Econ 156
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Midterm Answers

1. a. Don't buy a stock planning on selling it a short while later for a profit. The purchase should be justified by the cash flow if you never sell.
   b. The time to buy stocks is when the fears of others have caused prices to collapse; the time not to buy is when the greed of others has caused prices to soar.
   c. Institutions are generally speculators, not investors. If you want to be an investor, don't imitate institutions.
   d. Stock splits are nonevents, except for the wasteful transaction costs.
   e. You should value a stock the same way you value a bond, by discounting the anticipated cash flow.

2. \$4.4/\$20 + g, where g is the long-run annual rate of growth of energy costs. [Fortune, September 6, 2010, p. 17.]

3. Each firm retains 60% of earnings and has a growth rate of 6%: (1 - d)ROE = 0.6(0.10) = 0.06. The aggregate market values and per-share prices are:

$$n_A P_A = \frac{D_A}{R_A - g} = \frac{4}{0.08 - 0.06} = 200 \Rightarrow P_A = \frac{200}{20} = 10$$

$$n_B P_B = \frac{D_B}{R_B - g} = \frac{8}{0.10 - 0.06} = 200 \Rightarrow P_B = \frac{200}{10} = 20$$

   If firm A issues 30 million shares to take over Firm B, then the new price P is

$$P = \frac{200 + 200}{20 + 30} = 8$$

   The initial and new earnings per share are:

$$E_A = \frac{10}{20} = 0.50$$

$$E_B = \frac{20}{10} = 2.00$$

$$E = \frac{10 + 20}{20 + 30} = 0.60$$

   a. Company A's earnings per share are \$0.50 before the merger and \$0.60 after the merger.

   b. Company A's shareholders lose because the stock price drops from \$10 to \$8. Company B's shareholders gain because they get three shares worth \$8 each for one share worth \$20.

4. [Ben Inker, GMO, quoted in Morningstar Advisor, October/November 2010, p. 40.] Retaining earnings increase a company's growth rate, but do not benefit shareholders more than a dividend if the retained earning are invested at a rate of return that is lower than the shareholders' required return. Consider a company with \$100 in assets, a 5% return on assets, no debt, and a 10% shareholder required rate of return. If the company has a 0% retention rate, the growth rate is (1 - d)0.05 = 0.(0.05) = 0.0 and the value of the

company is

$$P = \frac{D}{R-g} = \frac{d\rho A}{R-(1-d)\rho} = \frac{1.0(0.05)(100)}{0.10-(1-1.0)0.05} = 50$$

If the company instead has a 50% retention rate, the growth rate increases from 0% to 2.5% ((1 - d)0.05 = 0.50(0.05) = 0.025), but the value of the company falls from \$50 to \$33.33:

$$P = \frac{D}{R-g} = \frac{d\rho A}{R-(1-d)\rho} = \frac{0.50(0.05)(100)}{0.10-(1-0.50)0.05} = 33.33$$

5. [Ben Inker, GMO, quoted in Morningstar Advisor, October/November 2010, p. 40.] Consider this balance sheet:

Assets		Liabilities	
Loans	120	Deposits	110
		Equity	10
	120		120

This bank has 12-1 leverage. If the value of the loans falls by 10%, from 120 to 108, the value of equity falls by 120%, from 10 to -2:

Assets		Liabilities	
Loans	108	Deposits	110
		Equity	-2
	108		108

6. We can estimate the duration by taking the derivative of the value of the stock with respect to the discount rate or directly from the duration formula. Taking derivatives:

$$P = \frac{X}{R-g}$$

$$\frac{\partial P}{\partial R} = -\frac{X}{(R-g)^2}$$

$$-\frac{1}{P}\frac{\partial P}{\partial R} = \frac{1}{R-g}$$

Because we have to multiply by 1 + R to obtain Macauley duration,

$$P = \frac{X}{R-g}$$

$$\frac{\partial P}{\partial R} = -\frac{X}{(R-g)^2}$$

$$-\frac{1+R}{P}\frac{\partial P}{\partial R} = \frac{1+R}{R-g}$$

The duration is not infinite unless g = R

Or we could reason as follows: if the duration is infinite, then a one percentage-point change in the required return would have an infinite effect on the value of the stock, which is clearly untrue.
[Ben Inker, GMO, quoted in Morningstar Advisor, October/November 2010, p. 40.]

7. [Ben Inker, GMO, quoted in Morningstar Advisor, October/November 2010, p. 40.]
   a. The price-earnings ratio is 11 - 12

b. The interest rate on 10-year Treasury bonds
c. For a given level of earnings, an increase in interest rates will increase required returns and reduce stock prices and P/E ratios.

8. With an upward sloping term structure, the yields on coupon bonds can be expected to be less than the yields on zeros. An upward sloping term structure (particularly one this dramatically upward sloping) suggests that investors expect interest rates to be higher in the future than they are today. If so, investors will accept lower yields on coupon bonds because the coupons can be reinvested at relatively high interest rates.

9. Because the benefits are in real terms, we discount by a monthly required real return R:

$$P_{66} = \sum_{t=1}^{n} \frac{\$2,365}{(1+R)^t}$$

$$P_{70} = \sum_{t=49}^{n} \frac{\$3,208}{(1+R)^t}$$

For a 3% real annual required return, the breakeven age at death is roughly 85, which is the approximate life expectancy of a 66 year-old. This, if his real required return is 3%, he should start at 66 if he anticipates a dying before 85 and start at 70 if he anticipates dying after 85.

10. Because the Social Security taxes are nominal and the benefits are real, we need to convert both to nominal or both to real. Let's convert both to nominal, assuming an annual rate of inflation p in the future. Working with annual numbers and a present value in 2012 when he is 66 years old, the implicit nominal rate of return is the value of R that solves this equation, where n is the number of years he lives past 66:

$$X_{1963}(1+R)^{2012-1963} + X_{1964}(1+R)^{2012-1964} + \quad + X_{2011}(1+R)^{2012-2011} = 2365(1+p)^2 + \frac{2365(1+p)^3}{(1+R)^1} + \quad + \frac{2365(1+p)^{n+2}}{(1+R)^n}$$

$$\sum_{t=1963}^{2011} X_t(1+R)^{2012-t} = \sum_{t=0}^{n} \frac{2365(1+p)^{t+2}}{(1+R)^t}$$