Lecture 2: Supplementary exercises.

4) Calculating Asset Values and Asset Betas (Case 1 – Assets). When we value projects, assets, and securities, we discount the expected cashflows at the risk adjusted discount rate. This discount rate (according to CAPM) depends upon the project's, asset's, or security's β. This set of exercises should help you develop your intuition about from where βs come, what they mean (measure), and how they are affected by changes in capital structure.

A) States of the world and the market return. The first step is familiarize yourself with the spreadsheet. To complete this exercise, you will need to down load the Excel spreadsheet supp_2c.xls from the web. The first step is to understand what it is doing. The spreadsheet describes a simple world where there are only 20 possible states. Across the states the systematic and idiosyncratic risk will differ. For example states 1-4 are severe recessionary states. The return on the market is low (-16.6%). Notice the market return is the same in each of these four states. States 17-20 are boom states. In these states the return on the market is high (42.8%). Calculate the expected market price of risk. This is the amount by which the market return is expected to exceed the risk free rate. To do this, calculate the excess return (r_{market} - $r_{riskfree}$) for reach state (in row 10). Then in cell E10 calculate the average.

B) Asset cash flows and asset returns. Calculate the return on the asset in each state. I have specified the cash flows to assets in the 20 states. Since this is a one period example there are no cash flows after next year. These are liquidating cash flows. The asset cash flows depend upon systematic risk. The cash flow to assets is lower in states 1-4 (severe recession) than it is in states 5-8 (recession). The cash flow to assets also depend upon idiosyncratic risk. State 1 is a recessionary state and customers don't like our product. Thus the cash flow is very negative. State 4 is a recessionary state also, but in this state customers do like our product. Thus the cash flow is greater than in state 1 (123.4 versus 43.4).

Calculate the return on the asset in row 15. This is a function of the cash flow to assets in each state and the value of the asset. Thus you will need to enter an asset value in cell C14. At the moment, this is just a guess. We will come back to this later. As a check, what is the average (expected) idiosyncratic return should be zero.

C) Asset β. To estimate the discount rate we need the risk free rate (which we have), the market price of risk (which we have) and the asset β (which we don't have). We must estimate the asset β. β measures how the return on an asset rises or falls with the return on the market. Remember from Finance I the expression for a β is[1]:

$$\beta_{Asset} = \frac{Cov[\ r_{Asset}\ ,\ r_{Market}\ ]}{Var[\ r_{market}\ ]}$$

[1] The formula really is the covariance of the excess return on the asset (r_{Asset} - $r_{Riskfree}$) with the excess return on the market (r_{Market} - $r_{Riskfree}$) over the variance of the excess return on the market. Since in this very special case the riskfree rate is constant, our 'incorrect' formula will still give us the correct answer. When calculating standard deviations and variances, use the population functions [stdevp() and varp()].

First calculate the covariance of the asset return with the market return (in Cell E17). You can use the COVAR() function in Excel. The standard deviation of the market's excess return is in Cell F10. Then calculate the asset β in Cell E18.

D) Asset Discount Rate. Calculate the asset discount rate (Cell E19).

E) Asset Valuation. To value the asset we discount the expected cash flows at the correct discount rate. Notice that the value you calculated for the asset (E20) is not consistent with your estimate. Cell C20 contains the difference. Your guess (C14) matters because you calculated asset returns based on this asset value. You then estimated the asset β and asset discount rate based on those asset returns. Your asset value depends upon that asset discount rate. To convince yourself that I am correct, change you guess (C14) to 95 and watch your calculated asset value (E20) change. Find the asset value which is correct. Use Goal Seek to do this. Have Goal Seek change Cell C14 until Cell C20 is zero. When your guess of the asset value (C14) is the same as the calculated asset value (E20), then you have the correct asset value. The button "Price the Asset" has a macro programmed into it which uses Goal Seek to price the asset. To test it, change you guess back to 90 (C14) and click on the button. What is the value of the asset?

5) Calculating Debt and Equity Values and Betas (Case 1 – Debt & Equity).

A) Valuing the debt. The firm that you worked with in question 1, is now going to issue some debt. It will go to the market with a debt security whose promised payment is $20 (C23). Thus bond holders will receive either the promised payment or all of the firm's assets, which ever are less. Value the debt (E30). You will want to use the same spreadsheet as you used in 1 (supp_2c.xls) To value the debt, calculate the expected cash flows to debt holders and discount this at the correct discount rate. To calculate the discount rate you will need to calculate the debt β. As above, you will need to first enter a guess for the debt value (C24), then work through the logic to arrive at a debt value that depends upon your guess. Adjust your guess until it is correct. Only one guess will work – which you can verify with your spreadsheet.

B) What is the promised return on the debt? Does it make sense why this must be the answer?

C) Value the equity. Given the promised debt payments and the asset cash flows, you can now value the equity. Use the same procedure you used for the assets and the debt. As a check, the debt plus equity should equal the asset value (Cell E42) and the weighted average of the debt and equity β should equal the asset β (Cell E43).

D) Why is the equity riskier?

6) Calculating Asset, Debt, and Equity Values and Betas (Case 2). If you increase the leverage of the firm, leaving the assets the same, then the debt and equity β's should rise, but the asset β should not. I want you to check this. Raise the promised payment on the debt to $60 from $20. To make this simpler, copy your current tab (from questions 1 and 2). Then edit this second tab. If you are clever and the spreadsheet is set up correctly, this question should take five minutes.

A) How does the value of the debt and equity change?

B) What is the promised rate on the debt?

C) What is the average return on the debt in default?

D) What is the expected return on the debt?
E) How do the debt and equity β s change? Calculate a weighed average of the debt and equity β where the weights are the value of the debt and equity. What do you get?

7) Calculating Asset, Debt, and Equity Values and Betas (Case 3). Now raise the promised payment on the debt to $80.
A) What is the value of the debt and equity now?
B) What is the promised rate on the debt?
C) What is the average return on the debt in default?
D) How do the debt and equity β s change? Calculate a weighed average of the debt and equity β where the weights are the value of the debt and equity. What do you get?