Problem Set 3 Explained

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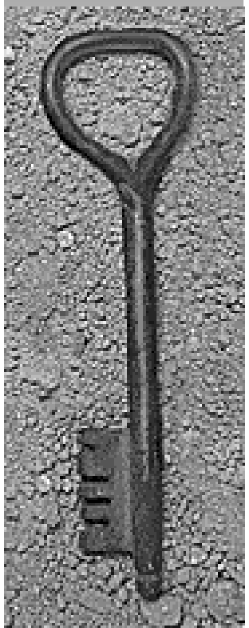


8-6 Bond Valuation

- Two bonds, L is 15 year, S is 1 year
- Both are $1000 par value and $100 coupon

a. If rate is 5, 8 and 12%, compute value of each bond.

$$V_b = C(PVIFA_{n,k}) + P(PVIF_{n,k})$$

5% Rate

$$V_L = 100(10.3797) + 1000(.4810) = \$1518.97 \text{ (1 point)}$$

$$V_S = 100(.9524) + 1000(.9524) = \$1047.64 \text{ (1 point)}$$

8% Rate

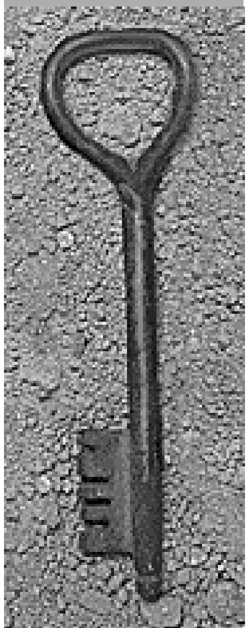
$$V_L = 100(8.5595) + 1000(.3152) = \$1{,}171.15 \text{ (1 point)}$$

$$V_S = 100(.9259) + 1000(.9259) = \$1{,}018.49 \text{ (1 point)}$$

12% Rate

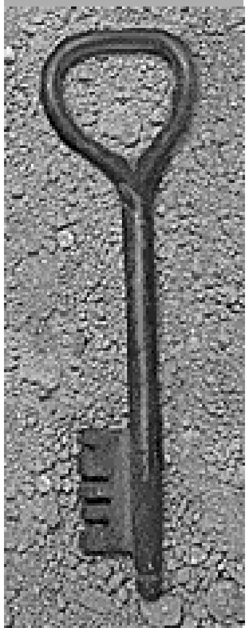
$$V_L = 100(6.8109) + 1000(.1827) = \$863.79 \text{ (1 point)}$$

$$V_S = 100(.8929) + 1000(.8929) = \$991.19 \text{ (1 point)}$$



8-6 Continued

- Explain why long term bond value changes more rapidly with interest rate that the shorter term bond value does.
  - Longer term bond par value is worth less with higher interest rates because it will be paid further into the future.
  - This means more of the return is in the future which increases risk
  - Higher risks mean higher variations in returns.



8-7 Yield to Maturity

- 4 years to maturity date
- Interest at 9% coupon paid annually
- Par value is $1000

a. If P = $829.00 what is k?

Trial and error solution: guess i, solve for P, adjust guess until P computed is $829.00

Since P < 1000, k must be greater than the coupon rate.

Try k = 10%

$$V_b = 90(3.1699) + 1000(.6830) = \$968.29$$

Try k = 12%

$$V_b = 90(3.0373) + 1000(.6355) = \$908.90$$

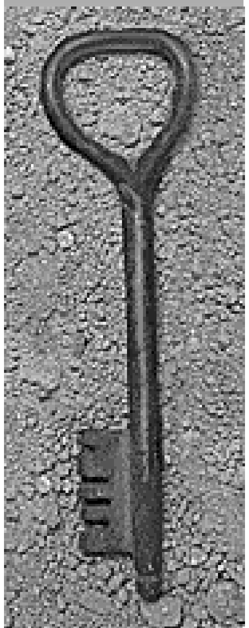
Try k = 14%

$$V_b = 90(2.9137) + 1000(.5921) = \$854.33$$

Try k = 16%

$$V_b = 90(2.7982) + 1000(.5523) = \$804.13$$

$$\Rightarrow 14 < k < 16 \Rightarrow k \cong 15\% \text{ (3 points)}$$



8-7 Continued (Part a Continued)

For the second part of this, $P = \$1104$ is given and a new interest rate, k, must be computed. Since P > Par, we know that $k <$ coupon rate, so $k < 9\%$. Using the same trial-and-error technique, we can solve for k.

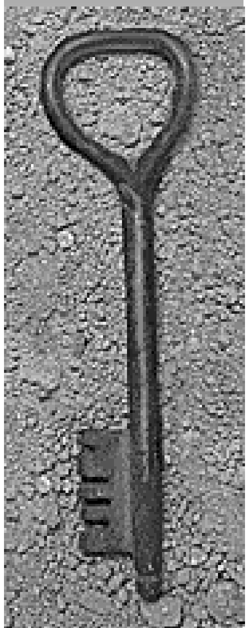
Assume $k = 7\%$

$$V_b = 90(3.3872) + 1000(.7629) = \$1{,}067.74$$

Assume $k = 6\%$

$$V_b = 90(3.4651) + 1000(.7921) = \$1103.95$$

$$\Rightarrow k \cong 6\% \text{ (1 point)}$$



8-7 b Bond Valuation

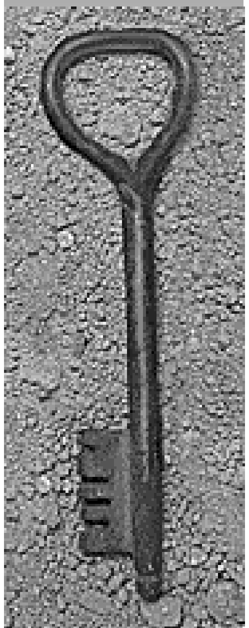
- If kd=12%, would you pay $829.00?

Simple bond valuation problem.

$$V_b = 90(3.0373) + 1000(.6355) = \$908.85$$

$$\text{Since } 908.85 > 829 \Rightarrow \text{Yes, bond is a good buy at } \$829$$

(1 point)



8-8 Yield to Call

- 6 years ago a 20 year bond was issued
- Callable with a 9% premium
- Face was \$1000
- Coupon of 14%
- What is yield to call?

$V_b = C(PVIFA_{k,n}) + (P + CP)(PVIF_{k,n})$

n is the number of years to the call date

CP is the call premium

k is the yield to call

Solve for k by trial and error

Try k = 16%

$V_b = 140(3.6847) + (1000 + 90)(.4104) = \$963.19$

$\Rightarrow k = 16\%$ (2 points)

8-13 Bond Valuation

- $1000 par value bond
- 10% Coupon
- Semi-annual payments (2 x per year)

a. If the market interest rate is reduced to 6% in the second year, what is the fair price of the bond?

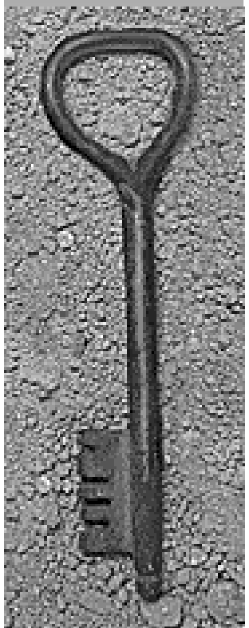
$$V_b = C(PVIFA_{k,n}) + Par(PVIF_{k,n})$$

$$\text{k} = 10/3 = 5\% \text{ paid twice a year}$$

After year 2, 2 x (10 - 2) = 16 payments remain so

n = 16 and the coupon is .05 x 1000 = $50

$$V_b = 50(12.5611) + 1000(.6232) = \$1215.25 \text{ (1 point)}$$



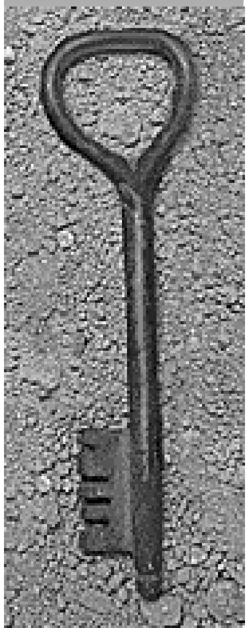
8-13 Continued

b. If the interest rate increased to 12%, what is a fair price for the bond?

$$V_b = 50(10.1059) + 1000(.3936) = \$898.89 \text{ (1 point)}$$

c. If interest rate changes to 6% and stays constant for rest of term, what happens to P?

- As t approaches maturity, the price will decrease until it is equal to par value on the day of maturity.



9-16 Supernormal Growth Valuation

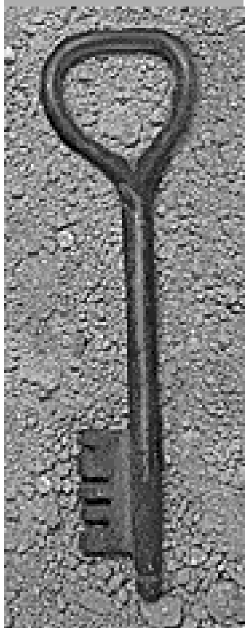
- No dividends for three years
- Year 3 pay $1.00 per share dividend
- Growth of 50% in year 4 and 5
- Then 8% per year thereafter
- Expected return is 15%

$$P = \sum_i \frac{D_i}{(1+k_s)^i} + \sum_n \frac{D_n}{(1+k_s)^n}$$

$$P = \sum_i \frac{D_i}{(1+k_s)^i} + \frac{D_{i+1}/(k_s - g)}{(1+k_s)^i}$$

$$P = \frac{1.00}{(1+.15)^3} + \frac{1.00(1.5)}{(1+.15)^4} + \frac{1.00(1.5)(1.5)}{(1+.15)^5} + \frac{2.25(1.08)/(.15-.08)}{(1+.15)^5}$$

$$P = \$19.89\ (3\ \text{points})$$



9-18 Constant Growth Valuation

- Dividend paid yesterday of $2
- Expected g is 5% for next 3 years
- Hold for three years then sell

a. What is the expected dividend for next 3 years? ($D_0 = 2.00$)

$$D_{i+1} = D_0(1+g)$$

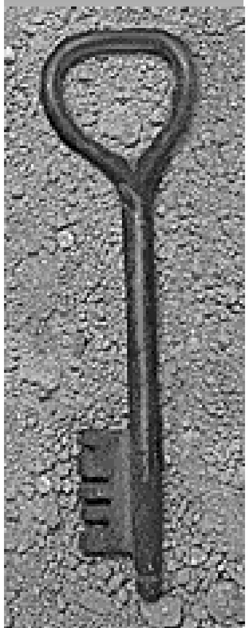
$$D_1 = 2(1+.05) = \$2.10$$

$$D_2 = 2.10(1+.05) = \$2.21$$

$$D_3 = 2.21(1+.05) = \$2.31$$

b. What is the present value of this dividend stream if $k = 12\%$?

$$PV = 2.10(.8929) + 2.21(.7972) + 2.31(.7118) = \$5.28 \text{ (1 point)}$$



9-18 Continued

c. In three years, P is expected to be \$34.73. What is the expected value of this stock price at a 12% discount rate?

$$PV = 34.73(.7118) = \$24.72 \text{ (1 point)}$$

d. What is the most you should pay for this stock under these conditions?

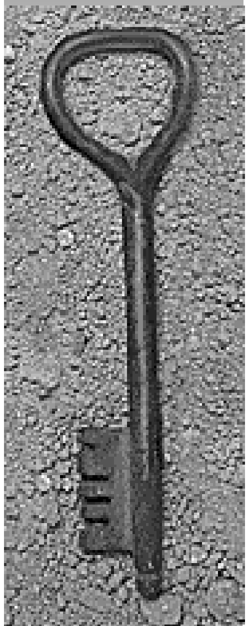
$$V_s = 24.72 + 5.28 = \$30.00 \text{ (1 point)}$$

e. Use the constant growth model to find the value of this stock if $g = 5\%$ and $k = 12\%$.

$$P = \frac{D_1}{(k_s - g)} = \frac{2.00(1.05)}{.12 - .05} = \$30.00 \text{ (1 point)}$$

f. Does the value of the stock depend on your holding period?

Answer: NO.



9-24 Equilibrium Stock Price

- Risk Free Return is 11%
- Required return on market is 14%
- Beta is 1.5

a. If D_1 is \$2.25 and g = constant 5%, what is P?

$$P = \frac{D_1}{k_s - g}$$

CAPM states the following for k_s

$$k_s = k_{rf} + b(k_m - k_{rf})$$

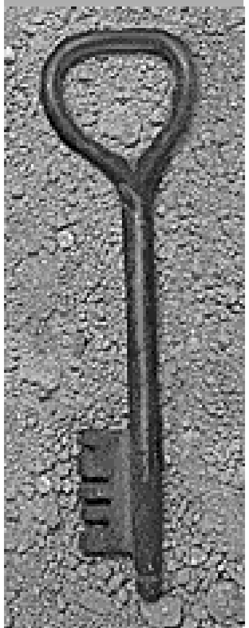
$$k_s = .11 + 1.5(.14 - .11) = .155$$

$$k_s = \frac{2.25}{.155 - .05} = \$21.43 \text{ (1 point)}$$

b. If k_{rf} is 9% and k_m is 12%, what is P?

$$k_s = .09 + 1.5(.12 - .09) = .135$$

$$P = \frac{2.25}{.135 - .05} = \$26.47 \text{ (1 point)}$$



9-24 Continued

c. If k_m is 11%, what is P?

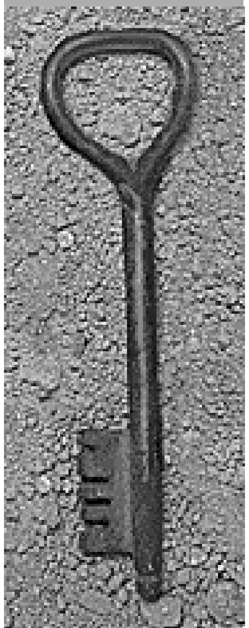
$$k_s = .09 + (.11 - .09)1.5 = .120$$

$$P = \frac{2.25}{.12 - .05} = \$32.14 \text{ (1 point)}$$

d. If g is 6% and b = 1.3, what is P?

$$k_s = .09 + (.11 - .09)1.3 = .136$$

$$P = \frac{2.25}{(.136 - .06)} = \$29.86 \text{ (1 point)}$$



20-2 Valuing Warrants

- Bond A: 20 years and 8% coupon.
- Bond B: 20 years, 6% coupon and warrants
- Par is \$1000 each
- What are warrants worth?

$$\text{Assume, since same firm issues } V_A = V_B$$

$$V_A = \$1000$$

$$V_B = C(PVIFA_{8\%,20}) + PAR(PVIF_{8\%,20}) + V_W$$

$$V_B = 60(9.8181) + 1000(.2145) + V_W$$

$$V_A = V_B = \$1000$$

$$V_W = 1000 - 60(9.8181) - 1000(.2145)$$

$$V_W = \$196.42 \text{ (2 points)}$$