

Lecture 8: 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. You will find the following table useful. We will use this example in Lecture 10.

You may also download a spreadsheet that will allow you to check your answer. It is also useful if you want to change any of the assumptions, such as the assumption that the debt beta is zero.¹

	Today		Next Year	
		Bad State	Good State	Expected Cashflow
Asset Cash Flows	-60	60	100	80
Bond Cash Flows	60			
Equity Cash Flows				

- A) If the debt beta is still zero beta, 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?

¹ To use the spread sheet, you will need to enter the level of debt and the promised payment on the debt. The spreadsheet will then calculate the equity value and the expected return on equity. Remember, this must be done by iteration. You may therefore need to hit F9 a couple of times for the answer to converge.

I have also added a button to the spreadsheet. It implements goal seek. By clicking the button, the spreadsheet will pick the promised interest payment such that the expected return (Cell E21) is equal to the required payment on debt (Cell B15). The difference (Cell B16) should be zero, when you have the correct promised payment. The correct promised payment is the payment you must promise so that the bond holders expected cashflow is equal to their required cashflow.

The answers in the spreadsheet will differ slightly from the ones in the text because of rounding.

Lecture 8: Supplementary exercise answers

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

	Today	Next Year		
		Bad State	Good State	Expected Cashflow
Asset Cash Flows	-60	60	100	80
Bond Cash Flows	60	-60	-68	-64
Equity Cash Flows	-60	0	-32	-16

A) If the debt has a zero beta, then it has an expected return equal to the risk free rate -- 6.6% in this example. Since the bondholders are lending \$60, there expected repayment is \$64.

$$E[\text{bond repayment}] = 60 (1 + .066) = 64 \quad (1)$$

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. They expected \$64, but are paid only \$60 and the equity holders receive nothing. Thus if bond holders are to receive \$64 on average, they must receive \$68 in the good state. The average of \$60 and \$68 is \$64. If you lend \$60 and are promised \$68 dollars, this implies a promised return of 13.2%. The promised rate of return on the bond is 13.2%.

$$r_{\text{promised}} = \frac{68 - 60}{60} = 13.2\% \quad (2)$$

C) The equity holders receive zero in the bad state -- the bond defaults. In the good state, the equity holders receive \$32. Their expected payment is \$16.

D) The value of equity is the expected cashflow to equity, \$16, discounted at the appropriate rate.

$$E = \frac{E[\text{Equity Cashflow}]}{1 + r_E} = \frac{16}{1 + r_E} \quad (3)$$

As before, you need the discount rate for equity cashflows.

$$r_E = r_A + \frac{D}{E}(r_A - r_D) = 15\% + \frac{60}{E}(15\% - 6.6\%) \quad (4)$$

You have two equations and two unknowns. Solving both of them yields the value of the equity is 9.6 and the discount rate for equity is 67.5%. This should strike you as incredibly high.

The equity beta is over 7 in this case. Part of the reason is the firm is 86% debt. However, FMC levered itself from 15 percent debt to 74 percent debt, and its equity beta did not rise nearly this high (see supplementary exercises to Lecture 2). The cause of this unrealistic answer is the assumption that the debt beta is zero. Given an asset beta of about one and a firm which is mostly debt, this cannot be true. A significant fraction of the business risk would be carried by the debt holders. In FMC's case, the debt beta rose to 0.66.

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.