

Session 23: Post Class tests

1. There is a basis for the argument that equity in a publicly traded company can be viewed as a call option on the company's assets. For this argument to be made, which of the following would need to hold?
 - a. Equity investors have limited liability, i.e., they cannot lose more than their equity investment
 - b. Equity investors run the business and can choose to liquidate the business at any time
 - c. Equity investors have a residual claim on the liquidation proceeds, i.e., they get all of the value left over after lenders have been paid.
 - d. The debt holders claim is on the liquidation proceeds is restricted to the outstanding debt (and unpaid interest expenses from prior periods)
 - e. All of the above
2. You decide to value equity as a call option on a troubled chemical company, with significant debt outstanding. You believe that the operating assets of the company can generate \$ 80 million in expected cash flows next year, growing 2% a year in perpetuity and that the cost of capital for these assets (to a healthy firm) is 10%. The company has only one debt issue, a \$1.5 billion zero coupon bond with 8 years left to maturity. The short term treasury bill rate is 1%, the longer term (6-10 years) treasury bond rate is 3% and the standard deviation in firm values for chemical companies is 45%. List the inputs that you will use in valuing equity as a liquidation option in this firm:
 - a. $S =$
 - b. $K =$
 - c. $t =$
 - d. $r =$
 - e. Standard deviation =
 - f. y (Dividend yield) =

Bonus: Value equity as a liquidation option

3. Now assume that you have plugged in the right values into an option pricing model and are looking at the following output from the model.
 $d1 = 0.5036, N(d1) = .6937$
 $d2 = -0.7664, N(d2) = .2217$
What is the "right" interest rate on the debt?
 - a. 3.00%
 - b. 6.13%
 - c. 12.91%
 - d. 22.17%
 - e. None of the above
4. Using the output from question (3), what is the likelihood that this firm will go bankrupt sometime over the next 8 years?
 - a. 0.00%
 - b. 22.17%

- c. 50.36%
 - d. 69.37%
 - e. 76.64%
 - f. 77.83%
5. If you buy into the notion that equity in deeply troubled firms can be viewed as options, in which of the following highly levered, money losing companies will equity be most highly valued?
- a. A company in a stable business with predominantly short term debt
 - b. A company in a risky business with predominantly long term debt
 - c. A company in a stable business with predominantly long term debt
 - d. A company in a risky business with predominantly short term debt

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1. **e. All of the above.** For equity to be viewed as a call option, equity investors have to be running the firm, have a residual claim on the assets in liquidation and have limited liability.
2. **Inputs to the option pricing model**
 - a. $S = 1000 = 80 / (.10 - .02)$
 - b. $K = 1500 =$ Face value of the zero coupon bond
 - c. $r = 3\%$
 - d. $t = 8$ years
 - e. $\sigma = 45\% =$ Standard deviation of chemical firm values
 - f. y (Cost of delay) = 0 (If the company had a contractual commitment to make cash flows every year, you could have used that cash flow to get your dividend yield)
3. **c. 12.91%.** Plugging in the values of $N(d1)$ and $N(d2)$ into the equation, we get:
 - Value of equity = $1000 (.6937) + 1500 \exp^{-(.03)(8)} (.2217) = \432.09
 - Value of zero coupon bond = $1000 - 432.09 = 567.91$
 - Interest rate on zero coupon bond = $(1000/567.91)^{1/8} - 1 = .1291$
4. **f. 77.83%.** It is $N(d2)$ that gives you the risk neutral probability that this option will be in the money (will have asset value > face value of debt). Therefore the probability that it will not have enough to cover its debt = $1 - .2217 = .7783$
5. **b. A company in a risky business with predominantly long-term debt.** The value of equity as an option increases with uncertainty (risky business) and with the option maturity (long term debt).