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Financial Modeling Fundamentals, Module 15: Debt Capital Markets (DCM) and Leveraged Finance (LevFin)

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Key Rule #5: Operational Scenarios and Covenants vs. Credit Stats and Ratios

Earlier, we went through the example for Central Japan Railway (CJR) and explained how bankers might recommend the most appropriate financing option:

1) Calculate the company's **After-Tax Costs of Equity and Debt** to confirm that Debt is, indeed, cheaper than Equity.

2) Create **operational scenarios**, including Upside, Base, and Downside cases, and reflect them in a cash flow projection model for the company.

3) Build a **Debt Schedule** in this model to track the company's Interest Expense, Debt Principal Repayments, and Debt and Cash balances over time.

4) Examine the company's **credit stats and ratios** in different scenarios, and pay attention to the most pessimistic ones. Reflect requirements from lenders here, such as maximum leverage or coverage ratios or a maximum Debt Service Coverage Ratio (DSCR).

5) If the company **breaches** the requirements from lenders in the more pessimistic cases (e.g., EBITDA / Interest is 5.5x, but the maximum is 5.0x), consider alternate structures, such as Convertible Bonds.

6) If Convertible Bonds are not viable, think about a **mix of Debt and Equity**. And if the company's profile is completely unsuitable for Debt, make it a 100% Equity deal.

That same process applies to any financing deal, but we wanted to go into more depth on a few steps within it, starting with the **operational scenarios**.

Creating Operational Scenarios

In credit analysis, the Base and Upside cases are nearly irrelevant because **lenders do not benefit AT ALL if the company performs well.**

Regardless of how much the company's margins or cash flows grow, lenders receive only a fixed amount of interest each year.

The *only* exception to this rule occurs if the Debt has warrants or equity options attached.

But even with those, lenders *still* focus heavily on the Downside cases because losing money would be catastrophic; a small percentage of the company's Equity is just a nice bonus.

To build these operational scenarios, you have to think about the company's industry, its past financial performance, and how similar companies performed in Downside scenarios.

If the industry is **cyclical** – e.g., real estate – it's straightforward to come up with the numbers: Just look at the performances of different companies in the last downturn.

For example:

- **Rental Income Growth:** Rents almost always decline in downturns, so if they fell by 10% in the last recession, you could use the same number in your model.

- **Expense Growth:** *Some* expenses decline in downturns, but others, such as concessions to tenants, **rise** because landlords need to attract more tenants.

  So, if general operating expenses declined by 2-3% per year but concessions rose by 5% per year in the last downturn, you might use these numbers in your Downside case.

- **Vacancy Rates:** These rise in a downturn because fewer tenants rent apartments. If the overall rate rose from 5% to 10% last time, you might assume the same this time.

It's a bit tougher to select numbers in other industries, but here's an example of the "Extreme Downside" case for Netflix:

		Historical			Projected					CAGR:
Income Statement:	*Units:*	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY14 - 19
Revenue:										
Domestic Streaming:	$ M	$ 2,184.9	$ 2,751.4	$ 3,431.4	$ 3,849.9	$ 4,103.6	$ 4,304.0	$ 4,472.3	$ 4,609.1	*6.1%*
International Streaming:	$ M	287.5	712.4	1,308.1	1,951.1	2,545.6	3,014.2	3,233.9	3,296.8	*20.3%*
Domestic DVD:	$ M	1,136.9	910.8	765.2	605.9	449.3	330.8	243.6	179.3	*(25.2%)*
Total Revenue:	$ M	**3,609.3**	**4,374.6**	**5,504.7**	**6,407.0**	**7,098.5**	**7,649.0**	**7,949.7**	**8,085.2**	*8.0%*
Revenue Growth:	%	*12.6%*	*21.2%*	*25.8%*	*16.4%*	*10.8%*	*7.8%*	*3.9%*	*1.7%*	
Cost of Revenue:	$ M	2,652.1	3,117.2	3,752.8	4,436.7	5,190.9	5,849.5	6,050.8	5,864.8	*9.3%*
Gross Profit:	$ M	**957.2**	**1,257.4**	**1,751.9**	**1,970.3**	**1,907.6**	**1,799.5**	**1,898.8**	**2,220.4**	*4.9%*
Gross Margin:	%	*26.5%*	*28.7%*	*31.8%*	*30.8%*	*26.9%*	*23.5%*	*23.9%*	*27.5%*	
Operating Expenses:										
Marketing:	$ M	439.2	469.9	607.2	853.5	975.3	1,020.3	1,016.9	975.3	*9.9%*
Technology & Development:	$ M	329.0	378.8	472.3	544.6	596.3	634.9	651.9	654.9	*6.8%*
General & Administrative:	$ M	139.0	180.3	269.7	320.3	362.0	397.7	421.3	436.6	*10.1%*
Total Operating Expenses:	$ M	**907.2**	**1,029.0**	**1,349.2**	**1,718.5**	**1,933.6**	**2,053.0**	**2,090.1**	**2,066.8**	*8.9%*
Operating Income (EBIT):	$ M	**50.0**	**228.3**	**402.6**	**251.8**	**(26.1)**	**(253.5)**	**(191.3)**	**153.7**	*(17.5%)*
Operating (EBIT) Margin:	%	*1.4%*	*5.2%*	*7.3%*	*3.9%*	*(0.4%)*	*(3.3%)*	*(2.4%)*	*1.9%*	

Even though it's the "Extreme Downside" case, we did **not** assume that revenue would fall by 50% or that Operating Income would decline to negative $1 billion.

Why?

Because it wouldn't make sense for this type of company.

When Tech/Internet companies do not perform well, they tend to stagnate, but they *rarely* go down in flames.

For example, when Yahoo began to struggle, its revenue stagnated at around $5 billion per year, and its operating margins declined to 0% or slightly negative percentages.

We've assumed something similar for Netflix: A stagnant subscriber count, revenue growth that declines greatly, and operating margins that turn slightly negative.

Our **Downside Case** for the company shows revenue growth declining from 20-25% to 5-10% and operating margins remaining under 5%, rising slightly by the end:

		Historical			Projected					CAGR:
Income Statement:	*Units:*	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY14 - 19
Revenue:										
Domestic Streaming:	*$ M*	$ 2,184.9	$ 2,751.4	$ 3,431.4	$ 3,983.0	$ 4,448.0	$ 4,912.4	$ 5,352.7	$ 5,763.7	*10.9%*
International Streaming:	*$ M*	287.5	712.4	1,308.1	2,038.8	2,827.9	3,593.5	4,168.6	4,590.8	*28.5%*
Domestic DVD:	*$ M*	1,136.9	910.8	765.2	618.2	478.4	370.2	285.6	220.2	*(22.1%)*
Total Revenue:	*$ M*	**3,609.3**	**4,374.6**	**5,504.7**	**6,640.0**	**7,754.3**	**8,876.1**	**9,807.0**	**10,574.7**	*13.9%*
Revenue Growth:	*%*	*12.6%*	*21.2%*	*25.8%*	*20.6%*	*16.8%*	*14.5%*	*10.5%*	*7.8%*	
Cost of Revenue:	*$ M*	2,652.1	3,117.2	3,752.8	4,503.5	5,458.2	6,406.1	6,962.9	7,132.9	*13.7%*
Gross Profit:	*$ M*	**957.2**	**1,257.4**	**1,751.9**	**2,136.5**	**2,296.1**	**2,470.0**	**2,844.1**	**3,441.8**	*14.5%*
Gross Margin:	*%*	*26.5%*	*28.7%*	*31.8%*	*32.2%*	*29.6%*	*27.8%*	*29.0%*	*32.5%*	
Operating Expenses:										
Marketing:	*$ M*	439.2	469.9	607.2	847.8	1,022.5	1,136.3	1,205.3	1,224.4	*15.1%*
Technology & Development:	*$ M*	329.0	378.8	472.3	564.4	651.4	736.7	804.2	856.5	*12.6%*
General & Administrative:	*$ M*	139.0	180.3	269.7	332.0	395.5	461.6	519.8	571.0	*16.2%*
Total Operating Expenses:	*$ M*	**907.2**	**1,029.0**	**1,349.2**	**1,744.2**	**2,069.3**	**2,334.5**	**2,529.3**	**2,652.0**	*14.5%*
Operating Income (EBIT):	*$ M*	**50.0**	**228.3**	**402.6**	**392.3**	**226.8**	**135.5**	**314.8**	**789.7**	*14.4%*
Operating (EBIT) Margin:	*%*	*1.4%*	*5.2%*	*7.3%*	*5.9%*	*2.9%*	*1.5%*	*3.2%*	*7.5%*	

A "pessimistic scenario" for a high-growth company means **stagnation and slower growth**, not a total collapse.

Our **Base Case** is a bit more optimistic:

Income Statement:	Units:	Historical FY12	FY13	FY14	Projected FY15	FY16	FY17	FY18	FY19	CAGR: FY14 - 19
Revenue:										
Domestic Streaming:	$ M	$ 2,184.9	$ 2,751.4	$ 3,431.4	$ 4,079.3	$ 4,725.4	$ 5,387.9	$ 6,063.0	$ 6,792.9	*14.6%*
International Streaming:	$ M	287.5	712.4	1,308.1	2,118.0	3,115.2	4,194.5	5,179.8	6,124.7	*36.2%*
Domestic DVD:	$ M	1,136.9	910.8	765.2	631.8	510.5	410.5	330.0	265.3	*(19.1%)*
Total Revenue:	$ M	**3,609.3**	**4,374.6**	**5,504.7**	**6,829.1**	**8,351.2**	**9,992.9**	**11,572.8**	**13,182.9**	*19.1%*
Revenue Growth:	%	*12.6%*	*21.2%*	*25.8%*	*24.1%*	*22.3%*	*19.7%*	*15.8%*	*13.9%*	
Cost of Revenue:	$ M	2,652.1	3,117.2	3,752.8	4,556.3	5,704.3	6,899.0	7,811.5	8,335.5	*17.3%*
Gross Profit:	$ M	**957.2**	**1,257.4**	**1,751.9**	**2,272.9**	**2,646.9**	**3,093.9**	**3,761.4**	**4,847.4**	*22.6%*
Gross Margin:	%	*26.5%*	*28.7%*	*31.8%*	*33.3%*	*31.7%*	*31.0%*	*32.5%*	*36.8%*	
Operating Expenses:										
Marketing:	$ M	439.2	469.9	607.2	804.5	1,015.3	1,186.0	1,313.8	1,366.9	*17.6%*
Technology & Development:	$ M	329.0	378.8	472.3	580.5	701.5	829.4	949.0	1,067.8	*17.7%*
General & Administrative:	$ M	139.0	180.3	269.7	341.5	425.9	519.6	613.4	711.9	*21.4%*
Total Operating Expenses:	$ M	**907.2**	**1,029.0**	**1,349.2**	**1,726.5**	**2,142.7**	**2,535.1**	**2,876.1**	**3,146.6**	*18.5%*
Operating Income (EBIT):	$ M	**50.0**	**228.3**	**402.6**	**546.4**	**504.2**	**558.8**	**885.2**	**1,700.8**	*33.4%*
Operating (EBIT) Margin:	%	*1.4%*	*5.2%*	*7.3%*	*8.0%*	*6.0%*	*5.6%*	*7.6%*	*12.9%*	

Even though we didn't assume a complete meltdown, there are **substantial differences** in each case: Revenue CAGRs of 8% vs. 14% vs. 19%, for example.

If the company were significantly more mature (e.g., Central Japan Railway), the operational cases would span much smaller differences. Here are the numbers in that model:

- **Base Case Revenue CAGR:** 2.5%
- **Downside Case Revenue CAGR:** 0.8%
- **Extreme Downside Case Revenue CAGR:** 0.1%

You **cannot** blindly make assumptions for the Downside Cases in credit analysis.

When you come up with these numbers, make sure you:

- **Consider the company's industry and maturity.** A "pessimistic outcome" for a biotech or mobile app company is much different from a pessimistic outcome for an airline or retailer.

- **Look at the company's historical performance in recessions.** How much has the company's revenue declined before? How exposed is the company to cyclical market conditions?

- **Look at peer companies that have not performed well.** If similar companies have stagnated instead of melting down, the same may happen here. But if other companies' revenues have fallen dramatically, this company's revenue might also decline.

Credit Stats, Ratios, and Covenants

Lenders normally determine the credit stats and ratios they are seeking based on the company's credit rating and financial and industry profile.

For example, let's say that most food processing companies with "BB+" credit ratings have Debt / EBITDA between 3x and 4x and EBITDA / Interest between 4x and 5x.

If we're analyzing a food processing company with the same credit rating, and this company wants to issue additional Debt, lenders will evaluate the company's ratios afterward.

If the company's Debt / EBITDA rises from 3.5x to 4.5x and its EBITDA / Interest falls from 4.2x to 3.4x, **there's a good chance that its credit rating will be downgraded.**

However, there's a difference between what lenders are *seeking* and what they *require*.

Credit rating agencies look at figures like the leverage ratio and interest coverage ratio to get a sense of the company's credit rating.

As a company raises more Debt, its Debt / EBITDA will increase, and its credit rating will decrease.

As a result, the company will start to pay higher interest rates on its Debt.

Rating agencies use these metrics to evaluate a company's creditworthiness, and Debt investors use them to assess reasonable interest rates for the company.

But even if the company's Debt has no maintenance covenants – no required Debt / EBITDA or EBITDA / Interest – lenders and rating agencies *still* use these figures to evaluate the company.

For example, most forms of "junior capital," such as Subordinated Notes and Mezzanine, have no requirements for these metrics.

But if the company issues Subordinated Notes, pushing its leverage ratio above 5x, lenders *will* notice, and the company's credit rating and borrowing costs will change.

If the company has Debt with **maintenance covenants** – primarily Revolvers and Term Loans – then these ratios are even more important.

If the company violates these covenants, it may pay penalty fees, its borrowing costs will increase, and its credit rating will fall.

The most common **maintenance covenants** are the leverage ratio (maximum Debt / EBITDA) and the interest coverage ratio (minimum EBITDA / Interest), but there are dozens of others:

- Minimum EBITDA
- Maximum Net Debt / EBITDA
- Maximum Debt / (EBITDA – CapEx)
- Maximum Senior Debt / EBITDA
- Minimum EBITDA / Cash Interest
- Minimum EBITDA / Senior Debt Interest
- Minimum Cash or Cash as a % of Total Expenses
- Minimum Debt Service Coverage Ratio (DSCR)
- Minimum Fixed Charge Coverage Ratio (similar to the DSCR)

We could also look at EBITDAR, capitalize the company's operating leases, and add them to Debt and Net Debt to get figures such as Debt + Capitalized Operating Leases or Net Debt + Capitalized Operating Leases.

And you could mix and match these metrics to come up with dozens of variations.

When a company has issued Term Loans or other Debt with maintenance covenants, lenders often calculate the "Cushion" for each covenant.

This "Cushion" represents how close the company is to breaching these covenants.

Here are a few examples for Netflix:

Covenant Analysis:	Units:	Projected FY15	FY16	FY17	FY18	FY19
Minimum LTM EBITDA:						
Consolidated EBITDA:	$ M	678.3	634.3	667.7	978.8	1,782.2
EBITDA Required by Covenants:	$ M	$ 400.0	$ 425.0	$ 450.0	$ 475.0	$ 500.0
Cushion %:	%	41.0%	33.0%	32.6%	51.5%	71.9%
Senior Debt / EBITDA:	x	3.48 x	3.72 x	3.54 x	2.41 x	1.33 x
Required by Covenants:	x	4.00 x	4.00 x	3.80 x	3.60 x	3.50 x
Required EBITDA:	$ M	590.6	590.6	621.7	656.3	675.0
EBITDA Cushion ($):	$ M	87.6	43.6	46.0	322.6	1,107.2
EBITDA Cushion (%):	%	12.9%	6.9%	6.9%	33.0%	62.1%
Total Debt / EBITDA:	x	3.48 x	3.72 x	3.54 x	2.41 x	1.33 x
Required by Covenants:	x	5.00 x	5.00 x	4.75 x	4.75 x	4.50 x
Required EBITDA:	$ M	472.5	472.5	497.4	497.4	525.0
EBITDA Cushion ($):	$ M	205.8	161.8	170.3	481.4	1,257.2
EBITDA Cushion (%):	%	30.3%	25.5%	25.5%	49.2%	70.5%
Minimum Interest Coverage Ratio:						
Total Interest Expense:	$ M	133.3	133.3	133.3	133.3	133.3
EBITDA / Interest Expense:	x	5.09 x	4.76 x	5.01 x	7.35 x	13.37 x
Required by Covenants:	x	3.00 x	3.00 x	2.75 x	2.75 x	2.75 x
Required EBITDA:	$ M	399.8	399.8	366.5	366.5	366.5
EBITDA Cushion ($):	$ M	278.5	234.5	301.2	612.3	1,415.7
EBITDA Cushion (%):	%	41.1%	37.0%	45.1%	62.6%	79.4%

The fact that the company comes so close to violating the Senior Debt / EBITDA covenant in the *Base Case* is concerning - the others also have less of a cushion than we'd like.

On the other hand, the company has more than enough interest coverage.

The Fixed Charge Coverage Ratio covenant is even more problematic – especially since this is just the *Base Case*:

Covenant Analysis:	Units:	Projected FY15	FY16	FY17	FY18	FY19
Fixed Charge Coverage Ratio:						
Consolidated EBITDA:	$ M	678.3	634.3	667.7	978.8	1,782.2
(-) CapEx:	$ M	(144.6)	(134.6)	(122.8)	(112.4)	(105.5)
(-) Cash Taxes:	$ M	(185.4)	(157.7)	(173.6)	(294.0)	(586.3)
(-) Management Fees:	$ M	-	-	-	-	-
(-) Common Dividends:	$ M	-	-	-	-	-
Free Cash Flow Available for Fixed Charges:	$ M	**348.2**	**342.0**	**371.3**	**572.4**	**1,090.4**
Total Interest Expense:	$ M	133.3	133.3	133.3	133.3	133.3
(+) Required Principal Repayments:	$ M	-	-	-	-	-
(+) Finance and Operating Lease Payments:	$ M	35.5	37.1	27.7	19.8	14.9
Total Fixed Charges:	$ M	**168.8**	**170.3**	**161.0**	**153.1**	**148.2**
Fixed Charge Coverage:	x	2.06 x	2.01 x	2.31 x	3.74 x	7.36 x
Required by Covenants:	x	1.50 x	1.50 x	1.50 x	1.40 x	1.40 x
Required EBITDA:	$ M	583.2	547.7	537.8	620.7	899.3
EBITDA Cushion ($):	$ M	95.1	86.5	129.9	358.1	882.9
EBITDA Cushion (%):	%	14.0%	13.6%	19.4%	36.6%	49.5%

A quick look at the **Downside Case** reveals a lot of problems:

Covenant Analysis:	Units:	Projected FY15	FY16	FY17	FY18	FY19
Minimum LTM EBITDA:						
Consolidated EBITDA:	$ M	521.5	349.5	233.3	394.9	855.7
EBITDA Required by Covenants:	$ M	$ 400.0	$ 425.0	$ 450.0	$ 475.0	$ 500.0
Cushion %:	%	23.3%	(21.6%)	(92.9%)	(20.3%)	41.6%
Senior Debt / EBITDA:	x	4.53 x	6.76 x	10.13 x	5.98 x	2.76 x
Required by Covenants:	x	4.00 x	4.00 x	3.80 x	3.60 x	3.50 x
Required EBITDA:	$ M	590.6	590.6	621.7	656.3	675.0
EBITDA Cushion ($):	$ M	(69.1)	(241.2)	(388.4)	(261.3)	180.7
EBITDA Cushion (%):	%	(13.3%)	(69.0%)	(166.5%)	(66.2%)	21.1%
Total Debt / EBITDA:	x	4.53 x	6.76 x	10.13 x	5.98 x	2.76 x
Required by Covenants:	x	5.00 x	5.00 x	4.75 x	4.75 x	4.50 x
Required EBITDA:	$ M	472.5	472.5	497.4	497.4	525.0
EBITDA Cushion ($):	$ M	49.0	(123.0)	(264.1)	(102.4)	330.7
EBITDA Cushion (%):	%	9.4%	(35.2%)	(113.2%)	(25.9%)	38.6%
Minimum Interest Coverage Ratio:						
Total Interest Expense:	$ M	133.3	133.3	133.3	133.3	133.3
EBITDA / Interest Expense:	x	3.91 x	2.62 x	1.75 x	2.96 x	6.42 x
Required by Covenants:	x	3.00 x	3.00 x	2.75 x	2.75 x	2.75 x
Required EBITDA:	$ M	399.8	399.8	366.5	366.5	366.5
EBITDA Cushion ($):	$ M	121.7	(50.3)	(133.1)	28.5	489.2
EBITDA Cushion (%):	%	23.3%	(14.4%)	(57.1%)	7.2%	57.2%

If Netflix underperforms even *slightly*, it cannot comply with these maintenance covenants.

Bankers reviewing this analysis would tell the company:

1) **Term Loans are not a great idea** because of the maintenance covenants; since your company is planning to spend a lot on growth, you may have trouble complying with these, which would result in fees and penalties.

2) **Because of your company's cash flow profile**, you'll have to consider junior capital such as Subordinated Notes, Mezzanine, or Convertible Bonds if you want to raise Debt rather than Equity.

3) **But even with those forms of Debt**, your credit rating will decline because your credit stats and ratios will decline. This problem won't make an immediate impact because interest rates are fixed. But if you refinance in a few years, you will pay higher rates.

This summary explains why Netflix is a **poor candidate** for traditional Debt.

Not only does its Cost of Debt *exceed* its Cost of Equity, but the company could raise a covenant-lite, low-interest-rate Convertible Bond more quickly and effectively.

And investors would easily buy into a Convertible Bond from a company like Netflix that is high-growth and speculative: It's a perfect candidate for a "hedged equity investment."

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Key Rule #6: Bond Yields, Pricing, Duration, and Convexity

If you're analyzing a **primary Debt issuance** from a company – what happens when the company issues new Debt to new investors – everything is quite straightforward.

For example, let's assume that the company issues a $1 billion 10-year bond with a 6% fixed coupon rate and bullet maturity.

You would add $60 million of interest to its financial statements and evaluate the most common credit stats and ratios in different operational cases of the model.

But bond analysis in the *secondary market* gets significantly more complicated.

The "secondary market" consists of investors buying bonds from and selling bonds to other investors.

And just like a company's stock price changes all the time, the **market prices** of a company's bonds can change as well.

In the example above (a $1 billion bond with a 6% fixed coupon rate), let's assume that prevailing interest rates for similar bonds in the market are also 6%.

This company has an excellent credit rating, so all the investors expect it to repay the bond upon maturity.

You can value this bond the same way you value any other asset: By discounting each future cash flow to its Present Value and summing up everything.

In this scenario, the bond price **would not change** immediately after issuance:

Bond Yields and Pricing - Simple Example
($ USD in Millions Except Per Share Amounts in USD as Stated)

The bond's coupon rate matches prevailing market rates... and the company has a 100% chance of repaying the bond.

Bond Yield and Pricing Assumptions:

Prevailing Interest Rates on Similar Bonds:	6.000%
Settlement Date:	2014-12-31
Bond Coupon Rate:	6.000%
Bond Principal or Par Value:	$ 1,000.0
Bond Maturity:	2024-12-31
Bond Redemption Value % Par Value:	100.0

# Years in Period:	10.0
Starting Year # for Bond Investment:	1.0
(+) PV of Future Interest Payments:	$ 441.6
(+) PV of Principal:	558.4
Bond Price:	**$ 1,000.0**

As a result, the bond's price immediately after issuance is exactly the same as the price it was issued at ($1 billion).

	Historical	Projected									
Interest and Principal Payments:	**FY14**	**FY15**	**FY16**	**FY17**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**	**FY23**	**FY24**
(-) Initial Investment:	$ (1,000.0)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
(+) Future Interest Payments:	-	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
(+) Future Principal Repayments:	-	-	-	-	-	-	-	-	-	-	1,000.0
Total Cash Flow:	**$ (1,000.0)**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 1,060.0**

But let's say that prevailing interest rates increase from **6% to 7%**, and the company's chances of repaying the bond upon maturity drop from **100% to 98%**.

Both changes **reduce the bond's market price** because investors now have better options elsewhere:

- Why buy a bond with a 6% coupon rate when you could buy one with a 7% rate?
- And why buy a bond with a 2% chance of default when you could buy one with a 0% chance?

Here's what happens in Excel:

Bond Yield and Pricing Assumptions:

Prevailing Interest Rates on Similar Bonds:	7.000%
Settlement Date:	2014-12-31
Bond Coupon Rate:	6.000%
Bond Principal or Par Value:	$ 1,000.0
Bond Maturity:	2024-12-31
Bond Redemption Value % Par Value:	98.0

# Years in Period:	10.0
Starting Year # for Bond Investment:	1.0
(+) PV of Future Interest Payments:	$ 421.4
(+) PV of Principal:	498.2
Bond Price:	**$ 919.6**

The PVs are lower now because we're discounting at 7% instead of 6%, and the Future Principal Repayment is $980 instead of $1000.

Bond price declines as a result!

	Historical	Projected									
Interest and Principal Payments:	**FY14**	**FY15**	**FY16**	**FY17**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**	**FY23**	**FY24**
(-) Initial Investment:	$ (919.6)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
(+) Future Interest Payments:	-	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
(+) Future Principal Repayments:	-	-	-	-	-	-	-	-	-	-	980.0
Total Cash Flow:	**$ (919.6)**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 1,040.0**

The fact that the bond's market price is now $920 rather than $1,000 is significant because **it affects the company's financing and refinancing options**.

For example, if the company wanted to refinance and replace this bond with a new one before the maturity date, investors wouldn't accept a 6% coupon anymore.

They would accept that coupon rate only if the company **issued the bond at a discount to par value**: In other words, if investors could buy the bond for $920 rather than $1,000.

If the company did *not* offer this discount, it would have to offer a higher coupon rate or other terms that improve investors' yield – to match the prevailing interest rates of 7%.

Other factors also impact a bond's market price, but these are two of the biggest: **The issuer's creditworthiness** and **prevailing interest rates vs. the bond's coupon rate.**

Here are all the extra items you must consider when you analyze bonds that a company has *already issued*:

1) **Market Prices** – See the example above.

2) **Timing** – Some bonds pay interest quarterly, some pay it semiannually, and some pay it annually.

3) **Accrued Interest** – If an investor buys a bond in between interest payments, he/she will also have to pay for the interest that has been **accrued** up to that point.

4) **Call, Put, and Conversion Options** – Companies can sometimes repay bonds early ("calling the bond"), but they must pay a **premium** to do so. Investors can also "put the bond" and force the company to repay it early. And Convertible Bonds allow investors to convert the bonds into common shares if the company's share price hits a certain level.

5) **Warrant and Equity Options** – Some bonds have equity options attached; for example, a company might issue a bond that gives investors 5% of the company's equity upon maturity (often to compensate for a reduced coupon rate).

You analyze bonds primarily for the following tasks:

1) **To Compare and Recommend Financing Options** – Similar to the approach in Key Rule #2 with operational scenarios and credit stats and ratios, you can also calculate bond prices and yields in different scenarios and use them to make recommendations.

2) **To Compare and Recommend Refinancing Options** – If a company wants to refinance its Debt, it is extremely helpful to know the effective yield that investors are currently earning on it. You can use bond analysis to determine this number.

Let's say a client has $1 billion of 10-year bonds with an 8% coupon rate and a 103% "redemption premium" if it calls the bond before the maturity date.

So, the client can repay those bonds early, but it has to pay 3% extra – $1.030 billion instead of $1.000 billion – to do so.

After the company had issued the bonds, interest rates fell, so the company believes it can issue new 10-year bonds at a lower coupon rate and reduce its interest expense.

This client approaches you with the following questions:

1) **Is it worth it?** Given the penalty and difference in interest rates, should the company refinance right now?

2) **If so,** what are the most appropriate terms for the new $1 billion bonds? What coupon rate could the company offer? If the bond is callable, what should the call protection period and redemption premiums be?

You'll understand how to answer questions like these after reading these next few sections.

The Basics: Interest Rates, Prices, and Yields

You've already seen how **bond prices** are affected by prevailing interest rates: When rates go up, bond prices go down, and when rates go down, bond prices go up.

"Prevailing interest rates" is another term for **the discount rate**, so you should understand why this statement is true: Future cash flows are worth **less** when the discount rate is higher because investors have better options elsewhere.

And future cash flows are worth **more** when the discount rate is lower because investors have worse options elsewhere.

If you consider **only** the prevailing interest rates and the bond's coupon rate, then the following relationships hold:

- **Interest Rates > Bond Coupon Rate:** Bond trades at a **discount** to par value (e.g., $950 rather than $1,000) – investors have better options!

- **Interest Rates < Bond Coupon Rate:** Bond trades at a **premium** to par value (e.g., $1,050 rather than $1,000) – this bond beats other options!

- **Interest Rates = Bond Coupon Rate:** Bond trades **at** its par value – other options are the same as this bond.

It's not quite that simple because the company's **default probability** also factors in – if it increases or decreases, that will also affect the bond's market price.

But if we assume there's no chance of default, then the bond's price depends on interest rates.

To measure how much investors are earning on a bond, you calculate its **yield**.

There are many yield-based metrics, but a few of the most important ones include **Current Yield** and **Yield to Maturity (YTM).**

The **Current Yield** represents the "effective interest rate" on the bond: If you bought the bond at its current market price, what percentage of that price would you earn in interest?

Here's an example:

- **Bond Par Value:** $1,000 (Company issued it at this price)
- **Coupon Rate:** 6.0%
- **Current Bond Price:** $950
- **Current Yield** = (6.0% * $1,000) / $950 = 6.3%

Since the bond trades at a **discount** to par value, its Current Yield exceeds its coupon rate.

Most likely, this happened because **interest rates rose** after the company issued this bond, so investors are no longer willing to pay full price for it.

The Current Yield is useful because it tells you at a glance how much investors could earn on a bond if they buy it today and hold it for a year.

But you tend to focus on the **Yield to Maturity (YTM)**, which measures the average annual yield if you buy a bond at its current market price and hold it until maturity.

The YTM is the **internal rate of return (IRR)** on a bond, and it uses many of the same assumptions as IRR:

- **Assumption #1:** You hold the bond until maturity rather than selling it early. Also, the company does not repay the bond early.

- **Assumption #2:** The company pays all coupon (interest) and principal payments, including the final maturity, in full, on the scheduled dates.

- **Assumption #3:** You reinvest the cash flows you earn at the same yield.

One or more of these assumptions could easily be false, so the YTM does **not** necessarily correspond to reality.

But you need to know the definition since bonds are often quoted in terms of their YTM.

You can calculate the YTM with the YIELD function in Excel, the IRR function (if the bond offers annual coupons), or the "quick and dirty method."

Here are the inputs to the YIELD function:

=YIELD(Settlement Date, Maturity Date, Coupon Rate, Bond Price % Par Value Out of the Number 100, Bond Redemption Value % Par Value Out of the Number 100, Coupon Frequency)

For example, if we purchase a bond on 2017-12-31, it matures on 2021-06-30, it has a coupon rate of 6% paid semiannually, its current market price is 101% of par value, and the company is expected to repay the bond in full upon maturity, we would calculate the YTM like this:

=YIELD("12/31/2017," "6/30/2021",6%,101.00,100.00,2) = 5.681%

The interpretation is simple: **We pay a slight premium for this bond, so we earn *slightly less* than its coupon rate of 6%.**

We can also approximate the YTM with this formula:

$$\frac{\text{Annual Interest} + (\text{Redemption Value} - \text{Bond Price}) / \text{\# Years to Maturity}}{(\text{Redemption Value} + \text{Bond Price}) / 2}$$

So, in this example, we could enter these numbers to approximate it (assuming a $1,000 bond):

= ($60 + ($1,000 – $1,010) / 3.5) / (($1,000 + $1,010) / 2)

= ($60 – $2.85) / $1,005 = 5.69%

It's a decent approximation because the Redemption Value and Bond Price are almost the same, and there are only a few years until maturity.

The **intuition** for this formula is that each year, you earn interest PLUS a gain on the bond (if you buy it at a discount) or a loss on the bond (if you purchase it at a premium).

And you earn that annual amount on the "average" between the initial bond price and the amount you earn back upon maturity.

You can see how the Current Yield and Yield to Maturity change in a few other scenarios below.

Scenario #1: Prevailing Interest Rates Far Exceed the Bond's Coupon Rate

Bond Yield and Pricing Assumptions:

Prevailing Interest Rates on Similar Bonds:	8.000%	# Years in Period:	10.0
		Starting Year # for Bond Investment:	1.0
Settlement Date:	2014-12-31		
Bond Coupon Rate:	6.000%	(+) PV of Future Interest Payments:	$ 402.6
Bond Principal or Par Value:	$ 1,000.0	(+) PV of Principal:	463.2
Bond Maturity:	2024-12-31	**Bond Price:**	**$ 865.8**
Bond Redemption Value % Par Value:	100.0		
		Current Yield:	6.930%
Bond Price via Excel Function:	$ 865.8	Yield to Maturity (YTM):	8.000%
		Internal Rate of Return (IRR):	8.000%
		Approximate Yield to Maturity:	7.870%

YTM far exceeds the Current Yield here because the bond trades at a massive discount to par value; much of the YTM comes from the gain upon redemption.

	Historical	Projected									
Interest and Principal Payments:	**FY14**	**FY15**	**FY16**	**FY17**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**	**FY23**	**FY24**
(-) Initial Investment:	$ (865.8)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
(+) Future Interest Payments:	-	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
(+) Future Principal Repayments:	-	-	-	-	-	-	-	-	-	-	1,000.0
Total Cash Flow:	**$ (865.8)**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 1,060.0**

Scenario #2: Prevailing Interest Rates Are Far Below the Bond's Coupon Rate

Bond Yield and Pricing Assumptions:

Prevailing Interest Rates on Similar Bonds:	4.000%	# Years in Period:	10.0
		Starting Year # for Bond Investment:	1.0
Settlement Date:	2014-12-31		
Bond Coupon Rate:	6.000%	(+) PV of Future Interest Payments:	$ 486.7
Bond Principal or Par Value:	$ 1,000.0	(+) PV of Principal:	675.6
Bond Maturity:	2024-12-31	**Bond Price:**	**$ 1,162.2**
Bond Redemption Value % Par Value:	100.0		
		Current Yield:	5.163%
Bond Price via Excel Function:	$ 1,162.2	Yield to Maturity (YTM):	4.000%
		Internal Rate of Return (IRR):	4.000%
		Approximate Yield to Maturity:	4.049%

The YTM is far below the Current Yield here because the bond trades at a big premium to par value; that "loss" upon redemption pushes down the YTM.

	Historical	Projected									
Interest and Principal Payments:	**FY14**	**FY15**	**FY16**	**FY17**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**	**FY23**	**FY24**
(-) Initial Investment:	$ (1,162.2)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
(+) Future Interest Payments:	-	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
(+) Future Principal Repayments:	-	-	-	-	-	-	-	-	-	-	1,000.0
Total Cash Flow:	**$ (1,162.2)**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 1,060.0**

Scenario #3: The Bond Redemption Value Falls Below Par Value

In this scenario, we're assuming that the company becomes less likely to repay the full bond principal upon maturity.

Technically, YTM assumes that the company *will* repay the full amount, so this metric is more like "Yield to Some Amount of Future Repayment by the Company."

But we'll label it "YTM" so we can keep using this model:

Bond Yield and Pricing Assumptions:

Prevailing Interest Rates on Similar Bonds:	6.000%	# Years in Period:		10.0
		Starting Year # for Bond Investment:		1.0
Settlement Date:	2014-12-31			
Bond Coupon Rate:	6.000%	(+) PV of Future Interest Payments:	$	441.6
Bond Principal or Par Value:	$ 1,000.0	(+) PV of Principal:		530.5
Bond Maturity:	2024-12-31	**Bond Price:**	**$**	**972.1**
Bond Redemption Value % Par Value:	95.0			
		Current Yield:		6.172%
Bond Price via Excel Function:	$ 972.1	Yield to Maturity (YTM):		6.000%
		Internal Rate of Return (IRR):		6.000%
		Approximate Yield to Maturity:		6.013%

The lower redemption value upon maturity reduces the bond's price. As a result, the Current Yield *increases* and goes above the bond's coupon rate, but the YTM is lower - because the bond investors take a loss upon maturity.

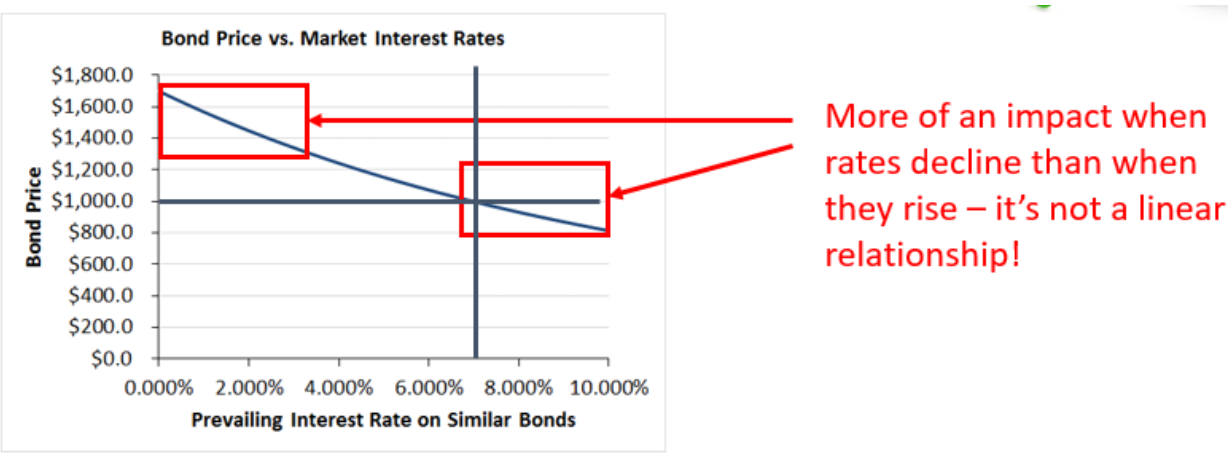
	Historical	Projected									
Interest and Principal Payments:	**FY14**	**FY15**	**FY16**	**FY17**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**	**FY23**	**FY24**
(-) Initial Investment:	$ (972.1)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
(+) Future Interest Payments:	-	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
(+) Future Principal Repayments:	-	-	-	-	-	-	-	-	-	-	950.0
Total Cash Flow:	**$ (972.1)**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 60.0**	**$ 1,010.0**

Interviewers can ask *tons* of questions on these concepts and the relationships between these terms; we'll cover quite a few in the section on interview questions.

Bond Relationships, Duration, and Convexity

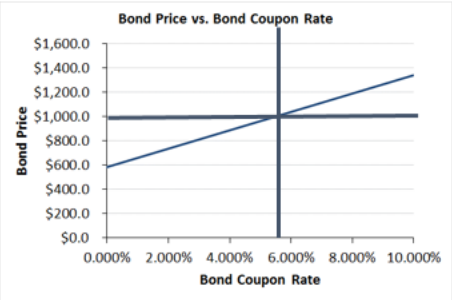
We can expand on these concepts and plot a few more key relationships.

For example, **bond prices** and **prevailing interest rates** are inversely correlated, but it's not linear; falling rates make a bigger impact than rising ones, which makes it a **convex** relationship:



As the market interest rates decrease, the discount factors in the Present Value formula decrease more and more quickly, which increases the bond's value non-linearly.

As the coupon rate increase, the bond's price increases, which makes intuitive sense and is more of a linear relationship.

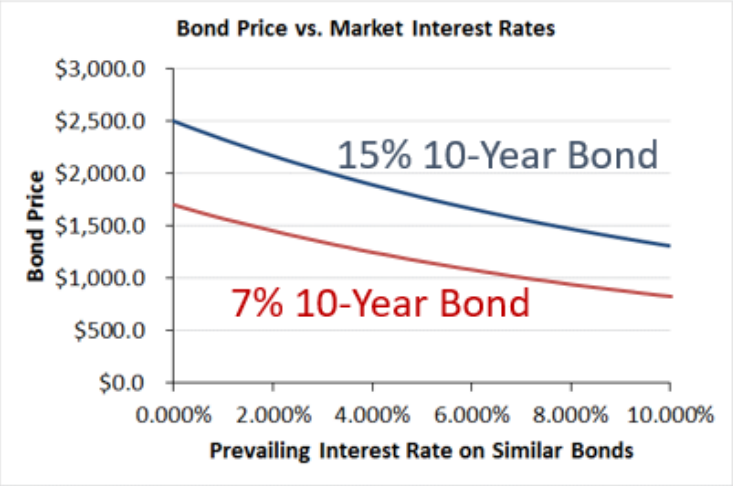


We can also summarize our findings in the previous section about bonds that trade at a premium or discount to par value:

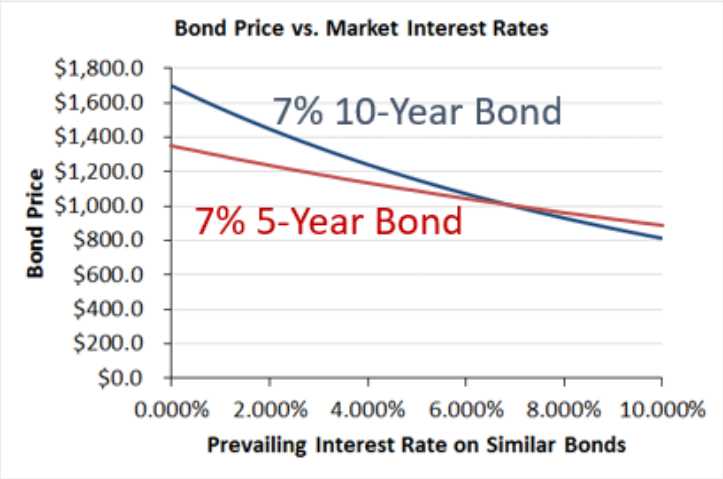
- **Discount Bond:** YTM > Current Yield > Coupon Rate
- **Bond at Par:** YTM = Current Yield = Coupon Rate
- **Premium Bond:** Coupon Rate > Current Yield > YTM

Bonds with **higher coupon rates** are less sensitive to changes in prevailing interest rates because bondholders receive more money earlier on.

A graph of 7% vs. 15% bonds might look like this:



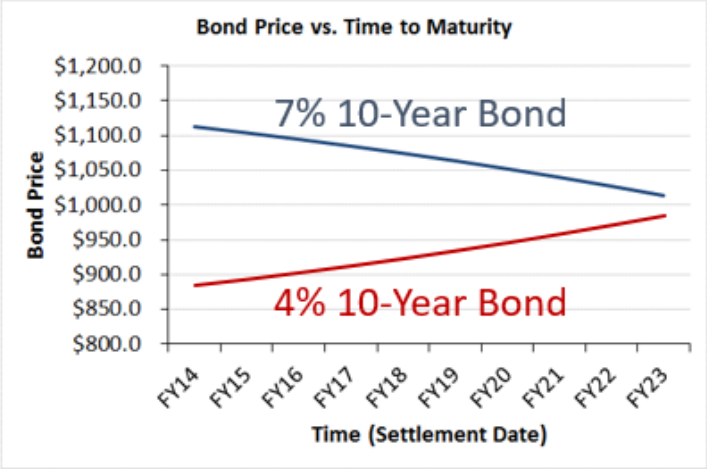
The **Time to Maturity** also affects bond prices: If interest rates change by the same amount, longer-term bond prices will change by more than shorter-term bond prices:



The intuition is that **more terms** in the Present Value formula for the bond's price will be affected by a different discount rate, and there will be a greater overall impact due to compounding.

If a bond trades at a premium or discount to par value, its price **approaches par value** as the bond approaches maturity.

The intuition is very similar to the statement above: There will be **fewer and fewer terms** and less of an effect from compounding as the years until maturity decline. Here's a graph:



Beyond these relationships, we can also predict **how quickly** a bond's price will change in response to changing interest rates.

A bond's **Duration** is the first derivative of the bond's price with respect to YTM (i.e., prevailing interest rates).

In other words, **Duration** tells you how the bond's price will change as prevailing interest rates change.

And a bond's **Convexity** is the second derivative of the bond's price with respect to YTM.

It tells you *how quickly* the bond's price will change as prevailing interest rates change.

If we use a physics analogy, **Duration** is like **velocity** (how quickly an object is moving) and **Convexity** is like **acceleration** (how quickly its velocity is *changing*).

We won't get into the full calculations here because they're beyond the scope of this guide, but you can use the DURATION function in Excel to calculate a bond's Duration; there is no built-in function for Convexity.

More importantly, you have to understand the **intuition** behind these concepts.

Duration tells you how many years it takes for the market price of a bond to be repaid with its internal cash flows.

For example, if a company issues a 10-year, zero-coupon bond, the Duration is **10 years** because the bond investors receive no interest or cash flow until maturity.

Upon maturity, they receive back the full principal, so it takes 10 years to earn back their initial investment.

But if the company issues a 10-year, 5% coupon bond, the Duration will be **less than 10 years** because the bond investors *will* earn cash flows before maturity.

You can calculate the Duration by taking the Present Value of each cash flow from the bond, multiplying each one by the time it was received (e.g., 8 for Year 8), adding them up, and dividing by the bond's market price.

But it's 100x easier to use the built-in Excel formula:

=DURATION(Settlement_Date, Maturity_Date, Coupon_Rate, YTM, 1)

In the example above, if we assume prevailing interest rates of 6%, we could write:

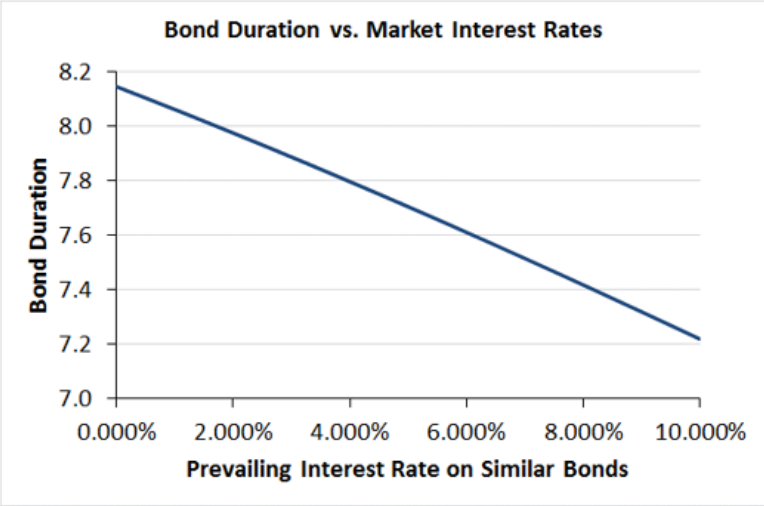
=DURATION("12/31/2017", "12/31/2027", 5%, 6%, 1) = **8.02**

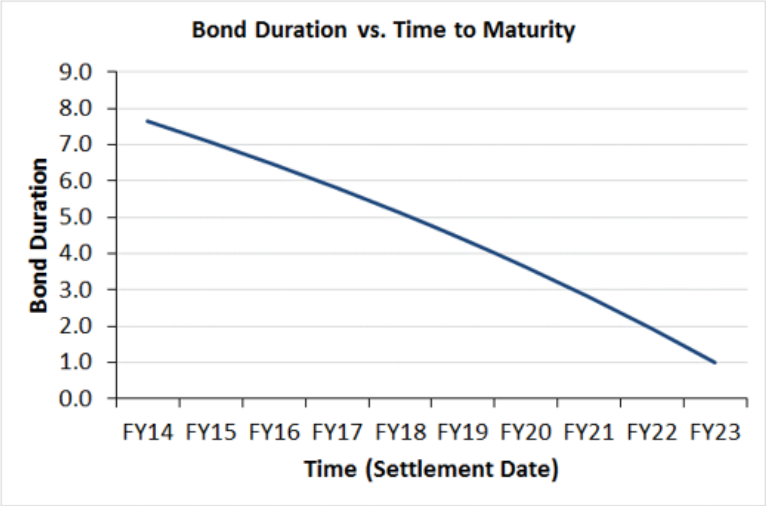
So, the investor would need just over 8 years to earn back the upfront investment (the price would be $926 in this case since interest rates exceed the bond's coupon rate).

That claim of "8 years" is not literally true: The investor receives only $50 in interest each year, so he/she won't earn back *everything* until the bond matures in Year 10.

But the Duration is a **weighted average**, which is why it's less than 10 here.

The Duration **decreases** as prevailing interest rates **increase**, and it **decreases** as the Time to Maturity **decreases:**





The logic for the first one is as follows: Higher interest rates reduce the bond's market price.

But the annual coupon stays the same, so with a *lower* upfront price, it takes *less time* for an investor to earn back the initial investment.

Technically, we could use Duration (or variants, such as Modified Duration) to "predict" a bond's price, but few people use it that way in real life.

Instead, Duration is a measure of **interest-rate risk**.

If a bond has a longer Duration, the investor is more exposed to the risk of interest rates changing.

You can also use Duration to compare the interest-rate risk of traditional bonds and zero-coupon bonds: Even if a bond pays no interest, its *market price* is still affected by prevailing interest rates.

You can also go beyond Duration and calculate the **Convexity** of a bond, which is the second derivative of the bond's price with respect to YTM.

We won't get into the calculations here, but **Convexity** tells you how quickly a bond's price will change as prevailing interest rates change. It also explains why this relationship is **not** linear.

If the YTM (prevailing interest rates) increases, Convexity decreases because the price-yield curve **flattens out**.

If the YTM decreases, Convexity increases because the price-yield curve becomes steeper.

Lower-coupon bonds have a higher Convexity than higher-coupon bonds for the same reason: Market prices change more quickly as interest rates change.

Zero-coupon bonds have the *highest* Convexity since they're the most sensitive to interest rates.

Why?

Because the investor gets no cash flows before maturity!

Therefore, the fixed annual coupon on a traditional bond cannot possibly affect the market price of a zero-coupon bond; only prevailing interest rates change it.

How to Use These Concepts in Real Life

These concepts of Duration and Convexity are "FYI" more than anything else.

You would **never** show a client a graph of these concepts, but you might display a price/yield graph in a presentation.

However, you may USE these concepts to explain how investors are thinking about a company's bonds.

Here's a specific example: Let's say a client has a 7% coupon rate, 10-year bond, with a Modified Duration of 7.25.

After the company had issued the bond, market interest rates fell from 5.5% to 3.5%, so the company wants to refinance and reduce its interest payments.

Since the company's old bonds were issued at 1.5% above prevailing rates, the company believes it can issue new bonds at a 5.0% coupon rate, which is 1.5% above 3.5%.

BUT with these assumptions, the Modified Duration of a 5.0% coupon bond is 7.95 – almost a year longer than the original bond.

As a result, investors who buy this new bond will have more interest-rate risk exposure, and this change will affect their entire portfolios.

And they may be reluctant to buy this issuance because of that added risk.

So, the company might be better off issuing a **9-year bond** at a 5.0% coupon rate. It would have a Modified Duration of 7.30, which is much closer to the original 7.25.

Purchase Timing and Accrued Interest

Up until this point, we've been assuming that all bonds pay interest *annually*.

That's true for many European bonds, but most North American, Asian, and other bonds make **semiannual** (twice per year) payments. Some bonds also make quarterly or monthly payments.

Also, the Maturity Date won't always be a "clean" figure like June 30th or December 31st.

The Settlement Date, i.e. the purchase date, could also be irregular.

As a result of these issues, you tend to use the built-in Excel functions to calculate the YTM, Duration, and Bond Price rather than doing it manually in Excel.

Another complication is **Accrued Interest:** What if you purchase a bond on March 15th, but the coupon payments are on January 1st and July 1st?

The existing owner won't just sell the bond for its "market price" on March 15th because he would **give up the interest that has accrued between January 1st and March 15th by doing so.**

73 days have passed, and there are about 181 days in this period, so the owner would lose 40% of the interest payment if he sold the bond without asking for extra.

You calculate and add this **Accrued Interest** to the bond's **"Clean Price"** (or "Flat Price") to calculate its **"Dirty Price"** (AKA "All-In Price" or "Gross Price").

That "Dirty Price" is what you, the new investor, will pay for the bond when you buy it on March 15th.

You'll pay that higher amount on March 15th, and then on July 1st, you'll get the interest coupon.

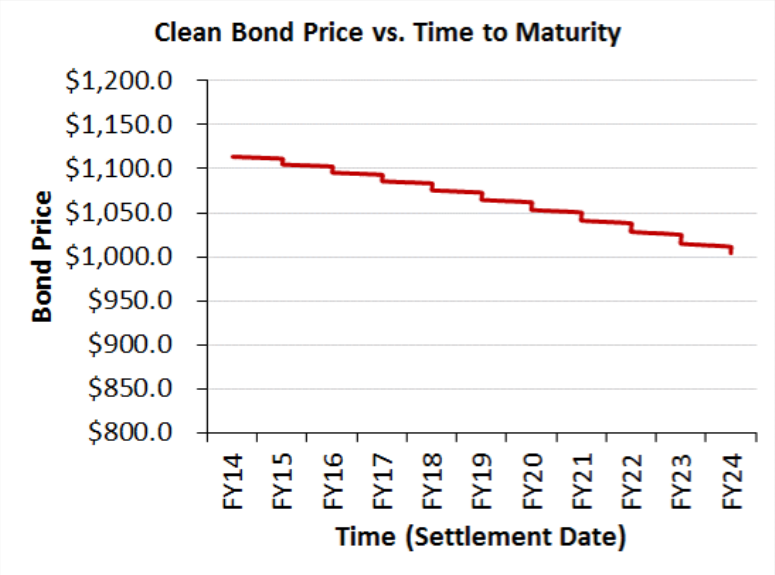
It is unnecessarily complicated to calculate the Accrued Interest in Excel, but you might use the COUPPCD function to find the last coupon payment date before the settlement date:

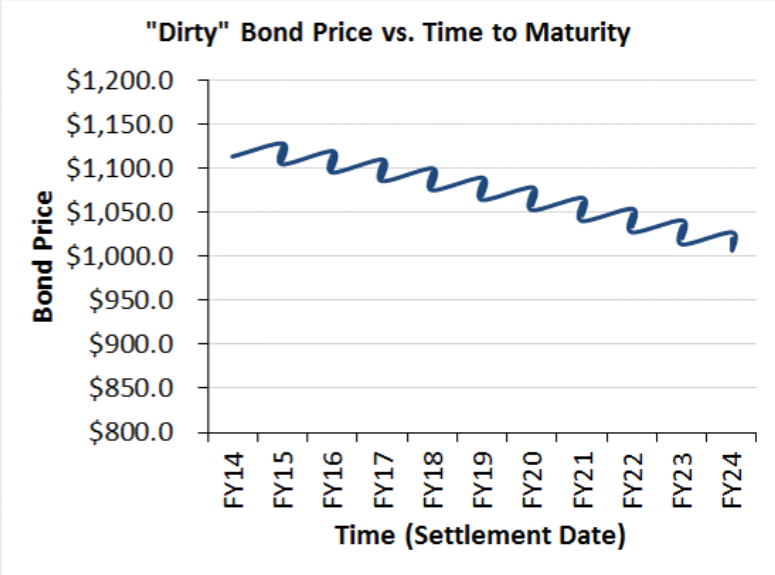
=COUPPCD(Settlement_Date, Maturity_Date, Num_Coupons)

And then you can calculate the Accrued Interest with:

=Coupon_Rate * Bond_Par_Value * YEARFRAC(Last_Coupon_Date, Settlement_Date, 1)

As you move closer to the coupon payment date, the "Dirty Price" keeps increasing to reflect this Accrued Interest, but the Clean Price stays the same:





The Implications

The conclusion is simple: You have to be **VERY** careful of the bond price you're using in these calculations.

In U.S. bond markets, prices from sources like Bloomberg, FactSet, and Reuters almost always quote the "Clean Prices" and, therefore, exclude Accrued Interest.

But in European markets, the price quotes are generally for "Dirty Prices." And since most European bonds pay annual interest, the Accrued Interest is far more significant.

When in doubt, ask for clarification and make sure you're using the correct price.

The "Dirty Price" is the real amount an investor would pay to purchase a bond from another investor, but the "Clean Price" is more useful for analytical purposes, such as many of the calculations we covered above.

Return to Top.

Key Rule #7: Call/Put Options, Redemption Premiums, and Make-Whole Provisions

Advising companies on their financing options is all about **trade-offs:** One type of Debt might be cheaper initially, but could be more expensive later on (e.g., Convertible Bonds).

One bond might offer a higher coupon rate, but also a higher chance of default.

And one bond might offer a shorter maturity and less interest-rate risk, but also a lower yield.

Call and put options give investors and companies yet another trade-off by granting them the ability to **get out early.**

For example, maybe a company with a BB+ credit rating issued a $1 billion bond at a fixed coupon rate of 8% when prevailing interest rates were 6%.

Several years later, the company's financial performance improves, and rating agencies upgrade its credit rating up to BBB+, which is "investment-grade."

Also, interest rates decline, and interest rates on similar bonds are now 4% rather than 6%.

As a result, the company believes it can refinance and issue the same $1 billion bond at a lower coupon rate of 5% rather than 8%.

This move would save the company $30 million per year in interest expense, but it's bad news for the investors because:

1) They'll have to spend time and money looking for another way to deploy their capital.

2) They'll almost certainly get a lower yield because interest rates have fallen.

Because of these downsides, most bonds offer **call protection** that restricts companies' ability to repay bonds early.

A typical pattern for a bond with a 10-year maturity might be the following:

1) **Years 1 – 3:** No early repayment is allowed.
2) **Year 4:** Early repayment is allowed, but the company has to repay 105% of the bond's par value (i.e., pay 5% extra to do it).
3) **Year 5:** Same, but now it's 104% of par value.
4) **Year 6:** 103%.
5) **Year 7:** 102%.
6) **Year 8:** 101%.
7) **Years 9 and 10:** 100%.

The figures such as 105%, 104%, and 103% are known as **redemption premiums** or **call premiums**.

This structure protects investors and discourages companies from refinancing early.

There is still *a risk* that the company will call the bond early, so callable bonds tend to offer **higher coupon rates** to investors.

Some bonds also come with **put options** attached.

These options let investors **force** an early redemption of the bond, usually at its par value.

In other words, investors could go to the company and say, "You borrowed $1 billion from us a few years ago, and we said you could keep it for 10 years. But we want it back early. Please repay us. Thanks!"

Investors might ask for a put option on a bond if they believe that **interest rates will rise** or that the company's **credit rating might decline.**

If interest rates rise, investors are at an immediate disadvantage because they're stuck with a lower-yielding bond when they could earn more with newer issuances.

If the company's credit rating declines, the bond's market price will decline.

So, new investors could purchase the bonds and earn a higher yield than the existing investors who bought the bonds at par value.

Put options reduce the risk for investors, so bonds with put options ("putable bonds") offer **lower coupon rates**.

Besides call and put options, there are also **conversion options** for bonds, which we've covered in previous sections.

Just as bonds with put options present less risk for investors, bonds with conversion options ("Convertible Bonds") also offer less risk, so coupon rates are even lower.

Convertible Bonds often **pay no coupon at all** ("zero-coupon bonds"), and investors treat them as hedged equity investments.

If the company's stock price never reaches the Conversion Price, investors lose nothing: The Convertible Bonds mature, and the investors get their full principal back.

But if the company's stock price does reach the Conversion Price, the investors can convert their bonds into shares, and they realize a significant gain in doing so.

Some bonds also offer **warrants** or **equity options**, especially if the company is distressed or otherwise needs to negotiate lower interest rates.

For example, a bond might offer a reduced coupon rate of 5% rather than 10%. To compensate investors, the bond might offer them 1% of the company's equity upon maturity.

Another bond might offer investors 2% of the company's equity upon maturity, but only if the company's stock price exceeds the price when the investors initially purchased the bond.

A few more notes:

- **Investment-Grade Bonds:** The concepts above rarely apply to investment-grade bonds (i.e., ones for companies with higher credit ratings) because those bonds tend **not** to be callable. Or if they are callable, they have extremely high redemption premiums.

  The features above are more common for non-investment-grade bonds – the offerings that Leveraged Finance, rather than Debt Capital Markets, works on.

- **Valuation/Analysis** – Valuing bonds with embedded options gets tricky because interest rates could change, and you have to create "probability trees" showing different progressions of interest rates and whether the company will hold or call the bond at each rate.

  Then, you have to calculate the Present Value of each node in the tree, multiply by the probability of reaching that node, and sum up everything.

  The value of a **callable bond** equals the value of the straight bond minus the value of the call option; the value of a **putable bond** equals the value of the straight bond plus the value of the put option.

Analysis of Bonds with Call and Put Options

You learned in the previous sections that the **Yield to Maturity (YTM)** represents the IRR an investor earns if he/she purchases a bond and holds it to maturity, and the company makes all required interest and principal payments, repaying the bond in full at maturity.

If a bond is callable, you can also calculate the **Yield to Call (YTC)**, which represents the investor's IRR *if the company redeems the bond before maturity for more than its par value*.

You can still use the YIELD function to calculate the Yield to Call; the inputs differ, but the same function works for both YTM and YTC.

Below, we'll cover an example for a $500 million bond that was issued at a 7% fixed coupon rate.

We purchased this bond **9 years** before its maturity date, and in between issuance and today, prevailing interest rates on similar bonds have fallen from 7% to 6%.

As a result, the bond now trades at a **premium** to par value.

This bond is **not callable** for the first 2 years but becomes callable at modest premiums (105%, 104%, 103%, etc.) each year after that. Here are the numbers:

Bond Yield and Pricing Assumptions:

"Clean" Bond Price:	$ 534.4	"Clean" Bond Price:	$ 534.4
Prevailing Interest Rate on Similar Bonds:	6.000%	(+) Accrued Interest:	-
# of Interest Coupons per Year:	2	**"Dirty" Bond Price:**	**534.4**
Settlement Date:	2015-06-30		
		Current Yield:	6.550%
Last Coupon Payment Date Before Settleme	2015-06-30		
		Yield to Maturity (YTM):	6.000%
Bond Coupon Rate:	7.000%	Approximate Yield to Maturity:	6.029%
Bond Principal or Par Value:	$ 500.0		
Bond Maturity Date:	2024-06-30	Yield to Worst (YTW):	5.708%

Bond trades at a premium to par since interest rates have fallen.

As a result, new investors get a Current Yield below the coupon rate, and a YTM that's the same as the prevailing interest rate of 6%.

	Historical	Projected							
	2014-12-31	2015-06-30	2015-12-31	2016-06-30	2016-12-31	2017-06-30	2017-12-31	2018-06-30	2018-12-31
Early Bond Redemption Allowed?		No	No	No	No	Yes	Yes	Yes	Yes
Bond Redemption Value % Par Value:		N/A	N/A	N/A	N/A	105.0	105.0	104.0	104.0
Yield to Call (YTC):		N/A	N/A	N/A	N/A	5.708%	5.887%	5.714%	5.845%

Bond is not callable in these first 2 years, so YTC is N/A.

After the first 2 years, the company can call the bond and repay it at a premium. This premium protects investors because they get MORE if the company repays the bond early. Without this redemption premium, the YTC would be far lower - only 3.4% on the first callable date! (2017-06-30)

If we calculate the yield *without* the redemption premium on the first callable date, it is **far lower:** Only around 3.4%!

We see why companies must offer these premiums when a bond is callable: Investors get an awful yield if the company decides to call the bond very early in its term.

Even if the company calls the bond in Years 4-5, the **Yield to Call without that premium** would be only 4.5% – 5.5%, which is far lower than the bond's Yield to Maturity.

That happens because investors pay a premium for the bond, they receive less interest than expected, and then they get back only the bond's par value upon maturity.

With those redemption premiums, however, the YTC is between 5.5% and 6.0% if the company calls the bond early.

That's less than the bond's YTM, but it's a far better outcome for the investor than an early call without the premium.

Accrued Interest creates some complications in these calculations.

Most sources agree that the YTM is based on the bond's **Clean Price**, i.e. its market price excluding Accrued Interest.

However, to calculate the bond's "true yield" to the investor, we must add Accrued Interest and use the Dirty Price in the YIELD formula.

And then we should also **add** the Accrued Interest as of the Call Date.

So, if the bond pays interest on June 30th and December 31st each year, and the company calls the bond on March 31st, we have to add the Accrued Interest from the first 25% of the year.

If we factor in Accrued Interest on the Settlement Date and the Call Date, the Yield to Call could be higher or lower; it depends on the timing.

For example, if we purchase the bond very close to its most recent coupon payment date, there won't be much Accrued Interest, so the Dirty Price will be close to the Clean Price.

And if the company calls the bond *right before* a coupon payment, the company will owe us, the investor, Accrued Interest as of that date.

In this scenario, the YTC *with* Accrued Interest would be higher than the YTC *without* Accrued Interest.

But if we reversed this scenario (significant Accrued Interest on the Settlement Date, but nothing on the Call Date), the opposite would happen.

Another useful metric is **Yield to Worst (YTW)**, which is the minimum between the bond's Yield to Call (YTC) on each possible Call Date and its Yield to Maturity (YTM).

This one helps investors evaluate the "worst-case scenario," assuming that the bond has a fixed coupon rate and that prevailing interest rates do not change.

Of course, the *real* worst-case scenario is that the company defaults, goes bankrupt, and never repays the bond.

So, the YTW is more like "the worst-possible yield, assuming the company stays solvent and that it makes all required payments before calling the bond or repaying it upon maturity."

Bonds are often quoted in terms of their YTM, and they may also be quoted in terms of their YTW. Here are the numbers in our example:

Bond Yield and Pricing Assumptions:

"Clean" Bond Price:	$ 534.4	"Clean" Bond Price:	$ 534.4
Prevailing Interest Rate on Similar Bonds:	6.000%	(+) Accrued Interest:	-
# of Interest Coupons per Year:	2	**"Dirty" Bond Price:**	**534.4**
Settlement Date:	2015-06-30		
		Current Yield:	6.550%
Last Coupon Payment Date Before Settleme	2015-06-30		
		Yield to Maturity (YTM):	6.000%
Bond Coupon Rate:	7.000%	Approximate Yield to Maturity:	6.029%
Bond Principal or Par Value:	$ 500.0		
Bond Maturity Date:	2024-06-30	Yield to Worst (YTW):	5.708%

In this case, the YTW is the YTC on the first Call Date. Since market interest rates are below the coupon rate, the YTW is <= the YTM.

	Historical	Projected							
	2014-12-31	2015-06-30	2015-12-31	2016-06-30	2016-12-31	2017-06-30	017-12-31	2018-06-30	2018-12-31
Early Bond Redemption Allowed?		No	No	No	No	Yes	Yes	Yes	Yes
Bond Redemption Value % Par Value:		N/A	N/A	N/A	N/A	105.0	105.0	104.0	104.0
Yield to Call (YTC):		N/A	N/A	N/A	N/A	5.708%	5.887%	5.714%	5.845%

When the prevailing interest rates are less than or equal to the bond's coupon rate, **the YTW is less than or equal to the YTM**.

If interest rates are below the bond's coupon rate, the bond trades at a **premium** to par value.

Therefore, a new investor would have to **pay extra** for this bond, and if he/she holds it until maturity, his/her YTM will equal the prevailing interest rates (6% here).

But if the company calls the bond early, the investor most likely earns *less* than the YTM (unless the redemption premium is very high).

Even if the redemption premium *is* extremely high, the rule doesn't change: In the case of a high premium that makes the YTC exceed the YTM, the YTW is still **the minimum** between them, so YTW = YTM in this case.

And in the more likely scenario that the premiums only boost yields modestly, the YTW is most likely one of the YTCs on an early callable date.

If prevailing interest rates **equal** the bond's coupon rate, YTW = YTM. Take a look at this scenario:

Bond Yield and Pricing Assumptions:

"Clean" Bond Price:	$ 500.0
Prevailing Interest Rate on Similar Bonds:	7.000%
# of Interest Coupons per Year:	2
Settlement Date:	2015-06-30
Last Coupon Payment Date Before Settleme	2015-06-30
Bond Coupon Rate:	7.000%
Bond Principal or Par Value:	$ 500.0
Bond Maturity Date:	2024-06-30

"Clean" Bond Price:	$ 500.0
(+) Accrued Interest:	-
"Dirty" Bond Price:	**500.0**
Current Yield:	7.000%
Yield to Maturity (YTM):	7.000%
Approximate Yield to Maturity:	7.000%
Yield to Worst (YTW):	7.000%

In this scenario, it's *better* for the investor if the company calls the bond early because it trades at par value, and those redemption premiums give the investor a bonus. But the company would also never call the bond early in this case!

	Historical	Projected										
	2014-12-31	2015-06-30	2015-12-31	2016-06-30	2016-12-31	2017-06-30	2017-12-31	2018-06-30	2018-12-31	2019-06-30	2019-12-31	2020-06-30
Early Bond Redemption Allowed?		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bond Redemption Value % Par Value:		N/A	N/A	N/A	N/A	105.0	105.0	104.0	104.0	103.0	103.0	102.0
Yield to Call (YTC):		N/A	N/A	N/A	N/A	9.332%	8.831%	8.203%	8.013%	7.655%	7.572%	7.338%

The company would be **crazy** to call the bond early in this scenario because it would **not** be able to refinance at a lower rate.

The worst-case scenario is that the company waits until the maturity date to repay the bond.

Finally, if market interest rates exceed the coupon rate, YTW = YTM once again.

In this case, the bond trades at a **discount to par value**, so investors can purchase it, hold it until maturity, and earn an average annual return *above* the coupon rate.

If the company calls the bond early, that's great for investors: They earn back the bond's par value early, and they get the bonus of the redemption premium on top of that!

Here's the math in Excel:

Bond Yield and Pricing Assumptions:

"Clean" Bond Price:	$ 468.4
Prevailing Interest Rate on Similar Bonds:	8.000%
# of Interest Coupons per Year:	2
Settlement Date:	2015-06-30
Last Coupon Payment Date Before Settleme	2015-06-30
Bond Coupon Rate:	7.000%
Bond Principal or Par Value:	$ 500.0
Bond Maturity Date:	2024-06-30

"Clean" Bond Price:	$ 468.4
(+) Accrued Interest:	-
"Dirty" Bond Price:	**468.4**
Current Yield:	7.473%
Yield to Maturity (YTM):	8.000%
Approximate Yield to Maturity:	7.955%
Yield to Worst (YTW):	8.000%

The bond trades at a discount to par value, so YTM = YTW. If the company repays the bond early, that's GREAT for investors! The worst case here is that the company waits until maturity and does not repay the bond early.

	Historical	Projected									
	2014-12-31	2015-06-30	2015-12-31	2016-06-30	2016-12-31	2017-06-30	2017-12-31	2018-06-30	2018-12-31	2019-06-30	2019-12-31
Early Bond Redemption Allowed?		No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bond Redemption Value % Par Value:		N/A	N/A	N/A	N/A	105.0	105.0	104.0	104.0	103.0	103.0
Yield to Call (YTC):		N/A	N/A	N/A	N/A	12.963%	11.774%	10.688%	10.175%	9.575%	9.306%

Once again, this scenario is unrealistic because the company would never call a bond early and refinance after interest rates *have risen*.

You can do a similar analysis with putable bonds as well, but there's less to say because the redemption premium is almost always 100%, i.e. par value with no premium.

The concept of "Yield to Worst" is less applicable there because **investors choose whether or not to force an early redemption**.

They might do this if prevailing interest rates have risen, and they could earn a higher yield on new issuances:

Bond Yield and Pricing Assumptions:

"Clean" Bond Price:	$ 468.4
Prevailing Interest Rate on Similar Bonds:	8.000%
# of Interest Coupons per Year:	2
Settlement Date:	2015-06-30
Last Coupon Payment Date Before Settleme	2015-06-30
Bond Coupon Rate:	7.000%
Bond Principal or Par Value:	$ 500.0
Bond Maturity Date:	2024-06-30

"Clean" Bond Price:	$ 468.4
(+) Accrued Interest:	-
"Dirty" Bond Price:	**468.4**

In this case, the bond trades at a discount to par value, so the investors would benefit from forcing an early redemption; the YTP on each Put Date exceeds the YTM and coupon rate.

	Historical	Projected									
	2014-12-31	2015-06-30	2015-12-31	2016-06-30	2016-12-31	2017-06-30	2017-12-31	2018-06-30	2018-12-31	2019-06-30	2019-12-31
Bond Put Allowed?		No	No	No	No	Yes	No	Yes	No	Yes	No
Bond Redemption Value % Par Value:		N/A	N/A	N/A	N/A	100.0	N/A	100.0	N/A	100.0	N/A
Yield to Put (YTP):		N/A	N/A	N/A	N/A	10.595%	N/A	9.473%	N/A	8.916%	N/A

But it wouldn't make sense to force an early redemption if interest rates have *fallen* or *stayed the same*.

How to Use Yield to Call (YTC) and Yield to Worst (YTW) in Real Life

You often use these metrics to advise clients on their **refinancing options**.

Here's an example: Let's say a client has a $500 million, 7.0% fixed rate 10-year bond.

The bond is callable, so the client is paying a higher coupon rate than it would be on a non-callable bond.

Management believes the company's core business has improved, and it wants to reduce its interest expense by refinancing with a non-callable bond to get a lower coupon rate.

Also, prevailing interest rates have declined and are now around 6.0% for similar companies in this industry.

The client approaches your firm with a simple question: **What range of coupon rates should it expect to pay on a new, non-callable bond?**

The bond's profile is the same as the first one we looked at above in the section on Yield to Call:

- **Bond Principal:** $500 million.
- **Coupon Rate:** 7.0%.
- **Prevailing Interest Rates:** 6.0%.
- **Maturity:** 10 years.
- **Lockout Period:** 2 years (no calls allowed).
- **Call Premiums:** 105% in Year 3, then 104%, 103%, 102%, 101%, and 100% in each subsequent year, and then 100% through maturity.
- **Today's Date:** ~1 year after initial bond issuance (i.e., 9 years left until maturity).

To answer this question, we could calculate the YTM and YTW for the bond and use rates in that range (5.7% – 6.0% here).

The real return probably won't be the YTW, but it also won't be quite as high as the YTM.

So, we might present this range to investors as a starting point for negotiations and say, "Your yield on the 7.0% bond will be between 5.7% and 6.0% since you purchased the bond at a premium to par value.

We want to refinance with a non-callable bond such that you earn about the same yield, so we think a coupon rate of 5.7% – 6.0% might be appropriate."

Bond Yield and Pricing Assumptions:

"Clean" Bond Price:	$ 534.4	"Clean" Bond Price:	$ 534.4
Prevailing Interest Rate on Similar Bonds:	6.000%	(+) Accrued Interest:	-
# of Interest Coupons per Year:	2	**"Dirty" Bond Price:**	**534.4**
Settlement Date:	2015-06-30		
		Current Yield:	6.550%
Last Coupon Payment Date Before Settleme	2015-06-30		
		Yield to Maturity (YTM):	6.000%
Bond Coupon Rate:	7.000%	Approximate Yield to Maturity:	6.029%
Bond Principal or Par Value:	$ 500.0		
Bond Maturity Date:	2024-06-30	Yield to Worst (YTW):	5.708%

If the company wanted to refinance with a non-callable bond at a lower coupon rate, we might use this 5.7% - 6.0% range in the starting negotiations.

	Historical	Projected							
	2014-12-31	2015-06-30	2015-12-31	2016-06-30	2016-12-31	2017-06-30	2017-12-31	2018-06-30	2018-12-31
Early Bond Redemption Allowed?		No	No	No	No	Yes	Yes	Yes	Yes
Bond Redemption Value % Par Value:		N/A	N/A	N/A	N/A	105.0	105.0	104.0	104.0
Yield to Call (YTC):		N/A	N/A	N/A	N/A	5.708%	5.887%	5.714%	5.845%

Make-Whole Provisions

Another concept related to calls and callable bonds is the **Make-Whole Provision.**

This one is a perfect example of the "fine print" in a bond's legal documents that you must pay attention to.

A "Make-Whole Provision" lets a company **call a bond early even if the bond is "non-callable" – IF the company compensates investors for the cash flow lost from a very early redemption.**

These Provisions provide an *extreme* disincentive for companies to redeem bonds early.

You typically calculate Make-Whole Provisions by taking the Present Value of future interest and principal payments, discounted at a spread above the rates of government bonds, such as 5-year or 10-year U.S. Treasuries.

The Redemption Premiums in the previous section were examples of "fixed" Make-Whole Provisions: They were linked to a set percentage of the bond's par value.

But Make-Whole Provisions can vary over time and depend on government bond interest rates and the bond's future interest and principal payments.

A simple analysis with an $850 million, 6.0% coupon rate bond that's called several years before its maturity date might look like this:

Bond Yield and Pricing Assumptions:

"Clean" Bond Price:	$ 865.8
Prevailing Interest Rate on Similar Bonds:	5.500%
U.S. 5-Year Treasury Rate on Call Date:	1.750%
# of Interest Coupons per Year:	2
LIBOR Units:	10,000
Call Date:	2017-03-15
Last Coupon Payment Date Before Call:	2016-12-15
Bond Coupon Rate:	6.000%
Bond Principal or Par Value:	$ 850.0
Bond Maturity Date:	2021-06-15

"Clean" Bond Price:	$ 865.8
(+) Accrued Interest:	12.6
"Dirty" Bond Price:	**878.4**
Current Yield:	5.890%
Yield to Maturity (YTM):	5.500%
Approximate Yield to Maturity:	5.483%
Make-Whole Price on Call Date:	$ 116.7

NOTE: This analysis assumes the "Make-Whole Price" is calculated based on the PV of interest + principal through maturity - but it might be based on some other date, such as the first available call date and the call premium on that date.

Bond trades at a premium to par because interest rates are below the bond's coupon rate.

These cash flows represent what investors MISS OUT ON if the company calls the bond early. You have to project them in any Make-Whole Analysis.

	Call Date	Projected									
Interest and Principal Payments:	**2017-03-15**	**2017-06-15**	**2017-12-15**	**2018-06-15**	**2018-12-15**	**2019-06-15**	**2019-12-15**	**2020-06-15**	**2020-12-15**	**2021-06-15**	**2021-12-15**
(+) Future Interest Payments:	$ 12.6	$ 12.9	$ 25.5	$ 25.5	$ 25.5	$ 25.5	$ 25.5	$ 25.5	$ 25.5	$ 25.5	$ -
(+) Future Principal Repayments:	-	-	-	-	-	-	-	-	-	850.0	-
Positive Cash Flow from Bond:	**12.6**	**12.9**	**25.5**	**25.5**	**25.5**	**25.5**	**25.5**	**25.5**	**25.5**	**875.5**	**-**
Discount Period (Years):	0.000	0.252	0.752	1.252	1.752	2.252	2.752	3.252	3.752	4.252	4.752

Once you've projected the future interest payments and principal repayments, you can discount these cash flow at interest rates ranging from 0% above the U.S. Treasury rate to 2.0% above it:

			Call Date	Projected									
Interest and Principal Payments:			**2017-03-15**	**2017-06-15**	**2017-12-15**	**2018-06-15**	**2018-12-15**	**2019-06-15**	**2019-12-15**	**2020-06-15**	**2020-12-15**	**2021-06-15**	**2021-12-15**
(+) Future Interest Payments:			$ 12.6	$ 12.9	$ 25.5	$ 25.5	$ 25.5	$ 25.5	$ 25.5	$ 25.5	$ 25.5	$ 25.5	$ -
(+) Future Principal Repayments:			-	-	-	-	-	-	-	-	-	850.0	-
Positive Cash Flow from Bond:			**12.6**	**12.9**	**25.5**	**25.5**	**25.5**	**25.5**	**25.5**	**25.5**	**25.5**	**875.5**	-
Discount Period (Years):			0.000	0.252	0.752	1.252	1.752	2.252	2.752	3.252	3.752	4.252	4.752
PV of Future Cash Flow:													
Discounted @:	T + 0	1.750%	12.6	12.9	25.2	25.0	24.7	24.5	24.3	24.1	23.9	813.2	-
Discounted @:	T + 25	2.000%	12.6	12.9	25.1	24.9	24.6	24.4	24.1	23.9	23.7	804.8	-
Discounted @:	T + 50	2.250%	12.6	12.9	25.1	24.8	24.5	24.3	24.0	23.7	23.5	796.5	-
Discounted @:	T + 75	2.500%	12.6	12.8	25.0	24.7	24.4	24.1	23.8	23.5	23.2	788.2	-
Discounted @:	T + 100	2.750%	12.6	12.8	25.0	24.6	24.3	24.0	23.7	23.3	23.0	780.1	-
Discounted @:	T + 150	3.250%	12.6	12.8	24.9	24.5	24.1	23.7	23.4	23.0	22.6	764.2	-
Discounted @:	T + 200	3.750%	12.6	12.8	24.8	24.4	23.9	23.5	23.0	22.6	22.2	748.6	-

PV on Call Date:	Implied Make-Whole Price:
1,010.4	118.87
1,001.0	117.76
991.7	116.67
982.6	115.59
=SUM(F36:P36)	114.53
955.8	112.44
938.4	110.40

Then, you discount all the cash flows at spreads above the Risk-Free Rate.

And then you add up the PVs of all the cash flows to get the bond's Present Value on this Call Date (2017-03-15) at a range of different discount rates.

And if the bond agreement indicates a 50 bps spread, the company has to pay 117% of the bond's par value to redeem it early on this date. 117% = $992 / $850.

Yes, you read that correctly: **If there's a Make-Whole Provision that specifies "T + 50 bps" for the discount rate, then the company has to repay 117% of the bond's par value if it chooses to call the bond early on this date of 2017-03-15.**

That is *far* higher than the typical Redemption Premiums on callable bonds, which explains why companies rarely want to pay it.

You might use this analysis in real life to determine whether or not a very early redemption makes sense.

If the company pays *that much extra*, it better be able to realize a vast amount of interest savings.

The chances of that happening are about the same as being struck by lightning, so companies **very rarely** pay this Make-Whole Provision to redeem a bond early.

A company might do it if:

1) Interest rates have fallen *dramatically*, and the company can save so much money by refinancing that it's worth paying a high premium to do so.

2) The company was distressed or wasn't performing well, so it had to borrow at an extremely high rate. But its financial performance and credit rating have now improved, so the company can pay significantly lower coupon rates on its bonds.

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Key Rule #8: Debt Comps and Refinancing Recommendations

In this section, we'll cover one final Debt-related analysis and then **put everything together** by walking through an example of how to analyze refinancing options and recommend the best one to a distressed company.

Before you make any recommendations on financing or refinancing, you should always look at the **Debt Comps.**

They're very similar to Equity Comps, i.e. Comparable Public Companies, but they relate to the Debt issued by public companies rather than their stock prices and valuation multiples.

You screen for these Debt Comps based on industry, geography, time, size, and **credit rating**.

The credit rating criterion makes this exercise different from Precedent Transactions: You can't compare the bonds of an AAA-rated company like Microsoft to those of a non-investment-grade company.

You shouldn't take credit ratings *too* seriously (See: Subprime mortgages), but they do correlate reasonably well with default rates over the long term.

Here's an example set of Debt Comps for a potential Unsecured Senior Note issuance from Netflix:

Netflix Inc. - Comparable Unsecured Senior Note Issuances from U.S.-Based Software and Media Companies Over the Past Two Years (Companies with "Non-Investment Grade Speculative" Credit Ratings: BB-, BB, and BB+ and Issuances Above $100 Million)

Geography, industry, time, size, and credit rating screening criteria.

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

Debt Issuances - Financial Statistics												
Company Name	Offering Date	Offering Amount	Bond Price	Coupon Rate	Maturity Date	Remaining Years to Maturity	Tenor (Years)	Issuer Credit Rating	Yield to Worst (YTW)	Estimated Yield to Maturity (YTM)	LTM EBITDA / Interest	LTM Debt / EBITDA
ACI Worldwide, Inc.	2013-02-07	$ 530.0	102.5	6.38%	2020-08-15	5.6	7.5	BB	5.10%	5.84%	5.25 x	4.34 x
ACI Worldwide, Inc.	2013-02-07	530.0	102.5	6.38%	2020-08-15	5.6	7.5	BB	5.10%	5.84%	5.25 x	4.34 x
Bankrate, Inc.	2013-05-15	1,350.0	100.6	6.13%	2018-08-15	3.6	5.3	BB-	5.59%	5.95%	4.90 x	2.88 x
Bankrate, Inc.	2013-04-03	290.0	100.6	6.13%	2018-08-15	3.6	5.4	BB-	5.59%	5.95%	4.90 x	2.88 x
Cardtronics Inc.	2013-04-02	1,100.0	N/A	5.13%	2022-08-01	7.6	9.3	BB+	N/A	N/A	7.02 x	2.58 x
Cardtronics Inc.	2013-07-29	1,099.6	N/A	5.13%	2022-08-01	7.6	9.0	BB+	N/A	N/A	7.02 x	2.58 x
CBS Outdoor Americas Capital LLC	2014-11-05	2,000.0	N/A	5.88%	2025-03-15	10.3	10.4	BB-	N/A	N/A	4.38 x	5.92 x
CBS Outdoor Americas Capital LLC	2014-11-05	2,000.0	N/A	5.88%	2025-03-15	10.3	10.4	BB-	N/A	N/A	4.38 x	5.92 x
CBS Outdoor Americas Capital LLC	2014-07-09	550.0	N/A	5.63%	2024-02-15	9.2	9.6	BB-	N/A	N/A	4.38 x	5.92 x
CBS Outdoor Americas Capital LLC	2014-02-10	500.0	101.5	5.25%	2022-02-15	7.2	8.0	BB-	4.79%	4.99%	4.38 x	5.92 x

These bonds trade at a premium to par value, so their YTW and YTM *should be* lower than their coupon rates.

You look at the same stats that you would examine in the analyses above: Size, market price of bond, coupon rate, time to maturity, credit rating, YTW, YTM, and the leverage and coverage ratios.

Then, we use those to assess whether or not the terms of a proposed issuance are realistic.

Here's an example based on the summary stats of this entire data set:

Netflix Inc. - Comparable Unsecured Senior Note Issuances from U.S.-Based Software and Media Companies Over the Past Two Years
(Companies with "Non-Investment Grade Speculative" Credit Ratings: BB-, BB, and BB+ and Issuances Above $100 Million)
($ USD in Millions Except Per Share Amounts in USD as Stated)

Debt Issuances - Financial Statistics Company Name	Offering Date	Offering Amount	Bond Price	Coupon Rate	Maturity Date	Remaining Years to Maturity	Tenor (Years)	Issuer Credit Rating	Yield to Worst (YTW)	Estimated Yield to Maturity (YTM)	LTM EBITDA / Interest	LTM Debt / EBITDA
Maximum	2014-12-30	$ 2,000.0	106.3	7.00%	2025-03-15	10.3	11.7		6.81%	6.61%	14.40 x	10.30 x
75th Percentile	2014-07-05	688.5	103.1	5.97%	2023-05-27	8.4	9.8		5.59%	5.84%	5.11 x	5.70 x
Median	**2013-09-26**	**500.0**	**102.3**	**5.38%**	**2022-06-15**	**7.5**	**8.3**		**4.78%**	**5.25%**	**4.38 x**	**4.83 x**
25th Percentile	2013-04-30	350.0	100.7	5.00%	2021-03-15	6.2	7.1		4.41%	4.74%	3.58 x	3.96 x
Minimum	2013-01-08	150.0	88.0	4.25%	2017-05-15	2.3	3.5		1.64%	3.58%	3.23 x	2.16 x

A $1.5 billion offering is on the high side, but do-able.

A 10-year maturity is on the high side; 8-9 years is more standard.

We might recommend coupon rates in this range so that investors can take advantage of market interest rates.

The company's credit stats should be in-line with these after the issuance.

Let's say that our client (Netflix) wants to raise $1.5 billion of Senior Unsecured Notes with a 10-year maturity at a 4.0% fixed coupon rate. The company has a BB credit rating, an existing interest coverage ratio of 5x, and an existing leverage ratio of 4x.

We might tell the company that these Senior Unsecured Note terms are unrealistic because:

- The client's credit rating, interest coverage ratio, and leverage ratio put it **roughly in the middle** of this set of Debt Comps.
- But a 4.0% coupon rate is **below the 25th percentile** of the YTMs and YTWs of this set of Debt Comps. It's also below the 25th percentile of coupon rates.
- A $1.5 billion issuance is close to the maximum of this set; the client should consider splitting it into **2-3 issuances** instead.
- The 10-year maturity is also on the high side since it's **above the 75th percentile** of the tenors in this set. Investors may not want to accept this much interest-rate risk, so a 7- or 8-year maturity might be more realistic.

If the company is also considering a Convertible Bond issuance, we can screen for Convertible Bond Comps as well:

Netflix Inc. - Comparable Convertible Bond Issuances from U.S.-Based Software and Media Companies Over the Past Two Years (Companies with "Non-Investment Grade Speculative" Credit Ratings: BB-, BB, and BB+ and Issuances Above $100 Million)

Almost the same screening criteria.

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

Debt Issuances - Financial Statistics Company Name	Offering Date	Offering Amount	Bond Price	Coupon Rate	Maturity Date	Remaining Years to Maturity	Tenor (Years)	Issuer Credit Rating	Yield to Worst (YTW)	Estimated Yield to Maturity (YTM)	LTM EBITDA / Interest	LTM Debt / EBITDA
Cardtronics Inc.	2014-11-21	$ 287.5	100.4	1.00%	2020-12-01	5.9	6.0	BB+	0.91%	0.93%	7.02 x	2.58 x
Cardtronics Inc.	2013-11-19	250.0	98.6	1.00%	2020-12-01	5.9	7.0	BB+	1.26%	1.26%	7.02 x	2.58 x
j2 Global, Inc.	2014-06-11	350.0	110.0	3.25%	2029-06-15	14.6	15.0	BB	2.43%	2.43%	7.99 x	2.38 x
LinkedIn Corporation	2014-11-06	1,150.0	100.6	0.50%	2019-11-01	4.8	5.0	BB+	0.37%	0.37%	34.20 x	4.65 x
Live Nation Entertainment, Inc.	2014-05-19	250.0	100.3	2.50%	2019-05-15	4.4	5.0	BB-	2.41%	2.44%	4.85 x	3.96 x
Twitter, Inc.	2014-09-11	900.0	89.0	1.00%	2021-09-15	6.7	7.0	BB-	2.83%	2.83%	NM	NM
Twitter, Inc.	2014-09-11	900.0	89.5	0.25%	2019-09-15	4.7	5.0	BB-	2.68%	2.68%	NM	NM
Verint Systems Inc.	2014-06-12	350.0	90.7	1.50%	2021-06-01	6.4	7.0	BB	3.13%	3.13%	4.33 x	4.57 x
Yahoo! Inc.	2014-12-05	1,437.5	99.3	0.00%	2018-12-01	3.9	4.0	BB+	0.18%	0.18%	9.91 x	1.78 x
Yahoo! Inc.	2013-11-21	1,250.0	98.1	0.00%	2018-12-01	3.9	5.0	BB+	0.49%	0.49%	9.91 x	1.78 x
Maximum	2014-12-05	$ 1,437.5	110.0	3.25%	2029-06-15	14.6	15.0		3.13%	3.13%	34.20 x	4.65 x
75th Percentile	2014-10-23	1,087.5	100.3	1.38%	2021-04-16	6.3	7.0		2.61%	2.62%	9.91 x	4.11 x
Median	**2014-07-27**	**625.0**	**98.9**	**1.00%**	**2020-05-17**	**5.4**	**5.5**		**1.83%**	**1.84%**	**7.51 x**	**2.58 x**
25th Percentile	2014-05-24	303.1	92.5	0.31%	2019-06-14	4.4	5.0		0.60%	0.60%	6.48 x	2.23 x
Minimum	2013-11-19	250.0	89.0	0.00%	2018-12-01	3.9	4.0		0.18%	0.18%	4.33 x	1.78 x

Offering amounts are in a similar range.

Much lower coupon rates due to the conversion option.

Shorter maturities, so lower interest-rate risk.

Many of these bonds trade at a discount, so YTM or YTW > coupon rates.

Healthier credit stats; these companies have less Debt.

There are also a few **additional stats** that we need to examine for Convertible Bonds:

Debt Issuances - Financial Statistics Company Name	Offering Amount	Bond Price	Conversion Price	Conversion Ratio	Stock Price as of Offering Date	Conversion Premium on Offering Date
Cardtronics Inc.	$ 287.5	100.4	$ 52.35	19.1022	$ 37.87	38.2%
Cardtronics Inc.	250.0	98.6	52.35	19.1022	42.40	23.5%
j2 Global, Inc.	350.0	110.0	69.21	14.4488	48.72	42.1%
LinkedIn Corporation	1,150.0	100.6	294.54	3.3951	231.13	27.4%
Live Nation Entertainment, Inc.	250.0	100.3	34.77	28.7604	22.30	55.9%
Twitter, Inc.	900.0	89.0	77.64	12.8800	52.64	47.5%
Twitter, Inc.	900.0	89.5	77.64	12.8800	52.64	47.5%
Verint Systems Inc.	350.0	90.7	58.70	17.0358	48.90	20.0%
Yahoo! Inc.	1,437.5	99.3	53.43	18.7161	36.30	47.2%
Yahoo! Inc.	1,250.0	98.1	53.43	18.7161	36.30	47.2%
Maximum	$ 1,437.5	110.0	$ 294.54	28.7604	$ 231.13	55.9%
75th Percentile	1,087.5	100.3	75.53	19.0057	51.71	47.4%
Median	**625.0**	**98.9**	**56.07**	**17.8759**	**45.56**	**44.6%**
25th Percentile	303.1	92.5	52.62	13.2722	36.69	30.1%
Minimum	250.0	89.0	34.77	3.3951	22.30	20.0%

The Conversion Premiums are the most important data here; we use these to suggest an appropriate premium to a client interested in a Convertible Bond.

The Conversion Ratios tell us how many shares each individual bond will convert into.

So, if the client wants to offer a **Conversion Premium** of 80%, we would say it's unrealistic because most of the peer companies have offered far lower premiums (and, therefore, a higher chance of conversion to shares).

If the company truly wants to offer a Conversion Premium this high, it might have to offer a higher coupon rate or other terms to compensate investors for the risk.

But even that may not be realistic because many investors do not care about the coupon rate on Convertibles; they view them as hedged equity investments instead.

Putting Everything Together: How to Advise a Distressed Company on its Refinancing Options

We'll conclude with an example of how you might use all these concepts to advise a distressed company on its refinancing options.

The company in this scenario has $250 million in bonds with a 13.0% coupon rate, maturing in about 2 years (on 2017-09-15).

This company is currently going through financial distress, so it won't have enough Cash to pay for the $250 million bond.

It has asked its investors for **an extension** – an extra 2 years to repay the bond in full.

But a large hedge fund recently purchased the company's bonds at 80% of their par value (i.e., a market price of $200 million).

The fund purchased the bonds on 2015-06-15, so there are just over 2 years until maturity.

The hedge fund is **not** happy with this extension because it creates more interest-rate risk. Also, the company is distressed, so it may not be able to repay the bonds at all.

A normal company might be able to solve this problem by offering a coupon rate higher than 13% so that investors would be compensated for the additional risk.

However, this company is distressed and cannot afford a coupon rate higher than 13% (about $33 million in interest expense per year). *At most*, it can go up to 14%.

So, it has to offer **something else** to the hedge fund for the additional risk it assumes as a result of this extension.

Two options for that "something else" include:

1) **Offering to Repay the Bonds at Greater Than Par Value** – In other words, the company could offer generous **Redemption Premiums** that are paid even if the company waits until maturity (or close to it) to redeem the bond.

2) **Offering an Equity Stake in the Company Upon Maturity or Call** – This feature is common with Mezzanine and other forms of more junior capital, and it's especially common with distressed companies.

To assess these options, we have to come up with a few proposals and calculate metrics such as Duration, YTM, YTC, YTW, and "Yield to Exit" (YTE) for each option.

Yield to Exit is an "all-in" yield metric that includes not just the interest, principal repayment, and Redemption Premiums, but also any Equity granted to the bond investors.

It also reflects any Accrued Interest as of the Settlement Date.

In real life, we might look at 4-5 alternatives using these concepts, but we'll simplify it a bit here by looking at **one refinancing solution** and comparing it to the company's existing bonds.

The company wants to issue the following bond to refinance its current $250 million bond:

- **Maturity Date:** 2019-09-15 (i.e., a 2-year extension)
- **Coupon Rate:** 14.0% (1.0% higher than the current rate)
- **Lockout Period:** Non-callable for the first 2.5 years (2015 through 2017)
- **2018 Redemption Price:** 103.0%
- **2018 Company Estimated Equity Value:** $150 million
- **2018 Equity Granted to Investors:** 10.0%
- **2019 Redemption Price:** 102.0%
- **2019 Company Estimated Equity Value:** $200 million
- **2019 Equity Granted to Investors:** 15.0%

We start by calculating the Current Yield, YTM, Yield to Exit, and Duration for the company's *current* $250 million in bonds:

Bond Yield and Pricing Assumptions:

Assumptions and Calculations for BOTH Bonds:	
Bond Principal or Par Value:	$ 250.0
Trading Price @ Settlement:	80.0%
"Clean" Bond Price @ Settlement:	$ 200.0
(+) Accrued Interest:	8.2
"Dirty" Bond Price:	**208.2**
# of Interest Coupons per Year:	2
Settlement Date:	2015-06-15
Last Coupon Payment Date Before Settlement:	2015-03-15

Assumptions and Calculations for the EXISTING Bond:	
Bond Coupon Rate:	13.000%
Bond Maturity Date:	2017-09-15
Current Yield:	16.250%
Yield to Maturity (YTM):	25.110%
Approximate Yield to Maturity:	25.556%
Yield to Assumed Exit:	**22.864%**
Modified Duration:	1.71

Current Yield is far lower than YTM and Yield to Exit because the bond trades at a 20% discount to par value. The Yield to Exit is lower than the YTM because the Yield to Exit also includes the Accrued Interest paid upon Settlement, while the YTM does not.

	Settlement	Projected									
Scenario 1 - Original Bond Stays in Place:	**2015-06-15**	**2015-09-15**	**2016-03-15**	**2016-09-15**	**2017-03-15**	**2017-09-15**	**2018-03-15**	**2018-09-15**	**2019-03-15**	**2019-09-15**	**2020-03-15**
(-) Initial Investment:	$ (208.2)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
(+) Future Interest Payments:	-	16.3	16.3	16.3	16.3	16.3	-	-	-	-	-
(+) Future Principal Repayments:	-	-	-	-	-	250.0	-	-	-	-	-
(+) Future Equity Grants:	-	-	-	-	-	-	-	-	-	-	-
Net Cash Flow:	**(208.2)**	**16.3**	**16.3**	**16.3**	**16.3**	**266.3**	**-**	**-**	**-**	**-**	**-**
Yield to Exit:	**22.864%**										

The bond's cash flow profile is the same for both YTE and YTM, but YTE includes Accrued Interest.

We conclude that the hedge fund investors are expecting a yield between **23% and 25%**.

Next, we do the same analysis, but with the company's proposed terms on its new bond instead:

Assumptions and Calculations for the NEW Bond:	
Coupon Rate:	14.000%
Maturity Date:	2019-09-15
Current Yield:	17.500%
Yield to Maturity (YTM):	21.359%
Approximate Yield to Maturity:	21.111%
Yield to Assumed Exit:	**22.408%**
Modified Duration:	2.80

The YTM is significantly lower, the Yield to Exit is about 0.5% lower, and the Duration is 2.8 rather than 1.7. We have a problem!

These terms reflect the Redemption Premiums and equity grants the company is offering; they boost the yield substantially, but the higher coupon rate of 14% also helps. Interestingly, it's **worst** for the investors if they hold the bond until maturity!

Early Bond Redemption Allowed?	No	No	No	No	No	Yes	Yes	Yes	Yes	No
Bond Redemption Value % Par Value:	N/A	N/A	N/A	N/A	N/A	103.0	103.0	102.0	102.0	N/A
% Equity to Investors:	N/A	N/A	N/A	N/A	N/A	10.0%	10.0%	15.0%	15.0%	N/A
Company's Estimated Equity Value:	N/A	N/A	N/A	N/A	N/A	$ 150.0	$ 150.0	$ 200.0	$ 200.0	N/A
Equity Granted to Investors:	N/A	N/A	N/A	N/A	N/A	15.0	15.0	30.0	30.0	N/A
Yield to Exit:	N/A	N/A	N/A	N/A	N/A	25.200%	23.604%	23.436%	22.408%	N/A

	Settlement	Projected									
Scenario 2 - Bond is Refinanced:	**2015-06-15**	**2015-09-15**	**2016-03-15**	**2016-09-15**	**2017-03-15**	**2017-09-15**	**2018-03-15**	**2018-09-15**	**2019-03-15**	**2019-09-15**	**2020-03-15**
(-) Initial Investment:	$ (208.2)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
(+) Future Interest Payments:	-	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	-
(+) Future Principal Repayments:	-	-	-	-	-	-	-	-	-	255.0	-
(+) Future Equity Grants:	-	-	-	-	-	-	-	-	-	30.0	-
Net Cash Flow:	**(208.2)**	**17.5**	**17.5**	**17.5**	**17.5**	**17.5**	**17.5**	**17.5**	**17.5**	**302.5**	**-**
Yield to Exit:	**22.408%**										

Despite the Redemption Premiums, equity grants, and higher coupon rate, the yield is still slightly lower.

The bond investors assume higher risk with a 4-year maturity rather than a 2-year maturity, but they do **not** earn a higher yield.

We don't know the exact yield that would satisfy investors in this scenario, but we might target something in the **25-26% range**, which matches the YTM of the original issuance.

The Yield to Exit on the first callable date above – 2018-03-15 – is close, at 25.2%.

But everything else is problematic, so we need to re-think the terms of this issuance:

- **Redemption Premiums:** We could set these to a much higher level, like 110%, and keep them the same in both years.

- **Equity Granted:** We could make this increase from 10% to 15% to 20% to 25%.

This solution represents a compromise for both sides: The company *could* redeem the bond early on and avoid future dilution in the process.

If the company does that, the investors will realize a higher Yield to Exit.

But the company could also wait until maturity to redeem the bond. If it does that, investors will earn a lower yield, and the company will create more dilution.

So, both sides are incentivized to aim for an earlier repayment, if possible.

Here are the numbers:

Much higher redemption premiums of 110% and equity grants that scale up from 10% to 25% over time, so the Yield to Exit is more like 25-27%. The company is also incentivized to redeem the bond early, if it can, and investors also benefit from an earlier redemption.

Early Bond Redemption Allowed?		No	No	No	No	No	Yes	Yes	Yes	Yes	No
Bond Redemption Value % Par Value:		N/A	N/A	N/A	N/A	N/A	110.0	110.0	110.0	110.0	N/A
% Equity to Investors:		N/A	N/A	N/A	N/A	N/A	10.0%	15.0%	20.0%	25.0%	N/A
Company's Estimated Equity Value:		N/A	N/A	N/A	N/A	N/A	$ 150.0	$ 150.0	$ 200.0	$ 200.0	N/A
Equity Granted to Investors:		N/A	N/A	N/A	N/A	N/A	15.0	22.5	40.0	50.0	N/A
Yield to Exit:		N/A	N/A	N/A	N/A	N/A	27.249%	25.951%	25.691%	24.923%	N/A
	Settlement	Projected									
Scenario 2 - Bond is Refinanced:	**2015-06-15**	**2015-09-15**	**2016-03-15**	**2016-09-15**	**2017-03-15**	**2017-09-15**	**2018-03-15**	**2018-09-15**	**2019-03-15**	**2019-09-15**	**2020-03-15**
(-) Initial Investment:	$ (208.2)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
(+) Future Interest Payments:	-	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	-
(+) Future Principal Repayments:	-	-	-	-	-	-	-	-	-	275.0	-
(+) Future Equity Grants:	-	-	-	-	-	-	-	-	-	50.0	-
Net Cash Flow:	**(208.2)**	**17.5**	**17.5**	**17.5**	**17.5**	**17.5**	**17.5**	**17.5**	**17.5**	**342.5**	**-**
Yield to Exit:	**24.923%**										

If you compare the full numbers for both options, you'll see why these revised terms are more realistic and appealing for investors:

Assumptions and Calculations for the EXISTING Bond:	
Bond Coupon Rate:	13.000%
Bond Maturity Date:	2017-09-15
Current Yield:	16.250%
Yield to Maturity (YTM):	25.110%
Approximate Yield to Maturity:	25.556%
Yield to Assumed Exit:	**22.864%**
Modified Duration:	1.71

Assumptions and Calculations for the NEW Bond:	
Coupon Rate:	14.000%
Maturity Date:	2019-09-15
Current Yield:	17.500%
Yield to Maturity (YTM):	21.359%
Approximate Yield to Maturity:	21.111%
Yield to Assumed Exit:	**24.923%**
Modified Duration:	2.80

The new bond has a maturity date further into the future, and a higher Duration, so it's riskier for investors. However, the Yield to Exit is also higher, so investors are compensated for this additional risk. And they get an even higher yield if the company calls the bond early.

There isn't necessarily a "correct answer" to this question.

The point of credit analysis is to present **different options** and explain the trade-offs of each one.

If a financing option is *not* realistic, you, as the banker, have to explain why it won't work and what the company might do instead.

And that's what we did here: We worked within the company's constraints and came up with a solution that might appease the existing bond investors.

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Key Rule #9: Convertible Bond Accounting, Valuation, and Analysis

We have referenced Convertible Bonds throughout the previous key rules, so you should already be familiar with the basics.

This section will summarize everything and explain the accounting treatment, valuation, and other analysis.

Entire *textbooks* have been written to explain Convertible Bonds, so we're going to limit the scope and focus on what might come up in **interviews and case studies.**

Convertible Bonds: The Basics

The basic features of Convertible Bonds include:

- **Coupon Rate** – The same as it is for normal bonds, but the coupon rate is often zero or extremely low (e.g., 1% or 2%).
- **Maturity** – The same as it is for normal bonds, but the maturity is often much shorter (e.g., 3-5 years rather than 10 years).
- **Conversion Price** – What does the company's stock price have to be for the Convertible Bondholders to **convert** their bonds into shares?
- **Conversion Premium** – By what percentage does the **Conversion Price** exceed the company's stock price at the time of its issuance?
- **Par Value:** What is each bond in the issuance worth? You normally assume the Par Value is $1,000 unless otherwise specified.
- **Conversion Ratio:** How many shares does each bond convert into? You calculate this by dividing the Par Value by the Conversion Price.
- **# of Convertible Bonds:** How many individual bonds are in the issuance? You calculate this by taking the face value of the Convertible Bonds and dividing by the Par Value.
- **Diluted Shares from Convertible Bonds:** This is equal to the # of Convertible Bonds times the Conversion Ratio.

Here's a specific example: Let's say that a company's current stock price is $100.00.

It launches a $500 million Convertible Bond issuance with a 30% Conversion Premium, a 1% Coupon Rate, a 3-year Maturity, and a Par Value of $1,000.

A 30% premium means that the Conversion Price is $130.00, or $100.00 * (1 + 30%). So, the bond investors can convert their bonds into shares if the company's share price reaches $130.00.

The Conversion Ratio is equal to Par Value / Conversion Price, so it is $1,000 / $130.00 = 7.7.

Therefore, each bond converts into 7.7 shares.

There will be 500,000 of individual bonds because it's a $500 million issuance, and the Par Value is $1,000; $500 million / $1,000 = 500,000.

Initially, the bond investors cannot convert the bonds into shares because the company's stock price is still $100.00.

But if the stock price reaches $130.00, they can convert. When that happens, the bonds go away, and the bond investors receive shares in the company instead.

They receive 3.9 million shares since 7.7 shares per bond * 500,000 bonds = ~3.9 million shares.

On the company's Balance Sheet, the Convertible Bond Liability disappears and Common Stock & APIC within Equity increases, so the BS remains in balance.

Convertible Bond Accounting for Issuances, Conversions, and Maturities

Under IFRS, companies must separate Convertible Bonds into Liability and Equity components and record them separately on the Balance Sheet.

Under U.S. GAAP, companies do this only if there's a cash-settlement option (i.e., the company can pay the investors in Cash rather than granting them shares if the investors convert).

If there's no cash-settlement option, U.S.-based companies just record the entire issuance as a Liability.

(NOTE: This point may change in the future since U.S. GAAP and IFRS have been converging over time.)

Throughout this section, we'll assume the IFRS treatment since many U.S.-based companies end up using it as well. Also, there's little to say about the U.S. GAAP version since it's so simple.

To determine the value of the Liability component, you take the Present Value of future cash flows *discounted at the coupon rate of a similar, non-convertible bond*.

Then, to determine the value of the Equity component, you subtract the Liability component from the face value of the bond.

Here's an example of how you would determine the Liability and Equity components for a $300 million Convertible Bond issuance with a 1.5% coupon rate and a 5-year maturity, assuming that the coupon rate on an equivalent, traditional bond is 6.25%:

Convertible Bond Information:	
Dollar Amount:	$ 300.0
Interest Rate:	1.5%
Maturity:	2019-12-31
Conversion Premium at Launch:	50.0%
Conversion Price:	$ 663.71
Par Value:	$ 1,000.0
Conversion Ratio:	1.5067
# Convertible Bonds (Millions):	0.3000

					Projected					
Company Share Price and Convertible Bond Status:	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24
Convertible Future Interest Payments:	4.5	4.5	4.5	4.5	4.5	-	-	-	-	-
Future Principal Repayments:	-	-	-	-	300.0	-	-	-	-	-

Coupon Rate on Equivalent Non-Convertible Debt:	6.250%
(+) PV of Future Interest Payments:	$ 18.8
(+) PV of Principal:	221.6
PV of Liability Component:	**240.4**
Fair Market Value of Convertible Bond at Issuance:	300.0
(-) Fair Market Value of Liability Component:	(240.4)
Fair Market Value of Equity Component:	**$ 59.6**

Tenor of Convertible Bonds:	5.0
Annual Discount to Be Amortized:	11.9

These amounts go on the company's Balance Sheet. Under U.S. GAAP, the full $300 million would be recorded as a Liability and there would be no equity component - unless there's a cash settlement option.

Also, you would deduct the **financing fees** from the Liability component on the L&E side of the Balance Sheet and Cash on the Assets side.

When a company separates a Convertible Bond into Liability and Equity components, it also has to record the **Amortization of the Convertible Bond Discount** on its financial statements.

For example, if the company issues a $1,000 Convertible Bond with a 5-year maturity, the Liability component is $950, and the Equity component is $50, then the "Convertible Bond Discount" is $50.

Therefore, you would amortize $10 per year since the bond's tenor is 5 years and $50 / 5 = $10.

Then, you would record this Amortization figure on the Income Statement, often under Interest Expense, and you would add it back as a non-cash charge on the Cash Flow Statement.

The Liability component would increase by $10 per year until it reaches $1,000 when the bond matures.

If the company's stock price reaches the Conversion Price, and the investors choose to **convert** the bond, you reflect it as follows:

- **Split Liability and Equity Components:** Debit both the Liability and Equity components, taking them to 0, and Credit Common Stock & APIC by the same total amount.

- **Only a Liability Component (U.S. GAAP):** Debt the Liability and Credit Common Stock & APIC.

Under both systems, the Liability component of the Convertible Bond becomes 0, and the company's Equity increases if the bonds are converted.

The difference is that under the split Liability/Equity treatment, the *amounts* will change each year because the Liability component changes each year.

If the Convertible Bond **matures** with no conversion – e.g., and the company's stock price never reaches the Conversion Price after 5 years – then you Debit the Liability component and Credit Cash on the Assets side for the same amount.

If the company **repays the Convertible Bond before maturity** (i.e., it calls the bond), then you have to calculate a Gain or Loss based on the PV of the Liability component at this time minus the book value of the Liability component.

Then, you have to record the Gain or Loss on the Income Statement, reduce the Equity component by (Fair Market Value of Convertible Bond – PV of Liability Component), Debit the entire Liability component, Debit the Gain or Loss, Debit part of the Equity component, and Credit Cash.

There is a 0.000001% chance you will get questions about this topic in interviews, so we're skipping the details of this process.

Convertible Bond Valuation

You value a Convertible Bond by valuing its Liability and Equity components separately.

That is true regardless of the *accounting treatment* of the bond – valuation works the same way under IFRS and U.S. GAAP.

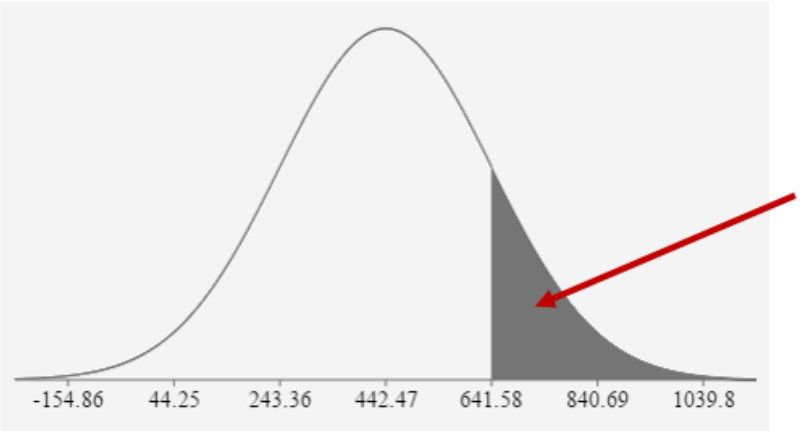
It's easy to value the Liability component: You can take the Present Value of the bond's future cash flows by discounting them at the coupon rate of a similar, non-convertible bond.

It's much trickier to value the Equity component because it consists of a **call option** on the company's shares.

There are many ways to value stock options, but the **Black-Scholes formula** is one of the most common ones.

The formula's derivation is beyond the scope of this guide, but the basic idea is that we need to estimate the **probability** that the company's stock price will exceed the bond's Conversion Price before the bond matures.

Here's an example based on a Convertible Bond for Netflix with a Conversion Price of $641.58:



This embedded call option is only worth something if the stock price exceeds the conversion price or strike price, as in this grey area – how can we estimate the **probability** of the stock price increasing to this region?

This call option embedded in the Convertible Bond is worth $0 if the company's stock price stays below $641.58.

But it's worth a *different amount* at each price above $641.58 – and the *probability* of reaching each stock price is different.

So, you would need to probability-weight and sum up all these values, starting like this:

- **Expected Value @ $641.58** = $641.58 * Probability of That Price
- **Expected Value @ $641.59** = $641.59 * Probability of That Price
- **Expected Value @ $641.60** = $641.60 * Probability of That Price
- **[Continue this series through infinity]**

The Black-Scholes formula uses calculus to estimate the value of a call option like this:

Call Option Value = $S * N(d_1) – X * e^{-rT} * N(d_2)$

The first part of the equation ($S * N(d_1)$) represents "what we get" by exercising the call option, and the second part ($X * e^{-rT} * N(d_2)$) represents "what we pay" to do so.

S is the company's current stock price, which was $442.47 in this case study.

$N(d_1)$ is a "probability factor" that represents a cumulative normal distribution around that stock price.

X is the exercise price of the call option, which is equal to $641.58, the Conversion Price, here.

The **e^{-rT}** term discounts the exercise price back to its Present Value *continuously*; **r** represents the Risk-Free Rate, and **T** is the number of years until expiration.

$N(d_2)$ is another "probability factor" that represents the risk-adjusted probability that the option will be exercised.

It's influenced by $N(d_1)$ because the exercise probability increases as the company's stock price increases.

You can think of the entire first term of this equation – **$S * N(d_1)$** – as the Present Value of the stock if and only if the option ends up being in-the-money.

The second term – **$X * e^{-rT} * N(d_2)$** – is the Present Value of the exercise price payment if and only if the option ends up being in-the-money.

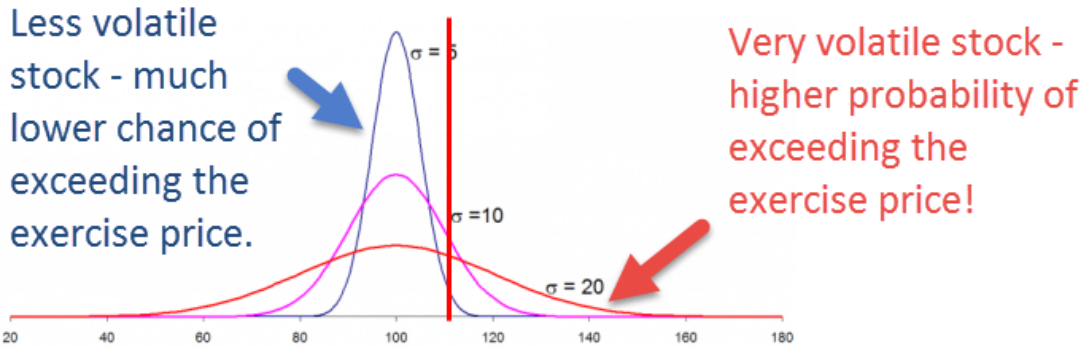
The formulas for $N(d_1)$ and $N(d_2)$ are affected by **the current stock price**, the **exercise price**, the **volatility** of the company's stock, the **risk-free rate**, and the **time to expiration**.

If the exercise price and stock price are closer, there's a **higher probability** that the option holders will be able to exercise their options (and that the bondholders will be able to convert their bonds).

If the risk-free rate or volatility are higher, there's also a **higher probability** of the option becoming exercisable.

Volatility makes a huge impact because it **flattens the normal distribution**.

Imagine the same stock, but with very different volatilities:



The calculations get complicated because people disagree over how to calculate **volatility**, you also need to factor in **dividends** if the company issues them, and a company's stock price doesn't necessarily move according to a normal distribution.

The output of a Convertible Bond valuation might look like the following in Excel, assuming a $1.5 billion issuance for Netflix as part of this same example:

Convertible Bond Valuation:

(+) PV of Bond Component of Convertible:	$ 1,186.9	Exercise Price of Call Option on Bond:	$ 641.58
(+) PV of Conversion Option:	337.6	# Shares That Each Bond Converts Into:	1.5586
Total Implied Value of Convertible Bonds:	**$ 1,524.5**	Option Time To Expiration:	6.0
		Risk-Free Interest Rate:	1.53%
Current Stock Price:	$ 442.47	Credit Spread:	4.12%
Annualized Standard Deviation of Stock Price:	45.0%		
Variance:	0.20	d1 =	0.2973
Annualized Dividend Yield of Stock:	-	N(d1) =	0.6169
Dilution (# Shares Created / Shares Outstanding):	3.7%	d2 =	(0.8049)
		N(d2) =	0.2104
Value per Call:	$ 149.79 ($ as Stated)		
Value of Conversion Option per Bond:	233.47 ($ as Stated)		
Value of Conversion Option Factoring in Dilution:	225.07 ($ as Stated)		
Value of Conversion Options on All Bonds:	337.6 ($ in Millions)		

Indicates there should be a fair amount of investor demand because the Convertible Bonds' intrinsic value exceeds their face value upon issuance.

You could then use the results to advise the company as follows:

Sensitivity Analysis for Implied Value of Convertible Bonds - Expected Stock Price Volatility vs. Stock Price:

		Expected Stock Price Volatility:									
		25.0%	30.0%	35.0%	40.0%	45.0%	50.0%	55.0%	60.0%	65.0%	70.0%
Current Share Price:	$ 300.00	$ 1,226.1	$ 1,252.6	$ 1,282.5	$ 1,314.4	$ 1,347.1	$ 1,380.2	$ 1,412.9	$ 1,445.1	$ 1,476.4	$ 1,506.6
	350.00	1,255.0	1,290.1	1,327.4	1,365.7	1,404.2	1,442.4	1,479.8	1,516.2	1,551.3	1,585.1
	400.00	1,292.9	1,335.8	1,379.6	1,423.6	1,467.1	1,509.8	1,551.2	1,591.3	1,629.9	1,666.7
	442.47	1,332.0	1,380.6	1,429.2	1,477.3	1,524.5	1,570.5	1,615.0	1,657.9	1,699.0	1,738.2
	500.00	1,394.3	1,449.1	1,503.0	1,555.9	1,607.3	1,657.1	1,705.2	1,751.4	1,795.6	1,837.7
	550.00	1,456.4	1,515.2	1,572.7	1,628.8	1,683.3	1,736.0	1,786.7	1,835.4	1,882.0	1,926.3
	600.00	1,525.0	1,586.6	1,646.9	1,705.6	1,762.6	1,817.6	1,870.7	1,921.6	1,970.3	2,016.7

If the company's stock price falls and its volatility stays the same or falls, we may have a lot of trouble selling these bonds; may have to reduce the Conversion Premium or sell them at a discount to par value.

Sensitivity Analysis for Implied Value of Convertible Bonds - Expected Stock Price Volatility vs. Strike Price of Call Option on Bond:

		Expected Stock Price Volatility:									
		25.0%	30.0%	35.0%	40.0%	45.0%	50.0%	55.0%	60.0%	65.0%	70.0%
Strike Price of Call Option on Bond:	$ 500.00	$ 1,480.1	$ 1,540.0	$ 1,598.6	$ 1,655.7	$ 1,711.1	$ 1,764.7	$ 1,816.3	$ 1,865.8	$ 1,913.1	$ 1,958.2
	550.00	1,413.6	1,469.8	1,525.0	1,579.0	1,631.4	1,682.2	1,731.2	1,778.3	1,823.3	1,866.2
	600.00	1,364.0	1,416.0	1,467.7	1,518.4	1,568.0	1,616.1	1,662.6	1,707.3	1,750.1	1,790.9
	641.58	1,332.0	1,380.6	1,429.2	1,477.3	1,524.5	1,570.5	1,615.0	1,657.9	1,699.0	1,738.2
	700.00	1,297.7	1,341.3	1,385.9	1,430.4	1,474.4	1,517.5	1,559.4	1,599.9	1,638.8	1,676.0
	750.00	1,275.5	1,315.2	1,356.3	1,398.0	1,439.4	1,480.2	1,520.0	1,558.6	1,595.7	1,631.3
	800.00	1,258.3	1,294.2	1,332.2	1,371.1	1,410.1	1,448.7	1,486.5	1,523.3	1,558.8	1,592.8

We could increase investor demand substantially by reducing the Conversion Premium.

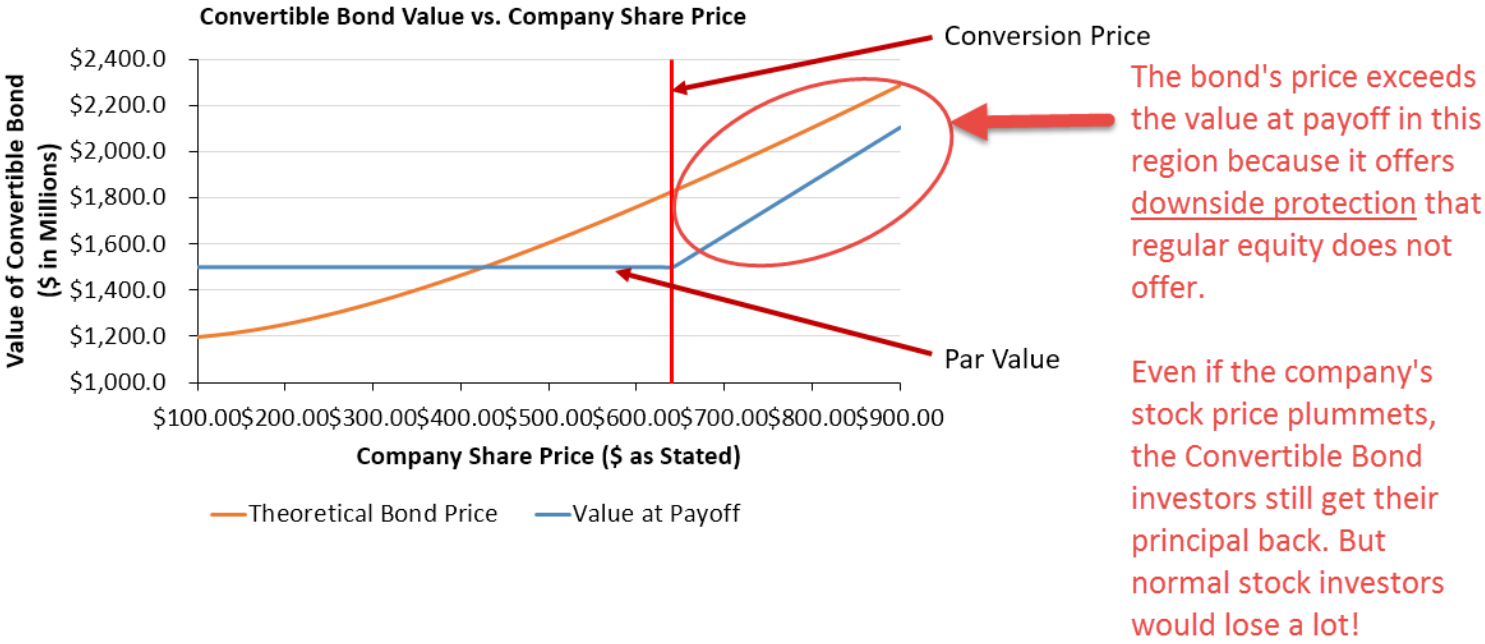
Other Analysis for Convertible Bonds: Payoff Diagrams, Payback Periods, and Hedges

There are many, many other analyses you could complete for Convertible Bonds; we'll just cover the basics here.

One common analysis is a **Payoff Diagram** that shows the Convertible Bond's value as the company's stock price changes.

You can calculate the numbers using the Convertible Bond valuation technique above.

Here's an example of such a diagram for Netflix:



This type of diagram shows a company how investor demand for its issuance might change as its stock price changes.

You could also determine the **potential downside** of a Convertible Bond and the amount of time it would take to **earn back** the Conversion Premium.

If the market price of a Convertible Bond is $1,400, and its price as a traditional bond is $1,200, then the **potential downside** = $1,400 / $1,200 – 1 = 16.7%.

The bond's price as a traditional bond with no embedded option should be **the floor** for the Convertible Bond's price – at that level, the conversion option is worth nothing.

This one is most relevant for investors that buy the bond in the secondary market – from other investors, *not* the company – after the bond's market price has changed significantly.

There's more downside risk in that scenario because the bond's market price **could decrease**, and the investors would lose money if they sell the bond at that reduced price.

But *in theory*, the bond's market price should not fall below its price as a traditional bond.

You can also calculate the **Payback Period** for a Convertible, which tells you how long it takes for the premium to pay for itself.

Example: A company's stock price is currently $100, but you can also buy a Convertible Bond that's convertible into one share for $120.

The Convertible Bond offers a coupon rate of 1%, which translates into $10.00 per share based on the company's total share count and total # of Convertible Bonds (these are arbitrary numbers).

The company also pays dividends of $6.00 per share.

So, if you buy 1 Convertible Bond instead of 1 share, you earn $10.00 per share in interest, but you give up $6.00 per share in dividends, which represents $4.00 per share in "extra income."

But you also paid a **$20 premium** for this Convertible Bond: It was $120, but a normal share was only $100.

Since $20 / $4.00 = 5, it will take **5 years** to earn back the premium you paid in the beginning.

The interpretation of this number depends on the **maturity** of the Convertible Bond.

If the maturity is 10 years, a 5-year Payback Period is positive: Halfway to the bond's maturity, you earn back the premium you paid in the beginning, and it's all upside for you after that.

But if the bond's maturity is 3 years, a 5-year Payback Period is negative: Unless the company's stock price rises, and you convert the bond into shares, **you've paid extra and gotten nothing.**

The Payback Period affects the marketing of the bond as well: If it's a 20-30-year period, then the Convertible Bond is a "hedged equity" instrument and will appeal to different investors.

But if the Payback Period is less than the bond's maturity, then more traditional fixed-income investors might be interested in the issuance.

Call Spreads and Convertible Note Hedges

While Convertible Bonds offer many benefits for both companies and investors, they also have one big downside: If the bonds ever convert, the company experiences dilution, just as it does with a normal Equity issuance.

To reduce this dilution, a company can use a **"call spread,"** where it buys call options on its own stock to offset the dilution and, at the same time, sells warrants on its stock to offset the cost of the call options.

A Convertible Bond still creates additional shares, but there are **fewer shares**, and they are created only at a **higher stock price** (i.e., some level *above* the Conversion Price).

Let's say a company has an outstanding Convertible Bond that will result in 5 million new shares if its stock price reaches the Conversion Price of $25.00.

The company wants to eliminate these new shares, so it spends $100 million to purchase 5 million call options, at an exercise price of $25.00, from a bank.

If the company's stock price increases to $25.00, investors will convert their bonds into 5 million new shares. The company will exercise its call options to repurchase all those shares, and the share count will stay the same.

That's great, but **the company spent $100 million to do this**, which increases the cost of the Convertible Bond.

The company can offset this cost by selling the same counterparty – the bank – **warrants** to purchase its shares at a higher exercise price, such as $30.00.

If the company sells the bank these warrants, the bank might pay $50 million for them.

If the company does that, then:

1) The net cost to reduce dilution falls from $100 million to **$50 million**.

2) There will be **no dilution** when the company's stock price is between $25.00 and $30.00.

3) There will be **modest dilution** (i.e., less than before) if the company's stock price exceeds $30.00.

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Interview Questions

These questions are primarily for **investment banking interviews** in groups such as Equity Capital Markets (ECM), Debt Capital Markets (DCM), and Leveraged Finance (LevFin).

We covered many Debt-related questions in the technical guide(s) to Leveraged Buyouts and LBO modeling, so we will **not** repeat all of those questions here.

You are unlikely to receive questions on these topics in private equity interviews, but they could come up if you interview at a **credit fund** rather than a traditional PE fund.

You could also get questions on these topics if you interview at a hedge fund that uses strategies such as Convertible Bond Arbitrage or otherwise invests in companies' credit.

You are **not** likely to receive questions on these topics in interviews for corporate finance, corporate development, or equity research roles.

Debt Analysis on the Financial Statements

These topics are more likely to come up if you've already had experience in credit analysis (e.g., in DCM, LevFin, corporate banking, or at a credit rating agency).

1. Would lenders ever pay attention to scenarios *other* than the Downside cases in a credit model?

Yes, potentially. Lenders focus on the Downside cases because their upside is limited to the interest rate on the Debt, while their downside consists of losing everything.

However, some forms of Debt, such as Mezzanine, may offer warrants or equity options, which could affect the numbers significantly.

For example, if the Downside case numbers look bad (e.g., a decent chance of recovering only 80% of a loan's principal), the lender might do the deal anyway if the equity options make the IRR high enough in the Base or Upside cases.

2. How might you determine the numbers for revenue growth, margins, and CapEx in Downside cases of a credit model?

First, you could look at the company's historical performance in recessions and see how its growth and margins have fallen and how its CapEx spending has changed when the economy has contracted.

You could also look at peer companies that have not performed well and see how much their growth and margins have declined.

Finally, you also have to consider the company's industry and maturity. A mature retailer with high fixed costs and inventory could easily crash and burn if demand falls, while a professional services company could adapt more smoothly by reducing its headcount.

3. You are completing credit models for a furniture retailer, a luxury hotel chain, and a real estate company that owns multifamily units (i.e., rental apartments).

Which of these companies is most likely to have the MOST EXTREME Downside case?

The luxury hotel chain will have the most extreme Downside case because hotel spending, especially in the luxury segment, declines far more than furniture spending or apartment rent in a downturn.

There might be a modest decline in apartment rents (e.g., 3-5%) during a recession as landlords try to attract new tenants, and furniture sales might also decline modestly (e.g., 5-10%) as fewer people buy homes and redecorate.

But luxury hotel spending *falls off a cliff* in a downturn – declines of 20-30% would not be unusual.

4. What would cause a company's credit rating to change?

A company's credit rating might change if its credit stats and ratios, such as Debt / EBITDA or EBITDA / Interest, improve or worsen significantly, or its qualitative risk factors change.

For example, if peer companies with "BB+" credit ratings have Debt / EBITDA between 4x and 5x, and the Debt / EBITDA of the company you're analyzing suddenly jumps to 6x, rating agencies will be likely to downgrade the company.

But even if a company's financial stats stay the same, its credit rating might decline if its industry experiences a downturn, a major new competitor enters, or the growth outlook falls.

5. Why are ratios such as Debt / EBITDA and EBITDA / Interest important even if a company's Debt has no maintenance covenants?

Because lenders and rating agencies still judge a company based on these metrics, even if the company is not "required" to keep them above or below certain levels.

For example, rating agencies often establish credit rating "bands" of Debt / EBITDA ratios (e.g., investment-grade companies might have Debt / EBITDA below 2x) and use them as guidelines to determine the ratings.

Also, some Debt investors become unwilling to invest in a company's Debt beyond certain thresholds. For example, Term Loan investors might go up to 2x Debt / EBITDA, and Senior Note investors might go up to 3-4x Debt / EBITDA.

But if the company wants to raise Debt beyond those levels, it will have to consider sources like Subordinated Notes or Mezzanine.

6. What conclusions can you draw if a company's EBITDA Cushion for its Interest Coverage Ratio covenant is 10% in the Downside case, but its Leverage Ratio covenant has a Cushion of 50%?

This result means that the company's Debt / EBITDA ratio is acceptable even if things go horribly wrong, but its EBITDA / Interest covenant is in danger of being breached if the company underperforms.

The company could solve this issue by negotiating for Debt with lower interest rates but offering other terms that are more favorable to the lender, or by raising Debt with no maintenance covenants.

7. If a company's cash flow fluctuates greatly from year to year, which financing source is most appropriate for it?

"Anything that lacks maintenance covenants" is the best answer here. But, more specifically, it depends on *how much* the company's cash flow fluctuates.

If the fluctuations are moderate, and the company never moves into crazy territory with its credit stats and ratios (e.g., nothing like 15x Debt / EBITDA), then it may be able to issue Senior Notes or Subordinated Notes, which have higher interest rates than Term Loans but which lack maintenance covenants.

But if the company's cash flows are so unstable that it can't maintain reasonable leverage or coverage ratios, then it will have to use more Equity and possibly skip Debt altogether.

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Bond Analysis

The sky is the limit when it comes to questions on **bond analysis** – prices, yields, duration, convexity, call protection, equity warrants, and more.

Realistically, however, you are *unlikely* to get complex questions on this topic unless you've had prior credit experience.

1. How do you value a bond?

The same way you value any other asset: By discounting its future cash flows (interest + principal repayment) to their Present Values based on an appropriate discount rate, and then summing them up.

With bonds, the "appropriate discount rate" is the **prevailing coupon rate** on similar bonds.

So, if your company has issued a bond with a 5% coupon rate, but interest rates have risen, and similar bonds now have 6% coupon rates, you would discount the bond's cash flows to Present Value based on a 6% discount rate.

2. It seems straightforward to model and value a bond. Why is it more difficult than it appears?

When a company *initially* issues a bond to investors to raise capital, it is straightforward to model. But in the *secondary markets* – where investors buy and sell bonds from other investors – it gets more complicated.

First off, the bond's market price can change over time. The timing also gets tricky because bonds pay interest at different intervals, and a new investor may have to pay for "Accrued Interest" if he/she purchases the bond in between interest payments.

Also, bonds often have embedded call, put, and conversion options, all of which complicate the analysis.

Finally, some bonds also have warrants or equity options attached, which make it trickier to calculate the yields.

3. What are the main factors that influence a bond's market price?

The bond's coupon rate, prevailing interest rates on similar bonds in the market, and the company's creditworthiness make the biggest impact on the bond's market price.

All of them appear in the pricing formula for a bond, but the company's creditworthiness makes a more indirect impact since it affects the "Redemption" term (lower creditworthiness means that the expected repayment percentage may be below 100%).

4. True or False: If Prevailing Interest Rates are below the bond's coupon rate, then the bond must trade at a premium to par value.

Technically, this is false. For *creditworthy* companies with almost no chance of default, this statement is correct: Bond prices are affected mostly by coupon rates and prevailing interest rates.

But if the company is distressed or has some chance of defaulting, the bond might trade *at* par value or *a discount* to par value, even if interest rates are below the bond's coupon rate.

That price reflects the additional risk investors are assuming by investing in a company that might default on its Debt obligations.

5. What does the "Yield to Maturity" (YTM) on a bond mean?

The YTM represents the internal rate of return (IRR) on a bond, with its current market price used as the upfront purchase price.

The YTM assumes that you hold the bond until maturity, the company makes all interest and principal payments in full on the scheduled dates, and that you reinvest the cash flows you earn from the bond at the same YTM.

The YTM is a useful way to compare bonds, but as with IRR, it rarely represents the real-life outcome because of all those assumptions.

6. You purchase a $100 bond at a 5% discount to par value. The bond's coupon rate is 8%, and it matures in 5 years.

What is the bond's approximate YTM?

You can approximate the YTM with:

(Annual Interest + (Redemption Value – Bond Price) / # Years to Maturity) / ((Redemption Value + Bond Price) / 2)

The annual interest is $8, the redemption value is 100 (since full repayment is assumed with YTM), the bond price is 95, and the # years to maturity is 5, so:

YTM = (8 + (100 – 95) / 5) / ((100 + 95) / 2)

YTM = (8 + 1) / 97.5 = 9.2% (You could say, "Between 9% and 10%" in an interview)

The intuition is that we earn 8% interest per year and also 1% on the bond's principal per year since it increases from 95% to 100% over 5 years.

7. What happens to the YTM and Current Yield on a bond if prevailing interest rates move above the bond's coupon rate?

In this scenario, the bond will trade at a discount to par value, so its Current Yield will exceed its coupon rate.

The bond's YTM will increase and exceed its Current Yield because the YTM of a bond should move to match prevailing interest rates.

Intuitively, you can think of it as: "The investor gets a higher-than-expected yield because the bond trades at a discount, and he/she ALSO realizes an annual gain each year from the bond's discounted price. That annualized gain makes the YTM exceed the Current Yield."

8. What happens to the YTM and Current Yield on a bond if the company's credit rating falls dramatically, but prevailing interest rates and the bond's coupon rate stay the same?

The bond will start to trade at a discount to par value if the company's credit rating falls dramatically, so the bond's Current Yield will increase above the coupon rate.

The bond's YTM should also increase because it's based on the assumption of full repayment upon maturity – even if that's no longer realistic.

The bond's YTM should increase to a figure above the Current Yield because investors now earn interest plus an annualized gain from buying the bond at a discount and earning back its par value upon maturity.

9. Why is the relationship between bond prices and prevailing interest rates convex?

This relationship is convex because declining interest rates make more of an impact on a bond's market price than rising interest rates. So, if you plot them on a graph, the slope gets steeper as interest rates decline.

As the prevailing interest rates decline, the discount factors in the Present Value formula decrease more and more quickly, which increases the bond's value non-linearly.

10. Will a 10% or 5% coupon rate bond be more sensitive to changes in prevailing interest rates?

The 5% coupon rate bond will be more sensitive to changes in prevailing interest rates because bondholders receive less money early in the holding period when there's less of a discount.

A greater percentage of the cash flow from a 10% bond comes from interest paid on the bond, so the bond's market price will be less sensitive to changes in rates.

11. If a bond is trading at a premium to par value, and it has a 10-year maturity, how does its market price change as it approaches maturity?

Its market price will approach par value as the bond approaches maturity.

The intuition is that there will be fewer and fewer terms in the Present Value formula that determines the bond's market price and, therefore, less and less of an effect from compounding.

Put differently: Investors have less to gain from a discounted bond and less to lose from a premium bond as each bond approaches maturity.

12. Which one has a higher Duration: A 10-year, zero-coupon bond, or a 15-year, 5% coupon bond? Assume prevailing interest rates are 5%.

Duration is the number of years it takes for the bond's cash flows to pay for the bond's upfront purchase price.

For a zero-coupon bond, the Duration is always equal to the maturity of the bond since there are no interest payments. So, the 10-year bond has a Duration of 10.

The 15-year bond's Duration will be less than 15 because it pays interest and, therefore, you won't need 15 entire years to earn back the upfront price (and the upfront price will be the bond's par value since the coupon rate = prevailing interest rates).

However, the 15-year bond's Duration will be greater than 10 because after 10 years, the bond will have paid only 10 * 5% = 50% of its par value in interest.

The remaining 5 years include 5 * 5% = 25% of the bond's par value in interest and then 100% of its par value at the end. So, the Duration is weighted toward the last 5 years since 125% of the bond's par value arrives then (vs. only 50% in the first 10 years).

Therefore, the 15-year bond has a higher Duration.

(The 15-year bond's Duration is 10.9 if you calculate it in Excel.)

13. What would happen if prevailing interest rates were 10% instead? Why?

If prevailing interest rates were 10% instead, nothing about the zero-coupon bond would change: It would still take 10 years to pay for the upfront investment, so the Duration would still be 10.

However, the 15-year bond would trade at a discount to par value, which would reduce the upfront price to buy the bond.

We don't know what the bond's market price would be, but if interest rates *double*, the discount would be significant; we can guesstimate it as between 40% and 50% due to compounding (it's 38% in real life).

At a 40-50% discount, you would recover the full purchase price before Year 10 because 10 * 5% = 50% of the bond's par value in interest.

But you would pay only 50-60% of the bond's par value – so you'd recover almost that entire amount before Year 10.

The Duration of the 15-year bond would be less than 10 in this case, making its Duration lower than that of the zero-coupon bond. If you calculate it in Excel, it's 9.6.

14. Which type of bond has the highest Convexity?

Zero-coupon bonds have the highest Convexity because they are the **most sensitive** to changes in interest rates.

Since zero-coupon bonds pay no interest, their value depends ONLY on the discount rate AKA prevailing interest rates. That makes them the most sensitive to interest rates and, therefore, the most Convex bonds.

15. Interest rates have fallen, and a company wants to refinance an 8%, 7-year bond with a 6%, 10-year bond.

Why might it not be able to do that?

The problem is the Duration – even if interest rates fall, bond investors want to maintain their *interest-rate risk exposure*.

The longer the maturity of the bond, the more interest-rate risk it has.

The Duration of the first bond is just under 6 years, but it's closer to 8 years for the proposed 10-year bond.

That's a significant difference in interest-rate risk, so the company may have to offer investors an improved yield to compensate.

16. A company has a 7%, 10-year bond with 5 years left until maturity. A group of investors just bought the bond at 109% of its par value (since interest rates have fallen).

The company wants to refinance because coupon rates on similar bonds are now 5% rather than 7%.

To refinance, the company must call the bond and pay a 103% redemption premium to do so.

If the company does this, what type of yield should it offer on its new issuance?

To answer this question, start by calculating the Yield to Exit on the company's existing bond.

We can approximate the YTE with:

(Annual Interest + (Redemption Value – Bond Price) / # Years to Exit) / ((Redemption Value + Bond Price) / 2)

If we assume a face value of $100 for the existing bond, the annual interest is $7.

The redemption value is 103, the bond price is 109, and there are 5 years to maturity, so:

YTE = (7 + (103 – 109) / 5) / ((103 + 109) / 2)

YTE = (7 – 1.2) / 106 = ~5.5%.

Therefore, the company will have to offer a yield slightly higher than 5% to satisfy the investors that just purchased its existing bond.

Intuition: The investors earn 7% per year in interest and lose just over 1% per year as the bond's price goes from 109 to 103 over 5 years. Therefore, you could approximate the yield as "Just below 6%."

17. As a bond that trades at a discount or premium to par value approaches maturity, how do its Clean Price and Dirty Price change?

Both the Clean Price and Dirty Price approach par value as the bond approaches maturity, but the Clean Price changes in a "step-like" fashion where it stays the same for a quarter, half-year, or year, and then changes once a coupon payment is made.

By contrast, the Dirty Price *continuously* increases in each period in between coupon payments as the bond accrues more interest.

So, a graph of the Dirty Price would look like squiggly lines that increase continuously over each period and then "reset" back to the Clean Price upon coupon payment.

18. Should the coupon rate of a bond with call protection be higher or lower than one without call protection?

The coupon rate should be lower because call protection reduces the risk for the bond investors. Lower risk means a lower potential return, so the coupon rate should be lower to compensate.

Call protection reduces the risk for investors by ensuring that the company cannot repay bonds early ("calling the bonds") for several years, and then allowing early repayment, but only at a premium to par value.

19. Why do the redemption premiums on callable bonds tend to decrease as the bond approaches maturity?

Because investors' yield drops **the most** if a company calls a bond early into its maturity period (e.g., Year 4 rather than Year 9 in a 10-year period).

To protect investors against that risk, redemption premiums tend to start off relatively high once the bond becomes callable (e.g., 105 to 110) and then decrease each year, often equaling the bond's par value (100) just before its maturity.

20. What's the relationship between Yield to Worst (YTW) and Yield to Maturity (YTM) when prevailing interest rates are less than or equal to a bond's coupon rate?

The YTW will be less than or equal to the YTM when this happens.

The bond will trade at a premium to par value when its coupon rate is higher than prevailing interest rates. A new investor would have to pay extra for this bond, and the YTM would equal prevailing interest rates.

But if the company calls the bond early, the investor would earn *less than* the YTM.

Even if the redemption premiums are very high, and the investor somehow earns more than the YTM, the YTW would simply equal the YTM since the YTM equals the minimum between the YTM and all the YTCs on all possible call dates.

21. Why do Make-Whole Provisions strongly discourage companies from calling bonds early?

Because Make-Whole Provisions are, effectively, extremely high redemption premiums.

To calculate the Make-Whole Provision, you sum up the Present Value of the bond's future cash flows at a discount rate that's just above the risk-free rate (e.g., the 10-year U.S. Treasury rate).

This discount rate is almost always far below the prevailing interest rates on similar bonds and, as a result, the bond's value is significantly higher at this rate.

It's not unusual for the company to repay 110% or 120% of the bond's par value if it calls the bond extremely early (e.g., Year 1 or 2 in a 10-year maturity) and there's a Make-Whole Provision.

That high a premium rarely make economic sense, so Make-Whole Provisions strongly discourage companies from calling bonds early.

22. What are the most important statistics in an analysis of Comparable Debt Issuances?

You typically screen the issuances by industry, geography, size, time, and credit rating; it doesn't make sense to compare Microsoft to a tech startup that just went public.

You look at statistics such as the median coupon rate, offering amount, bond price, maturity, YTW, YTM, and interest and coverage ratios to determine if your proposed issuance has appropriate terms.

For Convertible Bonds, you would also look at the median Conversion Ratio and Conversion Premium to ensure that your offering is in-line with similar, recent issuances.

23. If a company wants to extend the maturity of its bonds by refinancing, how might you advise it?

At a high level, you want to ensure that the bond investors receive a similar yield with a similar risk profile when the company refinances its bonds.

You can measure these attributes with the YTM, YTW, and Duration of the bonds and the company's credit rating before and after the issuance.

You would aim to issue new bonds that offer a similar yield and Duration and which do not negatively impact the company's credit rating.

For example, if the new bonds mature 2-3 years later than the old bonds, then the company might have to offer better terms to win over investors, such as a higher coupon rate or higher call premiums (since the interest-rate risk is higher with a longer maturity).

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Convertible Bonds

Questions about Convertible Bonds are the **least likely** ones in DCM/ECM/LevFin interviews.

But there's still a chance you could receive them, so we'll cover a few common questions and answers here.

1. A company issues $100 million of Convertible Bonds with a Par Value of $1,000 and a Conversion Premium of 50%. Its current stock price is $66.67.

How many new shares will be created if the company's stock price increases to the Conversion Price, and the bond investors convert their bonds into shares?

The Conversion Price is $100.00, or $66.67 * (1 + 50%), and the Conversion Ratio = Par Value / Conversion Price = $1,000 / $100.00 = 10.0, so each bond converts into 10 shares.

There are 100,000 individual bonds because $100 million / $1,000 = 100,000.

One million new shares will be created since 10 shares per bond * 100,000 bonds = 1 million shares.

2. A U.S.-based company issues a $500 million face-value Convertible Bond with a cash-settlement option and pays $5 million in financing fees to do so.

The Present Value of a traditional, non-convertible bond at prevailing interest rates is $400 million. How would the company record this issuance on its financial statements?

Since there's a cash-settlement option, you must split the bond into its Liability and Equity components.

Since the Liability component is $400 million, the Equity component is $500 million – $400 million = $100 million.

But you also have to deduct the financing fees from this Liability component and deduct them from Cash on the Assets side.

On the Balance Sheet, you increase the Convertible Bond item on the L&E side by $395 million (to reflect the financing fees), and you increase the company's Equity by $100 million.

On the Assets side, Cash goes up by $495 million to reflect the proceeds from the issuance minus the financing fees, and both sides balance.

3. This same company now calls the bond before its maturity and before conversion. What is the accounting treatment?

You may have to record a Gain or Loss if this happens. You measure the Present Value of the Liability component of the bond and then base the Gain or Loss on the PV of the Liability component minus the book value of this Liability component.

You record the Gain or Loss on the Income Statement, reduce the Equity component by (Fair Market Value of Convertible Bond – PV of Liability component), and then debit the Liability component, the Loss / (Gain), and part of the Equity component.

Then, on the Assets side, you credit the entire Cash amount used to repay the Convertible Bond.

4. A company has issued a Convertible Bond that is currently trading at a discount to its issuance price because it's a zero-coupon bond with a low probability of conversion.

If the company's stock-price volatility increases by 10%, how would the bond's value change?

Increased volatility always increases a Convertible Bond's value because it increases the probability that the bond can be converted into shares.

Since the value of a Convertible Bond equals the value of the traditional bond plus the value of the conversion option, increasing either one increases the value of the entire bond.

The increased volatility would increase the value of the conversion option; according to Black-Scholes, an option's value increases as volatility increases because there's a higher chance of the company's stock price reaching the option's exercise price.

5. Which factors might make a Convertible Bond *less* valuable?

A Convertible Bond is *less* valuable if its Conversion Price and the company's stock price are further apart, so any decline in the company's share price will also reduce the Convertible Bond's value.

A lower risk-free rate or lower volatility also reduce the chances of the company's stock price exceeding the Conversion Price, making the bond less valuable.

Finally, less time to expiration (i.e., a lower maturity) also makes the bond less valuable because it reduces the probability of the company's stock price exceeding the Conversion Price.

6. Which characteristics would make a Convertible Bond closer to Hedged Equity rather than Debt?

If the company's stock price at issuance and the Conversion Price of the Convertible Bond are very close, the bond is closer to "Hedged Equity" than traditional Debt.

Also, the lower the coupon rate on the bond, the closer it is to "Hedged Equity"; traditional bond investors have little reason to invest if it's a zero-coupon bond, for example.

A long Payback Period that exceeds the bond's maturity also makes it closer to Hedged Equity.

7. A co-worker has created a Payoff Diagram for a Convertible Bond, which shows that the bond's market value exceeds its payoff value when the company's stock price rises above the bond's Conversion Price.

In other words, the bond's market value might be $1500, but its value, when converted into shares, is only $1400. Why does this happen?

Because the Convertible Bond offers **downside protection**, unlike common shares. As a result, it's worth more than $1400 of the company's common shares.

If an investor simply purchases common shares, he/she could lose everything if the company's stock price declines.

But if the investor purchases a Convertible Bond instead, he/she still receives the bond principal upon maturity – even if the company's stock price plummets.

8. You're analyzing two 5-year Convertible Bonds. The first one has a Payback Period of 3 years, and the second one has a Payback Period of 25 years.

Which type of investor would each bond appeal to?

The "Payback Period" refers to the number of years it takes to earn back the premium you pay for purchasing a Convertible Bond rather than the underlying shares.

A longer Payback Period means that there's more risk in purchasing the Convertible Bond because you may never earn back the premium.

A bond with a Payback Period that's less than its maturity would appeal more to traditional fixed-income investors, while one with a longer Payback Period would appeal more to equity investors looking for a way to hedge their downside risk.

9. How could a company reduce dilution from a Convertible Bond?

A company could use a "call spread," where it buys call options on its own stock and sells warrants on its stock at a higher exercise price to offset the cost of the call options.

The net effect is that the company experiences no dilution from the Convertible Bonds until its stock price exceeds the exercise price of the warrants.

Past that level, there is dilution, but it is reduced significantly from the levels under a normal Convertible Bond.

The downside is that this strategy costs extra, and it may not be worth it depending on the company's share price and Cost of Equity.

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