.0%)	(48.0%)

And then we summed up the revenue and operating income for each segment within the Free Cash Flow projections:

Steel Dynamics Inc. - FCF Projections:	Units:	Projected FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
Revenue:	$ M	**$ 7,716.0**	**$ 8,406.2**	**$ 9,259.3**	**$ 10,127.2**	**$ 11,006.6**	**$ 11,881.3**	**$ 12,850.7**	**$ 13,435.9**	**$ 13,914.3**	**$ 14,301.6**
Revenue Growth Rate:	%	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*	*7.9%*	*8.2%*	*4.6%*	*3.6%*	*2.8%*
Operating Income (EBIT):	$ M	**379.4**	**461.2**	**566.3**	**660.0**	**789.2**	**903.0**	**1,002.4**	**1,051.8**	**1,093.2**	**1,125.6**
Operating Margin:	%	*4.9%*	*5.5%*	*6.1%*	*6.5%*	*7.2%*	*7.6%*	*7.8%*	*7.8%*	*7.9%*	*7.9%*
Growth Rate:	%	*6.7%*	*21.6%*	*22.8%*	*16.5%*	*19.6%*	*14.4%*	*11.0%*	*4.9%*	*3.9%*	*3.0%*

3) Calculate NOPAT (Net Operating Profit After Taxes).

You should use the company's **effective tax rate** to calculate Net Operating Profit After Taxes: EBIT * (1 – Tax Rate) = NOPAT.

Don't get hung up on effective vs. statutory rates; just use a percentage that's in-line with historical rates:

	A	B	C	D	E	F	J	K	L	M	N	O	P	Q	R	S
82																
83												Projected				
84			Steel Dynamics Inc. - FCF Projections:			Units:	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
85																
86			**Revenue:**			$ M	**$ 7,716.0**	**$ 8,406.2**	**$ 9,259.3**	**$ 10,127.2**	**$ 11,006.6**	**$ 11,881.3**	**$ 12,850.7**	**$ 13,435.9**	**$ 13,914.3**	**$ 14,301.6**
87			*Revenue Growth Rate:*			%	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*	*7.9%*	*8.2%*	*4.6%*	*3.6%*	*2.8%*
88																
89			**Operating Income (EBIT):**			$ M	**379.4**	**461.2**	**566.3**	**660.0**	**789.2**	**903.0**	**1,002.4**	**1,051.8**	**1,093.2**	**1,125.6**
90			*Operating Margin:*			%	*4.9%*	*5.5%*	*6.1%*	*6.5%*	*7.2%*	*7.6%*	*7.8%*	*7.8%*	*7.9%*	*7.9%*
91			*Growth Rate:*			%	*6.7%*	*21.6%*	*22.8%*	*16.5%*	*19.6%*	*14.4%*	*11.0%*	*4.9%*	*3.9%*	*3.0%*
92																
93			(-) Taxes, Excluding Effect of Interest:			$ M	(151.8)	(184.5)	(226.5)	=-M89*Tax_Rate		(361.2)	(400.9)	(420.7)	(437.3)	(450.3)
94																
95			**Net Operating Profit After Taxes (NOPAT):**			$ M	**227.7**	**276.7**	**339.8**	**396.0**	**473.5**	**541.8**	**601.4**	**631.1**	**655.9**	**675.4**

The taxes here should **NOT** reflect the tax benefits of Debt (i.e., the ability to deduct interest expense) since this is an Unlevered analysis.

4) Project Depreciation & Amortization and Possibly Other Non-Cash Adjustments.

You often project D&A as a percentage of revenue and use the average historical percentage or make it decrease slightly over time as CapEx spending falls.

Deferred Income Taxes as a percentage of Income Statement Taxes should *decrease* over time because they represent simple timing differences.

Something is wrong with your analysis if Deferred Taxes are a major value driver. They should almost always decline over time as these timing differences reverse:

Steel Dynamics Inc. - FCF Projections:	Units:	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
				Projected							
Revenue:	*$ M*	$ 7,716.0	$ 8,406.2	$ 9,259.3	$ 10,127.2	$ 11,006.6	$ 11,881.3	$ 12,850.7	$ 13,435.9	$ 13,914.3	$ 14,301.6
Revenue Growth Rate:	*%*	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*	*7.9%*	*8.2%*	*4.6%*	*3.6%*	*2.8%*
Operating Income (EBIT):	*$ M*	**379.4**	**461.2**	**566.3**	**660.0**	**789.2**	**903.0**	**1,002.4**	**1,051.8**	**1,093.2**	**1,125.6**
Operating Margin:	*%*	*4.9%*	*5.5%*	*6.1%*	*6.5%*	*7.2%*	*7.6%*	*7.8%*	*7.8%*	*7.9%*	*7.9%*
Growth Rate:	*%*	*6.7%*	*21.6%*	*22.8%*	*16.5%*	*19.6%*	*14.4%*	*11.0%*	*4.9%*	*3.9%*	*3.0%*
(-) Taxes, Excluding Effect of Interest:	*$ M*	(151.8)	(184.5)	(226.5)	(264.0)	(315.7)	(361.2)	(400.9)	(420.7)	(437.3)	(450.3)
Net Operating Profit After Taxes (NOPAT):	*$ M*	**227.7**	**276.7**	**339.8**	**396.0**	**473.5**	**541.8**	**601.4**	**631.1**	**655.9**	**675.4**
Adjustments for Non-Cash Charges:											
(+) Depreciation & Amortization:	*$ M*	246.9	=+K99*K86	268.5	293.7	308.2	332.7	347.0	362.8	375.7	386.1
% Revenue:	*%*	3.2%	3.2%	2.9%	2.9%	2.8%	2.8%	2.7%	2.7%	2.7%	2.7%
(+) Deferred Income Taxes:	*$ M*	37.9	36.9	34.0	26.4	31.6	18.1	20.0	21.0	21.9	22.5
% Income Statement Taxes:	*%*	25.0%	20.0%	15.0%	10.0%	10.0%	5.0%	5.0%	5.0%	5.0%	5.0%

The percentage is decreasing slightly over time since CapEx as a % of Revenue also falls.

Historically, Deferred Taxes as a % of Income Taxes have been very high. But we don't want them to be a major value driver, so we greatly decrease the percentages over time.

There may be other items in this section that are recurring, related to the company's core business, and available to all investors, such as Deferred Rent and Deferred Commissions.

For those, the same methodology applies: Use the average historical percentage of revenue or make the percentages decline since these items represent simple timing differences.

You could make this step more complicated by setting up a full PP&E schedule and splitting CapEx and D&A into different segments, but that's unnecessary for a quick analysis.

5) Project the Change in Working Capital.

If you've already built a full 3-statement projection model for the company, this part is easy: Link to the Change in Working Capital from the Cash Flow Statement projections.

If not, simplify it and project the Change in Working Capital as a percentage of the Change in Revenue or as a percentage of Revenue.

Remember what the "Change in Working Capital" means: **Does the company *generate* more cash than expected as it grows, or does it *require* more cash to fuel that growth?**

In other words, as the company's sales grow, is its Change in Working Capital positive or negative?

We used a simple approach for Steel Dynamics:

Steel Dynamics Inc. - FCF Projections:	Units:	Historical FY13	FY14	FY15	Projected FY16	FY17	FY18	FY19	FY20	FY21
Revenue:	$ M	$ 7,372.9	$ 8,756.0	$ 7,594.4	$ 7,716.0	$ 8,406.2	$ 9,259.3	$ 10,127.2	$ 11,006.6	$ 11,881.3
Revenue Growth Rate:	%	*1.1%*	*18.8%*	*(13.3%)*	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*	*7.9%*
Operating Income (EBIT):	$ M	**386.8**	**580.3**	**355.7**	**379.4**	**461.2**	**566.3**	**660.0**	**789.2**	**903.0**
Operating Margin:	%	*5.2%*	*6.6%*	*4.7%*	*4.9%*	*5.5%*	*6.1%*	*6.5%*	*7.2%*	*7.6%*
Growth Rate:	%	*(1.1%)*	*50.0%*	*(38.7%)*	*6.7%*	*21.6%*	*22.8%*	*16.5%*	*19.6%*	*14.4%*
(-) Taxes, Excluding Effect of Interest:	$ M	(154.7)	(232.1)	(142.3)	(151.8)	(184.5)	(226.5)	(264.0)	(315.7)	(361.2)
Net Operating Profit After Taxes (NOPAT):	$ M	**232.1**	**348.2**	**213.4**	**227.7**	**276.7**	**339.8**	**396.0**	**473.5**	**541.8**
Adjustments for Non-Cash Charges:										
(+) Depreciation & Amortization:	$ M	230.9	263.3	294.6	246.9	269.0	268.5	293.7	308.2	332.7
% Revenue:	%	3.1%	3.0%	3.9%	3.2%	3.2%	2.9%	2.9%	2.8%	2.8%
(+) Deferred Income Taxes:	$ M	30.7	(25.0)	(99.3)	37.9	36.9	34.0	26.4	31.6	18.1
% Income Statement Taxes:	%	30.9%	(34.2%)	102.5%	25.0%	20.0%	15.0%	10.0%	10.0%	5.0%
(+/-) Change in Accounts Receivable:	$ M	(78.2)	(2.2)	311.3						
(+/-) Change in Inventory:	$ M	(108.0)	68.7	488.0						
(+/-) Change in Other Assets:	$ M	13.7	3.1	3.3						
(+/-) Change in Accounts Payable:	$ M	40.1	(76.1)	(227.1						
(+/-) Change in Income Tax Payable:	$ M	(12.5)	(22.1)	12.7						
(+/-) Change in Accrued Expenses:	$ M	15.0	36.7	(60.7						
Net Change in Working Capital:	$ M	**(129.9)**	**8.1**	**527.5**	=+I111*(I86-H86)		**(42.7)**	**(43.4)**	**(44.0)**	**(43.7)**
% Change in Revenue:	%	(157.1%)	0.6%	(45.4%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)
% Revenue:	%	*(1.8%)*	*0.1%*	*6.9%*	*(0.1%)*	*(0.4%)*	*(0.5%)*	*(0.4%)*	*(0.4%)*	*(0.4%)*

We simplified these items and just projected the Net Change as a % of the Change in Revenue.

6) Project Capital Expenditures.

Capital Expenditures **must** be linked to the company's sales growth.

Some models assume that CapEx **drives** revenue – for example, as an airline purchases more planes, it can sell more tickets and fly more passengers.

But it doesn't always work like that; CapEx grows with revenue, but it doesn't necessarily *drive* revenue.

Some companies, such as those in the software and services sectors, also depend far less on CapEx for sales growth.

It's reasonable to make CapEx a percentage of revenue because that reflects both the company's *maintenance* and *growth* spending:

		Historical			Proje				
Steel Dynamics Inc. - FCF Projections:	***Units:***	**FY13**	**FY14**	**FY15**	**FY16**	**FY17**	**FY18**	**FY19**	**FY20**
Revenue:	*$ M*	**$ 7,372.9**	**$ 8,756.0**	**$ 7,594.4**	**$ 7,716.0**	**$ 8,406.2**	**$ 9,259.3**	**$ 10,127.2**	**$ 11,006.6**
Revenue Growth Rate:	*%*	*1.1%*	*18.8%*	*(13.3%)*	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*
Operating Income (EBIT):	*$ M*	**386.8**	**580.3**	**355.7**	**379.4**	**461.2**	**566.3**	**660.0**	**789.2**
Operating Margin:	*%*	*5.2%*	*6.6%*	*4.7%*	*4.9%*	*5.5%*	*6.1%*	*6.5%*	*7.2%*
Growth Rate:	*%*	*(1.1%)*	*50.0%*	*(38.7%)*	*6.7%*	*21.6%*	*22.8%*	*16.5%*	*19.6%*
(-) Taxes, Excluding Effect of Interest:	*$ M*	(154.7)	(232.1)	(142.3)	(151.8)	(184.5)	(226.5)	(264.0)	(315.7)
Net Operating Profit After Taxes (NOPAT):	*$ M*	**232.1**	**348.2**	**213.4**	**227.7**	**276.7**	**339.8**	**396.0**	**473.5**
Adjustments for Non-Cash Charges:									
(+) Depreciation & Amortization:	*$ M*	230.9	263.3	294.6	246.9	269.0	268.5	293.7	308.2
% Revenue:	*%*	3.1%	3.0%	3.9%	3.2%	3.2%	2.9%	2.9%	2.8%
(+/-) Deferred Income Taxes:	*$ M*	30.7	(25.0)	(99.3)	37.9	36.9	34.0	26.4	31.6
% Income Statement Taxes:	*%*	30.9%	(34.2%)	102.5%	25.0%	20.0%	15.0%	10.0%	10.0%
(+/-) Change in Accounts Receivable:	*$ M*	(78.2)	(2.2)	311.3					
(+/-) Change in Inventory:	*$ M*	(108.0)	68.7	488.0					
(+/-) Change in Other Assets:	*$ M*	13.7	3.1	3.3					
(+/-) Change in Accounts Payable:	*$ M*	40.1	(76.1)	(227.1)					
(+/-) Change in Income Tax Payable:	*$ M*	(12.5)	(22.1)	12.7					
(+/-) Change in Accrued Expenses:	*$ M*	15.0	36.7	(60.7)					
Net Change in Working Capital:	*$ M*	**(129.9)**	**8.1**	**527.5**	**(6.1)**	**(34.5)**	**(42.7)**	**(43.4)**	**(44.0)**
% Change in Revenue:	*%*	(157.1%)	0.6%	(45.4%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)
% Revenue:	*%*	*(1.8%)*	*0.1%*	*6.9%*	*(0.1%)*	*(0.4%)*	*(0.5%)*	*(0.4%)*	*(0.4%)*
(-) Capital Expenditures:	*$ M*	**(186.8)**	**(111.8)**	**(114.5)**	=+J115*J86	**(294.2)**	**(296.3)**	**(324.1)**	**(341.2)**
% Revenue:	*%*	(2.5%)	(1.3%)	(1.5%)	(3.5%)	(3.5%)	(3.2%)	(3.2%)	(3.1%)

CapEx is a simple % of Revenue, and i always stays ahead of D&A.

Notice how D&A as a % of Revenue comes *close to* but doesn't exactly *equal* CapEx as a % of Revenue. If the company is growing, these percentages *should* be different!

Some sources claim that CapEx "should equal" D&A by the end, but that is **completely wrong**, at least if you assume continued cash flow growth beyond the end of the projected period.

That assumption might make more sense if the company were stagnant or declining by the end.

7) Calculate Unlevered FCF.

Start with NOPAT, factor in the non-cash adjustments, add or subtract the Change in Working Capital, and subtract CapEx to calculate Unlevered FCF:

		Historical			Projected					
Steel Dynamics Inc. - FCF Projections:	***Units:***	**FY13**	**FY14**	**FY15**	**FY16**	**FY17**	**FY18**	**FY19**	**FY20**	**FY21**
Revenue:	*$ M*	**$ 7,372.9**	**$ 8,756.0**	**$ 7,594.4**	**$ 7,716.0**	**$ 8,406.2**	**$ 9,259.3**	**$ 10,127.2**	**$ 11,006.6**	**$ 11,881.3**
Revenue Growth Rate:	*%*	*1.1%*	*18.8%*	*(13.3%)*	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*	*7.9%*
Operating Income (EBIT):	*$ M*	**386.8**	**580.3**	**355.7**	**379.4**	**461.2**	**566.3**	**660.0**	**789.2**	**903.0**
Operating Margin:	*%*	*5.2%*	*6.6%*	*4.7%*	*4.9%*	*5.5%*	*6.1%*	*6.5%*	*7.2%*	*7.6%*
Growth Rate:	*%*	*(1.1%)*	*50.0%*	*(38.7%)*	*6.7%*	*21.6%*	*22.8%*	*16.5%*	*19.6%*	*14.4%*
(-) Taxes, Excluding Effect of Interest:	*$ M*	(154.7)	(232.1)	(142.3)	(151.8)	(184.5)	(226.5)	(264.0)	(315.7)	(361.2)
Net Operating Profit After Taxes (NOPAT):	*$ M*	**232.1**	**348.2**	**213.4**	**227.7**	**276.7**	**339.8**	**396.0**	**473.5**	**541.8**
Adjustments for Non-Cash Charges:										
(+) Depreciation & Amortization:	*$ M*	230.9	263.3	294.6	246.9	269.0	268.5	293.7	308.2	332.7
% Revenue:	*%*	3.1%	3.0%	3.9%	3.2%	3.2%	2.9%	2.9%	2.8%	2.8%
(+/-) Deferred Income Taxes:	*$ M*	30.7	(25.0)	(99.3)	37.9	36.9	34.0	26.4	31.6	18.1
% Income Statement Taxes:	*%*	30.9%	(34.2%)	102.5%	25.0%	20.0%	15.0%	10.0%	10.0%	5.0%
Net Change in Working Capital:	*$ M*	**(129.9)**	**8.1**	**527.5**	**(6.1)**	**(34.5)**	**(42.7)**	**(43.4)**	**(44.0)**	**(43.7)**
% Change in Revenue:	*%*	(157.1%)	0.6%	(45.4%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)
% Revenue:	*%*	*(1.8%)*	*0.1%*	*6.9%*	*(0.1%)*	*(0.4%)*	*(0.5%)*	*(0.4%)*	*(0.4%)*	*(0.4%)*
(-) Capital Expenditures:	*$ M*	**(186.8)**	**(111.8)**	**(114.5)**	**(270.1)**	**(294.2)**	**(296.3)**	**(324.1)**	**(341.2)**	**(368.3)**
% Revenue:	*%*	(2.5%)	(1.3%)	(1.5%)	(3.5%)	(3.5%)	(3.2%)	(3.2%)	(3.1%)	(3.1%)
Unlevered Free Cash Flow:	*$ M*	**$ 177.0**	**$ 482.8**	**$ 821.7**	**=+J95+J98+J101+J110+J114**			**$ 348.6**	**$ 428.1**	**$ 480.5**
Growth Rate:	*%*	*N/A*	*172.7%*	*70.2%*	*(71.2%)*	*7.4%*	*19.4%*	*14.9%*	*22.8%*	*12.2%*

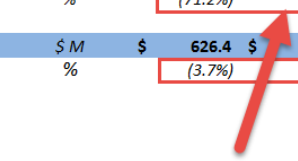
You might also include supplemental information, such as the growth rates and margins for different metrics, at the bottom.

You can check your work up to this point by calculating the **growth rates** for Revenue, Unlevered FCF, and EBITDA.

A company's FCF should grow more and more slowly until the end of the forecast period, and then it should grow at a low, constant rate – the Terminal Growth Rate – into perpetuity.

If your analysis does **NOT** reflect these slowing growth rates, or the rates are much higher than GDP growth by the end of the forecast period, then you need to re-think your assumptions:

			Projected									
Steel Dynamics Inc. - FCF Projections:	***Units:***	**FY16**	**FY17**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**	**FY23**	**FY24**	**FY25**
Revenue:	*$ M*	$ 7,716.0	$ 8,406.2	$ 9,259.3	$ 10,127.2	$ 11,006.6	$ 11,881.3	$ 12,850.7	$ 13,435.9	$ 13,914.3	$ 14,301.6
Revenue Growth Rate:	*%*	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*	*7.9%*	*8.2%*	*4.6%*	*3.6%*	*2.8%*
Unlevered Free Cash Flow:	*$ M*	$ 236.4	$ 253.9	$ 303.3	$ 348.6	$ 428.1	$ 480.5	$ 534.4	$ 582.6	$ 612.1	$ 635.6
Growth Rate:	*%*	*(71.2%)*	*7.4%*	*19.4%*	*14.9%*	*22.8%*	*12.2%*	*11.2%*	*9.0%*	*5.1%*	*3.8%*
EBITDA:	*$ M*	$ 626.4	$ 730.2	$ 834.8	$ 953.7	$ 1,097.4	$ 1,235.7	$ 1,349.3	$ 1,414.6	$ 1,468.9	$ 1,511.8
Growth Rate:	*%*	*(3.7%)*	*16.6%*	*14.3%*	*14.2%*	*15.1%*	*12.6%*	*9.2%*	*4.8%*	*3.8%*	*2.9%*



Notice how **ALL** of these growth rates slow down over time and approach the expected long-term GDP growth rate or rate of inflation by the end of the 10-year forecast period. That's what we want to see!

If we didn't see both of those, we'd have to go back and revisit the assumptions or possibly extend the forecast period.

You should also check:

- **Operating Margins and Items as Percentages of Revenue:** These should stabilize so that they are no longer changing much by the end of the forecast period.

- **Case Study Instructions:** Are you reflecting everything outlined in the case study instructions or the instructions from the senior banker? For example, if they told you to assume a pricing decline followed by a recovery, do your revenue projections match up?

- **ROIC, ROE, ROA, and Other Metrics:** You could check the returns-based metrics to make sure they stabilize by the end of the forecast period, but this will require more work since you'll have to track Debt, Equity, and Total Assets.

If anything above is problematic, you can fix it by **extending the projection period** and assuming slowing growth rates and stabilizing percentages as you move toward the end of that period.

Return to Top.

Key Rule #3: DCF – Discount Rates and WACC

Once you've projected the company's Unlevered Free Cash Flow in this explicit forecast period, you discount those cash flows at the appropriate Discount Rate.

The Discount Rate represents the **opportunity cost** for the investor – what he or she could earn each year by investing in other, similar companies.

A higher Discount Rate means the risk and potential returns are both higher; a lower Discount Rate implies lower risk and lower potential returns.

A *higher* Discount Rate makes a company *less* valuable because it means the investor has better options elsewhere; a *lower* Discount Rate makes a company *more* valuable because it means the investor has worse options elsewhere.

You can invest in a company in many ways: You can purchase its common shares, buy its bonds, buy its Preferred Stock, or purchase other securities it issues.

Since companies have multiple sources of capital, they also have multiple Discount Rates, and each part of the capital structure has a different rate.

The most important Discount Rates for valuation/DCF purposes are:

- **Cost of Equity:** This represents the "opportunity cost" for just the company's common stock – what investors could earn from stock price increases and dividends.
- **Cost of Debt:** This one is for the company's outstanding debt, and it represents what investors could earn from interest and changes in the market value of debt.
- **Cost of Preferred Stock:** This one is similar to the Cost of Debt, but it's for Preferred Stock, which tends to have higher coupon rates; also, Preferred Dividends are not tax-deductible.

To determine the *overall* Discount Rate for the company, you calculate **WACC**, the Weighted Average Cost of Capital:

WACC = Cost of Equity * % Equity + Cost of Debt * (1 – Tax Rate) * % Debt * + Cost of Preferred Stock * % Preferred Stock

WACC always pairs with Unlevered FCF because both WACC and Unlevered FCF represent **all** the investors in the company.

If you invest *proportionally* in the company's entire capital structure, WACC gives you the expected, long-term annualized return.

For example, if the company uses 80% Equity and 20% Debt and it has a 40% tax rate, and you decide to invest $1,000 in the company, you could calculate WACC with the following method:

- **Cost of Equity:** Similar companies' stock prices have increased by 8% per year, on average, and their dividends have yielded an additional 2%. The Cost of Equity is 10%.
- **Cost of Debt:** The effective yield on the company's Debt is 6%, and other companies also have yields of around 6%.
- **WACC:** It equals 10% * 80% + 20% * 6% * (1 – 40%) = 8.7%.

So, you should expect to earn an *average* of $87 on your initial $1,000 over the very long term (with big fluctuations in between).

A significant portion of this gain will come from stock price appreciation, so you won't earn anything close to $87 in cash until you sell your entire investment.

The Cost of Debt and Cost of Preferred Stock

These represent the rates the company would pay if it issued *additional* Debt or Preferred Stock.

You can't predict what those rates will be, but you can make a rough approximation by using the *current* coupon rates on the company's Debt or Preferred Stock.

So, if the company has $1,000 of bonds and the coupon rate is 5.0%, that's the company's Pre-Tax Cost of Debt. Interest paid on Debt is tax-deductible, so you multiply by (1 – Tax Rate) to use it in the WACC formula.

If the company has $1,000 of bonds at a coupon rate of 5.0% and another $1,000 of bonds at a coupon rate of 6.0%, then its Pre-Tax Cost of Debt is 5.5%.

If the company has $1,000 in Preferred Stock, and it issues $100 in Preferred Dividends per year, the Cost of Preferred Stock is 10.0%. Preferred Dividends are **not** tax-deductible, so you do **not** multiply by (1 – Tax Rate).

You could also look at the **Yield to Maturity (YTM)** on the Debt, which reflects its current market price, or you could look at coupon rates or the YTM of Debt issued by peer companies.

With the YTM, the basic idea is that if a company's bonds trade at a *discount* to par value (e.g., they were issued at $1,000, but you can buy them for $990 right now), then the yield is **higher** than the coupon rate on the bond.

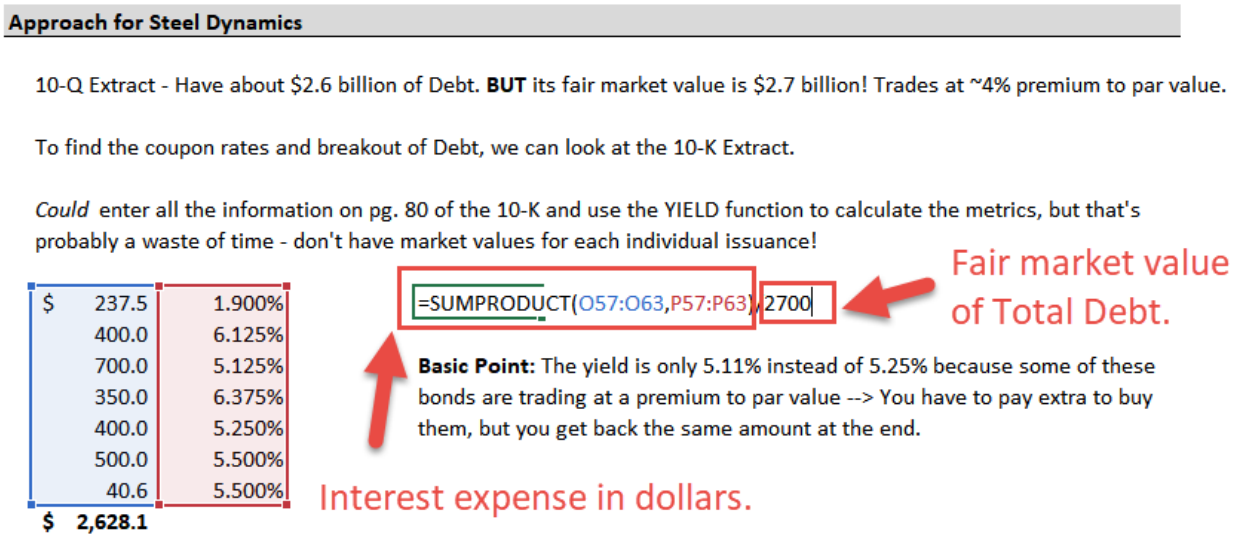
That's because you can purchase the bonds for only $990 but receive $1,000 at the end, as well as the interest in between. If the stated coupon rate is 5.0%, the actual yield is more like 5.2% over a 5-year holding period in this scenario.

The opposite applies to bonds trading at a *premium* to par value: The yield you receive will be **less** than the coupon rate on the bond since you get back *less* upon maturity.

Since YTM reflects market conditions, it might be closer to the rate the company would pay on *additional* Debt.

Steel Dynamics had ~$2.6 billion of Debt on its Balance Sheet at the time of this valuation, but the fair market value of the Debt was $2.7 billion.

To estimate the Cost of Debt, we calculated the company's annual interest expense and divided it by this $2.7 billion figure:



That resulted in a Pre-Tax Cost of Debt of 5.11% vs. 5.25% if we had ignored the market value of Debt. This difference is so small that it barely matters, but for some companies, it could be much bigger.

Finally, a more academic approach is to take the **Risk-Free Rate** – the coupon rate on government bonds in the country – and then add a "default spread" based on the company's expected credit rating after it issues additional Debt.

For example, if the company's EBITDA / Interest is currently 2x and is expected to remain below 2.5x following another issuance, that might imply a BB+ credit rating.

Companies with BB+ credit ratings might pay, on average, 2.50% above the Risk-Free Rate on Debt they issue.

So, if the Risk-Free Rate is currently 3.00%, then the company's Pre-Tax Cost of Debt is 5.50%.

You could use any of these methods to estimate the Cost of Debt, and for most *healthy* companies, they will produce similar results.

The only difference between the Cost of Debt and Cost of Preferred Stock is that you have to multiply the Cost of Debt by (1 – Tax Rate) since interest on Debt is tax-deductible.

But Preferred Dividends are not tax-deductible, so you don't do this for Preferred Stock.

Preferred Stock is uncommon in most industries, so you rarely calculate the Cost of Preferred; Steel Dynamics and all of its peer companies had no Preferred Stock, so we skipped this step.

The Cost of Equity

The **Cost of Equity** is much trickier to determine because you cannot observe it directly.

It tells you how much a company's stock "should" return each year, on average, over the long term, factoring in both stock price appreciation and dividends.

You usually use the **Capital Asset Pricing Model (CAPM)** to determine the Cost of Equity:

Cost of Equity = Risk-Free Rate + Equity Risk Premium * Levered Beta.

The **Risk-Free Rate (RFR)** represents what you could earn on "safe" government bonds denominated in the same currency as this company's cash flows.

If it's a French company but it has mostly U.S.-based customers, and it records its financials in U.S. Dollars, you would use the current rate on U.S. Treasury bonds.

You usually use the rate on 10-year government bonds to match the projection period of the DCF, but 20-year or 30-year rates are common as well.

Levered Beta tells you how *volatile* this stock is relative to the market as a whole, factoring in both the intrinsic business risk and the risk introduced by leverage (i.e., Debt).

If Beta is 1.0, when the market goes up by 10%, this company's stock goes up by 10%.

If Beta is 2.0, when the market goes up by 10%, this company's stock goes up by 20%.

If Beta is 0.5, when the market goes up by 10%, this company's stock goes up by 5%.

You could calculate Beta based on the company's stock price history or via analysis of peer companies.

And the **Equity Risk Premium (ERP)** represents the percentage the stock market will return each year, on average, above and beyond the rate on "safe" government bonds.

This one is always linked to the company's country and local stock market, but no one *ever* agrees on how to calculate it.

The main points of disagreement are:

- Do you use **historical numbers** or **projected ones**? Projected ones make more sense, but how can you "project" stock market performance?
- Do you use the **arithmetic** or **geometric** mean?
- What **period** do you use? Do you go back 10 years? 20? 50? 100?

Finance textbooks use numbers ranging from 3% to 11% for the ERP; we tend to use numbers in the middle of that range, such as 6-8%, for companies in developed countries like the U.S. and U.K.

You could also look at sources such as Damodaran's data on the ERP in different countries and time periods to estimate it based on historical performance.

The Equity Risk Premium will be significantly higher in emerging markets (Africa, Latin America, parts of Asia, etc.) because the risk and potential returns are both higher.

If the company operates in multiple countries, you might "weight" the Equity Risk Premium and multiply the ERP in each country by the percentage of revenue from that country to determine the company-wide ERP.

Don't obsess too much over these calculations.

No one agrees on how to calculate the Discount Rate, and in interviews, case studies, and modeling tests, it's far more important to project a company's cash flows reasonably.

The Process of Calculating Cost of Equity

Theoretically, you could use a company's historical Beta in the Cost of Equity calculation and leave it at that.

But it's better to look at **peer companies** and use the median figure from those.

The whole point of a valuation is to determine a company's **Implied Value:** What it *should be worth* according to your views.

Using the company's *past performance* for Beta corresponds more closely to its Current Value rather than its Implied Value, which runs counter to the purpose of a valuation.

So, just like you might calculate EV / EBITDA for similar companies and then apply the median multiple to the company you're valuing, you do something similar with Beta.

But it's not as simple as using the median Beta from similar companies.

Beta always reflects 2 risks: **Inherent business risk** and **risk from leverage**.

When you look up a company's Beta in Google Finance or Bloomberg, it reflects both those risks.

Each peer company has a different capital structure, so the **risk from leverage** will differ for each one.

To remove this risk from leverage and isolate the **inherent business risk**, you have to "un-lever Beta."

And then you have to "re-lever Beta" to make it reflect the risk from the leverage of the company you're valuing.

Unlevered vs. Levered Beta has nothing to do with Unlevered vs. Levered Free Cash Flow.

You complete this process of un-levering and re-levering Beta *regardless of the type of Free Cash Flow you're using*.

That's because you **always** calculate the Cost of Equity, and the same components **always** go into the Cost of Equity.

Here's a simple example: Let's say that "Levered Beta" for a peer company is 1.00, and the company has $500 of Debt and an Equity Value of $1,000. Its tax rate is 40%.

Leverage accounts for part of this company's risk, so you need to **reduce Beta** by removing the risk from leverage:

Unlevered Beta = Levered Beta / (1 + Debt / Equity Ratio * (1 – Tax Rate) + Preferred / Equity Ratio)

Unlevered Beta = 1.00 / (1 + $500 / $1000 * (1 – 40%)) = 0.7692.

This result means that **23% of this company's risk comes from Debt**. It's not 33% (1.00 / (1 + $500 / $1,000)) because the tax-deductibility of interest reduces the risk of Debt.

The formula includes a "1 +" in front of "Debt / Equity Ratio * (1 – Tax Rate)" to ensure that **Unlevered Beta is always less than or equal to Levered Beta**.

You look up the financial information for each peer company, un-lever Beta for each one, and calculate the median Unlevered Beta:

Comparable Companies - Unlevered Beta Calculation:

Name	Ticker	Levered Beta	Debt	% Debt	Preferred Stock	% Preferred	Equity Value	% Equity	Tax Rate	Unlevered
United States Steel Corp.	X	2.49	$ 3,140.0	50.1%	$ -	–	$ 3,130.1	49.9%	40.0%	=D15/(1+(E15/I15)*(1-K15)+G15/I15)
Nucor Corporation	NUE	1.50	4,357.5	21.8%	-	–	15,609.0	78.2%	29.7%	1.25
Commercial Metals Company	CMC	1.58	1,080.0	37.8%	-	–	1,776.7	62.2%	32.6%	1.12
AK Steel Holding Corporation	AKS	2.57	2,078.1	66.7%	-	–	1,036.2	33.3%	40.0%	1.17
Worthington Industries, Inc.	WOR	1.53	584.0	17.6%	-	–	2,732.3	82.4%	27.1%	1.32
Reliance Steel & Aluminum Co.	RS	1.59	2,169.4	29.2%	-	–	5,259.1	70.8%	31.8%	1.24
Median:		**1.59**	**$ 2,123.8**	**33.5%**	**$ -**	**–**	**$ 2,931.2**	**66.5%**	**32.2%**	**1.25**

Notice how Unlevered Beta is always **less than or equal to** Levered Beta. That's because Levered Beta reflects 2 "risks": Risk from Debt and Inherent Business Risk, while Unlevered Beta just reflects Inherent Business Risk.

If a company had **no Debt**, Unlevered and Levered Beta would be the same.

It's best to use the market values of Debt, Equity, and Preferred Stock, but it matters most for Equity; it's not the end of the world if you can't find it for Debt or Preferred Stock.

Then, you re-lever this median Unlevered Beta by flipping around the formula above:

Levered Beta = Unlevered Beta * (1 + Debt / Equity Ratio * (1 – Tax Rate) + Preferred / Equity Ratio)

Let's say the median Unlevered Beta for the peer companies is 0.80. The company we're valuing has $800 in Debt, Equity of $2,000, no Preferred Stock, and a tax rate of 40%.

We can re-lever Beta with this formula:

Levered Beta = 0.80 * (1 + $800 / $2000 * (1 – 40%))

Levered Beta = 0.992.

You can interpret this result as: "If we ignore the risk from the company's Debt, its stock price is ~80% correlated with the stock market as a whole. But once we factor in that risk from Debt, its stock price is nearly 100% correlated with the overall market."

We could then use this result to calculate Cost of Equity for the company.

If the Risk-Free Rate is 2.50%, the Equity Risk Premium is 7.00%, and Levered Beta is 0.992:

Cost of Equity = 2.50% + 7.00% * 0.992 = 9.44%.

Just one small problem: You don't necessarily want to use the company's *current* capital structure to calculate the Cost of Equity!

This point goes back to the **core purpose of valuation:** Calculating a company's *Implied Value* and comparing it with the company's *Current Value*.

You un-lever Beta from the peer companies and re-lever it to move closer to that *Implied Value*, and you should do something similar with the capital structure.

Finance textbooks tell you to use the company's "optimal capital structure" or "targeted capital structure" to do this.

So, if the company eventually plans to use 40% Debt, 50% Equity, and 10% Preferred Stock, then you should use those figures when re-levering Beta to calculate Cost of Equity.

But in real life, companies never disclose their planned capital structures.

"Optimal capital structure" is the mix of Debt, Equity, and Preferred Stock that minimizes WACC, but it's impossible to observe or calculate.

So, you often use the median capital structure percentages of the peer companies and apply them to your company to determine its "optimal" or "targeted" structure.

Let's say that we analyzed the peer companies for this company with $800 of Debt and Equity of $2,000. The median Debt / Total Capital Ratio was 20%, and the median Equity / Total Capital Ratio was 80%.

Our company has Total Capital of $2,800, so these percentages tell us that it "should have" 20% * $2,800, or $560, of Debt, and 80% * $2,800, or $2,240, of Equity.

As a result, the calculations for both Levered Beta and Cost of Equity change:

Levered Beta = 0.80 * (1 + $560 / $2,240 * (1 – 40%)) = 0.92.

Cost of Equity = 2.50% + 7.00% * 0.92 = 8.94%.

The interpretation is simple: **Since the company *should have* less Debt in the future, the risk from leverage *will be* lower, which means that Levered Beta and Cost of Equity will be *lower***.

You can still use the company's *current* capital structure, but you should then use its Historical Levered Beta – avoid the peer companies altogether – to keep things consistent.

Here's what it looks like in real life for Steel Dynamics:

Discount Rate Calculations - Assumptions:	
Risk-Free Rate:	1.55%
Equity Risk Premium:	7.00%
Pre-Tax Cost of Debt:	5.11%
Cost of Preferred Stock:	–

Comparable Companies - Unlevered Beta Calculation:

Name	Levered Beta	Debt	% Debt	Preferred Stock	% Preferred	Equity Value	% Equity	Tax Rate	Unlevered Beta
United States Steel Corp.	2.49	$ 3,140.0	50.1%	$ -	–	$ 3,130.1	49.9%	40.0%	1.55
Nucor Corporation	1.50	4,357.5	21.8%	-	–	15,609.0	78.2%	29.7%	1.25
Commercial Metals Company	1.58	1,080.0	37.8%	-	–	1,776.7	62.2%	32.6%	1.12
AK Steel Holding Corporation	2.57	2,078.1	66.7%	-	–	1,036.2	33.3%	40.0%	1.17
Worthington Industries, Inc.	1.53	584.0	17.6%	-	–	2,732.3	82.4%	27.1%	1.32
Reliance Steel & Aluminum Co.	1.59	2,169.4	29.2%	-	–	5,259.1	70.8%	31.8%	1.24
Median:	**1.59**	**$ 2,123.8**	**33.5%**	**$ -**	**–**	**$ 2,931.2**	**66.5%**	**32.2%**	**1.25**
Steel Dynamics Inc.	**1.72**								

Steel Dynamics Inc. - Levered Beta & WACC Calculation:

	Unlevered Beta	Debt	% Debt	Preferred Stock	% Preferred	Equity Value	% Equity	Tax Rate	Levered Beta
Current Capital Structure:	1.25	$ 2,700.0	30.9%	$ -	–	$ 6,043.2	69.1%	40.0%	1.58
"Optimal" Capital Structure:	1.25	2,929.3	33.5%	-	–	5,813.9	66.5%	40.0%	1.62

Cost of Equity Based on Comparables, Current Capital Structure:	12.62%
Cost of Equity Based on Comparables, "Optimal" Capital Structure:	12.92%
Cost of Equity Based on Historical Beta:	13.59%

There isn't necessarily one single "correct" way to calculate Cost of Equity, which is why we look at multiple methods here (Current vs. Optimal Capital Structure vs. Historical Beta).

Our **conclusion** is that Cost of Equity is most likely between 12.5% and 13.5%.

The screenshot above might resemble a bag of skittles, but the takeaway is simple: There are many ways of calculating the Cost of Equity.

No single method is necessarily "the best," so you look the *range* of outputs from different methods to estimate it.

Putting It All Together to Calculate WACC

Now you understand everything that makes WACC tricky to calculate:

WACC = Cost of Equity * % Equity + Cost of Debt * (1 – Tax Rate) * % Debt + Cost of Preferred Stock * % Preferred Stock

- You could use the company's **current capital structure** or **optimal/targeted capital structure** for the percentages of Equity, Debt, and Preferred Stock.

- There are different approaches for calculating **Cost of Equity**, including un-levering and re-levering Beta from peer companies or using the company's historical Beta.
- No one agrees on the appropriate **Equity Risk Premium** in the Cost of Equity calculation.
- And there are different approaches (Coupon rates, YTM, issuances from peer companies) for calculating the **Cost of Debt** and **Cost of Preferred Stock**.

Our advice remains the same: **Don't over-think the calculation**.

Rather than assuming that one approach is "the best," look at a variety of approaches and use the *range* of results. Here's an example for Steel Dynamics:

Steel Dynamics Inc. - Levered Beta & WACC Calculation:	Unlevered Beta	Debt	% Debt	Preferred Stock	% Preferred	Equity Value	% Equity	Tax Rate	Levered Beta
Current Capital Structure:	1.25	$ 2,700.0	30.9%	$ -	–	$ 6,043.2	69.1%	40.0%	1.58
"Optimal" Capital Structure:	1.25	2,929.3	33.5%	-	–	5,813.9	66.5%	40.0%	1.62

Cost of Equity Based on Comparables, Current Capital Structure:	12.62%
Cost of Equity Based on Comparables, "Optimal" Capital Structure:	12.92%
Cost of Equity Based on Historical Beta:	13.59%

WACC = Cost of Equity * % Equity + Cost of Debt * (1 - Tax Rate) * % Debt + Cost of Preferred Stock * % Preferred Stock

WACC, Current Capital Structure:	9.67%
WACC, "Optimal" Capital Structure:	9.62%
WACC, Current Capital Structure and Historical Cost of Equity:	10.34%
Average WACC Produced by All Methods:	9.88%

Valuation is all about **ranges**. Which Cost of Equity or WACC is "correct"?

We don't know, and there's no real way to tell. However, we can be reasonably certain that the company's Cost of Equity and WACC are somewhere *within, or close to, these ranges*.

When you create sensitivity tables to analyze the company's Implied value under different assumptions, you'll link the Discount Rates in the tables to these ranges.

Discounting the Cash Flows

Once you have WACC, you can go back to the Free Cash Flow projections and **discount FCF in each year to its Present Value**.

You could use the built-in NPV function in Excel, or you could use the formula you learned in the first guide:

Present Value = Cash Flow / ((1 + Discount Rate) ^ Year #)

The only question is whether or not you should use *the same* Discount Rate each year.

After all, couldn't a company's risk profile change as it matures over time?

Yes, it could. So, if the company is changing significantly in the explicit forecast period, you **should** change its Discount Rate over time.

You might assume that the company's "long-term" Discount Rate is close to the rate for mature companies in its industry.

If WACC is currently higher than that, you might start out at a higher number and make it decline to the "mature company rate" over time.

For example, if the company's current WACC is between 11% and 13%, and WACC for mature companies in the industry is between 8% and 9%, you might start it at 12% and reduce it by 0.4% per year until it reaches 8.4% in Year 10.

For Steel Dynamics, we used the same WACC each year because:

1) The company is mature and isn't expected to change significantly in the future.

2) Other mature companies in this industry have WACCs in a similar range.

So, we used the same Discount Rate each year, discounted each cash flow to its Present Value, and summed up everything as follows:

Steel Dynamics Inc. - FCF Projections:	Units:	Projected FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
Unlevered Free Cash Flow:	$ M	$ 236.4	$ 253.9	$ 303.3	$ 348.6	$ 428.1	$ 480.5	$ 534.4	$ 582.6	$ 612.1	$ 635.6
Growth Rate:	%	*(71.2%)*	*7.4%*	*19.4%*	*14.9%*	*22.8%*	*12.2%*	*11.2%*	*9.0%*	*5.1%*	*3.8%*
Discount Period:	#	1	2	3	4	5	6	7	8	9	10
Discount Rate (WACC):	%	9.88%	9.88%	9.88%	9.88%	9.88%	9.88%	9.88%	9.88%	9.88%	9.88%
Cumulative Discount Factor:	#	0.910	0.828	0.754	0.686	0.624	0.568	0.517	0.471	0.428	0.390
PV of Unlevered FCF:	$ M	$ 215.1	$ 210.3	=+L117*L122	$ 239.2	$ 267.3	$ 273.1	$ 276.4	$ 274.2	$ 262.2	$ 247.8

The company isn't changing much over time and is already mature, so we use the same Discount Rate each year. The "Cumulative Discount Factor" is just 1 / ((1 + Discount Rate)^Discount Period).

We have now completed the first part of this analysis – projecting the company's Unlevered Free Cash Flow in the explicit forecast period and discounting everything to Present Value.

Return to Top.

Key Rule #4: DCF – Terminal Value

Once you've projected the company's Unlevered FCF, calculated the Discount Rate, and summed up the Present Value of FCF each year, you calculate the company's value in the **far-future period**, otherwise known as the **Terminal Period**.

You also move back to my favorite formula:

Company Value = Cash Flow / (Discount Rate – Cash Flow Growth Rate), where Cash Flow Growth Rate < Discount Rate

This formula *alone* doesn't let you value any company because the company's Cash Flow, Cash Flow Growth Rate, and Discount Rate change over time.

As a result, you project the company's cash flows explicitly for the first 5, 10, or 15 years.

But in the Terminal Period, you assume that the company's Discount Rate and Cash Flow Growth Rate stay the same.

The company's Cash Flow might keep changing, but the two other components of that formula remain constant.

The company's value in this Terminal Period is called its **Terminal Value**, and you can use the same formula to calculate it:

Terminal Value = Unlevered FCF in Year 1 of Terminal Period / (WACC – Terminal Unlevered FCF Growth Rate)

Since you need the Unlevered FCF in Year 1 of the Terminal Period, you must project FCF one year *beyond* the end of the explicit forecast period.

You often do that by multiplying the last FCF in the forecast period by (1 + Terminal Growth Rate).

So, if you expect the company's FCF to grow at 3% indefinitely, you might assume that its first FCF in the Terminal Period equals its Final Forecast Year FCF * 1.03.

That's why people often write the formula like this:

Terminal Value = Final Forecast Year FCF * (1 + Terminal FCF Growth Rate) / (Discount Rate – Terminal FCF Growth Rate)

This calculation is known as the **Gordon Growth Method**.

The Terminal FCF Growth Rate should be **low** – below the GDP growth rate of the country, and perhaps in-line with the rate of inflation.

If the economy as a whole is growing at 3% per year, no company could ever grow at 5% into perpetuity.

If it did, eventually it would be bigger than the entire economy!

Even if a company grows at a higher rate initially, **growth always slows down over time**.

Here's a growth progression that makes sense and another one that does not make sense:

- **Makes Sense:** In the explicit forecast period, FCF Growth is 10% in Year 1, and it declines to 3% by Year 10. The Terminal FCF Growth Rate is 2%.

- **Does Not Make Sense:** In the explicit forecast period, FCF Growth is 10% in Year 1, and it declines to 8% by Year 10. The Terminal FCF Growth Rate is 6%.

The second scenario doesn't make sense because FCF growth doesn't decline enough in the explicit forecast period, and the Terminal FCF Growth Rate is far too high.

In *developed markets* such as the U.S., U.K., and Canada, you should use percentages in the low single digits (i.e., 1-3%) for the Terminal FCF Growth Rate.

But even in emerging markets, no company can grow at 6% forever.

China or India might be growing at 6-7% per year *right now*, but that rate will slow down eventually, and *individual companies* will grow at even lower rates.

So, even if you're in an emerging market, you shouldn't use a dramatically higher number for the Terminal FCF Growth Rate: Maybe 3-4% instead of 1-2%, but **not** 6-7%.

If the company's FCF growth rate far exceeds this percentage, even at the end of a 10-year period, you might extend the projection period to 15, 20, or even 30 years so that you can assume more of a decrease in the growth rate over time.

The FCF growth rate at the end of the explicit forecast period should be *fairly* close to the Terminal FCF Growth Rate.

From the last section, you know that **multiples are shorthand for valuation**, which means that you can also calculate the Terminal Value using the **Multiples Method**.

Terminal Value = Terminal EBITDA or EBIT or NOPAT or FCF Multiple * Relevant Metric

You might base the Terminal Multiple on the multiples of publicly traded peer companies, but you often apply a **substantial discount** because multiples tend to decrease over time.

If the Discount Rates of the peer companies are similar – which should be the case if you've selected them properly – then **higher multiples** imply **higher growth rates**.

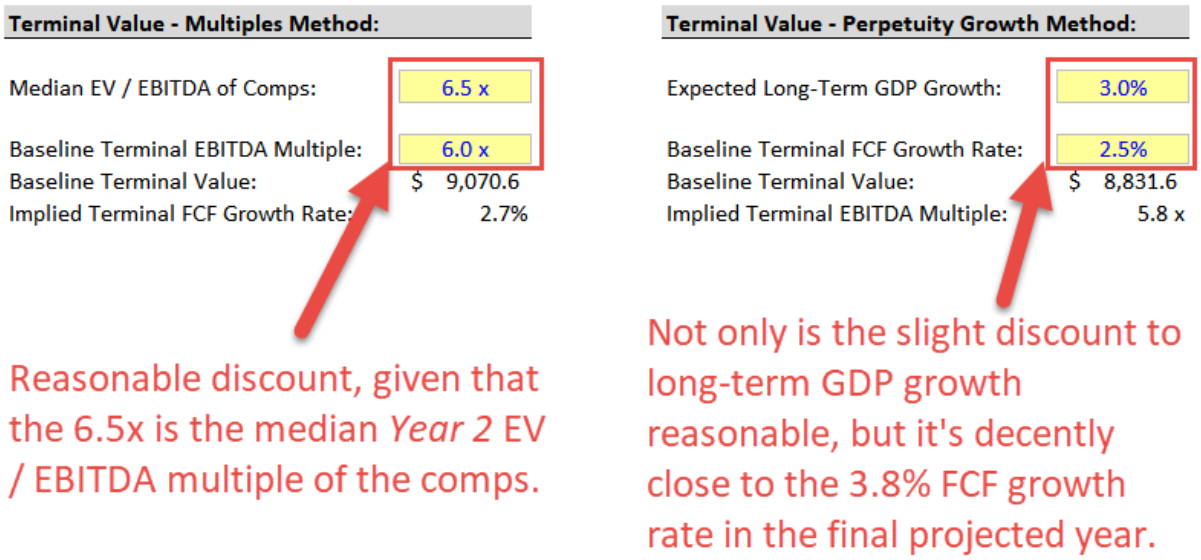
This relationship explains why young, fast-growing companies tend to trade at higher multiples, while older, mature companies tend to trade at lower multiples.

The Discount Rate will decline as companies grow bigger, but the expected growth rate will decline by *more than* the Discount Rate in most cases.

As a result, the denominator in the "Company Value" formula (Discount Rate – Cash Flow Growth Rate) will get bigger, and the output of the formula will decrease.

So, if the peer companies are trading at EBITDA multiples between 10x and 12x, you might assume 8x to 10x for your initial range in the analysis.

Here are the calculations for Steel Dynamics:



The Most Important Point: Cross-Check Your Work!

Neither method for calculating Terminal Value is "better": They just offer different advantages and disadvantages.

For example, if there are no truly comparable companies, the Multiples Method is useless.

But if your country's long-term GDP growth is highly uncertain, or your country's government is unstable, the Gordon Growth Method might not work so well.

Rather than relying on a single method, the BEST solution is to use <u>each</u> method to cross-check your work.

For example, let's say that you pick 3% for the Terminal FCF Growth Rate. That produces a Terminal Value of $1.5 billion, which represents a Terminal EBITDA Multiple of 10.0x.

The peer companies are currently trading at EBITDA multiples of 12.0x – 14.0x, so this result seems reasonable.

But now let's say that you pick a Terminal EBITDA Multiple of 8.0x, which produces a Terminal Value of $2 billion. The implied Terminal FCF Growth Rate is 6%.

Now you have a problem because this number is **way too high**. You need to pick a lower multiple so that the implied Terminal FCF Growth Rate makes more sense.

Calculating the implied Terminal Multiple if you've used the Gordon Growth Method is straightforward: Take the Terminal Value and divide by EBITDA, EBIT, or any other metric in the final year.

If you've used the Multiples Method, you can use algebraic manipulation to back into the Implied Growth Rate:

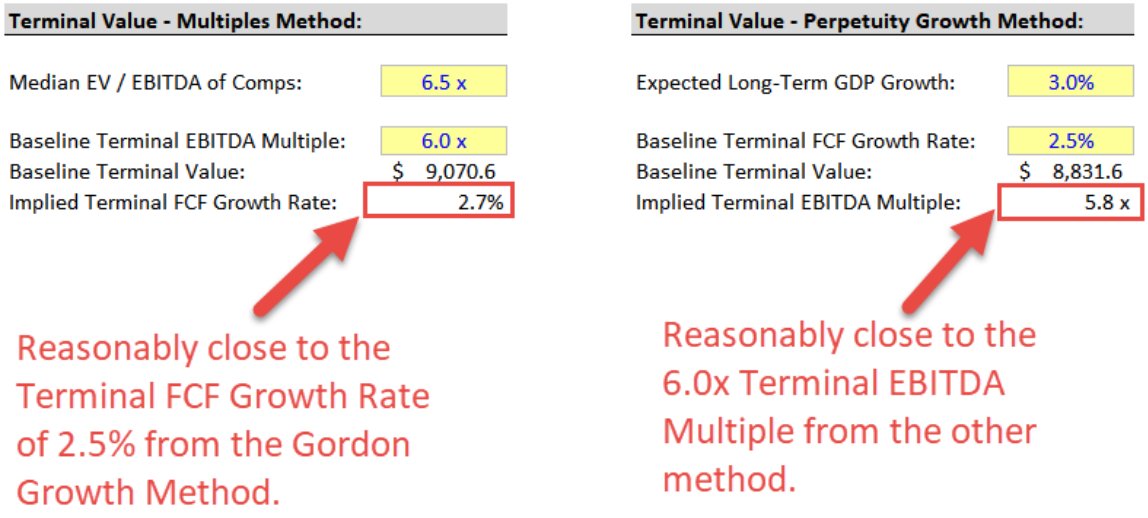
Terminal Value = Final Year FCF * (1 + Terminal FCF Growth Rate) / (Discount Rate – Terminal FCF Growth Rate)

Implied Terminal FCF Growth Rate = (Terminal Value * Discount Rate – Final Year FCF) / (Terminal Value + Final Year FCF)

We're not going to show the full derivation, but you start by multiplying both sides of the first equation by (Discount Rate – Terminal FCF Growth Rate), and then you use algebra to isolate the Terminal FCF Growth Rate term.

Use both methods to cross-check your work and ensure that your Terminal Value assumptions are reasonable.

If your assumptions are **not** reasonable, then you need to pick new ones or extend the forecast period. Here are the calculations for Steel Dynamics:



Based on these results, our assumptions seem reasonable.

Discounting and Summing the PV of the Terminal Value

Once you've calculated the Terminal Value, you must **discount it back to its Present Value**.

Remember that the Terminal Value represents a company's value *from* Year 5, 10, or 15, onward into infinity *as of the end* of Year 5, 10, or 15.

But you're calculating what the company is worth **today**.

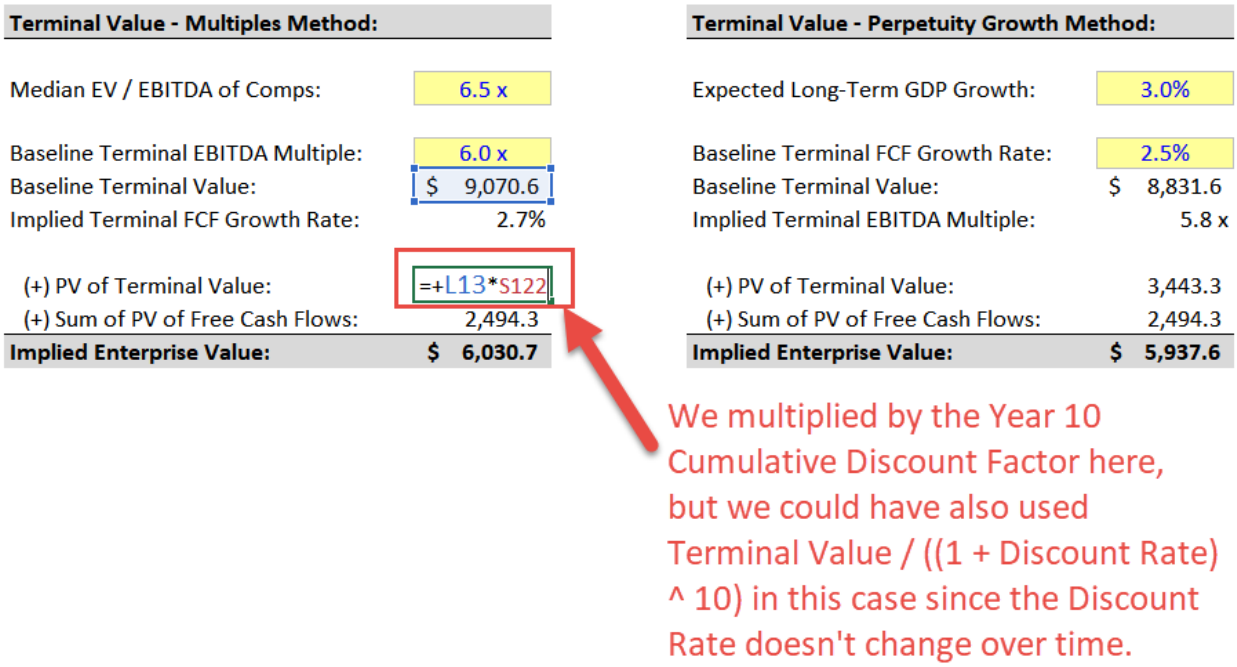
You can discount the Terminal Value using the same formula we used for the FCF:

Present Value = Terminal Value / ((1 + Discount Rate) ^ Year #)

However, it's slightly better to use the "Cumulative Discount Factor" just in case you've assumed a changing Discount Rate in the forecast period.

With Steel Dynamics, our Cumulative Discount Factor at the end of Year 10 was 0.390, so we multiplied each Terminal Value by this 0.390 to calculate the Present Values.

Then, we added the PV of the Terminal Value to the PV of the Free Cash Flows:



In an Unlevered DCF analysis, adding these two terms together gives you the company's **Implied Enterprise Value**.

You could stop at this point and compare that to the company's Current Enterprise Value.

And for private companies, you *do* stop here.

But if the company is **public**, you must complete one final step: Back into the company's Implied Equity Value and Implied Share Price.

To move from Enterprise Value to Equity Value, you *add* non-core-business Assets and *subtract* Liability and Equity line items that represent other investor groups.

Then, you divide by the company's diluted share count to calculate its Implied Share Price, which you then compare to its Current Share Price.

Here are the calculations for Steel Dynamics:

Terminal Value - Multiples Method:	
Median EV / EBITDA of Comps:	6.5 x
Baseline Terminal EBITDA Multiple:	6.0 x
Baseline Terminal Value:	$ 9,070.6
Implied Terminal FCF Growth Rate:	2.7%
(+) PV of Terminal Value:	3,536.5
(+) Sum of PV of Free Cash Flows:	2,494.3
Implied Enterprise Value:	**$ 6,030.7**
% of Implied EV from Terminal Value:	*58.6%*
(+) Cash & Cash-Equivalents:	$ 1,072.2
(+) Equity Investments:	-
(+) Other Non-Core Assets, Net:	-
(+) Net Operating Losses:	61.1
(-) Total Debt:	(2,700.0)
(-) Preferred Stock:	-
(-) Noncontrolling Interests:	11.2
(-) Unfunded Pension Obligations:	-
(-) Capital Leases:	-
(-) Restructuring & Other Liabilities:	-
Implied Equity Value:	**4,475.3**
Diluted Shares Outstanding:	242.017
Implied Share Price from DCF:	**$ 18.49**
Premium / (Discount) to Current:	**(25.9%)**

Terminal Value - Perpetuity Growth Method:	
Expected Long-Term GDP Growth:	3.0%
Baseline Terminal FCF Growth Rate:	2.5%
Baseline Terminal Value:	$ 8,831.6
Implied Terminal EBITDA Multiple:	5.8 x
(+) PV of Terminal Value:	3,443.3
(+) Sum of PV of Free Cash Flows:	2,494.3
Implied Enterprise Value:	**$ 5,937.6**
% of Implied EV from Terminal Value:	*58.0%*
(+) Cash & Cash-Equivalents:	$ 1,072.2
(+) Equity Investments:	-
(+) Other Non-Core Assets, Net:	-
(+) Net Operating Losses:	61.1
(-) Total Debt:	(2,700.0)
(-) Preferred Stock:	-
(-) Noncontrolling Interests:	11.2
(-) Unfunded Pension Obligations:	-
(-) Capital Leases:	-
(-) Restructuring & Other Liabilities:	-
Implied Equity Value:	**4,382.2**
Diluted Shares Outstanding:	242.017
Implied Share Price from DCF:	**$ 18.11**
Premium / (Discount) to Current:	**(27.5%)**

In real life, you would make the diluted shares calculation circular and calculate the share count *based on* the Implied Share Price, but we skipped that to simplify this model.

Technically, you should also value **out-of-the-money options** and subtract them to calculate the company's Implied Equity Value since they represent potential future ownership.

However, these options tend to be worth little, and banks rarely make this adjustment. Also, option valuation can get quite complicated, and it's not worth completing in a quick analysis.

There is one last point to be careful of: **Don't double-count items**.

It's the same principle that you learned with valuation multiples: If an expense is *included* in the denominator, you should *exclude* the corresponding Asset or Liability in the numerator and vice versa.

In a DCF analysis, if you *include* an expense within FCF, you should *exclude* the Asset or Liability that corresponds to that expense when moving from Implied Enterprise Value to Implied Equity Value, and vice versa.

For example, let's say that your FCF projections include the company's Rental Expense within Operating Expenses, so Operating Income and NOPAT are lower as a result.

You should **not** then capitalize the company's Operating Leases and subtract them as a Debt-like item when moving from Implied Enterprise Value to Implied Equity Value.

You've already counted them directly within FCF, so you'd be double-counting if you did this.

Similar logic applies to the Pension Expense and Unfunded Pensions: The *Service Cost* counts as an operating expense and should always be in FCF.

But the Interest Expense, Expected Return on Plan Assets, Amortization of Net Losses or Gains, and Other Adjustments are all financing costs that you should **exclude** from Unlevered FCF.

In the end, you should subtract the Unfunded Portion of the Pension as a Debt-like item when moving from Implied Enterprise Value to Implied Equity Value.

This rule also explains why you exclude Interest Income and Interest Expense when calculating Unlevered FCF.

If you *included* them, you would *not* subtract Debt and add Cash to move from Implied Enterprise Value to Implied Equity Value – you'd already **have** Implied Equity Value!

Putting It All Together: What the Steel Dynamics DCF Tells You

The output of a DCF gives you the company's **Implied Share Price** (or Implied Enterprise Value or Equity Value) across a range of assumptions.

You can then determine whether the company seems overvalued, undervalued, or valued appropriately.

Since the company's Implied Value varies widely, the DCF analysis is most useful for determining whether or not a company is **greatly** mispriced.

It's useless for detecting differences of, say, 2% or 5%.

You use the DCF, and valuation in general, to see if a company is mispriced by, say, 50%, 80%, or 100%.

The results for Steel Dynamics indicate that the company is **overvalued by around 25%**.

If you look at sensitivity tables based on Terminal Value and WACC, you get these results:

		Weighted Average Cost of Capital (WACC):										
		8.75%	9.00%	9.25%	9.50%	9.75%	**10.00%**	10.25%	10.50%	10.75%	11.00%	11.25%
Terminal EV / EBITDA Multiple (Terminal Value Calculated Using the Multiples Method):	7.00 x	$ 23.41	$ 22.83	$ 22.27	$ 21.73	$ 21.19	**$ 20.67**	$ 20.16	$ 19.66	$ 19.18	$ 18.70	$ 18.24
	6.75 x	22.73	22.17	21.63	21.10	20.58	**20.07**	19.57	19.09	18.62	18.15	17.70
	6.50 x	22.06	21.51	20.99	20.47	19.96	**19.47**	18.99	18.51	18.05	17.60	17.16
	6.25 x	21.38	20.86	20.34	19.84	19.35	**18.87**	18.40	17.94	17.49	17.05	16.62
	6.00 x	**20.71**	**20.20**	**19.70**	**19.21**	**18.73**	**18.26**	**17.81**	**17.36**	**16.93**	**16.50**	**16.09**
	5.75 x	20.03	19.54	19.05	18.58	18.11	**17.66**	17.22	16.79	16.37	15.95	15.55
	5.50 x	19.36	18.88	18.41	17.95	17.50	**17.06**	16.63	16.21	15.80	15.40	15.01
	5.25 x	18.68	18.22	17.76	17.32	16.88	**16.46**	16.04	15.64	15.24	14.85	14.47
	5.00 x	18.01	17.56	17.12	16.69	16.27	**15.86**	15.45	15.06	14.68	14.30	13.94

		Weighted Average Cost of Capital (WACC):										
		8.75%	9.00%	9.25%	9.50%	9.75%	**10.00%**	10.25%	10.50%	10.75%	11.00%	11.25%
Terminal FCF Growth Rate (Terminal Value Calculated Using the Gordon Growth Method):	2.90%	$ 24.48	$ 23.08	$ 21.79	$ 20.61	$ 19.51	**$ 18.49**	$ 17.54	$ 16.66	$ 15.83	$ 15.05	$ 14.33
	2.80%	24.12	22.76	21.50	20.34	19.27	**18.27**	17.34	16.47	15.66	14.90	14.18
	2.70%	23.78	22.45	21.22	20.09	19.04	**18.06**	17.15	16.29	15.50	14.75	14.04
	2.60%	23.45	22.15	20.95	19.84	18.81	**17.85**	16.96	16.12	15.34	14.60	13.91
	2.50%	**23.12**	**21.86**	**20.69**	**19.60**	**18.59**	**17.65**	**16.77**	**15.95**	**15.18**	**14.46**	**13.77**
	2.40%	22.81	21.58	20.43	19.37	18.38	**17.46**	16.59	15.79	15.03	14.32	13.65
	2.30%	22.51	21.30	20.18	19.14	18.17	**17.27**	16.42	15.63	14.88	14.18	13.52
	2.20%	22.22	21.04	19.94	18.92	17.97	**17.08**	16.25	15.47	14.74	14.04	13.39
	2.10%	21.94	20.78	19.71	18.71	17.77	**16.90**	16.08	15.32	14.59	13.91	13.27

Based on these tables, it seems **exceptionally likely** that the company is overvalued because its Implied Share Price is **always** below its Current Share Price of $24.97.

Even with the most optimistic assumptions, we don't quite reach $24.97 (only $24.48 in the top-left-hand corner of the second table).

We're less certain about the amount by which it is overvalued, but 20-30% might be a decent guess.

Return to Top.

Key Rule #5: How Different Factors Affect the DCF

Interview questions on **factors that impact a DCF and the Discount Rate** are common.

For example:

- Will Cost of Equity be higher for a $500 million or $5 billion company?
- Will a 1% difference in revenue or a 1% difference in the Discount Rate make a greater impact on the DCF?
- How does a company's WACC change as it uses more Debt?

To understand these questions fully, you need to play around with the **Excel file(s)** included in this course and see how these changes affect everything**.**

But here's the high-level summary:

Changes to the DCF Analysis and the Impact on Cost of Equity, Cost of Debt, WACC, and Implied Value:

DCF Change:	Cost of Equity:	Cost of Debt:	WACC:	Implied Value from Unlevered DCF:
Smaller Company	Higher	Higher	Higher(*)	Lower(*)
Bigger Company	Lower	Lower	Lower(*)	Higher(*)
Emerging Market	Higher	Higher	Higher	Lower
No Debt to Some Debt	Higher	Higher	Lower, then Higher	Higher, then Lower
Some Debt to No Debt	Lower	Lower	Depends	Depends
Higher Risk-Free Rate	Higher	Higher	Higher	Lower
Lower Risk-Free Rate	Lower	Lower	Lower	Higher
Higher Equity Risk Premium	Higher	N/A	Higher	Lower
Lower Equity Risk Premium	Lower	N/A	Lower	Higher
Higher Beta	Higher	N/A	Higher	Lower
Lower Beta	Lower	N/A	Lower	Higher
Higher Taxes	Lower(**)	Lower(**)	Lower(**)	Depends, Usually Lower
Lower Taxes	Higher(**)	Higher(**)	Higher(**)	Depends, Usually Higher

** Assumes the same capital structure percentages – if the capital structure changes, this one could go either way.*

*** Assumes the company has Debt. If it does not, taxes won't make an impact because there won't be any tax savings from interest paid on Debt.*

Overall Impact and Key Drivers

The **Discount Rate** and **Terminal Value** make the biggest impact on the DCF output.

That's because the Discount Rate affects *everything* and because the PV of the Terminal Value often represents over 50% of the company's Implied Value.

Changes in revenue growth, operating margins, and CapEx can also make an impact, but the changes must be *much* larger to make the same impact as a fairly small change to one of the assumptions above.

For example, increasing the Discount Rate from 8% to 9% will make a **far bigger** impact than increasing the revenue growth rate from 8% to 9%, or increasing the operating margin from 8% to 9%.

Since the Terminal Value contributes so much to the company's total value, small changes to the Terminal FCF Growth Rate or Terminal Multiple can also make a big impact on the output.

Company Size and Geography

Smaller companies tend to be **riskier** – they have higher growth potential, but also a higher chance of failing.

As a result, they tend to have higher Costs of Equity and Debt and higher WACC figures than larger companies.

Similarly, companies in emerging markets also tend to be **riskier**, with higher growth potential but also a higher risk of collapsing due to political instability.

So, the Cost of Equity, Cost of Debt, and WACC will be higher, and their Implied Values from a DCF will be lower.

Debt and Equity Levels

Be **very careful** with these questions because the impact of Debt is not so straightforward.

Recall the diagrams from the guides to Equity Value and Enterprise Value:

How Different Factors Impact WACC, the Cost of Debt, and the Cost of Equity:

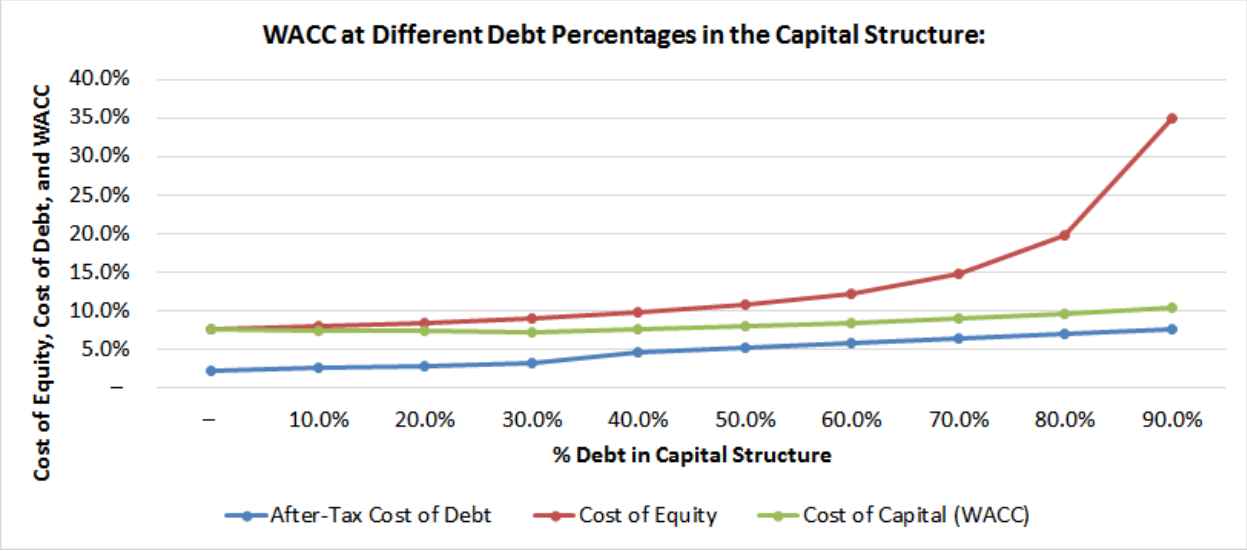
Debt / Total Cap.:	Debt / Equity:	Relevered Beta:	Risk Spread:	Cost of Debt: Pre-Tax:	Cost of Debt: After-Tax:	Cost of Equity:	Implied WACC:
–	–	0.72	1.0%	3.6%	2.2%	7.7%	7.7%
10.0%	11.1%	0.77	1.5%	4.1%	2.5%	8.0%	7.4%
20.0%	25.0%	0.83	2.0%	4.6%	2.8%	8.4%	7.3%
30.0%	42.9%	0.90	2.5%	5.1%	3.1%	8.9%	7.2%
40.0%	66.7%	1.01	5.0%	7.6%	4.6%	9.7%	7.6%
50.0%	100.0%	1.15	6.0%	8.6%	5.2%	10.7%	7.9%
60.0%	150.0%	1.37	7.0%	9.6%	5.8%	12.2%	8.3%
70.0%	233.3%	1.73	8.0%	10.6%	6.4%	14.7%	8.9%
80.0%	400.0%	2.44	9.0%	11.6%	7.0%	19.7%	9.5%
90.0%	900.0%	4.60	10.0%	12.6%	7.6%	34.8%	10.3%

As a company uses more Debt, its Cost of Debt and Cost of Equity will both increase.

More Debt makes the company riskier for everyone and increases the chance of bankruptcy, which would be catastrophic for *all* investors.

The tricky part is that **WACC decreases initially, but then starts increasing**.

Debt is cheaper than Equity, but past a certain point, the added risk from too much Debt starts to outweigh the cost benefits:



And here's the same annotated diagram we looked at previously:

Debt / Total Capital:	Debt / Equity:	Relevered Beta:	Risk Spread:	Cost of Debt: Pre-Tax:	Cost of Debt: After-Tax:	Cost of Equity:	Implied WACC:	"Accounting" Enterprise Value:	Implied Enterprise Value:
–	–	0.72	1.0%	3.6%	2.2%	7.7%	7.7%	$ 10,770.6	$ 10,413.3
10.0%	11.1%	0.77	1.5%	4.1%	2.5%	8.0%	7.4%	10,770.6	10,576.3
20.0%	25.0%	0.83	2.0%	4.6%	2.8%	8.4%	7.3%	10,770.6	10,696.1
30.0%	42.9%	0.90	2.5%	5.1%	3.1%	8.9%	7.2%	10,770.6	10,770.6
40.0%	66.7%	1.01	5.0%	7.6%	4.6%	9.7%	7.6%	10,770.6	10,431.4
50.0%	100.0%	1.15	6.0%	8.6%	5.2%	10.7%	7.9%	10,770.6	10,214.3
60.0%	150.0%	1.37	7.0%	9.6%	5.8%	12.2%	8.3%	10,770.6	9,918.1
70.0%	233.3%	1.73	8.0%	10.6%	6.4%	14.7%	8.9%	10,770.6	9,552.0
80.0%	400.0%	2.44	9.0%	11.6%	7.0%	19.7%	9.5%	10,770.6	9,126.8
90.0%	900.0%	4.60	10.0%	12.6%	7.6%	34.8%	10.3%	10,770.6	8,654.4

The company gets riskier and riskier for *all* investors as it takes on more Debt.

Initially, the Discount Rate decreases as the company uses more Debt, but past a certain point, more Debt starts *increasing* risk and therefore *increasing* the Discount Rate.

If you pretend that the Discount Rate does NOT change as the company uses more Debt, you get these results.

But in reality, the Discount Rate WILL change, so these results are more accurate.

One implication is that if a company goes from **some Debt to no Debt**, **WACC will not change predictably** because it depends on what "some Debt" means.

For example, in the diagram above, the company's WACC at an 80% Debt / Total Capital Ratio is 9.5%. So, removing Debt would *reduce* its WACC to 7.7% in this case.

But if the company had a 30% Debt / Total Capital Ratio, its WACC would be 7.2%. So, removing Debt would *increase* its WACC to 7.7% now!

Risk-Free Rate

A higher Risk-Free Rate (i.e., if government bonds in the country start offering higher coupon rates) increases the Cost of Equity and Cost of Debt, and, therefore, WACC.

When government bonds start offering higher rates, investors also start demanding higher rates on corporate bonds, and stock-market investors start seeking higher returns as well.

With a higher Risk-Free Rate, all investors have **better options elsewhere**.

As a result, a company's implied value from a DCF will decline.

Equity Risk Premium

A higher Equity Risk Premium will increase the Cost of Equity and WACC because it means that the stock market is expected to return a higher percentage *above* the Risk-Free Rate.

It won't affect the Cost of Debt because Debt investors earn fixed interest on their investments; stock-market performance is irrelevant to them.

So, if the ERP increases, the company's Implied Value in a DCF decreases; if it decreases, the company's Implied Value increases.

Beta

This one works the same way as the ERP above: Higher Beta increases the Cost of Equity and WACC and reduces a company's Implied Value, and a lower Beta does the opposite.

Just like the ERP, it does not affect the Cost of Debt.

A higher Beta means more **stock price volatility**. If a company's Beta is 1.00, investors will expect this company's stock price to increase by 10% when the market goes up by 10%.

But if its Beta is now 1.10, investors will expect this company's stock price to increase by 11% when the market goes up by 10%.

Since investors' expectations increase, the company's Implied Value *to them* decreases.

Tax Rate

A higher tax rate reduces the Cost of Debt because **it increases the tax benefits of Debt**.

Think about a simple example: If the coupon rate is 10%, the After-Tax Cost of Debt is 10% * (1 – 40%) = 6% at a 40% tax rate, but 10% * (1 – 50%) = 5% at a 50% tax rate.

But a higher tax rate will also **reduce the Cost of Equity** because you use that tax rate when re-levering Beta: Re-Levered Beta = Unlevered Beta * (1 + Debt / Equity Ratio * (1 – Tax Rate)).

A higher tax rate enhances the cost benefits of Debt, which means that additional Debt is *also* less risky for the Equity investors.

So, WACC **decreases** with a higher tax rate, assuming the company has Debt.

The company's Implied Value from a DCF is harder to predict, but it usually **decreases** because a higher tax rate also reduces the company's Free Cash Flow.

That FCF reduction tends to make a bigger impact than these changes to the Discount Rate, especially since lower FCF also means a lower Terminal Value.

Other Changes and Factors

We haven't covered every possible factor here, but if you understand these concepts, you can answer any question about a DCF and the Discount Rate.

For example, if the company starts using additional Equity, that's the same as using *less Debt*, so all those changes would apply.

Additional Preferred Stock is similar to additional Debt, but there's no tax benefit, which tends to make Preferred Stock more expensive than Debt and less expensive than Equity.

So, the Cost of Equity will increase, and WACC will decrease initially and then start increasing.

If the interest rate on Debt increases, the Cost of Debt will increase and WACC will also increase; the Cost of Equity won't change.

If a change increases the company's Free Cash Flow, the company's Implied Value will increase because the whole analysis is based on the Present Value of Free Cash Flows.

Return to Top.

Key Rule #6: DCF – More Advanced Points [OPTIONAL]

There are a few more advanced topics related to the DCF analysis; you're unlikely to get interview questions on these topics, so you can consider this section optional.

The Mid-Year Convention and Stub Periods

When you use discount periods of 1, 2, 3, 4, and so on, it's **not accurate** because these numbers imply that the company's cash flows arrive at the *end* of each year.

But that's not true: The company generates cash flow **every day**, and *on average*, that cash flow is evenly distributed throughout each year.

So, it is more accurate to use discount periods such as 0.5, 1.5, 2.5, and 3.5 when you're calculating the Cumulative Discount Factor and the Present Value of Free Cash Flows.

Using these discount periods in a DCF is known as the "Mid-Year Convention" because you're assuming that the cash flows arrive midway through each year rather than at the end.

The company's Implied Value will increase because the cash flows arrive earlier, and money today is worth more than money tomorrow.

Here is the Steel Dynamics analysis before and after making this change:

BEFORE:

Discount Period:	#	1	2	3	4	5
Discount Rate (WACC):	%	9.88%	9.88%	9.88%	9.88%	9.88%
Cumulative Discount Factor:	#	0.910	0.828	0.754	0.686	0.624
PV of Unlevered FCF:	$ M	$ 215.1	$ 210.3	$ 228.6	$ 239.2	$ 267.3

AFTER:

Discount Period:	#	0.5	1.5	2.5	3.5	4.5
Discount Rate (WACC):	%	9.88%	9.88%	9.88%	9.88%	9.88%
Cumulative Discount Factor:	#	0.954	0.868	0.790	0.719	0.655
PV of Unlevered FCF:	$ M	$ 225.5	$ 220.5	$ 239.7	$ 250.7	$ 280.2

The PV of each Unlevered Free Cash Flow increases because it's generated earlier.

There's another, trickier feature that results from timing differences as well: **Stub periods**.

When you value a company on a specific date, **much of its cash flow for the year has already been generated** (unless you're valuing it on January 1st).

So, you have to reduce the *projected* cash flow for the year by the amount that the company has *already* generated.

For example, if it's April 30th, the company is projected to generate $1,000 in FCF for the year, and it has *already* generated $300, you would subtract out that $300 and use $700 for the FCF in the first period of a DCF.

But you can't *just* subtract the already-generated cash flow – you must also change the **discount periods** because April 30th to December 31st represents a fraction of a year.

This period from April 30th to December 31st is called the **stub period**.

To determine the discount period for this **stub period**, take the remaining days of the year and divide by the total days in the year.

For example, if you're valuing a company on April 30th, there are 245 days until December 31st and 365 days in the year, assuming it's not a leap year.

Since 245 / 365 = 0.671, 0.671 will be the **discount period** for this first year.

The first discount period in a DCF will be 0.671 rather than 1.000, the next period will be 1.671 rather than 2.000, and the next one will be 2.671 rather than 3.000.

You subtract cash flow only in the first period; the cash flow in all the subsequent years is the same because no cash flow for Years 2, 3, and beyond has been generated as of April 30th.

You can also combine the stub period with the mid-year convention.

If you do this, the first discount period will be the stub period fraction divided by 2.

Continuing with the April 30th example, dividing by 0.671 by 2 gives you 0.336.

By doing this, you're saying, "Let's assume that the cash flow arrives **midway** between **now** – April 30th – and the **end of the year** – December 31st."

"Midway through the year" means August 31st here.

In each period AFTER that first one, you take the normal discount period and subtract 0.5.

Here are the normal and mid-year discount periods for a valuation on April 30th, 2014:

	A	B	C	D	I	J	K	L	M
409									
410									
411			**Practice Exercises for Stub Periods and the Mid-Year Convention:**		**FY14**	**FY15**	**FY16**	**FY17**	**FY18**
412									
413			**1. Valuation Date of April 30th, 2014.**						
414									
415			Stub Period Fraction:	0.671					
416			Normal Discount Period:	*Year Fraction*	0.671	1.671	2.671	3.671	4.671
417			Mid-Year Discount Period:	*Year Fraction*	0.336	=+J416-0.5	2.171	3.171	4.171

You do **NOT** keep dividing the "Normal Discount Period" by 2 – you do that only in Year 1!

If you divided the FY 15 "Normal Discount Period" by 2, you'd be saying that the cash flow for FY 15 arrives midway between April 30th, 2014 and December 31st, 2015.

In other words, you'd be saying that the *2015 full-year cash flow* arrived on **March 1st, 2015**.

But that's not what happens! If you assume the 2015 cash flow is evenly distributed, it should arrive on June 30th, 2015 – midway through *that year*.

By using the correct discount period – 1.171 – for FY 15, you're saying:

"Hey, today is April 30th, 2014. We don't get any 2015 cash flows in the year 2014, so let's add that whole stub period of 0.671. We do get cash flows in 2015, but they arrive midway

through the year, so let's add 0.5 to reflect the fact that we get them midway through 2015. 0.671 + 0.500 = 1.171."

If you go out another year, you have to add 0.671 for the remainder of FY 14, 1.000 for all of FY 15 (since no 2016 cash flows arrive then), and then 0.500 for the cash flows that arrive midway through FY 16.

That gives you 2.171 for the mid-year discount period.

The mid-year convention and stub periods impact the Present Value of a company's Free Cash Flows, but they also affect the **Terminal Value** and **PV of Terminal Value** calculations.

The PV of Terminal Value is easier to explain, so we'll start there: In an analysis with a 10-year explicit forecast period, you use the **Normal Discount Period** – *not* the Mid-Year Discount Period – to discount the Terminal Value to its Present Value.

So, if this is 9.671 because of an April 30th valuation date, you'd use 9.671 rather than 10.000 in the PV of Terminal value formula.

But if you're not factoring in the stub period, and so the Normal Discount period is just 10.000, you'd use 10.000 to discount the Terminal Value.

Only stub periods affect this part – the mid-year convention does not because the Terminal Value should account for the mid-year convention or ignore it altogether.

If you calculate the Terminal Value using the Multiples Method, the mid-year convention doesn't factor in because you apply the multiple to the company's full-year financial figures in the final year of the forecast period.

It's as if you're assuming the company **gets sold** at the *end of that year*, and, as a result, the fact that cash flows arrived midway through each year before that is irrelevant.

If you use the Gordon Growth Method, the same formula still applies, but you have to multiply the Terminal Value by (1 + Discount Rate) ^ 0.5 to "move it back" to the very end of the last year in the forecast.

Making this adjustment lets you compare the Terminal Values produced by both methods.

If you did *not* do this, then you would have to discount each Terminal Value using a different period, which **we strongly recommend against**.

The Normalized Terminal Year

Even if you project only 10 years of a company's FCF, you may have to go **one year beyond that** because the final year may not be truly representative of the company into perpetuity.

For example:

- What if a **key patent expires** for a pharmaceutical company in Year 9 or 10?
- What if the company has a huge **Other Intangibles** balance that it's amortizing each year, but which goes away completely in Year 10?
- What if the company's planned **CapEx** or its expected **operating margins** will be very different after Year 10?
- What if the company's **FCF Growth** in Year 10 is very different from the range of Terminal FCF Growth Rates you've selected?

In all these cases, it's worthwhile to create a **Normalized Terminal Year** and then use the FCF from this year in the Terminal Value calculations.

Here's an example of a pharmaceutical company (Jazz) that suffers from these problems:

Unlevered Free Cash Flow Projections:	Units:	Projected FY19	FY20	FY21	FY22	FY23	Normalized FY24
Revenue:	*$ M*	**$ 3,853.2**	**$ 4,552.3**	**$ 5,371.6**	**$ 1,662.1**	**$ 1,827.6**	**$ 1,919.0**
Annual Revenue Growth Rate:	*%*	*21.4%*	*18.1%*	*18.0%*	*(69.1%)*	*10.0%*	5.0%
Operating Income (EBIT):	*$ M*	2,044.0	2,424.9	2,870.7	739.4	825.0	964.2
Annual Operating Margin:	*%*	*53.0%*	*53.3%*	*53.4%*	*44.5%*	*45.1%*	45.0%
(-) Taxes, Excluding Effect of Interest:	*$ M*	(367.9)	(436.5)	(516.7)	(133.1)	(148.5)	(173.6)
Net Operating Profit After Tax (NOPAT):	*$ M*	**1,676.1**	**1,988.4**	**2,353.9**	**606.3**	**676.5**	**790.6**
Adjustments for Non-Cash Charges:							
Amortization of Intangible Assets:	*$ M*	100.7	100.7	100.7	100.7	100.7	-
Depreciation:	*$ M*	34.7	45.5	59.1	19.9	23.8	24.9
Acquired In-Process Research & Development:	*$ M*	-	-	-	-	-	-
Change in Fair Value of Contingent Consideration:	*$ M*	-	-	-	-	-	-
Deferred Income Taxes:	*$ M*	-	-	-	-	-	-
Goodwill Impairment:	*$ M*	-	-	-	-	-	-
Other Items and Adjustments:	*$ M*	4.1	4.1	4.1	4.1	4.1	4.1
Total Adjustments for Non-Cash Charges:	*$ M*	**139.4**	**150.3**	**163.9**	**124.7**	**128.5**	**29.0**
Changes in Operating Assets & Liabilities:							
Accounts Receivable:	*$ M*	(103.6)	(108.0)	(127.5)	554.8	(26.8)	
Inventories:	*$ M*	(20.5)	(21.1)	(24.8)	112.1	(5.0)	
Prepaid Expenses & Other Current Assets:	*$ M*	(45.4)	(50.4)	(59.1)	245.1	(12.8)	
Other Non-Current Assets:	*$ M*	-	-	-	-	-	
Accounts Payable:	*$ M*	16.1	16.6	19.5	(88.2)	3.9	
Accrued Liabilities:	*$ M*	63.2	70.1	82.3	(341.1)	17.8	
Income Taxes Payable:	*$ M*	-	-	-	-	-	
Deferred Revenue:	*$ M*	5.4	5.6	6.6	(29.7)	1.3	
Other Current & Non-Current Liabilities:	*$ M*	-	-	-	-	-	
Total Changes in Operating Assets & Liabilities:	*$ M*	**(84.7)**	**(87.2)**	**(103.0)**	**453.0**	**(21.5)**	**(11.0)**
% Change in Revenue:	*%*	*(12.5%)*	*(12.5%)*	*(12.6%)*	*(12.2%)*	*(13.0%)*	(12.0%)
(-) Capital Expenditures:	*$ M*	**(65.5)**	**(81.9)**	**(102.1)**	**(33.2)**	**(38.4)**	**(38.4)**
% Revenue:	*%*	*1.7%*	*1.8%*	*1.9%*	*2.0%*	*2.1%*	2.0%
Annual Unlevered Free Cash Flow:	*$ M*	**1,665.3**	**1,969.5**	**2,312.7**	**1,150.8**	**745.1**	**770.3**
Unlevered Free Cash Flow for Remaining Quarters:	*$ M*	**1,665.3**	**1,969.5**	**2,312.7**	**1,150.8**	**745.1**	**770.3**
Present Value of Free Cash Flow:	*$ M*	**1,117.0**	**1,222.4**	**1,328.2**	**611.6**	**366.4**	**350.5**
Normal Discount Period:	*Year Frac.*	5.647	6.647	7.647	8.647	9.647	10.647
Mid-Year Discount Period:	*Year Frac.*	5.147	6.147	7.147	8.147	9.147	10.147
Annual Free Cash Flow Growth Rate:	*%*	*20.7%*	*18.3%*	*17.4%*	*(50.2%)*	*(35.2%)*	*3.4%*

Much lower growth rate in-line with company's long-term prospects.

Lower margins to reflect less profitable divisions.

The company's Intangibles amortize completely in Year 10, so we leave them out of the non-cash adjustments.

Slightly lower figures for the Change in WC that better represent the company into perpetuity.

Most importantly, the FCF Growth Rate in the final year is now much closer to the Terminal Growth Rate.

As a result of this Normalized Terminal Year FCF, you no longer multiply the Year 10 FCF by (1 + Terminal FCF Growth Rate) to calculate the first Free Cash Flow in the Terminal Period – you use the FCF *in* this Normalized Terminal Year instead.

Creating a Normalized Terminal Year could make the company's Implied Value from a DCF higher or lower depending on your assumptions.

However, in *most* cases, the Normalized Terminal Year will reduce a company's Implied Value because you tend to adjust **down** the company's growth rate and margins in this year.

Net Operating Losses

Remember one of the key principles for calculating FCF and backing into the company's Implied Equity Value at the end:

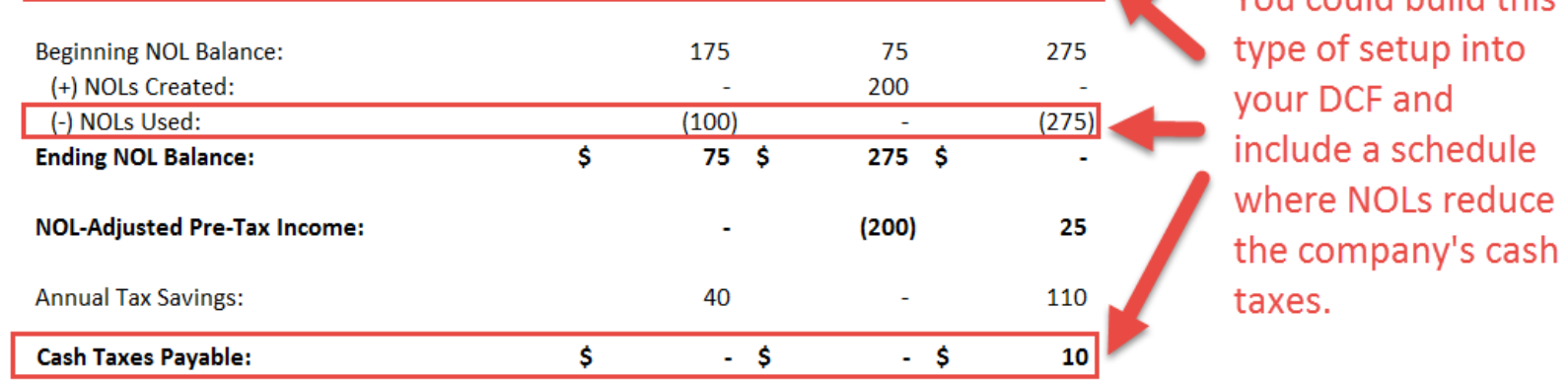
If you include an income or expense line item within Free Cash Flow, you should NOT factor in the corresponding Asset or Liability when going from Implied Enterprise Value to Implied Equity Value.

The opposite applies if you have *excluded* an income or expense line item from FCF.

So, it's easiest to count **Net Operating Losses** as non-core-business Assets and add them when moving from Implied Enterprise Value to Implied Equity Value at the end.

But you could also make them reduce the company's cash taxes each year, similar to the setup in the lessons and guides on NOLs:

Combined Company:	Year 1	Year 2	Year 3
Pre-Tax Income:	$ 100	$ (200)	$ 300
Income Taxes:	40	(80)	120
Beginning NOL Balance:	175	75	275
(+) NOLs Created:	-	200	-
(-) NOLs Used:	(100)	-	(275)
Ending NOL Balance:	**$ 75**	**$ 275**	**$ -**
NOL-Adjusted Pre-Tax Income:	**-**	**(200)**	**25**
Annual Tax Savings:	40	-	110
Cash Taxes Payable:	**$ -**	**$ -**	**$ 10**



You'd have to create a separate schedule and then record a *positive* entry under Deferred Income Taxes since the company's cash flow increases when NOLs are applied.

We **strongly recommend against this setup** for a few reasons:

1) **What if the NOLs haven't been used up by the end of the forecast period?** You'll run into problems because the FCF projections alone won't capture their full value.

2) **It takes more work** to set up the analysis this way, and it doesn't add much since the Balance Sheet value of the NOLs represents their future tax savings anyway.

3) **If the company has negative Pre-Tax Income**, that would create extra NOLs and would increase the chances of the full NOL balance *not* being utilized by the end.

Noncontrolling Interests and Equity Investments (Associate Companies)

Leave Net Income Attributable to/from these items **out** of the FCF projections.

You could follow the inclusion/exclusion principle and include Net Income Attributable to Noncontrolling Interests and Net Income from Equity Investments in FCF, and then *exclude* Noncontrolling Interests and Equity Investments from the Enterprise Value to Equity Value calculation…

…But think of the challenges that presents:

- In an **Unlevered analysis**, you'd have to reverse the partially-owned companies' taxes, net interest expense, and other income/expense so you can determine their EBITs, and then subtract or add the relevant percentages of their EBITs.

- And most companies don't **disclose** nearly enough information to do that.

- This process would be easier in a Levered DCF (see the next section), but that analysis presents many other problems, such as inconsistent FCF and disagreement over certain calculations.

The Bottom Line: Noncontrolling Interests and Equity Investments should **not** affect the company's Unlevered FCF at all.

Just include these items at the end when moving from Implied Enterprise Value to Implied Equity Value.

The Levered DCF, Adjusted Present Value (APV), and Other Variations

In addition to the standard Unlevered DCF analysis, which we strongly recommend in almost all cases, there is also the Levered DCF analysis.

In this one, you calculate the Free Cash Flow available to only equity investors in the company, and you calculate the company's Implied Equity Value directly.

That creates many differences in the analysis, including:

1) **Cost of Equity, Not WACC** – Since Levered FCF is only available to equity investors, you use the Discount Rate that represents only the equity investors.

2) **Subtract the Net Interest Expense and Add/Subtract Net Borrowings** – These items all affect the cash flow to equity investors, so you must factor them in. Effectively, you start with Net Income rather than NOPAT and factor in changes in the company's Debt principal as well.

   NOTE: There is some controversy over exactly what to add/subtract – some people say all changes in Debt, some say just the repayments, some say just the mandatory repayments, and the list goes on.

3) **Terminal Value with P / E or Equity Value-Based Multiples** – You're only considering equity investors, so the Terminal Value must use an Equity Value-based multiple (if you're not using the Multiples Method to calculate it).

4) **Calculate Implied Equity Value Directly at the End** – You don't need a "bridge" between Equity Value and Enterprise Value because the analysis never produces the Implied Enterprise Value. In a Levered DCF, adding the PV of Free Cash Flows and the PV of the Terminal Value gives you the Implied Equity Value directly.

5) **You Must Reflect the Items Formerly in the Bridge in the FCFs Instead** – So, you now need to factor in the tax savings from NOLs, Interest Income and Interest Expense, and Preferred Dividends if the company has Preferred Stock (and more!).

We strongly recommend against using a Levered DCF unless someone has *specifically* asked you to build one.

Here are some of the many problems with it:

1) It takes **more time and effort** to build because you have to project the company's Cash and Debt balances, Net Interest Expense, and changes in Debt principal.

2) The FCF numbers are more **volatile** than the ones produced by an Unlevered DCF because Debt principal repayments can be $0 in some years and massive in others. Also, companies don't necessarily issue extra Debt on a recurring, predictable schedule.

3) You will **NOT** get the same results from a Levered DCF analysis because it is almost impossible to pick "equivalent" assumptions.

4) There's disagreement over how to **calculate Levered FCF**: Some people factor in *all* Debt issuances and repayments, some factor in *all* repayments but no issuances, and some factor in *only* mandatory repayments.

An Unlevered DCF is easier to set up, less ambiguous, and more consistent.

There are a few specialized cases where a Levered DCF might be helpful (restructuring/bankruptcy scenarios, changing capital structures, or REITs that issue and repay Debt constantly), but in 99% of cases, the Unlevered DCF is superior.

A related concept is the **Adjusted Present Value (APV)** analysis. It's similar to an *Unlevered* DCF, but it values the "tax shield" from a company's Debt and then adds the value of that tax shield to the company's Implied Enterprise Value.

You still calculate Unlevered Free Cash Flow and Terminal Value in the same way, but a few other components change:

- **Discount Rate:** You use the *Unlevered* Cost of Equity instead of WACC. To calculate it, you un-lever Beta for each peer company and take the median, but you do **not** re-lever Beta according to the subject company's capital structure or the median capital structure percentages of the peer companies. Then, you use this median Unlevered Beta in the usual formula for Cost of Equity and keep the Risk-Free Rate and Equity Risk Premium the same.

- **Interest Tax Shield:** You project the company's Net Interest Expense and multiply it by the Tax Rate to determine the tax savings from interest. But you also have to ensure that this number is *less than* the total amount of Taxes in the EBIT → NOPAT calculation.

  If it's not, you use that total tax number instead and use the excess interest tax shield to offset *future* taxable income.

- **Discount Rate for Interest Tax Shield:** Once again, you use the Unlevered Cost of Equity.

- **Interest Tax Shield Terminal Value:** You calculate the Terminal Value of the Interest Tax Shield with Tax Rate * Debt in Terminal Year * Unlevered Cost of Equity * (1 + Terminal FCF Growth Rate) / (Unlevered Cost of Equity – Terminal FCF Growth Rate)^2

That formula says that the value of the future benefits from the Tax Shield is proportional to the company's Tax Rate, Debt, and how quickly its cash flows are growing relative to the Discount Rate.

You sum up the Present Value of the Unlevered FCFs, the PV of Terminal Value, the PV of Interest Tax Shields, and the PV of the Interest Tax Shield Terminal Value to get the company's "Adjusted Present Value," which is a variation of its Implied Enterprise Value.

You would then back into the company's Implied Equity Value and Implied Share Price with the same "bridge" between Enterprise Value and Equity Value.

Some people argue that that the APV method produces "more accurate results" because it takes into account the interest rate on Debt, while the Unlevered DCF does not.

It's true that the APV method fixes that one specific issue, but it also creates many new problems:

- **No Downside for Debt:** It's incorrect to include only the *benefits* of Debt without also factoring in the major downside: The increased risk of bankruptcy. You could attempt to add this risk to the APV analysis, but no one agrees on how to estimate the probability of bankruptcy.

- **Overstated Values for Firms with High Debt Balances:** The APV method will produce high values for companies with very high Debt balances because of the Interest Tax Shield. But companies with high Debt balances should see **lower implied** values because the risk of bankruptcy starts to outweigh the tax benefits of Debt at this stage.

- **The Requirement to Project Interest Expense:** It takes extra time and effort to forecast the company's Interest Expense because you must project its Debt and Cash balances into the future.

While the traditional Unlevered DCF has its flaws, using WACC for the Discount Rate accounts for **both** the tax benefits of Debt and the added bankruptcy risk.

The APV method, by contrast, solves one minor issue with the Unlevered DCF but creates other, more serious problems in the process, which is why we recommend against it unless someone asks for it specifically.

Return to Top.

Key Rule #7: Comparable Public Companies (Public Comps)

"Valuation" refers to the **discounted cash flow (DCF) analysis**.

The other valuation methodologies, such as comparable public companies and precedent transactions, are just **shorthand for valuation**.

Instead of projecting and analyzing a company's cash flows, you compare the company to other, similar companies (or similar companies that were acquired) and use the valuation multiples from *those* companies to value the one you're looking at.

Even though these methodologies are less rigorous, they are still useful because they let you cross-check your results from the DCF analysis.

Also, in some sectors, such early-stage technology startups, the DCF is less useful because it requires too much guesswork about far-in-the-future events.

To use comparable public companies to value a company, you can follow these steps:

1) **Select** the appropriate set of comparable companies.
2) **Determine** the metrics and multiples you want to use.
3) **Calculate** the metrics and multiples for all the companies.
4) **Apply** the median (or 25th or 75th or other percentile) multiples to *your* company to estimate its Implied Enterprise Value and Implied Equity Value.

Here's the detail behind each step:

1) Select the Appropriate Set of Comparable Companies

You normally start with a broad set of companies and then narrow it based on **industry**, **geography**, and **size**.

You could get the names of companies from Google Finance, Capital IQ, equity research, or even a company's filings where it lists its competitors.

If you're valuing Steel Dynamics, you might start by looking at all steel manufacturing companies in the world.

There are hundreds of companies worldwide, so you have to narrow the set based on geography, industry, and size to get companies that are more similar to STLD.

A set of **5-10 companies** is a good target – a set of 50 companies is too large to be "comparable," while a set of 1-2 companies is less useful because the data is too limited.

For Steel Dynamics, we used this screen:

- **Geography:** U.S.
- **Industry:** Steel Manufacturers
- **Size:** Projected revenue between $1 billion and $20 billion USD

Comparable Companies - U.S.-Based Steel Manufacturer Companies with FY16 Projected Revenue Between $1 Billion and $20 Billion

($ USD in Millions Except Per Share Amounts in USD as Stated)

Geographic, industry, and size screen.

Operating Statistics:	Capitalization		Revenue			EBITDA		
Company Name	Equity Value	Enterprise Value	LTM	FY16	FY17	LTM	FY16	FY17
United States Steel Corp.	$ 3,130.1	$ 5,451.1	$ 10,327.0	$ 10,545.2	$ 11,231.3	$ (128.0)	$ 675.0	$ 921.4
Nucor Corporation	15,609.0	17,982.3	15,643.6	16,684.8	16,937.1	1,972.9	2,291.4	2,539.6
Commercial Metals Company	1,776.7	2,373.0	4,813.4	4,683.9	4,780.1	431.9	367.4	423.1
AK Steel Holding Corporation	1,036.2	3,437.7	6,263.6	5,991.8	6,108.2	547.2	469.2	580.9
Worthington Industries, Inc.	2,732.3	3,358.5	2,819.7	2,891.3	2,971.4	239.9	281.5	324.1
Reliance Steel & Aluminum Co.	5,259.1	7,340.6	8,679.0	8,890.4	9,303.6	784.6	850.7	928.7
Maximum	$ 15,609.0	$ 17,982.3	$ 15,643.6	$ 16,684.8	$ 16,937.1	$ 1,972.9	$ 2,291.4	$ 2,539.6
75th Percentile	4,726.9	6,868.3	9,915.0	10,131.5	10,749.3	725.3	806.8	926.9
Median	**$ 2,931.2**	**$ 4,444.4**	**$ 7,471.3**	**$ 7,441.1**	**$ 7,705.9**	**$ 489.6**	**$ 572.1**	**$ 751.1**
25th Percentile	2,015.6	3,378.3	5,176.0	5,010.9	5,112.1	287.9	392.9	462.6
Minimum	1,036.2	2,373.0	2,819.7	2,891.3	2,971.4	(128.0)	281.5	324.1
Steel Dynamics Inc.	**$ 6,043.2**	**$ 7,501.1**	**$ 7,307.2**	**$ 7,716.0**	**$ 8,406.2**	**$ 862.8**	**$ 626.4**	**$ 730.2**

Six companies in the set is a good result; you usually want between 5 and 10 companies.

This screen is important because you want these companies to have similar DISCOUNT RATES.

As always, it goes back to my favorite formula:

Company Value = Cash Flow / (Discount Rate – Cash Flow Growth Rate), where Cash Flow Growth Rate < Discount Rate

By picking "similar companies," you're ensuring that the Cash Flow and Discount Rate for the companies are in similar ranges.

Therefore, if one company trades at higher multiples than another, its Cash Flow Growth Rate *should* be higher (in theory).

In this example with Steel Dynamics, we can look at the 6 companies and say: "They're all about the same size and are in the same industry, so their Discount Rates and Cash Flow figures are similar. So, companies with higher multiples most likely have higher expected growth rates."

But if the companies were very different, the link between expected cash flow growth and valuation multiples would break down, and we would not be able to draw that conclusion.

There are few hard-and-fast rules for screening companies; if you can't get enough companies in your set, expand the screening criteria, and if you get too many, narrow it.

In large countries, such as the U.S., China, and India, there are so many domestic companies that the geographic screen might be *just* that country.

But if your company is in a small European country, such as Estonia or Finland, you'll probably have to use a European-wide geographic screen to get enough companies in the set.

The same logic applies to the industry screen: Make it as specific as possible, but if you get a set with only 1-2 companies, broaden the criteria.

For example, let's say that you're valuing a niche Software-as-a-Service (SaaS) company such as **Fleetmatics**, which provides software for GPS tracking and vehicle fleet management.

You shouldn't make the industry screen "SaaS companies providing transportation and logistics software" because there might not *be* any other public companies doing that.

Even if there are 1-2 other companies, the screen is still too specific to be useful.

So, you'd probably expand it and use "Software-as-a-Service Companies" for the industry screen, and then narrow the set based on financial criteria.

You can screen by financial metrics such as revenue, EBITDA, or FCF, but you should **avoid** screening by *both* financial metrics and Equity Value or Enterprise Value.

For example, you should **NOT** use this screen: "Companies with revenue under $1 billion and Enterprise Values above $2 billion."

If you do that, you're **artificially constraining the multiples** because EV / Revenue must be above 2x for every company in the set.

Even screening by Equity Value or Enterprise Value alone is questionable because you constrain the valuations by doing so. It's best to screen based on simple metrics like revenue, EBITDA, or FCF and leave it at that.

2) Determine the Metrics and Multiples You Want to Use

In *most* industries, you'll look at 1 sales-based metric (and corresponding multiple) and 2 profitability-based metrics (and corresponding multiples).

For example, the following set of metrics and multiples is common in many industries:

- **Revenue**, EV / Revenue, and Revenue Growth
- **EBITDA**, EV / EBITDA, and EBITDA Growth and Margins
- **Net Income**, P / E, and Net Income Growth and Margins

There is no "best" metric or multiple. Each one has its strengths and weaknesses, and in a valuation, you want to get *the big picture* by examining many metrics and multiples.

Sometimes, you'll exclude Revenue-based metrics and multiples and focus on the profitability-based ones, such as EBITDA, EBIT, and Net Income.

And if you're in an industry with significantly different metrics and multiples, such as commercial banks, you'll use the metrics that are important there (P / BV, P / E, Total Assets, ROE, etc.).

You also have to consider **the time periods** you use.

You can look at a company's *historical* Revenue or EBITDA that it earned last year or in the past 12 months, but you can also look at its *projected* Revenue or EBITDA for the next 12 months or next calendar year (or the year after next).

You almost always use a mix of historical and projected metrics. Often, you'll use 1 historical version and 2 projected versions of each metric.

For example, if the valuation date is June 30th, 2025, you might use these revenue figures for a comparable company:

- **Last Twelve Months (LTM) Revenue:** This is the company's revenue between June 30th, 2024, and June 30th, 2025; it's based on **what happened in real life**.

- **2025 Projected Revenue:** This is what the market expects the company to earn in revenue for this entire current year. It's based on the first half of this year, but also on what's *expected* to happen in the second half.

- **2026 Projected Revenue:** This is what the market expects the company to earn in revenue for the *next* year. This one is based 100% on **expectations** since the next year hasn't started yet.

Historical metrics are useful because they're based on real events, but they can also be deceptive if there were non-recurring items, acquisitions, or divestitures.

Projected metrics are useful because they assume that the company will operate in a "steady state," without acquisitions, divestitures, or non-recurring items, but they're also less reliable because they're predictions of the future.

3) Calculate the Metrics and Multiples for All the Companies

Since you use only **public companies**, the calculations are straightforward.

You calculate each company's **Current Equity Value** and **Current Enterprise Value** based on its current share price, shares outstanding, and most recent Balance Sheet.

Then, you retrieve the historical figures for revenue, EBITDA, Net Income, and any other metrics by going through the company's annual and quarterly reports and looking at the Income Statements and Cash Flow Statements there.

To calculate the LTM figures, you take the previous fiscal year's numbers, add the figures from the most recent "partial period," and subtract the figures from the same "partial period" in the previous year.

Example: You want to calculate a company's LTM revenue as of June 30th, 2025. If the company's fiscal year ends on December 31st, you would:

1. Start with the revenue on its Income Statement for the full year 2024, i.e., what the company has earned between January 1st, 2024 and December 31st, 2024.

2. Then, add the revenue for the 6 months from January 1st, 2025 through June 30th, 2025.

3. Then, subtract the revenue for the 6 months between January 1st, 2024 and June 30th, 2024.

You calculate the LTM figures this way because no company discloses its "LTM revenue" – companies only provide annual and quarterly figures.

If the company has **non-recurring charges** – Restructuring, Write-Downs, Legal Expenses, Goodwill Impairment, etc. – then you'll add back these charges in the calculations for the financial metrics affected by these non-recurring items.

Use extreme caution when doing so because many of these charges are not, in fact, non-recurring.

For example, many companies are always restructuring, but pretend that Restructuring Expenses are unusual one-time events.

But if the expense occurs frequently (say, 2-3 years in the past 5 years), it should **not** count as non-recurring.

Once you calculate the historical versions of these metrics, you have to find the **projected figures**.

You do **NOT** make your own projections for each comparable company because the point of the analysis is to use each company's **CURRENT** Value and **CURRENT** valuation multiples.

So, you use what the *market as a whole* thinks about each company.

You can find these figures in equity research reports issued by banks, or you can look up consensus estimates on Bloomberg, Capital IQ, and other financial news sources.

One issue with projected metrics is that **comparable companies often have fiscal years that end on different dates**.

For example, one company's fiscal year ends on June 30th but another company's fiscal year ends on September 30th.

If that happens, you **"calendarize"** the figures so that the metrics line up.

The full explanation for calendarization is beyond the scope of this guide, but at a high level, you add and subtract quarters or half-year periods until you get matching figures or roughly-matching figures.

For example, if it's a June 30th vs. September 30th mismatch, you could make each projected year for the June 30th company match up by:

- Taking the *full fiscal-year projections* (i.e., the numbers from July 1st to June 30th in a future year).
- **Adding** the first quarter of the *next* fiscal year after that (June 30th to September 30th).
- And then **subtracting** that same period (June 30th to September 30th) from the prior fiscal year.

Sometimes you can't get an exact match – if one company's fiscal year ends on April 30th and another's ends on June 30th, for example – so you might multiply the financial metrics by fractions to make the projections match up.

Often, you calendarize to make the comparable companies' fiscal years **match the fiscal year of the company you are valuing**.

If the company's fiscal year ends on December 31st, and other companies in the set have fiscal years that end on June 30th and September 30th, you'll change the other companies to use calendar-year figures (i.e., the year ending December 31st).

But if *every* company in the set has a fiscal year ending on June 30th, and your company's FY ends on December 31st, then you might just change your company to match the rest.

One Final Note: For both historical and projected metrics, you **ALWAYS** use the company's **Current Equity Value** or **Current Enterprise Value** to calculate the valuation multiples.

In other words, you don't "project" Equity Value or Enterprise Value.

If a company is growing, its multiples should **decline** into the future. For example, let's assume that a company's LTM Revenue is $1,000, its Year 1 Projected Revenue is $1,200, and its Year 2 Projected Revenue is $1,500.

If its Current Enterprise Value is $2,000, then its EV / Revenue multiples are 2x for the LTM period, 1.7x for Year 1, and 1.3x for Year 2.

You don't project Equity Value or Enterprise Value because **a company's share price already reflects its historical performance and expectations for future performance**.

To project these items, you'd have to time travel to the future, see what expectations are at *that* point in the future, and then time travel back to the present.

So, if you can break all known laws of physics, you can attempt to project Equity Value and Enterprise Value; otherwise, though, always use the **Current** values for both.

Here's our set of comparable public companies for Steel Dynamics:

Operating Statistics:	Capitalization		Revenue			EBITDA			Net Income			Projected Revenue	Projected EBITDA	EBITDA Margin		
Company Name	Equity Value	Enterprise Value	LTM	FY16	FY17	LTM	FY16	FY17	LTM	FY16	FY17	Growth	Growth	LTM	FY16	FY17
United States Steel Corp.	$ 3,130.1	$ 5,451.1	$ 10,327.0	$ 10,545.2	$ 11,231.3	$ (128.0)	$ 675.0	$ 921.4	$ (1,692.0)	$ (74.9)	$ 333.8	6.5%	36.5%	(1.2%)	6.4%	8.2%
Nucor Corporation	15,609.0	17,982.3	15,643.6	16,684.8	16,937.1	1,972.9	2,291.4	2,539.6	469.6	818.3	1,001.0	1.5%	10.8%	12.6%	13.7%	15.0%
Commercial Metals Company	1,776.7	2,373.0	4,813.4	4,683.9	4,780.1	431.9	367.4	423.1	129.4	127.4	171.5	2.1%	15.2%	9.0%	7.8%	8.9%
AK Steel Holding Corporation	1,036.2	3,437.7	6,263.6	5,991.8	6,108.2	547.2	469.2	580.9	(135.0)	57.3	128.9	1.9%	23.8%	8.7%	7.8%	9.5%
Worthington Industries, Inc.	2,732.3	3,358.5	2,819.7	2,891.3	2,971.4	239.9	281.5	324.1	143.7	177.4	220.3	2.8%	15.1%	8.5%	9.7%	10.9%
Reliance Steel & Aluminum Co.	5,259.1	7,340.6	8,679.0	8,890.4	9,303.6	784.6	850.7	928.7	313.1	390.2	441.6	4.6%	9.2%	9.0%	9.6%	10.0%
Maximum	$ 15,609.0	$ 17,982.3	$ 15,643.6	$ 16,684.8	$ 16,937.1	$ 1,972.9	$ 2,291.4	$ 2,539.6	$ [illegible]	$ 818.3	$ 1,001.0	6.5%	36.5%	12.6%	13.7%	15.0%
75th Percentile	4,726.9	6,868.3	9,915.0	10,131.5	10,749.3	725.3	806.8	926.9	270.8	337.0	414.6	4.2%	21.6%	9.0%	9.7%	10.7%
Median	**$ 2,931.2**	**$ 4,444.4**	**$ 7,471.3**	**$ 7,441.1**	**$ 7,705.9**	**$ 489.6**	**$ 572.1**	**$ 751.1**	**$ 136.6**	**$ 152.4**	**$ 277.0**	**2.4%**	**15.1%**	**8.9%**	**8.7%**	**9.7%**
25th Percentile	2,015.6	3,378.3	5,176.0	5,010.9	5,112.1	287.9	392.9	462.6	(68.9)	[illegible]	183.7	2.0%	11.9%	8.6%	7.8%	9.0%
Minimum	1,036.2	2,373.0	2,819.7	2,891.3	2,971.4	(128.0)	281.5	324.1	(1,692.0)	[illegible]	128.9	1.5%	9.2%	(1.2%)	6.4%	8.2%
Steel Dynamics Inc.	**$ 6,043.2**	**$ 7,501.1**	**$ 7,307.2**	**$ 7,716.0**	**$ 8,406.2**	**$ 862.8**	**$ 626.4**	**$ 730.2**	**$ 12.1**	**$ 170.7**	**$ 205.8**	**8.9%**	**16.6%**	**11.8%**	**8.1%**	**8.7%**

Valuation Statistics:	Capitalization		Enterprise Value / Revenue			Enterprise Value / EBITDA			P / E Multiple		
Company Name	Equity Value	Enterprise Value	LTM	FY16	FY17	LTM	FY16	FY17	LTM	FY16	FY17
United States Steel Corp.	$ 3,130.1	$ 5,451.1	0.5 x	0.5 x	0.5 x	NM	8.1 x	5.9 x	NM	NM	9.4 x
Nucor Corporation	15,609.0	17,982.3	1.1 x	1.1 x	1.1 x	9.1 x	7.8 x	7.1 x	33.2 x	19.1 x	[illegible]
Commercial Metals Company	1,776.7	2,373.0	0.5 x	0.5 x	0.5 x	5.5 x	6.5 x	5.6 x	13.7 x	[illegible]	10.4 x
AK Steel Holding Corporation	1,036.2	3,437.7	0.5 x	0.6 x	0.6 x	6.3 x	7.3 x	5.9 x	NM	18.1 x	8.0 x
Worthington Industries, Inc.	2,732.3	3,358.5	1.2 x	1.2 x	1.1 x	14.0 x	11.9 x	10.4 x	19.0 x	15.4 x	12.4 x
Reliance Steel & Aluminum Co.	5,259.1	7,340.6	0.8 x	0.8 x	0.8 x	9.4 x	8.6 x	7.9 x	16.8 x	13.5 x	11.9 x
Maximum	$ 15,609.0	$ 17,982.3	1.2 x	1.2 x	1.1 x	14.0 x	11.9 x	10.4 x	33.2 x	19.1 x	15.6 x
75th Percentile	4,726.9	6,868.3	1.1 x	1.0 x	1.0 x	9.4 x	8.5 x	7.7 x	22.6 x	18.1 x	12.3 x
Median	**$ 2,931.2**	**$ 4,444.4**	**0.7 x**	**0.7 x**	**0.7 x**	**9.1 x**	**8.0 x**	**6.5 x**	**17.9 x**	**15.4 x**	**11.1 x**
25th Percentile	2,015.6	3,378.3	0.5 x	0.5 x	0.5 x	6.3 x	7.5 x	5.9 x	16.0 x	13.9 x	9.6 x
Minimum	1,036.2	2,373.0	0.5 x	0.5 x	0.5 x	5.5 x	6.5 x	5.6 x	13.7 x	13.5 x	8.0 x
Steel Dynamics Inc.	**$ 6,043**	**$ 7,501**	**1.0 x**	**1.0 x**	**0.9 x**	**8.7 x**	**12.0 x**	**10.3 x**	**NM**	**35.4 x**	**29.4 x**

Notice how the multiples **DECLINE** over time because we use the same Equity Value and Enterprise Value, but the company's Revenue and EBITDA grow each year.

If the multiples do **not** decline, it means the underlying metrics have stayed the same or shrunk.

4) Apply the Multiples to Your Company

This part is simple: You calculate the minimum, 25th percentile, median, 75th percentile, and maximum for each version of each multiple (see the diagram above), and then you apply those multiples to your company to value it.

Example: The median LTM EV / EBITDA multiple for the comparable companies is 12x. The LTM EBITDA of the company you're valuing is $500 million. Therefore, your company's *Implied Enterprise Value* based on the LTM EV / EBITDA of the public comps is 12 * $500 million, or $6 billion.

You repeat this same process for all the multiples, and then you back into the company's Implied Equity Value and Implied Share Price for each one:

Valuation Summary - Steel Dynamics Inc.	Steel Dynamics Inc. - Range of Valuation Multiples / Premiums						Steel Dynamics Inc. - Implied Per Share Value Range				
Methodology Name	Maximum Multiple	75th Percentile Multiple	Median Multiple	25th Percentile Multiple	Minimum Multiple	Applicable Company Figure	Minimum Multiple	25th Percentile Multiple	Median Multiple	75th Percentile Multiple	Maximum Multiple
Public Company Comparables:											
LTM EV / Revenue:	1.2 x	1.1 x	0.7 x	0.5 x	0.5 x	$ 7,307.2	$ 8.86	$ 10.07	$ 15.03	$ 26.39	$ 29.94
FY 16 EV / Revenue:	1.2 x	1.0 x	0.7 x	0.5 x	0.5 x	7,716.0	10.13	10.91	16.28	26.33	31.01
FY 17 EV / Revenue:	1.1 x	1.0 x	0.7 x	0.5 x	0.5 x	8,406.2	10.53	11.80	17.45	28.49	33.24
LTM EV / EBITDA:	14.0 x	9.4 x	9.1 x	6.3 x	5.5 x	862.8	14.56	16.37	26.47	27.33	43.89
FY 16 EV / EBITDA:	11.9 x	8.5 x	8.0 x	7.5 x	6.5 x	626.4	10.69	13.27	14.58	15.95	24.85
FY 17 EV / EBITDA:	10.4 x	7.7 x	6.5 x	5.9 x	5.6 x	730.2	10.90	11.83	13.59	17.20	25.25
LTM P / E:	33.2 x	22.6 x	17.9 x	16.0 x	13.7 x	12.1	0.69	0.80	0.90	1.13	1.66
FY 16 P / E:	19.1 x	18.1 x	15.4 x	13.9 x	13.5 x	170.7	9.51	9.84	10.87	12.76	13.46
FY 17 P / E:	15.6 x	12.3 x	11.1 x	9.6 x	8.0 x	205.8	6.84	8.18	9.47	10.44	13.26

To calculate Steel Dynamics' Implied Share Price at the 25th percentile LTM EV / Revenue multiple, you multiply 0.5x by $7,307.2, its LTM Revenue. That gives you its Implied Enterprise Value of $3,895.4.

Then, you back into the Implied Equity Value by adding non-core-business Assets and subtracting L&E items that represent different investor groups, and you divide by the share count to calculate the company's Implied Share Price.

You complete this process because you want to get a **range of Implied Values for the company**.

No one ever knows *exactly* how much a company is worth, so you can't make a statement like: "Steel Dynamics is worth exactly $23.51 per share!"

Instead, the goal is to say: "Steel Dynamics might be worth between $15.00 and $20.00 per share according to revenue multiples, or between $17.00 and $23.00 per share according to EBITDA multiples."

Even though the mechanics are simple, **the big idea** may not be obvious.

With Public Comps, you are calculating the company's **Implied Value** by using the **Current Values** of other, similar companies.

Unlike in a DCF, where *your views* of the company's revenue, expenses, and cash flow explain the company's Implied Value, *the views of the market as a whole* explain the company's Implied Value here.

That's why Public Comps are a "relative valuation methodology" – you use market data, so the company's Implied Value is based on the values of *other* companies.

You should now understand one of the major downsides of Public Comps: **What if the market is completely wrong?**

For this reason, you should consider relative valuation methodologies **"supplemental."**

You'll almost always use them, and they can help confirm or deny the results of your DCF analysis, but **the discounted cash flow analysis IS valuation**.

Return to Top.

Key Rule #8: Precedent Transactions (M&A Comps)

Almost everything in the section above on Comparable Public Companies also applies to **Precedent Transactions**.

The main difference is that with this methodology, you calculate valuation multiples based on what **acquirers have paid to acquire other companies**, not what those companies' shares are currently trading at on the stock market.

Here are the **key differences** in this methodology:

- **Screening Criteria:** You still screen by **industry**, **geography**, and **size**, but each rule is based on *the seller*. If the geographic screen is U.S.-based companies, it's fine to use a deal with a U.S.-based seller and a Japanese buyer.

  One additional criterion is **time**. The M&A market changes greatly over time, so multiples that were accurate 10 years ago might be ridiculous today. Often, you look at transactions from only the past 2-3 years (sometimes up to 5 years). Going back 10 years is usually too far in the past to be useful.

  For the financial criteria, you often use **Transaction Value** (Enterprise Value or Equity Value based on the purchase price for the seller) rather than revenue, EBITDA, or Net Income. Deals of very different sizes might not be comparable at all, so these screens are common.

  Finally, you often use **broader** screening criteria for M&A deals because there may not *be* enough deals if you use narrow criteria.

- **Metrics and Multiples:** You still look at both sales-based and profitability-based metrics and multiples, but you focus more on **historical metrics and multiples** – LTM Revenue and LTM EBITDA are the most common ones.

  You do that because it can be extremely difficult to find *projections* for acquired companies *as of the time they were acquired*.

So, you use a shorter, simpler set of metrics and multiples: You might just list each acquirer's name, each target's name, the purchase price, announcement date, LTM Revenue and EBITDA, and LTM EV / Revenue and EV / EBITDA.

- **Calculations of Metrics and Multiples:** With Precedent Transactions, everything is based on the **purchase price as of the announcement date of the deal**. The LTM figures are based on the most recent data that was available *at the time the deal was announced*.

  Example: A company has 100 shares outstanding, and its share price is $10.00. An acquirer announces plans to buy the company for $15.00 / share. Therefore, you would use 100 * $15.00, or $1,500, for the company's **Transaction Equity Value**, and you would calculate the Transaction Enterprise Value using the company's most recent Balance Sheet as of the time of the deal announcement.

  If this transaction were announced on May 15th, the most recent financial figures would be from the quarter ending March 31st, so you would use those and create LTM figures based on that March 31st period.

  If this transaction were announced on July 5th, the June 30th results would not be available for another few weeks, so you would *still* use the March 31st results for the LTM figures and Balance Sheet data.

  You don't need to worry about calendarization too much because you'll almost always focus on LTM metrics and multiples. If you do use forward numbers, you might base them on "Next Twelve Months" (NTM) figures, which also means there is no need to calendarize anything. The same points about non-recurring charges apply: Yes, add them back if they affect figures like EBIT or EBITDA, but only if they *are* non-recurring.

- **Output:** You get the same output from Precedent Transactions that you do from Public Comps: The minimum, 25th percentile, median, 75th percentile, and maximum for each version of each multiple.

  But the data tends to be **less consistent** because companies get acquired for *very* different reasons. A "strategic acquirer" (i.e., a normal company) might pay a ridiculous amount because the CEO is having an affair with the CEO of the target company, or because the VP of Sales expects to realize significant synergies.

But a private equity acquirer might take a more scientific approach and pay based on the company's financial value, ignoring everything else.

Often, Precedent Transactions produce **higher multiples** than Public Comps because of the **control premium** built into M&A deals.

To acquire 100% of another company, the buyer must offer a **premium** above the other company's Current Share Price. If the company's shares are trading at $10.00, why would it sell itself for only $10.00 per share? Investors could get that price by selling their shares individually!

So, the acquirer might have to offer $12.00 per share or $15.00 per share to do the deal. This "extra amount" above the seller's Current Share Price is the **control premium**.

Control premiums vary based on industry and geography, but they're often between **10% and 30%**. As a result, multiples from Precedent Transactions are often higher than multiples from Public Comps.

However, this rule doesn't always apply because Precedent Transactions also include acquisitions of private companies, the M&A market might be priced differently from the public market, and control premiums might be unusually high or low.

- **Transaction Structures and Other Points:** Ideally, you will use real **acquisitions** – deals where one company buys 100% of another company – in your set of Precedent Transactions.

  In many cases, however, there won't be enough 100% acquisition deals, so you'll also have to use acquisitions for less than 100% of the other company.

  It's fine to use **majority-stake deals**, i.e., ones where the acquirer purchased at least 50% of the seller, but you should **NOT** include both minority and majority-stake deals.

  The dynamics are very different when the buyer purchases 5% or 10% of the seller rather than 70% or 90%.

M&A deals can be structured in different ways, which also creates issues with Precedent Transactions.

For example, some deals include **earn-outs** where a portion of the purchase price is paid out several years into the future, but only if the seller meets certain financial goals (e.g., the seller receives $200 million upfront and $100 million in 3 years if it reaches $50 million in EBITDA by then). With earn-outs, you often assume a 50% payout probability and then add 50% of the earn-out amount to the Transaction Value.

The fact that some deals are **cash purchases** while others are **stock purchases** (i.e., the acquirer issues shares to acquire the seller) also creates differences. Companies are more likely to overpay in stock deals because the money seems "less real."

Here's our set of Precedent Transactions for Steel Dynamics:

Precedent Transactions - North American Steel Manufacturer Sellers with Transaction Enterprise Values Above $500 Million USD

Announced Between January 1st, 2011 and September 2nd, 2016

($ USD in Millions Except Per Share Amounts in USD as Stated)

TIME is an additional screening criterion.

Steel Dynamics Inc. - Comparable M&A Transactions:						Valuation Multiples	
Acquirer Name	Target Name	Announcement Date	Transaction Enterprise Value	LTM Revenue	LTM EBITDA	EV / LTM Revenue	EV / LTM EBITDA
Ontario Steel Investment Limited	Essar Steel Algoma Inc.	2016-07-10	$ 903.0	$ 1,678.5	$ (42.0)	0.5 x	NM
BlueScope Steel Limited	North Star BlueScope Steel, LLC	2015-10-26	1,481.0	1,167.7	185.9	1.3 x	8.0 x
Nucor Corporation	Gallatin Steel Company	2014-09-15	770.0	N/A	N/A	N/A	N/A
Hitachi Metals, Ltd.	Waupaca Foundry, Inc.	2014-08-19	1,337.8	1,735.0	161.7	0.8 x	8.3 x
Steel Dynamics Inc.	Severstal Columbus, LLC	2014-07-21	1,625.0	1,938.6	144.7	0.8 x	11.2 x
AK Steel Corporation	Severstal Dearborn, Inc.	2014-07-21	707.0	2,018.1	24.0	0.4 x	29.4 x
Trinity Industries Inc.	Meyer Steel Structures	2014-06-27	600.0	199.8	31.39	3.0 x	19.1 x
ArcelorMittal and Nippon Steel & Sumitomo Metal Corporation	ThyssenKrupp Steel USA, LLC	2013-11-29	1,550.0	1,662.1	80.2	0.9 x	19.3 x
Reliance Steel & Aluminum Co.	Metals USA Holdings Corp.	2013-02-06	1,216.5	1,983.6	143.3	0.6 x	8.5 x
Nucor Corporation	Skyline Steel L.L.C.	2012-05-17	684.0	873.0	N/A	0.8 x	N/A
Winsway Coking Coal Holdings Limited & Marubeni Corporation	Grande Cache Coal Corporation	2011-10-31	1,028.4	289.0	74.2	3.6 x	13.9 x
	Maximum		$ 1,625.0	$ 2,018.1	$ 185.9	3.6 x	29.4 x
	75th Percentile		1,409.4	1,887.7	144.7	1.2 x	19.2 x
	Median		**$ 1,028.4**	**$ 1,670.3**	**$ 80.2**	**0.8 x**	**12.5 x**
	25th Percentile		738.5	946.7	31.4	0.7 x	8.4 x
	Minimum		600.0	199.8	(42.0)	0.4 x	8.0 x

We focus on historical (LTM) multiples.

Notice how these multiples are *higher* than the ones from the Public Comps (0.7x and 9.1x median LTM multiples there), as expected.

But the data is all more random, and the multiples span a much wider range.

The Bottom Line: Precedent Transactions are useful for valuing companies that lack good Public Comps or that have difficult-to-forecast cash flows.

However, they are **less reliable and consistent** than the other methodologies because of the issues described above.

If you look at the sets of Precedent Transactions throughout our modeling courses, they often produce the most **random** output that spans the widest range of values.

You need to know about Precedent Transactions for interviews, and you'll almost always use them in valuations, but they are still less reliable and consistent than the other methodologies.

Return to Top.

Key Rule #9: Other Valuation Methodologies [OPTIONAL]

Besides the 3 main methodologies – the DCF analysis, Public Comps, and Precedent Transactions – there are a few others.

You are unlikely to get questions on these methodologies in interviews, so consider this section "Optional."

Asset-Based Valuations

Remember the definitions of Equity Value and Enterprise Value: They're both linked to a company's **Balance Sheet** because they relate to its core vs. non-core Assets and the Liability & Equity items that represent other investor groups vs. those that don't.

So, you could skip cash flows and multiples and simply **estimate the market values of the company's Assets and Liabilities**.

You could then subtract the market-valued Liabilities from the market-valued Assets to get the company's **Implied Equity Value**.

This method is called a **Liquidation Valuation**, but it also goes by other names, such as the "Net Asset Value" (NAV) model.

It produces the company's Implied Equity Value because you're valuing *all its Assets*, **not** just its core-business Assets, and you're not distinguishing between Liabilities that represent other investor groups and ones that don't.

This methodology seems nice in theory, but there are a few problems with it:

1) **It's difficult to determine the market values of everything**. There are some rules of thumb – for example, Cash is almost always worth 100% of its book value, and Goodwill is worth $0 – but to value an Asset like PP&E, you'd have to do a ton of research.

2) **It tends to undervalue healthy, growing companies**. If a company is distressed and about to collapse, often it must sell its Assets and repay its Liabilities, so Liquidation Valuation can be reasonably accurate. But healthy companies tend to be worth far more than the Assets on their Balance Sheets because of their growth potential.

Here's an example analysis:

Yahoo! Inc. - Liquidation Valuation					
		Assumed Recovery		Liquidation Value	
	Last FY	Low	High	Low	High
Assets					
Current Assets:					
Cash and Cash Equivalents:	$1,514	95.0%	100.0%	$1,438	$1,514
Short-Term Debt Investments:	$488	70.0%	90.0%	$341	$439
Accounts Receivable, Net:	$1,056	95.0%	100.0%	$1,003	$1,056
Prepaid Expenses & Other Current Assets:	$181	95.0%	100.0%	$172	$181
Total Current Assets:	**$3,238**			**$2,954**	**$3,189**
Long-Term Debt Investments:	$362	70.0%	90.0%	$253	$326
Net PP&E:	$1,332	90.0%	95.0%	$1,198	$1,265
Goodwill:	$4,002	0.0%	0.0%	$0	$0
Net Intangible Assets:	$611	0.0%	0.0%	$0	$0
Other Long-Term Assets:	$504	90.0%	95.0%	$454	$479
Investments in Equity Interests:	$2,181	N/A	N/A	$5,362	$5,362
Total Assets:	**$12,230**			**$10,222**	**$10,621**
Liabilities					
Current Liabilities:					
Accounts Payable:	$176			$176	$176
Accrued Expenses & Other Current Liabilities:	$1,006			$1,006	$1,006
Short-Term Deferred Revenue:	$368			$368	$368
Short-Term Debt:	$750			$750	$750
Total Current Liabilities:	**$2,300**			**$2,300**	**$2,300**
Long-Term Deferred Revenue:	$95			$95	$95
Long-Term Debt:	$0			$0	$0
Other Long-Term Liabilities:	$28			$28	$28
Deferred and Other Long-Term Tax Liabilities, Net:	$261			$261	$261
Commitments and Contingincies:	$0			$0	$0
Noncontrolling Interests	$12			$12	$12
Total Liabilities:	**$2,697**			**$2,697**	**$2,697**

Implied Equity Value:	**$7,525**	**$7,924**
Implied Share Price:	**$ 5.63**	**$ 5.93**

The Dividend Discount Model (DDM)

The DDM is an alternative to the DCF analysis that is critical in some industries (commercial banks and insurance), important in a few others (utilities and some energy companies), and useless in most others (technology, healthcare, retail, etc.).

Instead of valuing a company by projecting its Unlevered Free Cash Flows and discounting them with WACC, you use the company's **Dividends** and **Cost of Equity** instead.

In a DDM, you project down to the company's Net Income, make Dividends a % of Net Income, and then calculate the Terminal Value based on a P / E multiple, just like in a Levered DCF.

But a DDM is only useful for companies that issue recurring, predictable Dividends, or for companies where the traditional concept of "Free Cash Flow" doesn't apply.

And Free Cash Flow applies to companies in almost every industry, except for commercial banks and insurance firms.

The only firms *outside* those industries that tend to issue Dividends on a recurring, predictable basis are utility companies and some trusts, partnerships, and MLPs (Master Limited Partnerships), which are common in the midstream energy (pipelines) sector.

If you're working in one of those industries, the DDM might be useful; if not, it's not important.

Variations of Comparable Companies and Precedent Transactions

One variation of Precedent Transactions is the **M&A Premiums Analysis**, where you look at the **premium** each acquirer paid over each seller's share price and use those figures to value your company.

For example, if you're valuing Steel Dynamics, you might gather a set of 20-30 public manufacturing companies that have been acquired over the past 5 years and calculate the premium the buyer paid in each case.

If a seller's share price was $20.00 before the acquisition, and the buyer paid $25.00 per share for the company, that's a **25%** premium.

You collect that data for all the transactions and then apply the median figure (or some other percentile) to your company's current share price.

If the median figure is 25%, and your company's share price is currently $28.00, then the company is worth $28.00 * (1 + 25%), or $35.00, according to this methodology.

This method sounds simple, but a few points make it more complicated:

- **Selection Criteria:** You often use broader selection criteria than with Precedent Transactions because you can include only acquisitions of **public companies**. So, instead of screening based on U.S.-based steel companies worth at least $500 million, you might reduce the threshold to $100 million.

- **Which Premium?** Often, rumors of an M&A deal break before the actual deal is announced. So, the 1-day premium (i.e., Offer Price / Share Price One Day Prior – 1)

might be deceptive. As a result, some people use 30-day or 60-day premiums, or even the premium to the *average* share price over the past 30, 60, 90, or 180 days.

- **It Only Works for Public Companies:** This methodology only works for standalone public companies that might be acquired in full. It doesn't apply to private companies or acquisitions of less-than-100% stakes.

Here's an example analysis for Jazz Pharmaceuticals that's combined with normal Precedent Transactions:

Precedent Transactions - U.S. and Canada-Based Pharmaceutical Sellers with LTM Revenue Between $500 Million and $5 Billion Announced Between August 16th, 2012 and August 16th, 2017
($ in Millions Except Per Share and Per Unit Data)

Jazz Pharmaceuticals plc - Comparable M&A Transactions				Operating Metrics		Valuation Multiples		Premiums Paid		
Acquirer Name	Target Name	Date	Transaction Enterprise Value	LTM Revenue	LTM EBITDA	EV / LTM Revenue	EV / LTM EBITDA	1-Day Prior	1-Week Prior	1-Month Prior
Fresenius Kabi USA, LLC	Akorn, Inc.	2017-04-24	$ 4,789.0	$1,101.9	$ 445.9	4.3 x	10.7 x	3.3%	6.3%	49.5%
Lonza Group Ltd	Capsugel Inc.	2016-12-15	5,500.0	1,000.0	344.0	5.5 x	16.0 x	N/A	N/A	N/A
Danaher Corporation	Cepheid	2016-09-06	4,078.8	564.3	0.6	7.2 x	NM	54.0%	52.8%	41.0%
Pfizer Inc.	Medivation, Inc.	2016-08-22	13,941.9	1,027.1	456.5	13.6 x	30.5 x	21.4%	24.8%	30.1%
Endo International plc	Par Pharmaceutical Holdings, Inc.	2015-05-18	10,202.5	1,378.8	471.0	7.4 x	21.7 x	N/A	N/A	N/A
AbbVie Inc.	Pharmacyclics LLC	2015-03-04	20,166.7	816.1	112.9	24.7 x	NM	20.8%	18.9%	56.9%
Valeant Pharmaceuticals International, Inc.	Salix Pharmaceuticals Ltd.	2015-02-22	14,837.9	1,133.5	154.8	13.1 x	95.9 x	9.6%	13.6%	37.4%
Pfizer Inc.	Hospira Inc.	2015-02-05	16,940.7	4,463.7	746.8	3.8 x	22.7 x	40.8%	40.9%	50.5%
Merck & Co., Inc.	Cubist Pharmaceuticals LLC	2014-12-08	9,488.3	1,164.5	203.6	8.1 x	46.6 x	37.2%	34.9%	44.9%
Mallinckrodt Public Limited Company	Questcor Pharmaceuticals, Inc.	2014-04-07	5,300.3	890.9	516.9	5.9 x	10.3 x	26.8%	32.6%	30.4%
Actavis plc	Forest Laboratories, LLC	2014-02-18	23,538.4	3,371.4	418.3	7.0 x	56.3 x	25.3%	28.7%	30.2%
Forest Laboratories, LLC	Aptalis Holdings Inc.	2014-01-08	2,900.0	700.2	275.6	4.1 x	10.5 x	N/A	N/A	N/A
Amgen Inc.	Onyx Pharmaceuticals, Inc.	2013-08-25	9,259.3	516.0	(151.5)	17.9 x	NM	6.9%	7.9%	(5.1%)
Valeant Pharmaceuticals International, Inc.	Medicis Pharmaceutical Corporation	2012-09-03	2,328.8	763.7	191.4	3.0 x	12.2 x	39.4%	34.5%	31.0%
	Maximum		$ 23,538.4	$4,463.7	$ 746.8	24.7 x	95.9 x	54.0%	52.8%	56.9%
	75th Percentile		14,613.9	1,156.8	453.8	11.9 x	38.6 x	38.3%	34.7%	47.2%
	Median		**$ 9,373.8**	**$1,013.5**	**$ 309.8**	**7.1 x**	**21.7 x**	**25.3%**	**28.7%**	**37.4%**
	25th Percentile		4,916.8	776.8	163.9	4.6 x	11.5 x	15.2%	16.2%	30.3%
	Minimum		2,328.8	516.0	(151.5)	3.0 x	10.3 x	3.3%	6.3%	(5.1%)

"N/A" for all acquisitions of private companies and < 100% stake deals. For public companies, we just compare the offer price to the seller's share price on a prior date in each case.

Based on these figures, we might conclude that a 25-35% premium for Jazz would be reasonable if it wanted to sell.

A variation of Public Comps is the **Future Share Price Analysis**.

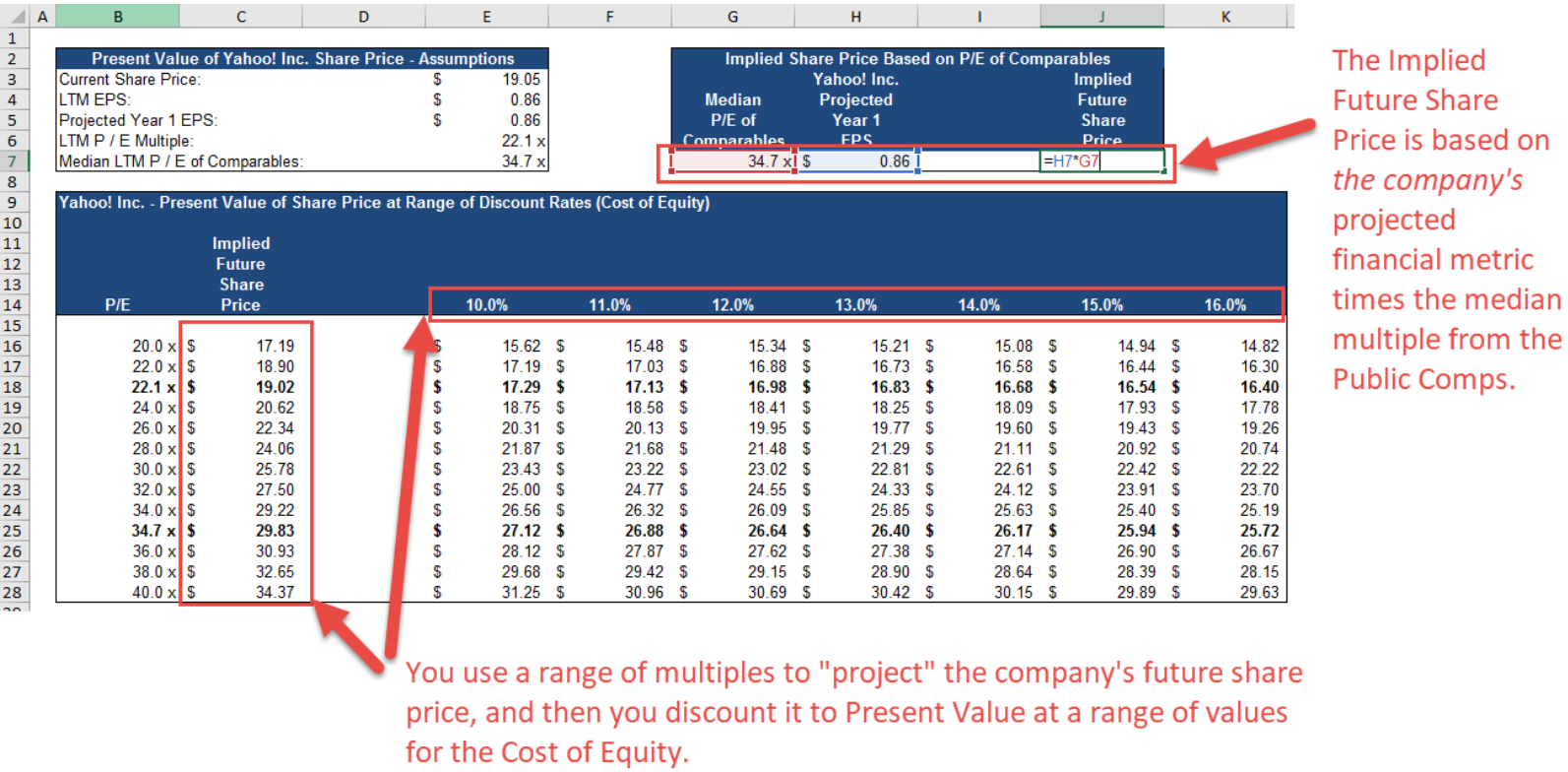
In this one, you take the median *historical* multiple from the Public Comps, usually the P / E multiple, and multiply it by the *projected* metric of the company you're valuing.

You "project" the company's share price by assuming that in 1-2 years, the company will be trading *at* the median multiple the comps are currently trading at.

Since money today is worth more than money tomorrow, you then **discount** this future share price back to its Present Value by using Discount Rates linked to the company's Cost of Equity.

If you're using Enterprise Value-based multiples instead, you back into the Implied Equity Value and Implied Share Price in the future year. And you still discount that share price to its Present Value by using the Cost of Equity.

Here's an example analysis:



Present Value of Yahoo! Inc. Share Price - Assumptions	
Current Share Price:	$ 19.05
LTM EPS:	$ 0.86
Projected Year 1 EPS:	$ 0.86
LTM P / E Multiple:	22.1 x
Median LTM P / E of Comparables:	34.7 x

Implied Share Price Based on P/E of Comparables			
Median P/E of Comparables		Yahoo! Inc. Projected Year 1 EPS	Implied Future Share Price
34.7 x	$	0.86	=H7*G7

Yahoo! Inc. - Present Value of Share Price at Range of Discount Rates (Cost of Equity)

P/E		Implied Future Share Price		10.0%	11.0%	12.0%	13.0%	14.0%	15.0%	16.0%
20.0 x	$	17.19	$	15.62	$ 15.48	$ 15.34	$ 15.21	$ 15.08	$ 14.94	$ 14.82
22.0 x	$	18.90	$	17.19	$ 17.03	$ 16.88	$ 16.73	$ 16.58	$ 16.44	$ 16.30
22.1 x	**$**	**19.02**	**$**	**17.29**	**$ 17.13**	**$ 16.98**	**$ 16.83**	**$ 16.68**	**$ 16.54**	**$ 16.40**
24.0 x	$	20.62	$	18.75	$ 18.58	$ 18.41	$ 18.25	$ 18.09	$ 17.93	$ 17.78
26.0 x	$	22.34	$	20.31	$ 20.13	$ 19.95	$ 19.77	$ 19.60	$ 19.43	$ 19.26
28.0 x	$	24.06	$	21.87	$ 21.68	$ 21.48	$ 21.29	$ 21.11	$ 20.92	$ 20.74
30.0 x	$	25.78	$	23.43	$ 23.22	$ 23.02	$ 22.81	$ 22.61	$ 22.42	$ 22.22
32.0 x	$	27.50	$	25.00	$ 24.77	$ 24.55	$ 24.33	$ 24.12	$ 23.91	$ 23.70
34.0 x	$	29.22	$	26.56	$ 26.32	$ 26.09	$ 25.85	$ 25.63	$ 25.40	$ 25.19
34.7 x	**$**	**29.83**	**$**	**27.12**	**$ 26.88**	**$ 26.64**	**$ 26.40**	**$ 26.17**	**$ 25.94**	**$ 25.72**
36.0 x	$	30.93	$	28.12	$ 27.87	$ 27.62	$ 27.38	$ 27.14	$ 26.90	$ 26.67
38.0 x	$	32.65	$	29.68	$ 29.42	$ 29.15	$ 28.90	$ 28.64	$ 28.39	$ 28.15
40.0 x	$	34.37	$	31.25	$ 30.96	$ 30.69	$ 30.42	$ 30.15	$ 29.89	$ 29.63

The Implied Future Share Price is based on *the company's* projected financial metric times the median multiple from the Public Comps.

You use a range of multiples to "project" the company's future share price, and then you discount it to Present Value at a range of values for the Cost of Equity.

We do **NOT** recommend this analysis unless someone specifically asks you for it.

There are dozens of problems with it, but let's start with the biggest ones:

1) **Why Would You Apply Historical Multiples to *Projected* Metrics?** This idea is questionable because multiples change over time. There's no guarantee that the LTM multiple of the Public Comps *today* will be the same in 1-2 years.

2) **What Value Does This Add Over a Normal Public Comps Analysis?** This method is another way to use valuation multiples to value a company, but how is it better or more useful than standard Public Comps?

3) **You Shouldn't Try to "Project" Share Prices.** Finally, a company's current share price reflects **past performance** and **future expectations**. So, how could you possibly

"project" what it will be in the future? You'd have to jump into the future and assess future expectations *at that point* – and then time travel back to the present.

Sum-of-the-Parts (SOTP) Valuation

This methodology makes some amount of sense, unlike the others listed above.

With **Sum of the Parts**, you value each division of a company separately, add up the Implied Enterprise Value for each division, and then back into the Implied Equity Value and Implied Share Price for the entire company at the end.

Sum of the Parts works best for companies with *very* different division: Firms like General Electric or Samsung that operate in everything from aviation to healthcare to transportation.

It makes sense for these companies because the divisions have different Discount Rates, Cash Flow Growth Rates, Comparable Public Companies, and Precedent Transactions.

Here's a simple example:

Yahoo! Inc. - Sum of the Parts Valuation Based on Estimated Revenue Multiples					
	Projected Year 1 Revenue:	Low Multiple	High Multiple	Low EV	High EV
Revenue by Segment:					
Search Advertising:	$ 1,384	6.0 x	7.0 x	$ 8,302	$ 9,685
Display Advertising:	2,415	4.0 x	5.0 x	9,660	12,075
Affiliate Site Revenue:	656	2.0 x	3.0 x	1,313	1,969
Premium Fees:	934	2.0 x	3.0 x	1,868	2,802
Other Revenue:	412	1.0 x	2.0 x	412	823
Total:	**$ 5,801**	**15.0 x**	**20.0 x**	**$ 21,554**	**$ 27,355**
		Implied Share Price:		**$ 21.33**	**$ 25.53**

Yahoo's divisions at this time were a bit different, but not *that* different, so it's a stretch to use this methodology here.

Sum of the Parts makes no sense for a company like Steel Dynamics – it has different business divisions, but they're all related to **steel manufacturing**.

Other companies in the sector all have the same types of divisions as well, so you wouldn't be able to find Public Comps to value each division separately.

The main downsides to Sum of the Parts are:

1) **It Takes A LOT More Time and Effort to Use** – If the company has 10 divisions, you need to find 10 different sets of Public Comps and Precedent Transactions, build 10 different DCF analyses, and so on.

2) **You May Not Have Enough Information to Use It** – For example, many companies disclose *revenue by segment*, but **not** operating income, taxes, Working Capital, or CapEx by segment. It's tough to build a separate DCF for each division without this information.

   All companies also have **corporate overhead expenses** that are not allocated to one specific division. You need to factor these in when you calculate the Implied Value for the entire company, but not all companies disclose these expenses.

Leveraged Buyout (LBO) Valuation

This one is a whole separate topic (see the LBO lessons/sections/guides), but you can also value a company by assuming that a private equity firm buys it, runs it for several years, and sells it in the future and that it targets a specific IRR or multiple with the investment.

For example, let's say that a private equity firm plans to acquire a company, hold it, and sell it in 5 years.

They believe they can sell it for an EV / EBITDA multiple between 12x and 15x, and they want to use 50% Debt and 50% Equity to purchase it. They are targeting a 20% IRR.

You could set up the LBO model and then use the "Goal Seek" function in Excel to determine the **maximum purchase price** that would yield that 20% IRR.

That price would depend on the exit multiple, so you would show the maximum purchase price at exit multiples ranging from 12x to 15x.

You use this methodology as more of a "sanity check" or "initial screen" – for example, a private equity firm might run this analysis to decide if a deal makes sense before spending time/money on it.

If the maximum amount the PE firm can pay to realize a 20% IRR is $1 billion, but the company's Current Enterprise Value is $1.5 billion, the deal cannot work.

But if the company's Current Enterprise Value is only $800 million, then the deal might work.

Industry-Specific Valuation

This topic is beyond the scope of this guide, so take a look at the summary in the Equity Vale and Enterprise Value Guide or our industry-specific guides and courses.

In short, there are also industry-specific valuation methodologies in industries such as commercial banking, insurance, real estate investment trusts (REITs), and oil & gas.

But these methodologies aren't "new": They're primarily variations of the DCF Analysis.

For example, the **Net Asset Value (NAV) Model** for oil & gas is a DCF with no Terminal Value.

After an initial exploration/growth period, you assume that the company stops exploring for more oil and gas and that it produces everything until its reserves are depleted.

As a result, its Cash Flow eventually drops to $0 in the future.

You discount and sum up all the cash flows, as you do in any DCF, but you skip the Terminal Value because it makes no sense here.

For life insurance, the **embedded value** methodology is a similar, far-in-the-future DCF analysis where a company's Implied Value is linked to its Balance Sheet (Assets minus Liabilities) plus the Present Value of Future Cash Profits from its policies.

Since life insurance policies can last for 20-30 years, you might create projections for decades into the future with this one.

For most other industries, the standard metrics, multiples, and methodologies described in this guide apply.

Return to Top.

Key Rule #10: How to Put Together and Use a Full Valuation

When you've finished the DCF, Public Comps, and Precedent Transactions, you can see how all the methodologies stack up.

You do this by showing the range of multiples from each methodology on the same page.

Here's our summary page for Steel Dynamics:

Valuation Summary - Steel Dynamics Inc.	Steel Dynamics Inc. - Range of Valuation Multiples / Premiums					
Methodology Name	Maximum Multiple	75th Percentile Multiple	Median Multiple	25th Percentile Multiple	Minimum Multiple	Applicable Company Figure
Public Company Comparables:						
LTM EV / Revenue:	1.2 x	1.1 x	0.7 x	0.5 x	0.5 x	$ 7,307.2
FY 16 EV / Revenue:	1.2 x	1.0 x	0.7 x	0.5 x	0.5 x	7,716.0
FY 17 EV / Revenue:	1.1 x	1.0 x	0.7 x	0.5 x	0.5 x	8,406.2
LTM EV / EBITDA:	14.0 x	9.4 x	9.1 x	6.3 x	5.5 x	862.8
FY 16 EV / EBITDA:	11.9 x	8.5 x	8.0 x	7.5 x	6.5 x	626.4
FY 17 EV / EBITDA:	10.4 x	7.7 x	6.5 x	5.9 x	5.6 x	730.2
LTM P / E:	33.2 x	22.6 x	17.9 x	16.0 x	13.7 x	12.1
FY 16 P / E:	19.1 x	18.1 x	15.4 x	13.9 x	13.5 x	170.7
FY 17 P / E:	15.6 x	12.3 x	11.1 x	9.6 x	8.0 x	205.8
Precedent Transactions:						
LTM EV / Revenue:	3.6 x	1.2 x	0.8 x	0.7 x	0.4 x	7,307.2
LTM EV / EBITDA:	29.4 x	19.2 x	12.5 x	8.4 x	8.0 x	862.8
Discounted Cash Flow Analysis:						
9.00% - 11.00% WACC, 2.10% - 2.90% Terminal FCF Growth Rate:						

Then, you calculate the **Implied Enterprise Value** or **Implied Equity Value** based on each multiple in this set and the company's applicable figure.

For example, if the minimum LTM EV / Revenue multiple is 2.0x, and the company's LTM revenue is $1,000, then its Implied Enterprise Value is $2,000 based on that multiple.

For private companies, you often stop there.

But if you're valuing a public company, you then back into the Implied Equity Value by adding non-core-business Assets and subtracting Liability and Equity items that represent other investor groups.

And then you divide by the company's share count to get its Implied Share Price.

You repeat this process for all the multiples to calculate **ranges of Implied Share Prices:**

Valuation Summary - Steel Dynamics Inc.	Steel Dynamics Inc. - Range of Valuation Multiples / Premiums						Steel Dynamics Inc. - Implied Per Share Value Range				
Methodology Name	Maximum Multiple	75th Percentile Multiple	Median Multiple	25th Percentile Multiple	Minimum Multiple	Applicable Company Figure	Minimum Multiple	25th Percentile Multiple	Median Multiple	75th Percentile Multiple	Maximum Multiple
Public Company Comparables:											
LTM EV / Revenue:	1.2 x	1.1 x	0.7 x	0.5 x	0.5 x	$ 7,307.2	$ 8.46	$ 9.67	$ 14.63	$ 25.99	$ 29.54
FY 16 EV / Revenue:	1.2 x	1.0 x	0.7 x	0.5 x	0.5 x	7,716.0	9.73	10.51	15.88	25.93	30.61
FY 17 EV / Revenue:	1.1 x	1.0 x	0.7 x	0.5 x	0.5 x	8,406.2	10.43	11.39	17.05	28.08	32.83
LTM EV / EBITDA:	14.0 x	9.4 x	9.1 x	6.3 x	5.5 x	862.8	13.16	15.97	26.07	26.93	43.48
FY 16 EV / EBITDA:	11.9 x	8.5 x	8.0 x	7.5 x	6.5 x	626.4	10.29	12.87	14.18	15.55	24.45
FY 17 EV / EBITDA:	10.4 x	7.7 x	6.5 x	5.9 x	5.6 x	730.2	10.50	11.43	13.18	16.80	24.84
LTM P / E:	33.2 x	22.6 x	17.9 x	16.0 x	13.7 x	12.1	0.69	0.80	0.90	1.13	1.66
FY 16 P / E:	19.1 x	18.1 x	15.4 x	13.9 x	13.5 x	170.7	9.51	9.84	10.87	12.76	13.46
FY 17 P / E:	15.6 x	12.3 x	11.1 x	9.6 x	8.0 x	205.8	6.84	8.18	9.47	10.44	13.26
Precedent Transactions:											
LTM EV / Revenue:	3.6 x	1.2 x	0.8 x	0.7 x	0.4 x	7,307.2	4.15	13.28	18.06	29.33	101.01
LTM EV / EBITDA:	29.4 x	19.2 x	12.5 x	8.4 x	8.0 x	862.8	21.98	23.64	38.30	61.91	98.55
Discounted Cash Flow Analysis:											
9.00% - 11.00% WACC, 2.10% - 2.90% Terminal FCF Growth Rate:							13.91	15.63	17.65	20.09	23.08

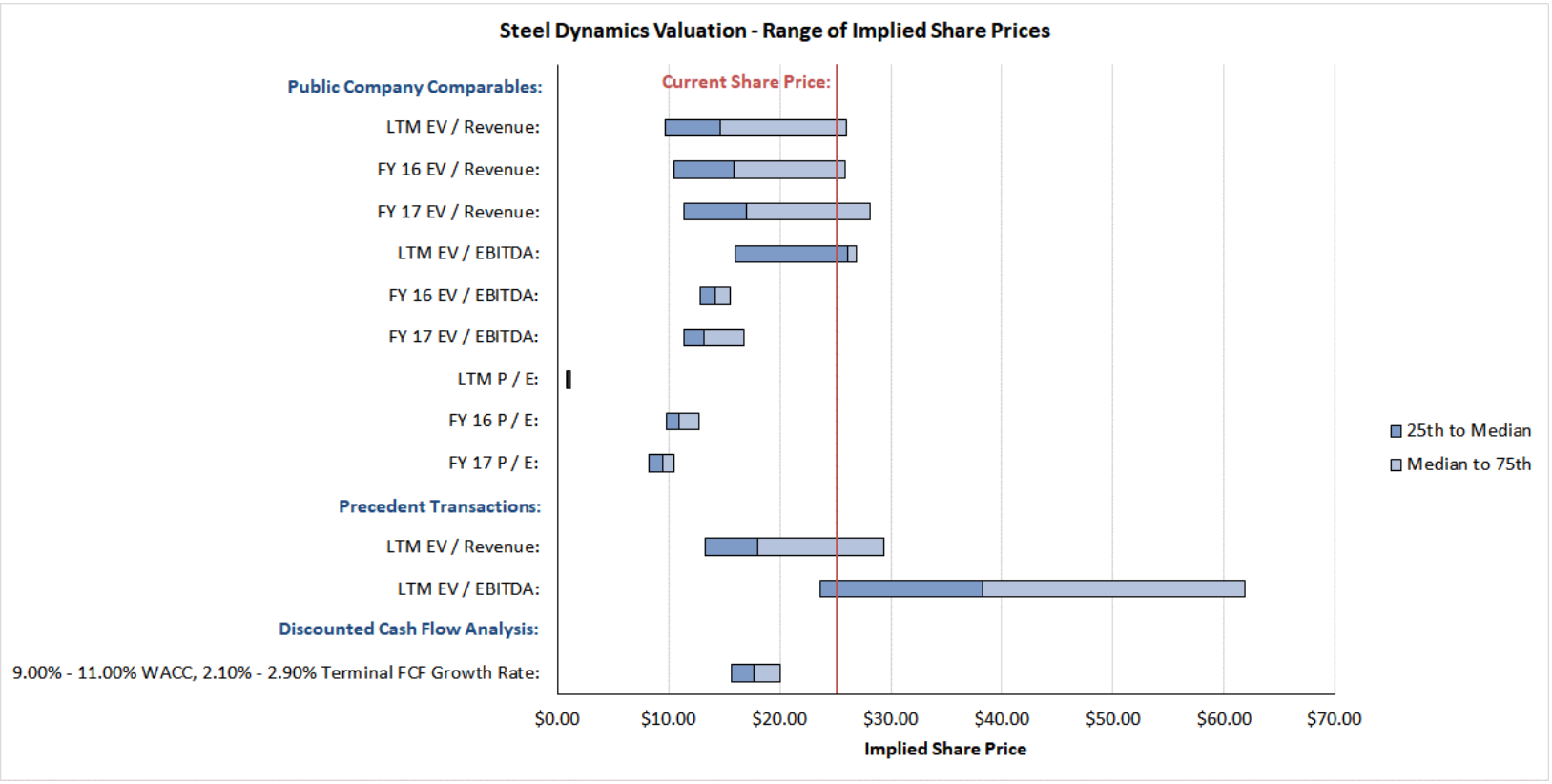
You use the range of multiples on the left, apply each one to the relevant financial stats for Steel Dynamics, and calculate the Implied Share Prices for different multiples and time frames.

For the DCF, you just take the range of Implied Share Prices from the sensitivity tables.

You don't use this process for the DCF because the DCF should calculate the Implied Share Price directly. So, you simply link to a range of values around the center of the sensitivity table:

		Weighted Average Cost of Capital (WACC):										
		8.75%	9.00%	9.25%	9.50%	9.75%	**10.00%**	10.25%	10.50%	10.75%	11.00%	11.25%
Terminal FCF	2.90%	$ 24.48	$ 23.08	$ 21.79	$ 20.61	$ 19.51	**$ 18.49**	$ 17.54	$ 16.66	$ 15.83	$ 15.05	$ 14.33
Growth Rate	2.80%	24.12	22.76	21.50	20.34	19.27	**18.27**	17.34	16.47	15.66	14.90	14.18
(Terminal	2.70%	23.78	22.45	21.22	20.09	19.04	**18.06**	17.15	16.29	15.50	14.75	14.04
Value	2.60%	23.45	22.15	20.95	19.84	18.81	**17.85**	16.96	16.12	15.34	14.60	13.91
Calculated	**2.50%**	**23.12**	**21.86**	**20.69**	**19.60**	**18.59**	17.65	**16.77**	**15.95**	**15.18**	**14.46**	**13.77**
Using the	2.40%	22.81	21.58	20.43	19.37	18.38	**17.46**	16.59	15.79	15.03	14.32	13.65
Gordon	2.30%	22.51	21.30	20.18	19.14	18.17	**17.27**	16.42	15.63	14.88	14.18	13.52
Growth	2.20%	22.22	21.04	19.94	18.92	17.97	**17.08**	16.25	15.47	14.74	14.04	13.39
Method):	2.10%	21.94	20.78	19.71	18.71	17.77	**16.90**	16.08	15.32	14.59	13.91	13.27

Once you have this, you then create a "Football Field" chart that shows the ranges of Implied Share Prices using bar charts:



Our conclusions here might be:

1) **Implied Value** – Steel Dynamics is likely worth between $15.00 and $20.00 per share because the DCF output is in that range, as are some of the median Implied Share Prices from the Public Comps.

   The company's share price was $24.97 at the time of this analysis, making it overvalued by 25-35%.

2) **Useless Methodologies and Multiples** – The P / E multiples seem so far off from everything else that we shouldn't pay much attention to them. The Precedent Transactions also produce odd values, though the Implied Value from the median EV / Revenue multiple seems plausible.

Your next steps depend on **where you're working** and the purpose of this analysis.

For example, if you're working at an investment bank and you advise companies on deals, you might tell the Steel Dynamics management team the following based on this analysis:

- **Company Value** – If the team wants to know what the company is "really worth," you'd likely tell them, "Between $15.00 and $20.00 per share."

- **It's Probably Not a Good Time to Sell** – The company trades at a premium to its intrinsic value, and an acquirer would have to pay even more to acquire the company. A standard 30% premium would make the company even more overvalued, meaning that an acquirer would need to realize massive synergies to make the math work.

- **But It Might Be a Good Time to Raise Equity** – Companies benefit from raising Equity when they trade at higher multiples and premiums to their intrinsic values; Equity produces less dilution in those cases because the company can issue fewer shares to raise the same amount of capital.

On the other hand, if you're working in a **buy-side role**, such as at a hedge fund or private equity firm, your interpretation would be different.

In those roles, the key question is whether or not you should **invest** in a company.

Buying a company, or buying a small stake in a company, makes the most sense when it appears to be **undervalued** and when specific events ("catalysts") might cause the share price to change in the next 6-12 months.

A private equity firm might conclude that since Steel Dynamics trades at a premium to its intrinsic value, it is **not** a great investment right now.

The firm might still build a leveraged buyout model and see if it can achieve its targeted IRRs, but the valuation alone would make a deal less likely.

A hedge fund might conclude that the company is **overvalued** and that its share price could decline in the next 6-12 months.

That makes it, potentially, a good **"Short"** candidate. You would *sell* the company's shares and then *buy* them back at a lower level to profit from the company's share-price decline.

If you're wrong, you could lose an unlimited amount of money, which is why you would need to hedge yourself and limit your potential losses in this scenario.

Steel Dynamics isn't overvalued by that much, so many hedge funds would stay away.

Funds often seek companies that are mispriced by much greater percentages (e.g., 50%+) so that they have a higher **margin of safety.**

Return to Top.

Key Rule #11: The Trade-Offs of Different Methodologies

We've covered a lot in this guide, so this last section provides a **summary** of the trade-offs of different methodologies:

Advantages and Disadvantages of the Main Valuation Methodologies:

Methodology Name:	Public Comps	Precedent Transactions	Discounted Cash Flow Analysis
Advantages:	• Based on **real market data**. • **Less** dependent on future assumptions. • **Quick** to calculate and easy to understand/explain.	• Based on what real companies have **actually** paid for other companies. • May show **industry trends** more effectively than Public Comps.	• **Not** as subject to market fluctuations/conditions. • Most "correct" methodology according to **finance theory**. • Better reflects **company-specific** factors and scenarios/stages.
Disadvantages:	• There may not be **truly comparable** companies. • Less accurate for thinly traded stocks or **volatile** companies. • May **undervalue** companies' long-term potential. • The market might be **wrong**!	• **Data** can be limited and misleading. • There may not be **truly comparable** transactions. • Multiples don't capture **all the aspects** of a deal. • Specific **market conditions** can greatly impact output.	• Very dependent on **far-in-the-future** assumptions. • Bankers are notoriously **bad** at making reasonable assumptions. • Widespread **disagreement** on how to calculate figures like Cost of Equity and WACC.

And then for the more "exotic" methodologies:

- **Liquidation Valuation** – It's difficult to determine the market values of everything on the Balance Sheet, and it undervalues healthy, growing companies; it's more appropriate for distressed companies.

- **Dividend Discount Model** – Useful for companies that issue predictable Dividends or for industries in which Free Cash Flow is meaningless, but it's not useful for non-Dividend-paying companies.

- **M&A Premiums Analysis** – It's helpful for assessing what an acquirer might have to pay for an entire public company, but it's not useful for valuing private companies or non-100% acquisitions.

- **Future Share Price Analysis** – There are no real positives. The methodology itself – applying historical multiples to projected metrics – is questionable, and it doesn't fix or improve anything from normal Public Comps. Even if you apply *future* multiples to *future* metrics, it doesn't add much over Public Comps.

- **Sum of the Parts** – It's useful for valuing conglomerates and companies with very different divisions, but it takes a lot more time and effort to use, and the company may not disclose all the information you need.

- **Leveraged Buyout Valuation** – It's helpful for PE firms thinking about the maximum amount they could pay for a company to achieve a certain IRR, but it's more of an initial screening tool or sanity check than a strict valuation methodology.

Comparing Expected Values from Different Methodologies

Since all the methodologies depend on your assumptions, it's difficult to make universal statements about which one, if any, produces the "highest" values.

But here's what we *can* say:

- **Precedent Transactions vs. Public Comps:** Transactions *tend* to produce higher Implied Values due to the **control premium**. But this rule doesn't always hold up, especially if market conditions have suddenly changed.

- **M&A Premiums Analysis vs. Public Comps:** Like the Precedent Transactions, the M&A Premiums Analysis tends to produce higher Implied Values because of the **control premium**.

- **Discounted Cash Flow Analysis:** This one often produces the most *variable* output since it's the most dependent on far-in-the-future assumptions. But if you use reasonable assumptions, you should get reasonable results, as we did for Steel Dynamics.

- **Liquidation Valuation:** This one will produce the **lowest** Implied Values for healthy companies because they're worth significantly more than what their Balance Sheets suggest.

- **Sum of the Parts:** If a company truly *is* worth more in "parts," then this one will produce higher Implied Values than if you valued the entire company using *one* DCF, *one* set of comparable companies, and so on.

- **LBO Valuation:** This one tends to produce values on the lower end of the range because it tells you the *maximum price* a PE firm could pay to achieve a *minimum IRR*. Unlike the other methodologies, it sets a "ceiling" on valuation.

There are so many exceptions to these rules that we suggest **avoiding** this topic in interviews.

It's best to turn the conversation back to the trade-offs of the different methodologies and explain *why* they differ rather than claiming that one specific approach will always produce the highest or lowest values.

Return to Top.

Interview Questions

Interview questions on valuation are extremely common, but we've already covered many of them in the Equity Value, Enterprise Value, and Valuation Multiples guide.

As a result, we're going to focus on the DCF analysis here, as well as how to use methodologies like Public Comps and Precedent Transactions in real life.

Interviews have evolved to the point where simple questions with easily-memorized answers (e.g., "What are the 3 valuation methodologies?") are no longer common.

Instead, interviewers are more likely to test your **conceptual understanding** by asking you to walk through analyses, explain the trade-offs, and apply the methodologies to advise clients and make investment recommendations.

The Purpose of Valuation

These questions are quite high-level, but many candidates don't understand *the point* of valuation.

You can't answer the more detailed questions without knowing that, so don't dismiss this category as "too basic" – even if you have significant work experience.

1. What's the point of valuation? WHY do you value a company?

You value a company to determine its **Implied Value** according to your views of it.

If this Implied Value is very different from the company's Current Value, you might be able to invest in the company and make money if its value changes.

If you are advising a client company, you might value it so you can tell management the price that it might receive if the company sells, which is often different from its Current Value.

2. But public companies already have Market Caps and Share Prices. Why bother valuing them?

Because a company's Market Cap and Share Price reflect its **Current Value** according to "the market as a whole" – but the market might be wrong!

You value companies to see if the market's views are correct or incorrect.

3. What are the advantages and disadvantages of the 3 main valuation methodologies?

Public Comps are useful because they're based on real market data, are quick to calculate and explain, and do not depend on far-in-the-future assumptions.

However, there may not be truly comparable companies, the analysis will be less accurate for volatile or thinly traded companies, and it may undervalue companies' long-term potential.

Precedent Transactions are useful because they're based on the **real prices** that companies have paid for other companies, and they may better reflect industry trends than Public Comps.

However, the data is often spotty and misleading, there may not be truly comparable transactions, and specific deal terms and market conditions might distort the multiples.

DCF Analysis is the most "correct" methodology according to finance theory, it's less subject to market fluctuations, and it better reflects company-specific factors and long-term trends.

However, it's also very dependent on far-in-the-future assumptions, and there's disagreement over the proper calculations for key figures like the Cost of Equity and WACC.

4. Which of the 3 main methodologies will produce the highest Implied Values?

This is a trick question because almost any methodology *could* produce the highest Implied Values depending on the industry, time period, and assumptions.

Precedent Transactions often produce higher Implied Values than the Public Comps because of the **control premium** – the extra amount that acquirers must pay to acquire sellers.

But it's tough to say how a DCF stacks up because it's far more dependent on your assumptions.

The best answer is: "A DCF tends to produce the most variable output since it's so dependent on your assumptions, and Precedent Transactions tend to produce higher values than the Public Comps because of the control premium."

5. When is a DCF more useful than Public Comps or Precedent Transactions?

You should pretty much always build a DCF since it **IS** valuation – the other methodologies are supplemental.

But it's especially useful when the company you're valuing is mature and has stable, predictable cash flows, or when you lack good Public Comps or Precedent Transactions.

6. When are Public Comps or Precedent Transactions more useful than the DCF?

If the company you're valuing is early-stage, and it is impossible to estimate its future cash flows, or if the company has no path to positive cash flows, you have to rely on the other methodologies.

These other methodologies can also be more useful when you run into problems in the DCF, such as an inability to estimate the Discount Rate or extremely volatile cash flows.

7. Which one should be worth more: A $500 million EBITDA healthcare company or a $500 million EBITDA industrials company?

Assume the growth rates, margins, and all other financial stats are the same.

In all likelihood, the healthcare company will be worth more because healthcare is a **less asset-intensive industry**. That means the company's CapEx and Working Capital requirements will be lower, and its Free Cash Flow will be higher (i.e., closer to EBITDA) as a result.

Healthcare, at least in some sectors, also tends to be more of a "growth industry" than industrials.

The Discount Rate might also be higher for the healthcare company, but the lower asset intensity and higher expected growth rates would likely make up for that.

However, this answer is an *extreme* generalization, so you would need more information to make a real decision.

8. How do you value an apple tree?

The same way you value a company: Comparables and a DCF. You'd look at what similar apple trees have sold for, and then calculate the expected future cash flows from this tree.

You would then discount these cash flows to Present Value, discount the Terminal Value to PV, and add up everything to determine the apple tree's Implied Value.

The Discount Rate would be based on your **opportunity cost** – what you might be able to earn each year by investing in other, similar apple trees.

9. People say that the DCF is an intrinsic valuation methodology, while Public Comps and Precedent Transactions are relative valuation.

Is that correct?

No, not exactly. The DCF **is** based on the company's expected future cash flows, so in that sense, it is "intrinsic valuation."

But the **Discount Rate** used in a DCF is linked to peer companies (market data), and if you use the Multiples Method to calculate Terminal Value, the multiples are also linked to peer companies.

The DCF depends less on the market than the other methodologies, but there is still *some* dependency.

It's more accurate to say that the DCF is *more of* an intrinsic valuation methodology than the others.

Return to Top.

DCF Analysis – Walking Through and Explaining It

Questions on how to set up a DCF are the most common ones in interviews. Even if you don't understand the advanced items that go into the analysis, you **must** be able to walk through it.

You must also understand the relationship between a DCF and other methodologies, and, in particular, why valuation multiples are **shorthand** for real valuation.

1. Why do you build a DCF analysis to value a company?

You build a DCF analysis because a company is worth the Present Value of its expected future cash flows:

Company Value = Cash Flow / (Discount Rate – Cash Flow Growth Rate), where Cash Flow Growth Rate < Discount Rate

But you can't just use that single formula because a company's **Cash Flow Growth Rate** and **Discount Rate** change over time.

So, in a Discounted Cash Flow analysis, you divide the valuation into two periods: One where those assumptions change (the **explicit forecast period**) and one where they stay the same (the **Terminal Period**).

You then project the company's cash flows in both periods and discount them to their Present Values based on the appropriate Discount Rate(s).

Then, you compare this sum – the company's Implied Value – to the company's Current Value or "Asking Price" to see if it's valued appropriately.

2. Walk me through a DCF analysis.

A DCF values a company based on the Present Value of its Cash Flows in the explicit forecast period plus the Present Value of its Terminal Value.

You start by projecting the company's Free Cash Flows over the next 5-10 years by making assumptions for revenue growth, margins, Working Capital, and CapEx.

Then, you discount the cash flows using the Discount Rate, usually the Weighted Average Cost of Capital, and sum up everything.

Next, you estimate the company's Terminal Value using the Multiples Method or the Gordon Growth Method; it represents the company's value *after* those first 5-10 years into perpetuity.

You then discount the Terminal Value to Present Value using the Discount Rate and add it to the sum of the company's discounted cash flows.

Finally, you compare this Implied Value to the company's Current Value, usually its Enterprise Value, and you'll often calculate the company's Implied Share Price so you can compare it to the Current Share Price.

3. How do you move from Revenue to Free Cash Flow in a DCF?

First, **confirm** that the interviewer is asking for *Unlevered* Free Cash Flow (AKA Free Cash Flow to Firm). If so:

Subtract COGS and Operating Expenses from Revenue to reach Operating Income (EBIT).

Then, multiply Operating Income by (1 – Tax Rate), add back Depreciation & Amortization, and factor in the Change in Working Capital.

If the company *spends* extra cash as it grows, the Change in Working Capital will be negative; if it *generates* extra cash flow as a result of its growth, it will be positive.

Finally, subtract Capital Expenditures to calculate Unlevered Free Cash Flow.

Levered Free Cash Flow (Free Cash Flow to Equity) is similar, but you subtract the Net Interest Expense before multiplying by (1 – Tax Rate), and you also factor in changes in Debt principal.

4. What does the Discount Rate mean?

The Discount Rate represents the **opportunity cost** for the investors – what they could earn by investing in other, similar companies in this industry.

A **higher** Discount Rate means the risk and *potential* returns are both higher; a **lower** Discount Rate means lower risk and lower *potential* returns.

A **higher** Discount Rate makes a company **less valuable** because it means the investors have better options elsewhere; a **lower** Discount Rate makes a company **more valuable**.

5. How do you calculate Terminal Value in a DCF, and which method is best?

You can use the **Multiples Method** or the **Gordon Growth Method** (AKA Long-Term Growth Method, Perpetuity Growth Method, etc.).

With the first one, you apply a Terminal Multiple to the company's EBITDA, EBIT, NOPAT, or FCF in the final year of the forecast period. For example, if you apply a 10x EV / EBITDA multiple to the company's Year 10 EBITDA of $500, its Terminal Value is $5,000.

With the Gordon Growth Method, you assign a "Terminal Growth Rate" to the company's Free Cash Flows in the Terminal Period and assume they'll grow at that rate forever.

Terminal Value = Final Year Free Cash Flow * (1 + Terminal Growth Rate) / (Discount Rate – Terminal Growth Rate)

The Gordon Growth Method is better because growth *always* slows down over time; all companies' cash flows eventually grow more slowly than GDP.

If you use the Multiples Method, it's easy to pick a multiple that **makes no logical sense** because it implies a growth rate that's too high.

However, many bankers still use and prefer the Multiples Method because it's "easier" or because they don't understand the need to cross-check the output.

6. What are some signs that you might be using the incorrect assumptions in a DCF?

The most common signs of trouble are:

1. **Too Much Value from the PV of Terminal Value** – It usually accounts for at least 50% of the company's total Implied Value, but it shouldn't account for, say, 95% of its value.

2. **Implied Terminal Growth Rates or Terminal Multiples That Don't Make Sense** – If you pick a Terminal Multiple that implies a Terminal FCF Growth Rate of 8%, but the country's long-term GDP growth rate is 3%, something is wrong.

3. **You're Double-Counting Items** – If an income or expense line item is *included* in FCF, you should **not** count the corresponding Asset or Liability in the Implied Enterprise Value → Implied Equity Value "bridge" at the end. And if a line item is *excluded* from FCF, you **should** count the corresponding Asset or Liability in the "bridge" at the end.

4. **Mismatched Final Year FCF Growth Rate and Terminal Growth Rate** – If the company's Free Cash Flow is growing at 15% in the final year, but you've assumed a 2% Terminal Growth Rate, something is wrong. FCF growth should decline over time and approach the Terminal Growth Rate by the end of the explicit forecast period.

7. If your DCF *seems* off, what are the easiest ways to fix it?

The simplest method is to **extend the explicit forecast period** so that the company's Free Cash Flow contributes more value, and so that there's more time for FCF growth to slow down and approach the Terminal Growth Rate.

So, if you're using a 5-year forecast period, extend it to 10-15 years and reduce the company's FCF growth in those extra years as it approaches maturity.

To avoid double-counting items… look at what you're doing and don't double count!

Finally, you can reduce the Terminal Value by picking a lower Terminal Growth Rate or lower Terminal Multiple. Terminal Value tends to be overstated in financial models because people don't understand the theory behind it.

8. How do you interpret the results of a DCF?

You compare the company's *Implied* Enterprise Value, Equity Value, or Share Price to its *Current* Enterprise Value, Equity Value, or Share Price to see if it might be overvalued or undervalued.

You do this over a **range of assumptions** because investing is probabilistic.

For example, if you believe that the company's Implied Share Price is between $15.00 and $20.00, but its Current Share Price is $8.00, then that is good evidence that the company may be **undervalued**.

But if its Current Share Price is $17.00, then it may be valued appropriately.

9. Does a DCF ever make sense for a company with negative cash flows?

Yes, it may. A DCF is based on a company's **expected future cash flows**, so even if the company is cash flow-negative right now, the analysis could work if it starts generating positive cash flows in the future.

If the company has no path to positive cash flows, or you can't reasonably forecast its cash flows, then the analysis doesn't make sense.

10. How do the Levered DCF Analysis and Adjusted Present Value (APV) Analysis differ from the Unlevered DCF?

In a Levered DCF, you use Levered FCF for the cash flows and Cost of Equity for the Discount Rate, and you calculate Terminal Value using Equity Value-based multiples such as P / E.

You don't back into Implied Equity Value at the end because the analysis produces the Implied Equity Value directly.

An APV Analysis is similar to a traditional Unlevered DCF, but you value the company's **Interest Tax Shield** separately and add the Present Value of this Tax Shield at the end.

You still calculate Unlevered FCF and Terminal Value in the same way, but you use *Unlevered* Cost of Equity for the Discount Rate (i.e., Risk-Free Rate + Equity Risk Premium * Median Unlevered Beta from Public Comps).

You then project the Interest Tax Shield each year, discount it at that same Discount Rate, calculate the Interest Tax Shield Terminal Value, discount it, and add up everything at the end.

11. Will you get the same results from an Unlevered DCF and a Levered DCF?

No. The simplest explanation is that an Unlevered DCF does **not** factor in the interest rate on the company's Debt, while the Levered DCF does.

That alone will create differences, but the volatile cash flows in a Levered DCF (due to changes in Debt principal) will also contribute; it's very difficult to pick "equivalent assumptions" in both analyses.

12. Why do you typically use the Unlevered DCF rather than the Levered DCF or APV Analysis?

The traditional Unlevered DCF is easier to set up, forecast, and explain, and it produces more consistent results than the other methods.

With the other methods, you have to project the company's Cash and Debt balances, Net Interest Expense, and changes in Debt principal, all of which require more time and effort.

The Levered DCF sometimes produces odd results because Debt principal repayments can spike the Levered FCF up or down in individual years.

The APV Analysis is flawed because it doesn't factor in the **main downside of Debt:** Increased chances of bankruptcy. You can try to reflect this risk, but no one agrees on how to estimate it numerically.

The Unlevered DCF solves this issue because WACC decreases with additional Debt, at first, but then starts *increasing* past a certain level, which reflects both the advantages and disadvantages of Debt.

Return to Top.

DCF Analysis – Calculating Free Cash Flow

Calculating Unlevered FCF is simple if you remember the key rule: Include only *recurring* items that are related to the company's *core business* and that are available to *all* the investor groups.

There are some trickier topics, but you can answer 90% of interview questions by understanding that rule.

1. Why do you calculate Unlevered Free Cash Flow by including and excluding various items on the financial statements?

Unlevered FCF must capture the company's **core, recurring line items that are available to ALL investor groups**.

That's because Unlevered FCF corresponds to Enterprise Value, which also represents the value of the company's core business available to all investor groups.

So, if an item is **NOT** recurring, **NOT** related to the company's core business, or **NOT** available to all investor groups, you leave it out.

This rule explains why you exclude all of the following items:

- **Net Interest Expense** – Only available to Debt investors.
- **Other Income / (Expense)** – Corresponds to non-core-business Assets.
- **Most non-cash adjustments besides D&A** – They're non-recurring.
- **All Items in Cash Flow from Financing** – They're only available to certain investors.
- **Most of Cash Flow from Investing** – Only CapEx is a recurring, core-business item.

2. How does the Change in Working Capital affect Free Cash Flow, and what does it tell you about a company's business model?

The Change in Working Capital tells you whether the company *generates* more cash than expected as it grows, or whether it *requires* more cash to fuel that growth.

It's related to whether a company records expenses and revenue *before* or *after* paying or collecting them in cash.

For example, retailers tend to have negative values for the Change in Working Capital because they must pay for Inventory upfront before they can sell products.

But subscription-based software companies often have positive values for the Change in Working Capital because they collect cash from long-term subscriptions upfront and recognize it as revenue over time.

The Change in WC could increase or decrease the company's Free Cash Flow, but it's rarely a major value driver because it's fairly small for most companies.

3. Should you add back Stock-Based Compensation to calculate Free Cash Flow? It's a non-cash add-back on the Cash Flow Statement.

No! You should consider SBC a *cash expense* in the context of valuation because it creates **additional shares** and dilutes the existing investors.

By contrast, Depreciation & Amortization relate to **timing differences**: The company paid for a capital asset earlier on but recognizes that payment over many years.

Stock-Based Compensation is a non-cash add-back on the Cash Flow Statement, but the **context** is different: Accounting rather than valuation.

In a DCF, you should count SBC as a real cash expense or, if you count it as a non-cash add-back, you should reflect the additional shares by increasing the company's diluted share count, which will reduce the Implied Share Price.

Most DCFs get this completely wrong because they use neither approach: They pretend that SBC is a normal non-cash charge that makes no impact on the share count (wrong!).

4. What's the proper tax rate to use when calculating FCF – the effective tax rate, the statutory tax rate, or the cash tax rate?

The company's Free Cash Flows should reflect the **cash taxes** it pays.

So, it doesn't matter which rate you use as long as the cash taxes are correct.

For example, you could use the company's effective tax rate (Income Statement Taxes / Pre-Tax Income), and then include Deferred Taxes within the non-cash adjustments.

Or you could calculate and use the company's "cash tax rate" and skip the Deferred Tax adjustments.

You could even use the statutory tax rate and make adjustments for state/local taxes and other items to arrive at the company's real cash taxes.

It's most common to use the **effective tax rate** and then adjust for Deferred Taxes based on historical trends.

5. How should CapEx and Depreciation change within the explicit forecast period?

Just like the company's Free Cash Flow growth rate should decline in the explicit forecast period, the company's CapEx and Depreciation should also decline.

High-growth companies tend to spend more on Capital Expenditures to support their growth, but this spending declines over time as the companies move from "growth" to "maintenance."

If the company's FCF is **growing**, CapEx should always exceed Depreciation, but there may be less of a difference by the end.

Also, if the company's FCF is growing, CapEx should **not** equal Depreciation – even in the Terminal Period.

That's partially due to inflation (capital assets purchased 5-10 years ago cost less), and partially because Net PP&E must keep growing to support FCF Growth in the Terminal Period.

If you're assuming that the company's FCF stagnates or declines, then you might use different assumptions.

6. Should you reflect inflation in the FCF projections?

In most cases, no. Clients and investors tend to think in nominal terms, and assumptions for prices and salaries tend to be based on nominal figures.

If you reflect inflation, then you also need to *forecast* inflation far into the future and adjust all figures in your analysis.

That's rarely worthwhile because of the uncertainty, extra work, and extra explanations required.

7. If the company's capital structure is expected to change, how do you reflect it in FCF?

You'll reflect it directly in a Levered DCF because the company's Net Interest Expense and Debt principal will change over time. You'll also change the Cost of Equity over time to reflect this.

The changing capital structure won't show up *explicitly* in Unlevered FCF, but you **will** still reflect it in the analysis with the Discount Rate – WACC will change as the company's Debt and Equity levels change.

8. What's the relationship between including an income or expense line item in FCF and the Implied Equity Value calculation at the end of the DCF?

If you **include** an income or expense line item in Free Cash Flow, then you should **exclude** the corresponding Asset or Liability when moving from Implied Enterprise Value to Implied Equity Value at the end (and vice versa for items you **exclude**).

For example, if you capitalize the company's operating leases and count them as a Debt-like item at the end, then you should **exclude** the rental expense from FCF, making it higher.

This rule also explains why you factor in Cash and Debt when moving to the Implied Equity Value in an Unlevered DCF: You've **excluded** the corresponding items on the Income Statement (Interest Income and Interest Expense).

9. How do Net Operating Losses (NOLs) factor into Free Cash Flow?

You could set up an NOL schedule and apply the NOLs to reduce the company's cash taxes, also factoring in NOL accruals if the company earns negative Pre-Tax Income.

If you do this, then you don't need to count the NOLs in the Implied Enterprise Value → Implied Equity Value calculation at the end.

However, it's **far easier** to skip that separate schedule and add NOLs as a non-core-business Asset in this calculation at the end.

Beyond the extra work, one problem with the first approach is that the company may not **use** all of its NOLs by the end of the explicit forecast period!

10. How does the Pension Expense factor into Free Cash Flow?

There are different components of the Pension Expense, including the Service Cost, the Interest Expense, the *Expected* Return on Plan Assets, the Amortization of Net Losses or Gains, and Other Adjustments.

The Service Cost is an **operating expense** and should always be included in the company's Free Cash Flow.

In an Unlevered DCF, you **exclude** the Interest Expense, Expected Return on Plan Assets, and Amortization of Net Losses or Gains, and then subtract the Unfunded portion of the Pension Obligation when moving from Implied Enterprise Value to Implied Equity Value.

Some companies embed these items within Operating Expenses on the Income Statement, so you may have to review the filings to calculate EBIT properly.

If company contributions into the pension plan are tax-deductible (varies by country), you have to multiply the Unfunded Pension by (1 – Tax Rate) as well.

11. Should you ever include items such as asset sales, impairments, or acquisitions in FCF?

For the most part, no. You certainly **shouldn't** make speculative projections for these items – they are all non-recurring.

If a company has announced plans to sell an asset, make an acquisition, or record a write-down **in the near future**, then you might factor it into FCF for that year.

And if it's an acquisition or divestiture, you'll have to adjust FCF to reflect the cash spent or received, and you'll have to change the company's cash flow after the deal takes place.

Return to Top.

DCF Analysis – Discount Rates and WACC

Questions related to the Discount Rate and WACC in a DCF are surprisingly tricky because it's not always easy to explain how the assumptions are linked.

You don't need to know every single detail of these calculations, but you should know the **intuition** behind everything.

If you know that the Discount Rate represents the opportunity cost and that the Debt and Equity levels affect *all* investors, you can answer many of these questions.

1. What does the Cost of Equity mean intuitively?

It tells you the average percentage a company's stock "should" return each year, over the very long term, factoring in both stock-price appreciation and dividends.

In a valuation, it represents the percentage an Equity investor might earn each year (averaged over decades).

To a company, the Cost of Equity represents the cost of funding its operations by issuing additional shares to investors.

The company "pays for" Equity via potential Dividends (a real cash expense) and also by diluting existing investors (thereby giving up stock-price appreciation potential).

2. What does WACC mean intuitively?

WACC is similar to Cost of Equity, but it's the expected annual return if you invest proportionately in *all* parts of the company's capital structure – Debt, Equity, Preferred Stock, and anything else it has.

To a company, WACC represents the cost of funding its operations by using **all** its sources of capital and keeping its capital structure percentages the same over time.

Investors might invest in a company if their expected IRR exceeds WACC, and a company might decide to fund a new project, acquisition, or expansion if its expected IRR exceeds WACC.

3. How do you calculate Cost of Equity?

Cost of Equity = Risk-Free Rate + Equity Risk Premium * Levered Beta

The Risk-Free Rate represents what you would earn on "risk-free" government bonds denominated in the same currency as the company's cash flows. You usually use 10-year or 20-year bonds to match the explicit forecast period of the DCF.

Levered Beta represents how volatile this stock is relative to the market as a whole, factoring in both **intrinsic business risk** and **risk from leverage**.

And the Equity Risk Premium represents how much the stock market in the company's country will return above the "risk-free" government bond in the long term.

Stocks are riskier and have higher potential returns than government bonds, so you take the rate of return on those government bonds, add the *extra* returns you could get from the stock market, and then adjust for *this company's* specific risk and potential returns.

4. If a company operates in the EU, U.S., and U.K., what should you use for its Risk-Free Rate?

You should use the rate on the government bonds denominated in the currency of the company's cash flows.

So, if the company reports its financials in USD, you might use the 10-year U.S. Treasury Rate; if it reports them in EUR or GBP, you might use the rate on 10-year bonds issued by the European Central Bank or the Bank of England.

5. What should you use for the Risk-Free Rate if government bonds in the country are NOT risk-free (e.g., Greece)?

One option is to take the Risk-Free Rate in a country that is "risk-free," like the U.S. or U.K., and then add a **default spread** based on your country's credit rating.

For example, you might start with a rate of 2.5% for 10-year U.S. Treasuries and then add a spread of 11.2% for Greece based on its current credit rating.

That rate of 13.7% represents how yields are much higher in Greece due to the significant chance of government default.

6. How do you calculate the Equity Risk Premium?

Stock-market returns differ based on the period and whether you use an arithmetic mean, a geometric mean, or other approaches, so there's no universal method.

Many firms use a publication called "Ibbotson's" that publishes Equity Risk Premium data for companies of different sizes in different industries each year; some academic sources also track and report this data.

You could also take the historical data for the U.S. stock market and add a premium based on the default spread of your country/market.

For example, if the historical U.S. premium is 7%, you might add 3% to it if your country's credit rating is Ba2, and that rating corresponds to a 3% spread.

Finally, some groups use a "standard number" for each market, such as 5-6% in developed countries.

7. How do you calculate the Equity Risk Premium for a multinational company that operates in many different geographies?

You might take the percentage revenue earned in each country, multiply it by the ERP in that market, and then add up everything to get the weighted average ERP.

To calculate the ERP in each market, you might use one of the methods described in the previous question. The "Historical U.S. stock market returns + default spread" approach is common here.

8. What does Beta mean intuitively?

Levered Beta tells you how volatile a company's stock price is relative to the stock market as a whole, factoring in both **intrinsic business risk** and **risk from leverage** (i.e., Debt).

If Beta is 1.0, when the market goes up 10%, this company's stock price also goes up by 10%.

If Beta is 2.0, when the market goes up 10%, this company's stock price goes up by 20%.

Unlevered Beta excludes the risk from leverage and reflects only the intrinsic business risk, so it's always less than or equal to Levered Beta.

9. Could Beta ever be negative?

Yes, it's possible. The company's stock price must move in *the opposite direction* of the entire market for Beta to be negative.

Gold is commonly cited as an Asset that has a negative Beta because it often performs better when the stock market declines, and it acts as a "hedge" against disastrous macroeconomic events.

However, negative Betas for *companies* are quite rare and usually revert to positive figures, even if they're negative for short periods.

10. Why do you have to un-lever and re-lever Beta when calculating the Cost of Equity?

You don't "have to" un-lever and re-lever Beta: You could just use the company's *historical Beta*, i.e., its own Levered Beta, and skip this step.

But in a valuation, you're estimating the company's **Implied Value** – what it *should be worth*.

The historical Beta corresponds more closely to the company's Current Value – what the market says it's worth *today*.

By un-levering Beta for each comparable company, you isolate each company's **inherent business risk**.

Each company might have a different capital structure, so it's important to remove the risk from leverage and isolate just the inherent business risk.

You then take the median Unlevered Beta from these companies and re-lever it based on the capital structure (targeted or actual) of *the company you're valuing*.

You do this because there will always be business risk and risk from leverage, so you need to reflect both for the company you're valuing.

You can think of the result – Re-Levered Beta – as: "What the **volatility** of this company's stock price, relative to the market as a whole, *should be*, based on the median business risk of its peer companies and *this company's* capital structure."

11. What are the formulas for un-levering and re-levering Beta, and what do they mean?

Assuming the company has only Equity and Debt:

Unlevered Beta = Levered Beta / (1 + Debt / Equity Ratio * (1 – Tax Rate))

Levered Beta = Unlevered Beta * (1 + Debt / Equity Ratio * (1 – Tax Rate))

If the company has Preferred Stock, you add another term for the Preferred / Equity Ratio.

You use a "1 +" in front of Debt / Equity Ratio * (1 – Tax Rate) to ensure that Unlevered Beta is always less than or equal to Levered Beta.

And you multiply the Debt / Equity Ratio by (1 – Tax Rate) because the tax-deductibility of interest reduces the risk of Debt.

The formulas *reduce* Levered Beta to represent the *removal* of risk from leverage, but they *increase* Unlevered Beta to represent the *addition* of risk from leverage.

12. In those formulas, you're not factoring in the interest rate on Debt. Isn't that wrong? More expensive Debt should be riskier.

Yes, this is one drawback. However:

1. **The Debt / Equity ratio is a proxy for interest rates on Debt** because companies with high Debt / Equity ratios tend to pay higher interest rates as well.

2. **The risk isn't directly proportional to interest rates**. Higher interest on Debt will result in lower coverage ratios (EBITDA / Interest) and, therefore, more risk, but it's not as simple as saying, "Interest is now 4% rather than 1% – risk is 4x higher."

An interest rate that's 4x higher might barely change a large company's financial profile, but it might make a much bigger difference for a small company.

13. Do you still un-lever and re-lever Beta even when you're using Unlevered FCF?

Yes. Un-levering and re-levering Beta has **nothing** to do with Unlevered vs. Levered FCF.

A company's capital structure affects both the Cost of Equity and WACC, so you un-lever and re-lever Beta regardless of the type of Free Cash Flow you're using.

14. What are some different ways to calculate Beta in the Cost of Equity calculation?

Some people argue that you should use the *Predicted Beta* instead of the Historical Beta because the Cost of Equity relates to *expected future returns*.

If you do use historical data, you could use the company's Historical Beta or the re-levered Beta based on comparable companies.

And if you re-lever Beta, you could do it based on the company's current capital structure, its targeted or "optimal" structure, or the capital structure of the comparable companies.

Most of these methods produce similar results, and you always use a *range* of values when calculating Cost of Equity and WACC.

15. How would you estimate the Cost of Equity for a U.S.-based technology company?

This question tests your ability to make a guesstimate based on common sense and your knowledge of current market rates.

You might say, "The Risk-Free Rate is around 1.5% for 10-year U.S. Treasuries. A tech company like Salesforce is more volatile than the market as a whole, with a Beta of around 1.5. So, if you assume an Equity Risk Premium of 8%, Cost of Equity might be around 13.5%."

The numbers will change based on market conditions, but that's the idea.

16. How do you calculate WACC, and what makes it tricky?

The *formula* for WACC is simple:

WACC = Cost of Equity * % Equity + Cost of Debt * (1 – Tax Rate) * % Debt + Cost of Preferred Stock * % Preferred Stock

But it's tricky to calculate because of the ambiguity with many of these items:

1. **Cost of Debt:** Do you use the weighted average coupon rate on the company's bonds? Or the Yield to Maturity (YTM)? Or the YTM of Debt from comparable companies?

2. **Percentages of Debt, Equity, and Preferred Stock:** Do you use the company's current capital structure, "optimal" structure, or targeted structure? Or do you use the median percentages from the comparable public companies?

3. **Cost of Equity:** There are different ways to calculate Beta, and no one agrees on the Equity Risk Premium.

17. WACC reflects the company's entire capital structure, so why do you pair it with Unlevered FCF? It's not capital structure-neutral!

Think of Unlevered FCF as "Free Cash Flow to Firm," or FCFF, instead.

And think of this relationship as: "Unlevered FCF, or FCFF, is available to **ALL** investors, and WACC represents **ALL** investors. Therefore, you pair WACC with Unlevered FCF."

No Discount Rate can be "capital structure-neutral" since each part of a company's capital structure affects the other parts.

"Capital-structure neutrality" is a property of Free Cash Flow, not the Discount Rate.

18. Should you use the company's current capital structure or optimal capital structure to calculate WACC?

A company's "optimal" capital structure is the one that minimizes its WACC. But there's no way to calculate it because you can't tell *in advance* how the Costs of Equity, Debt, and Preferred will change as the capital structure changes.

So, in practice, you'll often use the median capital structure percentages from the comparable public companies as a proxy for the "optimal" capital structure.

It's the same as the logic for un-levering and re-levering Beta: You want to capture what this company's capital structure *should be*, not what it is right now.

It's better to use this *expected* capital structure because the company's Implied Value in a DCF is based on its *expected*, future cash flows.

19. Should you use Total Debt or Net Debt to determine the capital structure percentages in the WACC calculation?

Some textbooks claim that you should use Equity Value + Debt + Preferred Stock – Cash, rather than Equity Value + Debt + Preferred Stock, for the denominator of the capital structure percentages.

However, we **disagree** with this approach for several reasons:

1) **Cash Does Not "Offset" Debt** – For example, many forms of Debt do not allow for early repayment or penalize the company for early repayment. So, a high Cash balance doesn't necessarily reduce the risk of Debt on a 1:1 basis.

2) **You May Get Nonsensical Results with High Cash Balances** – For example, if the company's Cash exceeds its Debt, Debt as a Percentage of Total Capital will be far too low. This will artificially *inflate* the Discount Rate since Equity is more expensive than Debt for most companies.

20. Why is Equity more expensive than Debt?

Because it offers higher risk and higher potential returns.

Expected stock market returns (plus dividends) exceed the interest rates on Debt in most cases, which already makes the Cost of Equity higher. But the interest on Debt is also tax-deductible, which further reduces its cost.

In developed markets like the U.S., the average annualized stock market return is around 10-11%. So, a company with a Beta of 1.0 will have a Cost of Equity in that range.

For the Cost of Debt to be higher, the *Pre-Tax Cost* would have to be ~17-18% at a 40% tax rate. Hardly any Debt has interest rates that high.

21. How does the Cost of Preferred Stock compare with the Costs of Debt and Equity?

Preferred Stock tends to be more expensive than Debt but less expensive than Equity: It offers higher risk and potential returns than Debt, but lower risk and potential returns than Equity.

That's because the coupon rates on Preferred Stock tend to be higher than the rates on Debt, and Preferred Dividends are **not** tax-deductible.

But these rates are still lower than expected stock market returns. The risk is also lower since Preferred Stock investors have a higher claim on the company's Assets than Equity investors.

22. How do you determine the Cost of Debt and Cost of Preferred Stock in the WACC calculation, and what do they mean?

These Costs represent the rates a company would pay if it issued *additional* Debt or *additional* Preferred Stock.

There is no way to observe these rates directly, but you can estimate them.

For example, you could calculate the weighted average coupon rate on the company's existing Debt or Preferred Stock or the median coupon rate on the outstanding issuances of comparable public companies.

You could also use the Yield to Maturity (YTM), which reflects the market prices of the bonds (a bond with a coupon rate of 5% that's trading at a discount to par value will have a YTM higher than 5%).

Finally, you could also take the Risk-Free Rate and add a **default spread** based on the company's expected credit rating if it issues more Debt or Preferred Stock. If you think its credit

rating will fall from BB+ to BB after issuing Debt, you'd look up the average spread for BB-rated companies and add it to the Risk-Free Rate.

23. How do convertible bonds factor into the WACC calculation?

If the company's current share price exceeds the conversion price of the bonds, you count the bonds as Equity and factor them in by using a higher diluted share count, resulting in a higher Equity Value for the company and a greater Equity weighting in the WACC formula.

But if the bonds are **not** currently convertible, you count them as Debt and use the coupon rate (or YTM, or another method) to calculate their Cost.

Convertible bonds offer lower coupon rates than standard corporate bonds, so you should use the rate on *equivalent, non-convertible bonds*.

Convertible bonds almost always reduce WACC when they count as Debt since the Cost of Debt is lower than the Cost of Equity.

24. How do the Cost of Equity, Cost of Debt, and WACC change as a company uses more Debt?

The Cost of Equity and Cost of Debt **always increase** because more Debt increases the risk of bankruptcy, which affects all investors.

As a company goes from no Debt to some Debt, WACC decreases at first because Debt is cheaper than Equity, but it starts increasing at higher levels of Debt as the risk of bankruptcy starts to outweigh the lower Cost of Debt.

However, the exact impact depends on where you are on that curve. If the company already has a very high level of Debt, WACC is likely to increase with more Debt; at lower levels of Debt, WACC is more likely to decrease with more Debt.

25. How do those figures change as the company uses less Debt?

The Cost of Equity and Cost of Debt decrease for the reasons stated above: Less Debt means a lower risk of bankruptcy and, therefore, less risk for *all* investors.

WACC could go either way depending on where you are on the curve. If the company already has a very high level of Debt, WACC will likely decrease with less Debt; if its Debt level is much lower, WACC will likely increase with less Debt.

26. If a company previously used 20% Debt and 80% Equity, but it just paid off all its Debt, how does that affect its WACC?

It depends on how you're calculating WACC. If you're using the company's *current* capital structure, WACC will *most likely* increase because 20% Debt is a fairly low level. At that low level, the benefits of Debt still outweigh its risks, so less Debt will increase WACC.

But if you're using the targeted, optimal, or median capital structure from the comparable companies, this change won't affect WACC because you're not using the company's current capital structure at all.

27. Should you ever use *different* Discount Rates for different years in a DCF?

Yes, sometimes it makes sense to use different Discount Rates.

For example, if a company is growing quickly right now, but is expected to grow more slowly in the future, you might decrease the Discount Rate each year until the company reaches maturity.

So, if the company's current WACC is between 11% and 13%, and WACC for mature companies in the industry is between 8% and 9%, you might start it at 12% and then reduce it by 0.4% in each year of the explicit forecast period until it reaches 8.4% by the end.

It makes less sense to do this if the company is already mature and is not expected to change much over time.

Return to Top.

DCF Analysis – Calculating the Terminal Value

Many guides and textbooks tend to focus on the basics of Terminal Value, such as the different ways to calculate it.

But it's more important to understand the **trade-offs** of the methods and how to use them to cross-check your work, which is why most of the questions here go beyond the basics.

1. What is the difference between the explicit forecast period and the Terminal Period in a DCF?

The company's Free Cash Flow Growth Rate, and possibly its Discount Rate, change over time in the explicit forecast period since the company is still growing and changing.

But in the Terminal Period, you assume that the company remains in a "steady state" forever: Its Free Cash Flow grows at the same rate each year, and its Discount Rate remains the same.

2. What's the intuition behind the Gordon Growth formula for Terminal Value?

The typical formula is:

Terminal Value = Final Year FCF * (1 + Terminal FCF Growth Rate) / (Discount Rate – Terminal FCF Growth Rate)

But it's more intuitive to think of it as:

Terminal Value = FCF in Year 1 of Terminal Period / (Discount Rate – Terminal FCF Growth Rate)

A company is **worth less** if the Discount Rate is higher and **worth more** if the Terminal FCF Growth Rate is higher.

For example, let's say the company's FCF is not growing, and its Discount Rate is 10%. It has $100 in FCF in the first year of the Terminal Period.

You would be willing to pay $100 / 10%, or $1,000, so the Terminal Value is $1,000. If the Discount Rate falls to 5%, now you'd pay $100 / 5%, or $2,000. If it increases to 20%, you'd pay $100 / 20%, or $500.

The company is **worth more** when you have *worse* investment options elsewhere, and **worth less** when you have *better* investment options elsewhere.

Now let's say the company's FCF is growing. If it grows by 3% per year, you'd be willing to pay $100 / (10% – 3%), or ~$1,429 for it. But if its FCF growth rate increases to 5% per year, you'd be willing to pay $100 / (10% – 5%), or $2,000, for it.

Higher growth lets you achieve the same targeted return even when you pay more.

3. If you use the Multiples Method to calculate Terminal Value, do you use the multiples from the Public Comps or Precedent Transactions?

Neither one – you just use them as *starting points* in the analysis, and then you adjust once you've calculated the Terminal FCF Growth Rates implied by the selected multiples.

It's better to start with the multiples from the Public Comps, ideally the ones from 1-2 years into the future, because you **don't** want to reflect the control premium inherent in Precedent Transactions, at least not if you're completing a standalone valuation of the company.

Then, if the multiples imply a reasonable Terminal FCF Growth Rate, you might stick with your initial guess; if not, adjust it up or down as necessary.

4. How do you pick the Terminal Growth Rate when you calculate the Terminal Value using the Gordon Growth Method?

This growth rate should be *below* the country's long-term GDP growth rate and in-line with other macroeconomic variables like the rate of inflation.

For example, if you're in a developed country where the expected long-term GDP growth rate is 3.0%, you might use numbers ranging from 1.5% to 2.5% for the range of Terminal Growth Rates.

You should **NOT** pick a rate above the country's long-term GDP growth rate because the company will become bigger than the economy as a whole after a certain point!

You can then check your work by calculating the Terminal Multiples implied by these growth rates.

5. Why do you need to discount the Terminal Value back to its Present Value?

Because the Terminal Value represents the Present Value of the company's cash flows from the very *end* of the explicit forecast period into perpetuity. In other words, it represents the company's **value IN a future period AT a point in the future**.

Valuation tells you what a company is worth **TODAY**, so any "future value" must always be discounted back to its Present Value.

If you did **not** discount the Terminal Value, you'd greatly overstate the company's Implied Value because you'd be acting as if its Year 6, 11, or 16 cash flows arrived *next year*.

6. When you discount the Terminal Value, why do you use the number of the last year in the forecast period for the discount period (for example, 10 for a 10-year forecast)?

Shouldn't you use 11 since Terminal Value represents the Present Value of cash flows starting in Year 11?

No. The Terminal Value does represent the Present Value of cash flows *starting* in Year 11, but it's the Present Value *as of the very end of Year 10*.

You would use 11 for the discount period only if your explicit forecast period went to Year 11 and the Terminal Period started in Year 12.

7. What do you do after summing the PV of Terminal Value and the PV of Free Cash Flows?

If you're building a Levered DCF analysis, you're almost done because this summation gives you the company's Implied Equity Value. The last step is to divide the company's Implied Equity Value by its diluted share count to get its Implied Share Price (if the company is public).

In an Unlevered DCF, the PV of Terminal Value + PV of Free Cash Flows equals the company's Implied Enterprise Value, so you have to "back into" the Implied Equity Value and then calculate its Implied Share Price.

You do this by *adding* non-core-business Assets (Cash, Investments, etc.) and *subtracting* Liability and Equity items that represent other investor groups (Debt, Preferred Stock, Noncontrolling Interests, etc.).

Then, you divide by the company's diluted share count to get its Implied Share Price.

8. The diluted share count includes dilution from the company's *in-the-money* options.

But what about its *out-of-the-money options*? Shouldn't you account for them in a DCF?

In theory, yes. Some professors, such as Damodaran, use Black-Scholes to value these out-of-the-money options and then subtract them to determine the company's Implied Equity Value.

In practice, banks rarely include out-of-the-money options in a DCF. These options tend to make a small impact on most companies, and options valuation is tricky and requires inputs that you may or may not have. So, it is usually not worth the time and effort.

9. How can you check whether or not your Terminal Value estimate is reasonable?

It's an iterative process: You start by entering a range of assumptions for the Terminal Multiple or Terminal FCF Growth Rate, and then you cross-check your assumptions by calculating the Growth Rates or Multiples they *imply*.

If it seems wrong, then you adjust the range of Terminal Multiples or Terminal FCF Growth Rates until you get more reasonable results.

Example: You start by picking 10x EV / EBITDA for the Terminal Multiple. At a Discount Rate of 12%, this multiple implies a Terminal FCF Growth Rate of 5%, which is too high.

So, you reduce it to 6x EV / EBITDA, but now the Implied Terminal FCF Growth Rate drops to 1%, which is too low.

So, you guess 8x EV / EBITDA, which implies a Terminal FCF Growth Rate of 2.3%. That is more reasonable since it's below the expected long-term GDP growth rate, but it's also slightly above the inflation rate.

This 8x figure might be your "Baseline Terminal Multiple," so you would start there and go slightly above and below it in the sensitivity tables.

10. What's one problem with using EV / EBITDA multiples to calculate Terminal Value?

The biggest issue is that EBITDA ignores CapEx. Two companies with similar EV / EBITDA multiples might have very different Free Cash Flow and FCF growth figures. As a result, their Implied Values might differ significantly even if they have similar EV / EBITDA multiples.

You may get better results by using EV / EBIT, EV / NOPAT, or EV / Unlevered FCF, but those multiples create other issues, such as less comparability across peer companies.

This problem is one reason why the Gordon Growth Method is still the "real" way to calculate Terminal Value.

11. Would it ever make sense to use a negative Terminal FCF Growth Rate?

Yes. For example, if you're valuing a biotech or pharmaceutical company and the patent on its key drug expires within the explicit forecast period, you might assume that the company's cash flows eventually decline to $0.

A negative Terminal FCF Growth Rate represents your expectation that the company will stop generating cash flow eventually.

It doesn't make the company "worthless"; it just means that the company will be *worth less*.

12. How can you determine which assumptions to analyze in sensitivity tables for a DCF?

The same assumptions make a big impact in any DCF: The Discount Rate, the Terminal FCF Growth Rate or Terminal Multiple, and the revenue growth and margin figures.

It doesn't make sense to sensitize much else – the assumptions for CapEx and Working Capital, for example, tend to make a small difference.

There may also be industry-specific assumptions that are worth sensitizing, such as the patent expiration dates for drugs in the biotech/pharmaceutical industry.

Return to Top.

DCF Analysis – More Advanced Features

You're **unlikely** to get questions on these topics unless you have significant valuation-related work experience.

The most important questions here relate to the mid-year convention and stub periods; the math can be a bit tricky, so it helps to complete a few examples yourself.

1. Why do you use the mid-year convention in a DCF analysis?

You use it because a company's cash flows do not arrive 100% at the end of each year – the company generates cash flow *throughout* each year.

Using 1, 2, 3, 4 for the discount periods implies that the first year's cash flow arrives after *one entire year* has passed.

If you use 0.5, 1.5, 2.5, 3.5 instead, you assume that only *half a year* passes before the first cash flow is generated, which is a better approximation of real life.

2. What impact does the mid-year convention make?

A DCF that uses the mid-year convention will produce **higher Implied Values** because the discount periods are lower. A formula like this:

Present Value = $100 / ((1 + 10%) ^ Year#)

Will produce **higher values** because the Year # of the first period would be 1.0 *without* the mid-year convention, but 0.5 *with* the mid-year convention.

3. Why might you include a "stub period" in a DCF, and what does it mean?

You might include a "stub period" if you're valuing a company midway through the year, and it has already reported some of its financial results for the year.

A DCF is based on *expected future cash flow*, so you should **exclude** these previously reported results and adjust the discount periods as well.

For example, maybe it's September 30th, and the company's fiscal year ends on December 31st.

The company's *future cash flow for this year* will be generated between September 30th and December 31st.

Therefore, you should exclude the cash flow from January 1st to September 30th in your projections since that part of the year has already passed.

So, for the first year in the analysis, you would include only the projected FCF from September 30th to December 31st. To discount the FCF in that 3-month period, you would use 0.25 for the discount period because 3 months is 25% of the year.

You would then use 1.25 for the discount period of the next year, 2.25 for the year after that, and so on.

4. You're valuing a company on April 30th, and you want to include both the stub period and the mid-year convention in your analysis.

How would you change the company's Free Cash Flow, and which discount periods would you use?

For the FCF, you would exclude everything generated between January 1st and April 30th and include **only** the projected FCF to be generated between April 30th and December 31st.

Since most companies report only quarterly results, you would most likely exclude the **first quarter**, not exactly the first 4 months.

To reflect both the stub period and the mid-year convention, you would divide the stub period of the first year by 2. And then in each year after that, you would subtract 0.5 from the "normal" discount period.

In this case, April 30th is 1/3 through the year. Two-thirds of the year remains, so the "normal" stub discount period is 0.67.

You would divide that by 2 to get 0.34. You would then use that 0.34 period to discount the company's FCF from April 30th to December 31st.

The "normal" discount period of the next year would be 0.67 + 1.00, or 1.67. So, you would take the 1.67 and subtract 0.50 to get 1.17.

For the next year after that, the "normal" discount period is 0.67 + 2.00, or 2.67, so you would subtract 0.50 to get 2.17. You would continue that for the rest of the years in the forecast.

5. Continuing with the same example, how would the Terminal Value and PV of Terminal Value change with this April 30th valuation?

It depends on how you calculate the Terminal Value. With the **Multiples Method**, the Terminal Value calculation stays the same since it's based on the company's EBITDA (or another metric) in the final projected year times an appropriate multiple.

When you discount the Terminal Value, the stub period affects the discount period, but the mid-year convention does **not** because the Terminal Value is **as of the END of the last projected year**.

So, if the valuation date is April 30th, and there are 10 years in the projection period, you would use 9.67 for the discount period to calculate the PV of the Terminal Value.

With the **Gordon Growth Method**, if you're using the mid-year convention, you must **adjust** the Terminal Value by multiplying it by (1 + Discount Rate) ^ 0.5.

You do this because the normal formula – FCF in Year 1 of Terminal Period / (Discount Rate – Terminal Growth Rate) – gives you the Present Value at **Year 10.5** if you're using the mid-year convention.

When you multiply by (1 + Discount Rate) ^ 0.5, you "move back the Terminal Value" to Year 10.0 instead.

Discounting the Terminal Value works the same way as it does with the Multiples Method: Only the stub period affects it. So, you would also use 9.67 for the discount period.

6. Why do you need to adjust the Terminal Value when you use the mid-year convention? Can't you just discount it to Present Value using a different discount period?

Yes, you could discount the Terminal Value to its Present Value by using a different discount period instead.

However, the Terminal Values calculated via both methods should be **directly comparable**.

In other words, **BOTH** Terminal Values should be as of the end of Year 10 in a 10-year analysis.

If you do *not* adjust the Terminal Value produced by the Gordon Growth Method, and you're using the mid-year convention, you cannot compare it to the Terminal Value produced by the Multiples Method because one TV is as of Year 10.0, and the other is as of Year 10.5.

7. Why might you create a "Normalized Terminal Year" in a DCF?

You might create a Normalized Terminal Year if something about the company's revenue growth, margins, Working Capital, or CapEx is expected to change in a major way in the Terminal Period.

As a result of this change, multiplying Final Year FCF by (1 + Terminal FCF Growth Rate) won't produce accurate results in the Terminal Value formula.

For example, a key drug patent might expire in Year 9 or 10, or the company might have a huge Intangibles balance that gets completely amortized in Year 10.

The first scenario would make a huge impact on the company's revenue, growth rates, and margins, and the second would affect the company's margins and non-cash add-backs.

You use the FCF *in this Normalized Year* for the numerator in the Terminal Value calculation rather than multiplying Final Year FCF by (1 + Terminal FCF Growth Rate).

8. What impact does the Normalized Terminal Year make?

Technically, it could go either way, but in *most* cases, the Normalized Terminal Year will reduce a company's Implied Value because you often **adjust down** the company's growth rates and

margins in this year (and remove non-cash adjustments that might have benefited the company in previous periods).

Return to Top.

Factors That Affect a DCF Analysis

This section is short because much of it has been covered in the previous sections.

Interviewers like to ask these questions because they test whether or not **you understand the big picture**.

Anyone can memorize a DCF walkthrough, but you can answer these questions only if you understand the underlying concepts.

1. Which assumptions make the biggest impact on a DCF?

The **Discount Rate** and **Terminal Value** make the biggest impact on the DCF.

That's because the Discount Rate affects the PV of everything and because the PV of the Terminal Value often represents 50%+ of the company's Implied Value.

The assumptions for revenue growth and operating margins also make a significant impact, but less than the ones above. Other items, such as CapEx, Working Capital, and non-cash adjustments, make a smaller impact.

2. Should Cost of Equity and WACC be higher for a $5 billion or $500 million Equity Value company?

Assuming that both companies *have the same capital structure percentages*, Cost of Equity and WACC should both be higher for the $500 million company.

All else being equal, smaller companies tend to offer higher potential returns and higher risk than larger companies, which explains why Cost of Equity will be higher.

Since smaller companies have a higher chance of defaulting on their Debt, their Cost of Debt (and Preferred) also tends to be higher.

And since all the Costs tend to be higher for smaller companies, WACC must be higher, *assuming the same capital structure percentages*.

3. Would increasing the revenue growth from 9% to 10% or increasing the Discount Rate from 9% to 10% make a bigger impact on a DCF?

The Discount Rate increase will make a bigger impact. Increasing revenue growth from 9% to 10% will barely impact FCF and Terminal Value, but the Discount Rate will affect the Present Value of everything, and 9% vs. 10% is a significant difference.

4. Would it make a bigger impact to increase revenue growth from 9% to 20%, or to increase the Discount Rate from 9% to 10%?

It's harder to tell here. Doubling a company's revenue growth could make a bigger impact than changing the Discount Rate by 1%, but when the changes are this different, you'd have to run the numbers to tell.

These operational changes make a bigger impact in longer projection periods than they do in shorter ones, so you would see more of a difference in a 10-year DCF than a 5-year one.

5. Two companies produce identical total Free Cash Flows over a 10-year period, but Company A generates 90% of its Free Cash Flow in the first year and 10% over the remaining 9 years. Company B generates the same amount of Free Cash Flow in every year.

Which company will have the higher Implied Value in a DCF?

This is a trick question because it depends on what you count toward the Implied Value. If it's **just** this series of cash flows, Company A will have the higher Implied Value because of the time value of money: The cash flows arrive earlier, so they're worth more.

However, Company B will almost certainly have a much higher Terminal Value because it has a much higher FCF in Year 10.

So, if you count the PV of Terminal Value in the analysis, it's a good bet that **Company B** will have the higher Implied Value.

6. How does the tax rate affect the Cost of Equity, Cost of Debt, WACC, and the Implied Value from a DCF?

The tax rate affects the Cost of Equity, Cost of Debt, and WACC **only if the company has Debt**. If the company does not have Debt, or its targeted/optimal capital structure does not include Debt, the tax rate doesn't matter because there's no tax benefit to interest paid on Debt.

If the company has some Debt, a higher tax rate will **reduce** the Cost of Equity, Cost of Debt, and WACC.

It's easy to see why it reduces the Cost of Debt: Since you multiply by (1 – Tax Rate), a higher rate always reduces the after-tax cost.

But it also reduces the Cost of Equity for the same reason: With a greater tax benefit, Debt is less risky even to Equity investors. And if both of these are lower, WACC will also be lower.

However, the **Implied Value from a DCF will also be lower** because the higher tax rate reduces FCF and the company's Terminal Value. Those changes outweigh a lower WACC.

The opposite happens with a lower tax rate: The Cost of Equity, Cost of Debt, and WACC are all higher, and the Implied Value is also higher.

Return to Top.

Public Comps and Precedent Transactions

This section is short because we covered many of these questions in the guide to Equity Value, Enterprise Value, and Valuation Multiples.

Public Comps and Precedent Transactions relate to how you *use* valuation multiples in real life.

If you already understand what multiples mean and how to calculate them, you just need to understand the execution to answer these questions.

1. Can you walk me through how you use Public Comps and Precedent Transactions in a valuation?

First, you select the companies and transactions based on criteria such as industry, size, and geography (and time for the transactions).

Then, you determine the appropriate metrics and multiples for each set – for example, revenue, revenue growth, EBITDA, EBITDA margins, and revenue and EBITDA multiples – and you calculate them for all the companies and transactions.

Next, you calculate the minimum, 25th percentile, median, 75th percentile, and maximum for each valuation multiple in the set.

Finally, you apply these numbers to the financial metrics of the company you're analyzing to estimate its Implied Value.

For example, if the company you're valuing has $100 million in LTM EBITDA, and the median LTM EV / EBITDA multiple in a set of comparable companies is 7x, then the company's implied Enterprise Value is $700 million.

You then calculate its Implied Value for all the other multiples to get a range of possible values.

2. Why is it important to select Public Comps and Precedent Transactions that are similar?

Because the comparable companies and transactions should have similar Discount Rates and Free Cash Flow figures.

Remember that a company's valuation multiples depend on its Free Cash Flow, Discount Rate, and Expected FCF Growth Rate.

If the companies in your set all have similar Discount Rates and Free Cash Flows, it's easier to conclude that one company trades at higher multiples *because* its expected growth rate is higher.

If the companies do not have similar Discount Rates and Free Cash Flows, it's harder to draw meaningful conclusions.

3. How do you select Comparable Companies and Precedent Transactions?

You screen based on **geography**, **industry**, and **size**, and also **time** for Precedent Transactions.

Here are a few example screens:

- **Comparable Company Screen:** U.S.-based steel manufacturing companies with over $500 million in revenue.
- **Comparable Company Screen:** European legacy airlines with over €1 billion in EBITDA.
- **Precedent Transaction Screen:** Latin American M&A transactions over the past 3 years involving consumer/retail sellers with over $1 billion USD in revenue.

- **Precedent Transaction Screen:** Australian M&A transactions over the past 2 years involving infrastructure sellers with over $200 million AUD in revenue.

4. Are there any screens you should AVOID when selecting Comparable Companies and Precedent Transactions?

You should **avoid** screening by *both* financial metrics *and* Equity Value or Enterprise Value.

For example, you should **NOT** use this screen: "Companies with revenue below $1 billion and Enterprise Values above $2 billion."

If you use that screen, you're **artificially constraining the multiples** because EV / Revenue must be above 2x for every company in the set.

5. Public Comps and Precedent Transactions seem similar. What are the main differences?

The idea is similar – you use *Current* valuation multiples from similar companies or deals to value a company – but the execution is different.

Here are the differences for Precedent Transactions:

- **Screening Criteria:** In addition to industry, size, and geography, you also use **time** because you only want transactions from the past few years. You might also use **Transaction Size**, and you might use broader screening criteria in general.

- **Metrics and Multiples:** You focus on **historical metrics and multiples**, especially LTM revenue and EBITDA as of the announcement date.

- **Calculations:** All the multiples are based on the purchase price as of the announcement date of the deal.

- **Output:** The multiples produced tend to be higher than the multiples from Public Comps because of the **control premium**. But the multiples also tend to span wider ranges because deals can be done for *many* different reasons.

6. Can you walk me through the process of finding market and financial information for the Public Comps?

You start by finding each company's most recent annual and interim (quarterly or half-year) filings. You calculate its diluted share count and Current Equity Value and Current Enterprise Value based on the information there and its most recent Balance Sheet.

Then, you calculate its Last Twelve Months (LTM) financial metrics by taking the most recent annual results, adding the results from the most recent partial period, and subtracting the results from the same partial period the *last year*.

For the projected figures, you look in equity research or find consensus figures on Bloomberg. And then you calculate all the multiples by dividing Current Equity Value or Current Enterprise Value by the appropriate metric.

7. Can you walk me through the process of finding market and financial information for the Precedent Transactions?

You find the acquired company's filings from *just before* the deal was announced, and you calculate the LTM financial metrics using those.

To calculate the company's Transaction Equity Value and Enterprise Value, you use the purchase price the acquirer paid, and you move from Equity Value to Enterprise Value in the same way you usually do, using the company's most recent Balance Sheet as of the announcement date.

You calculate all the valuation multiples in the same way, using Transaction Equity Value or Transaction Enterprise Value as appropriate.

8. How do you decide which metrics and multiples to use in these methodologies?

You usually look at a sales-based metric and its corresponding multiple and 1-2 profitability-based metrics and multiples. For example, you might use Revenue, EBITDA, and Net Income, and the corresponding multiples: EV / Revenue, EV / EBITDA, and P / E.

You do this because you want to value a company in relation to how much it sells and to how much it *keeps* of those sales.

Sometimes, you'll drop the sales-based multiples and focus on profitability or cash flow-based ones (EBIT, EBITDA, Net Income, Free Cash Flow, etc.).

9. Why do you look at BOTH historical and projected metrics and multiples in these methodologies?

Historical metrics are useful because they're based on what actually happened, but they can also be deceptive if there were non-recurring items or if the company made acquisitions or divestitures.

Projected metrics are useful because they assume the company will operate in a "steady state," without acquisitions, divestitures, or non-recurring items, but they're also less reliable because they're based on predictions of the future.

10. When you calculate forward multiples for the comparable companies, should you use each company's Current Equity Value or Current Enterprise Value, or should you project them to get the Year 1 or Year 2 values?

No, you **always** use the Current Equity Value or Current Enterprise Value. **NEVER "project" either one.**

A company's share price, and, therefore, both of these metrics, is based on past performance and future expectations.

So, to "project" these metrics, you'd have to jump into the future and see what future expectations are at *that* point, which doesn't make sense.

11. What should you do if some companies in your set of Public Comps have fiscal years that end on June 30th and others have fiscal years that end on December 31st?

You have to "calendarize" by adjusting the companies' fiscal years so that they match up.

For example, to make everything match a December 31st year-end date, you take each company with a June 30th fiscal-year end and do the following:

- Start with the company's full June 30th fiscal-year results.
- Add the June 30th – December 31st results from *this* year.
- Subtract the June 30th – December 31st results from the *previous* year.

Normally, you calendarize to match the fiscal year of the company you're valuing.

But you might pick another date if, for example, all the comparable companies have December 31st fiscal years but your company's ends on June 30th.

12. How do you interpret the Public Comps? What does it mean if the median multiples are above or below the ones of the company you're valuing?

The interpretation depends on how the growth rates and margins of your company compare to those of the comparable companies.

Public Comps are most meaningful when the growth rates and margins are **similar,** but the multiples are different. This could mean that the company you're valuing is **mispriced** and that there's an opportunity to invest and make money.

For example, all the companies are growing their revenues at 10-15% and their EBITDAs at 15-20%, and they all have EBITDA margins of 10-15%. Your company also has multiples in these ranges.

However, your company trades at EV / EBITDA multiples of 6x to 8x, while the comparable companies all trade at multiples of 10x to 12x.

That could indicate that your company is **undervalued** since its multiples are lower, but its growth rates, margins, industry, and size are all comparable.

If the growth rates and margins are very different, it's harder to draw conclusions.

13. Is it valid to include both announced and closed deals in your set of Precedent Transactions?

Yes, because Precedent Transactions reflect **overall market activity**. Even if a deal hasn't closed yet, the simple *announcement* of the deal reflects what one company believes another is worth.

Note that you base all the metrics and multiples on the financial information as of the *announcement dates*.

14. Why do Precedent Transactions often result in more "random" data than Public Comps?

The problem is that the circumstances surrounding each deal might be **very different**.

For example, one company might have sold itself because it was distressed and about to enter bankruptcy.

But another company might have sold itself because the acquirer desperately needed it and was willing to pay a high price.

Some deals are competitive and include multiple acquirers bidding against each other, while others are more targeted and do not involve competitive bidding.

All these factors mean that the multiples tend to vary widely, more so than the multiples for Public Comps.

15. How do you factor in earn-outs and expected synergies in Precedent Transactions?

You generally don't factor in expected synergies because they're so speculative. If you do include them, you might *increase* the sellers' projected revenue or EBITDA figures so that the valuation multiples end up being *lower*.

Opinions differ on earn-outs, but you could assume that they have a 50% chance of being paid out, multiply the earn-out amounts by 50%, and add them to the purchase prices.

Other people ignore earn-outs or add the full earn-out amounts to the purchase prices.

16. Are there any rules about filtering out deals for less than 100% of companies or about stock vs. cash deals in Precedent Transactions?

Ideally, your set of Precedent Transactions will include **only** 100% acquisition deals.

However, you may need to go beyond that and also include **majority-stake deals** (ones where the acquirer buys more than 50% but less than 100% of the seller).

You can include those because the dynamics are similar, but you should **not** include minority-stake deals because acquiring 10% or 20% of a company is quite different.

Stock vs. cash consideration affects buyers' willingness to pay in M&A deals, but you typically include **all** deals regardless of the form of consideration.

You may note whether each deal was cash, stock, or a mix of both.

17. If there's a Precedent Transaction where the buyer acquired 80% of the seller, how do you calculate the valuation multiples?

The multiples are always based on **100%** of the seller's value.

So, if the acquirer purchased 80% of the seller for $500 million, the Purchase Equity Value would be $500 million / 80% = $625 million. And then you would calculate the Purchase Enterprise Value based on that figure plus the usual adjustments.

You would then calculate the valuation multiples based on those figures and the financial stats for 100% of the seller.

18. Why do you use median multiples rather than average multiples or other percentiles?

Median multiples are better than average multiples because of **outliers**.

If there are 5 companies in your set, and the multiples are 8x, 10x, 9x, 8x, and 25x, you don't want the 25x multiple to push up the average when it's clearly an outlier.

However, there's no "rule" that you have to use the median rather than other percentiles, so you could make an argument for using the 25th percentile or 75th percentile.

For example, you could argue that your company's growth rates and margins are in-line with those of companies in the 75th percentile of your set and that the 75th percentile multiples are, therefore, most applicable to your company.

Return to Top.

Other Valuation Methodologies

These questions are unlikely to come up unless you have significant finance experience.

If they do come up, they'll most likely be in the form of straightforward questions on how to set up different analyses and the advantages and disadvantages of each one.

1. What is a Liquidation Valuation, and when is it useful and not so useful?

In a Liquidation Valuation, you value a company by determining the fair market values of all its Assets, adding them up, and subtracting the fair market values of all its Liabilities.

It gives you the company's **Implied Equity Value** because you're valuing *all* the company's Assets rather than just its core-business Assets.

This methodology is useful for distressed companies because it tells you how much they might be worth if they have to liquidate and shut down.

It's less useful for healthy, growing companies because it tends to undervalue them greatly. A growing company is worth a lot more than what's on its Balance Sheet because of its future growth potential.

2. How does a Dividend Discount Model (DDM) differ from a DCF?

In a DDM, rather than projecting Free Cash Flow, you project the company's **Dividends**, usually based on a percentage of Net Income. You then discount the Dividends to their Present Value using the Cost of Equity and add them up.

To calculate the Terminal Value, you use an Equity Value-based multiple such as P / E (or the Gordon Growth Method), and then you discount it to its Present Value using the Cost of Equity.

You calculate the company's Implied Equity Value at the end rather than its Implied Enterprise Value, and you divide it by the diluted share count to get the company's Implied Share Price.

The DDM is essential in some industries, such as commercial banks and insurance, useful for other industries that pay regular dividends, such as REITs, utilities, and some MLPs, and not so useful for most others.

3. Why might you use an M&A Premiums analysis to value a company?

The M&A Premiums analysis applies only to **public companies** because you look at acquisitions of similar public companies and calculate the "premium" each buyer paid for each seller.

For example, if the seller's share price was $12.00 before the deal, and the buyer paid $15.00 per share, that represents a 25% premium.

You take the median for a set of transactions and then use that percentage to value your company. If the median premium is 20%, and your company's share price is $10.00, it's worth $12.00 per share.

This analysis is useful when Precedent Transactions give nonsensical results, and you want to use something *other* than traditional multiples to value your company.

For example, if the Precedent Transactions were all done at EV / EBITDA multiples between 6x and 8x, and your company is currently at trading at 10x EV / EBITDA, the results don't make sense: A public company can't sell for *less than* its current multiples.

So, you could look at the **M&A premiums** instead. If the median premium is 25%, you might apply that to your company's share price and say that a buyer might have to pay that much to do the deal.

4. How do you build a Future Share Price Analysis?

You take the median historical multiple from the Public Comps, often the P / E multiple, and apply it to the *future* metric of the company you're valuing (Net Income or EPS with the P / E multiple).

You assume that in 1-2 years, the company will be trading at the median multiple the comparable companies are *currently* trading at.

For example, if the median P / E is 15x, and the company's Year 1 projected EPS is $1.00, you could say the company's expected "future share price" is 15 * $1.00 = $15.00.

Then, you discount this future share price to its Present Value by using a range of values for the company's Cost of Equity.

For Enterprise Value-based multiples, you back into the Implied Equity Value and Implied Share Price in future years and then discount that share price to its Present Value.

5. What are the advantages and disadvantages of a Sum-of-the-Parts Valuation?

The Sum-of-the-Parts methodology, where you value each division of a company separately and add them up to determine the company's Implied Value, works well for conglomerates like General Electric that have *very* different divisions.

The divisions operate in such different industries that it would be meaningless to value the company as a whole – no other company would be truly comparable.

But Sum of the Parts also takes far more time and effort to set up because you have to find comparable companies and transactions for **each division**, build a separate DCF for each division, and so on.

Also, you may not have enough information to use it – companies sometimes don't disclose EBIT or CapEx by division, and they may not disclose the corporate overhead expenses that you must factor in at the end of the analysis.

6. How do you set up an LBO valuation, and when is it useful?

You set up the LBO valuation by creating a leveraged buyout model where a private equity firm acquires a company using Debt and Equity, holds it for several years, and then sells it for a certain multiple of EBITDA.

Since most private equity firms target an internal rate of return (IRR) in a specific range, you **work backward** and determine the maximum purchase price the PE firm can pay to achieve a minimum IRR.

You use the "Goal Seek" function in Excel to do this, and you solve for the purchase price based on constraints for the IRR, exit multiple, and Debt / Equity split.

This methodology is useful for setting a **floor** on the company's valuation – you're constraining the price because of the IRR requirement.

It's also useful for estimating what a private equity firm, rather than a normal company, might be willing to pay for a company.

Return to Top.