

## Session 20a: Post class test solutions

- c. The cost of capital will remain unchanged.** To prove it, start with the cost of capital at a zero debt ratio. With the unlevered beta of 0.90:

  - Cost of equity = Cost of capital =  $3\% + 0.9 \times 6\% = 8.4\%$
  - If the firm moves to any debt to capital ratio (say 20%), it will be borrowing at the risk free rate of 3% (since there is no default risk) and the levered beta will rise  
Levered beta =  $0.90 (1 + (1-0) (20/80)) = 1.125$   
Cost of equity =  $3\% + 1.125 (6\%) = 9.75\%$   
Cost of capital =  $9.75\% (.8) + 3\% (.2) = 8.4\%$
- d. Retained earnings, Debt, Convertible debt, New stock issues.** Managers value flexibility and control. Retained earnings is best since it gives them both. Straight debt and convertible debt make you accountable to lenders (which reduces flexibility and control), but companies seem to prefer this to issuing new stock, which require you to get board approval and open you up for examination by investors.
- b. The operating income of the firm will not change as the debt ratio changes.** For a lower cost of capital to result in higher firm value, the operating cash flow of the firm will have to remain fixed (or unchanged) as the debt ratio changes. For operating cash flow to not change, operating income has to be fixed as the debt ratio changes.
- c. 1.30.** If the debt to capital ratio now is 20%, the debt to equity ratio is 25% (20/80). To get the new beta, you first have to unlever the existing beta:  
Unlevered beta =  $1.15 / (1 + (1-.4) (.25)) = 1.00$   
The new debt to capital ratio is 33.33%, resulting in a debt to equity ratio of 50%. Relever back at the new debt ratio of 50%:  
Levered beta =  $1.00 (1 + (1-.4) (.50)) = 1.30$
- c. 2.92 (mechanical answer), a. 2.33 (better answer).** To get the mechanical answer, you keep the existing debt of \$400 million at the old interest rate of 3.5% and add the new debt of \$200 million at the new interest rate of 5%:  
Interest expenses =  $.035(400) + .05 (200) = \$24$  million  
Interest coverage ratio =  $70/24 = 2.92$   
However, it is unlikely that the old debt holders will settle for the old interest rate. As the debt gets refinanced (forcibly or with the passage of time), the interest rate on all of the debt will converge on 5%  
Interest expenses =  $.05 (600) = 30$   
Interest coverage ratio =  $70/30 = 2.33$
- d. 5.5%.** To get to this answer, first recognize that if the firm doubles its debt and the interest rate doubles, the interest expense will be higher than the operating income:  
Interest expense on debt =  $200 (.075) = 15$   
Operating income = Maximum interest tax deduction = 10  
Tax savings on maximum deduction =  $10 (.40) = \$4$  million  
Adjusted marginal tax rate on all interest expense =  $4/15 = 26.67\%$   
After-tax cost of debt =  $7.50\% (1-.2667) = 5.5\%$