Lecture 7: Supplementary exercises

1) Capital structure irrelevance. For additional practice, work through the example we did in class, but with a higher debt level. Start with the same firm. It has two assets: $60 in cash and the investment project. The firm issues $60 of debt and pays a dividend to its shareholders of $60. The risk-free rate is 6.6%, the asset beta is 1.0, and the market risk premium is 8.5%. You will find the following table useful. We will use this example in Lecture 9.

		Next Year		
	Today	Bad State	Good State	Expected Cash Flow
Asset cash flows	-60	60	100	80
Bond cash flows	60			
Equity cash flows				

A) Now that the firm is highly leveraged, the debt will inherit a significant fraction of the risk of the assets. Assume the debt beta is 0.79. What payment do debt holders expect to receive next year?

B) What is the promised rate of return on the bond?

C) What is the expected payment to equity holders next year?

D) What is the value of the equity today? You will need to calculate the expected return on the equity to answer this question.

E) When the firm levered itself, what was the effect on the wealth of the shareholders?

Lecture 7: Answers to supplementary exercises

1) Capital structure irrelevance when debt is risky. I have filled in the table:

		Next Year		
	Today	Bad State	Good State	Expected Cash Flow
Asset cash flows	-60	60	100	80
Bond cash flows	60	-60	-76	-68
Equity cash flows		0	-24	-12

You can also download a spreadsheet from the course webpage that will allow you to check your calculations and answers. You can also use the spreadsheet to see how changing any of the assumptions (such as the assumption that the debt bet is 0.79) affects the calculations. Because everything in the spreadsheet is already calculated, you will get the most out of it if you wait to look at it until after you have worked through the numbers on your own.

A) If the debt beta is 0.79, then it has an expected return of 13.3%.

$$r_D = r_{risk-free} + \beta_D E\left[r_{Market} - r_{risk-free}\right]$$
$$= 6.6 + 0.79\left[8.5\right] = 13.3\%$$

Since the bondholders are lending \$60, there expected repayment is \$68.

$$\text{E[Bond repayment]} = 60 * (1+.133) = 68$$

B) The promised rate of return on a bond is the rate of return if the bond does not default. In the bad state, the firm is worth less than the expected payment to bond holders. The bond must default in this state. Remember, the promised rate of return can never be less than the expected rate of return on a bond. In the bad state, the bond holders receive everything. You know the promised payment is greater than 68 and thus greater than 60. Thus the debt holders get 60 in the bad state (all of the firm's assets), and the equity holders receive nothing. Thus if bond holders are to receive \$68 on average, they must receive \$76 in the good state. The average of \$60 and \$76 is \$68. If you lend \$60 and are promised \$76 dollars, this is a promised return of 26.6%. The promised rate of return on the bond is 26.6%.

$$r_{promised} = \frac{76-60}{60} = 26.6\%$$

C) The equity holders receive zero in the bad state – the bond defaults. In the good state, the equity holders receive \$24. Their expected payment is \$12.

D) The value of equity is the expected cash flow to equity, \$12, discounted at the appropriate rate.

$$E = \frac{E[\text{ Equity Cashflow }]}{1 + r_E} = \frac{12}{1 + r_E}$$

As before, you need the discount rate for equity cash flows.

$$r_E = r_A + \frac{D}{E}(r_A - r_D) = 15\% + \frac{60}{E}(15\% - 13.3\%)$$

You have two equations and two unknowns. Solving them finds: the value of equity is 9.6, and the discount rate for equity is 25.6%. This is high, but that is because the firm has an asset beta of 1 and the firm is 86% debt. Very high leverage will lead to high expected returns on equity. Compare this to FMC from the supplementary exercises to Lecture 2. In that case, the asset beta was 0.77 (as opposed to 1) and the firm was 74% debt (as opposed to 86%), resulting in a lower equity beta.

E) Given that the MM assumptions hold, you know before looking at the question that the wealth of shareholders is unchanged. Before the leveraged recapitalization, the equity holders owned equity worth \$69.6. After the leveraged recapitalization, the equity holders owned equity worth \$9.6 and have received a dividend of \$60. Their wealth was still \$69.6.