Econ 156
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Midterm Answers

1. The price of the bond with the 4 percent coupon could be sufficiently low to make it attractive.

2. The implicit annual rate of return can be determined be this present-value equation:

$$\$5{,}000{,}000 - \$1{,}350{,}000 = \frac{\$1{,}350{,}000}{(1+R)^1} + \frac{\$1{,}350{,}000}{(1+R)^2} + \ldots + \frac{\$1{,}350{,}000}{(1+R)^{19}}$$

   The answer works out to be 36.89%.

3. For simplicity, consider a flat term structure. A Fed purchase of Treasury bills pushes T-bill prices up and T-bill rates down, say by 0.5%. If investors believe that this signals a permanent 0.5% decline in T-bill rates, the Expectation Hypothesis implies that all interest rates will decline by 0.5%. If investors expect the decline to be temporary, so that future short-term rates will not be as low as they are currently, then long-term rates will decline by less than 0.5%. (For a specific example, think about the interest rates on 1-year and 2-year zeros, where the current 1-year rate falls from 2% to 1.5% while the anticipated 1-year rate a year from now either falls from 2% to 1.5% or stays at 2%.)

4. a. The monthly payments are lower on the 30-year mortgage, so that the loan is not paid off as quickly.
   b. The 30-year mortgage has the higher unpaid balance after 5 years, because the monthly payments are lower so that the loan is not repaid as quickly.
   c. The 30-year mortgage has the higher total payments because the funds are borrowed for a longer period of time and, consequently, more interest must be paid.
   d. For either loan, no matter when the mortgage is paid off, the present value of the payments at a 4 percent required return (the interest rate on the loan) is equal to the amount borrowed.
   e. In comparison with the 15-year mortgage, the 30-year mortgage has lower monthly payments and a higher unpaid balance after 5 years; it therefore has the longer duration. An increase in the required return will reduce the present value of the loan with the longer duration, here the 30-year mortgage. Thus the 15-year mortgage has the higher present value. Or, think of it this way, with a 10% required return, it is better to postpone the repayment of the loan.

5. Tobin's q is equal to market value divided by assets, so we need to find the market value. Using the constant-dividend growth model, the growth rate is g = (1 - d)ρ = (1 - 2/3)(0.15) = 0.05 and market value is

$$P = \frac{D}{R-g} = \frac{d\rho A}{R-(1-d)\rho} = \frac{(2/3)(0.15)100}{0.10-0.05} = 200$$

   Tobin's q = 200/100 = 2.

6. The EVA model gives a value of

$$V = A_0 + \frac{\rho A_0 - RA_0}{(1+R)^1} + \frac{\rho A_1 - RA_1}{(1+R)^2} + \ldots$$

$$= A_0 + \frac{(\rho - R)A_0}{(1+R)^1} + \frac{(\rho - R)A_1}{(1+R)^2} + \ldots$$

   Now, using the fact that assets grow by 5% a year, we have

$$V = A_0 + \frac{(\rho - R)A_0}{(1+R)^1} + \frac{(\rho - R)A_1}{(1+R)^2} + \ldots$$
$$= 100 + \frac{(0.15 - 0.10)100}{(1+0.10)} + \frac{(0.15 - 0.10)100(1+0.05)}{(1+0.10)^2} + \ldots$$
$$= 100 + \frac{5}{(1+0.10)} + \frac{5(1+0.05)}{(1+0.10)^2} + \ldots$$

Finally, using the constant dividend-growth model formula $P = \frac{D}{R-g}$, where D = 5, we have

$$V = 100 + \frac{5}{0.10 - 0.05} = 100 + 100 = 200$$

Not surprisingly, the EVA model gives the same valuation as the dividend discount model.

7. Leverage = assets/equity = 320,000/40,000 = 8/1

8. In general, borrowing money at low interest rates is profitable, and borrowing money at high interest rates is unprofitable. It is not profitable to pay down his current low-interest loan. It would make more sense to invest the money now and pay down the loan *after* interest rates have risen. The only advantage of paying the loan down now is if he does not have the discipline to save for a future pay down.

9. a. Because the yield to maturity is equal to the coupon rate, it sold for par.
   b. The total return is the 7.5% coupon plus the capital gain (or loss):
   7.5% + x% = –4.19% implies x = –11.69%
   7.5% + x% = 23% implies x = +15.5%
   The duration is evidently between 11.69 and 15.5 years. (Because of the nonlinearity, the actual percentage changes are not exactly equal to each other or to the duration.) Halfway between is (11.69 + 15.5)/2 = 13.6. (The actual duration is 13.8 years.) Alternatively, we can divide the difference in the percentage returns by the two-percentage-point difference in the yield to maturity: (4.19 + 23)/2 = 13.6.

10. (Dan Ariely, "Gamed," *Wired*, July 2011, p. 136.) With sunk costs, which the $79 fee is, customers should ignore the fee and think on the margin: Is the cost of this product worth it? Free shipping makes it more likely that the product is worth it, but the customers' objective should not be to reduce the average cost.