

Cost of Capital

Objectives

- Calculate the cost of equity using the CAPM
 - Describe how to calculate beta, the risk-free rate, and the market risk premium
- Describe how to calculate the cost of debt for a firm
- Calculate a WACC
- Suggested problems from Chapter 13:
 - 10th edition: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
 - 11th edition: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
 - 12th edition: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13

Discounted cash flow valuation

- This is our fundamental valuation technique
- The DCF approach has its foundation in the Present Value Rule:

$$Value = \sum_{t=1}^n \frac{FCF \text{ to Firm}_t}{(1 + r)^t}$$

Where:

n = life of the asset

$FCF \text{ to firm}_t$ = expected free cash flow to firm in period t

r = an appropriate discount rate

Estimating discount rates

- Critical ingredient to any discounted cash flow valuation
- Mistakes in estimating the rate can lead to serious valuation errors
 - Too high a rate will lead us to underestimate value
 - Too low a rate will lead us to overestimate value
- Intuitively, the discount should be consistent with riskiness of cash flows
 - The higher the risk, the higher the discount rate

What we are after...

- We need a discount rate that captures the riskiness of the firm
- It should capture the:
 - Return required by debtholders
 - Return required by stockholders
- This is the Weighted Average Cost of Capital:

$$WACC = \frac{D}{V} \times (1 - t) \times r_D + \frac{E}{V} \times r_E$$

where $V = D + E$

- r_D is the cost of debt
- r_E is the cost of common stock
- D is the market value of debt, E is the market value of equity
- V is the market value of the firm, t is the firm's marginal tax rate

Relationship between returns and cost of capital

- Investors require a certain return on their investment
 - They don't give money to entrepreneurs/firms for free
 - This is true for common stock, preferred stock, bonds, ...
- The return that the firm must pay to investors is a cost for the firm
- In this sense, returns and the cost of capital are the same thing, but from a different perspective

Cost of Equity

How to estimate the cost of equity?

- Simply use the CAPM!
 - This is the most widely used method
 - There are other techniques, but we will not cover them in this course
- We know the CAPM gives us the expected return from the shareholders' perspective
 - Why is that the same thing as the cost of equity financing from the firm's perspective?

CAPM – Estimation of Parameters

- Risk-free rate R_f :
 - Use the current value of R_f . But which one?
 - In the U.S., use the Treasury Bond yield
 - For a single-year application, use the one-year Treasury yield
 - In a multi-year application, the expected average one-year Treasury yield should be used
 - As an approximation, we choose a Treasury security with a maturity that matches the length of the project

Estimating the risk-free rate

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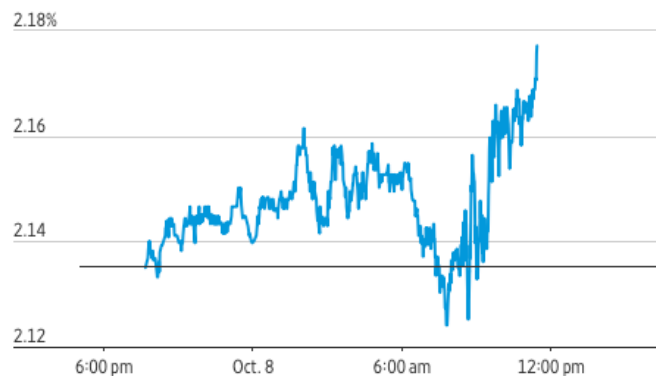
U.S. Treasurys

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	COUPON (%)	PRICE CHG	YIELD (%)	YIELD CHG
30-Year Bond	2	-30/32	2.176	0.040
10-Year Note	1.25	-25/32	1.612	0.035
7-Year Note	1.25	-2/32	1.396	0.033
5-Year Note	0.875	-2/32	1.056	0.033
3-Year Note	0.375	-1/32	0.585	0.025
2-Year Note	0.25	0/32	0.314	0.000
1-Year Bill	0	0/32	0.095	-0.001
6-Month Bill	0	0/32	0.063	0.003
3-Month Bill	0	0/32	0.050	0.000
1-Month Bill	0	0/32	0.025	0.002

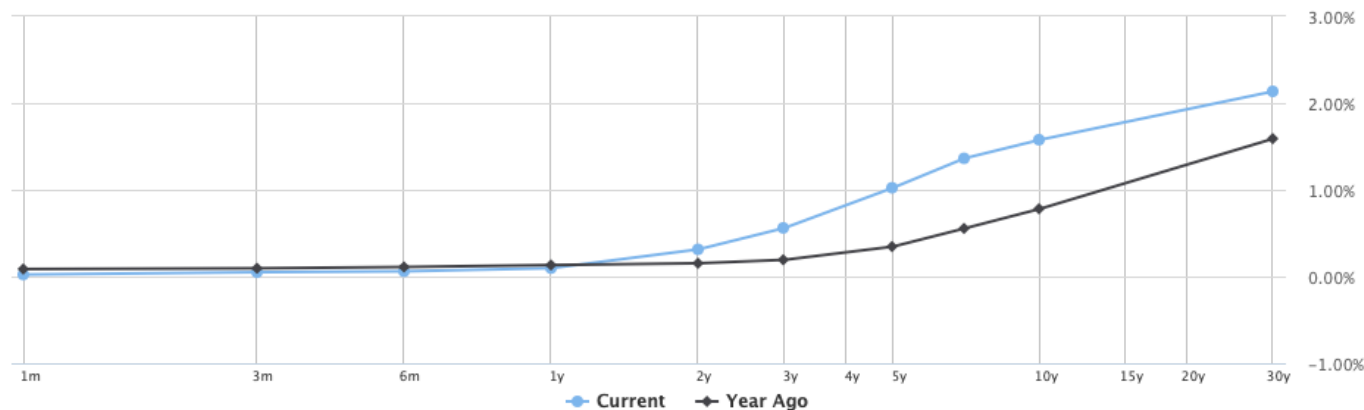
[View Treasury Quotes Page](#)

30-Year Bond



30-Year Bond 1D 5D 3M YTD 1Y 3Y

Yield Curve



CAPM – Estimation of Parameters

- Market Risk Premium (MRP):
 - In the U.S., the most common estimate is 5.5%, but there's a lot of uncertainty
 - Outside of U.S., Market Risk Premiums depend on underlying economy variance, political risk, structure of the market:

Emerging + Political Risk (South America)	8.5%
Emerging (Mexico, Asia, Central Europe)	7.5%
Developed Markets (USA, Japan, UK)	5.5%
Developed with Large Companies	4.5%-5.5%
Developed + "Super Stable" (Germany, Switzerland)	3.5%-4.0%

Survey on the market risk premium used in 2021

- Survey of finance/economics professors, analysts, and managers

Table 2. Market Risk Premium (MRP) used for 88 countries in 2021

MRP	Number of Answers	Average	Median	MAX	min
USA	1756	5,5%	5,5%	8,0%	3,1%
Spain 2021	539	6,4%	6,4%	11,4%	4,0%
Angola	11	11,5%	11,7%	15,0%	6,0%
Argentina	16	17,4%	16,5%	60,0%	4,0%
Australia	31	6,4%	6,3%	10,0%	2,0%
Austria	96	5,9%	6,0%	8,0%	4,0%
Bangladesh	13	7,0%	7,1%	15,0%	1,1%
Barbados	10	11,1%	11,3%	12,4%	8,0%
Belgium	98	5,9%	6,0%	8,0%	4,0%
Bolivia	11	9,1%	9,4%	10,5%	6,6%
Bosnia	9	10,1%	10,3%	11,4%	6,8%
Brazil	42	7,7%	7,8%	12,0%	2,0%
Bulgaria	15	6,8%	6,7%	8,1%	6,3%
Canada	38	5,6%	5,5%	9,2%	3,5%

- Fernandez/Bañuls/Acín, “Survey: Market Risk Premium and Risk-Free Rate used for 88 countries in 2021”, IESE Business School

CAPM: Beta Estimation

- Beta measures how sensitive a stock is to overall market movements.
 - How much does the stock go up or down when the market goes up or down?
- We can think of beta as the slope from the following regression:

$$R_i = \alpha_i + \beta_i R_M + \varepsilon_i$$

where ε = firm – specific risk(i.e., diversifiable risk)

β = sensitivity to market returns

R^2 = explained variance(fraction of returns explained by the market)

Determinants of Beta

- Equity beta risk has two sources:
 - Business risk (the risk of the firm's cash flows)
 - Financial risk
 - The magnification of the business risk from the perspective of the equity holders because of the presence of debt in the capital structure.
 - The higher the use of debt financing (i.e., the higher leverage), the higher is the financial risk

What we are after...

- We need a discount rate that captures the riskiness of the firm
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- This is the Weighted Average Cost of Capital:

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Cost of Debt

Cost of Debt

- The cost of debt is the return that investors require when they invest in bonds
- In contrast to the cost of equity, the cost of debt is directly observable
- It's the Yield-to-Maturity (YTM) on outstanding debt
 - Recall that the YTM is the required rate of return that makes the discounted cash flows from a bond equal to the bond's price. YTM is a rate that is determined by 'market'!

Complications to estimating the cost of debt

- What if your company has several debt issues?
- Compute weighted average of YTMs of all debt issues!

	Market Value (\$ Mil)	YTM
Issue A	75	10.5%
Issue B	150	11.0%
Issue C	200	10.0%

What is the company's cost of debt r_D ?

$$r_D = w_A \text{YTM}_A + w_B \text{YTM}_B + w_C \text{YTM}_C$$

$$r_D =$$

Tax deductibility of interest payments

- Interest payments are treated as *costs* by accountants
 - Therefore, interest payments lower taxable income
 - Interest payments lower taxes!!
- Example: In 2003, JMI Inc., had sales of \$100 mil, costs of \$50 mil. The company paid depreciation expenses of \$20 mil.

Q: What taxes did the company pay assuming a tax rate of 35%?

A: Taxes = $T_C * (\text{Sales} - \text{Costs} - \text{Depr.}) = 0.35 * (100 - 50 - 20) = \10.5 mil

- Assume now that the company has $D = \$100 \text{ mil}$ of debt issued. Company pays $r = 10\%$ interest on the debt issued.

Q: What taxes did the company paid now?

A: Taxes = $T_C * (\text{Sales} - \text{Costs} - \text{Depr.} - r * D) = 0.35 * (100 - 50 - 20 - 10) = \7 mil

Tax deductibility of interest payments

- Therefore, by issuing \$100 mil of debt with 10% interest rate, the company *saved* \$3.5 mil ($=T_C * r * D$) on taxes.
- Is the 10% interest rate the *true* rate the company pays on its debt?
 - No, the company pays interest payments of $r * D = \$10$ mil, but by doing it the company saves $T_C * r * D = \$3.5$ mil. As the result, the company pays only:
 $r * D - T_C * r * D = \$10 \text{ mil} - \$3.5 \text{ mil} = \$6.5 \text{ mil}$ of interest payments
which corresponds to paying the interest rate of $r * (1 - T_C) = 6.5\%$
- Implication: Because of tax deductibility of interest payments, the true cost of debt for the company is:

$$\text{Cost of debt} = r_D * (1 - T_C)$$

Example: Calculate Eastman Chemical's WACC

- Eastman Chemical has 78.26 million shares of common stock outstanding. The book value per share is \$22.40 but the stock sells for \$58. The market value of equity is \$4.54 billion. Eastman's stock beta is .90. T-bills yield 4.5%, and the market risk premium is assumed to be 9.2%. The tax rate is 35%.
- The firm has four debt issues outstanding:

Coupon	Book Value	Market Value	Yield-to-Maturity
6.375%	\$ 499m	\$ 501m	6.32%
7.250%	495m	463m	7.83%
7.635%	200m	221m	6.76%
7.600%	<u>296m</u>	<u>289m</u>	7.82%
Total	\$1,490m	\$ 1,474m	

Practice Problem #2

- ABC Manufacturing's current capital structure is comprised of 35% debt and 65% equity (based on market values). Their current equity beta is 1.40. The company's bonds have a 7% annual coupon, 20-years to maturity, and currently trade at \$1100. The risk-free rate is 4.5% on long-term government bonds. The market risk premium is 5.25%. Assume a marginal tax rate of 35%.
- What is ABC's weighted average cost of capital?

Can Apple reduce the WACC by optimizing the capital structure?

- r_D = Apple's long-term bond yields are currently around ____%
 - finra.org/marketdata
 - Use the longest available maturity
- The cost of equity is roughly:
 - Apple's beta = ____ ([Yahoo Finance](#))
 - r_F = Treasury yield 30 year = ____% ([WSJ](#))
 - Market risk premium = 5.5% (assumption)
 - $r_E = r_F + \text{beta} * 0.055 = \text{____}\%$ (CAPM)
- $E = \$\text{____}$ billion, $D = \$\text{____}$ billion
- WACC =
- Can Apple reduce its WACC by issuing more debt?
 - How does the WACC change if D/V increases to 50%?