Solutions to Questions and Problems

NOTE: All end-of-chapter problems were solved using a spreadsheet. Many problems require multiple steps. Due to space and readability constraints, when these intermediate steps are included in this solutions manual, rounding may appear to have occurred. However, the final answer for each problem is found without rounding during any step in the problem.

NOTE: Most problems do not explicitly list a par value for bonds. Even though a bond can have any par value, in general, corporate bonds in the United States will have a par value of $1,000. We will use this par value in all problems unless a different par value is explicitly stated.

Basic

1. The price of a pure discount (zero coupon) bond is the present value of the par. Remember, even though there are no coupon payments, the periods are semiannual to stay consistent with coupon bond payments. So, the price of the bond for each YTM is:

a. $P = \$1{,}000/(1 + .05/2)^{20} = \$610.27$

b. $P = \$1{,}000/(1 + .10/2)^{20} = \$376.89$

c. $P = \$1{,}000/(1 + .15/2)^{20} = \$235.41$

2. The price of any bond is the PV of the interest payment, plus the PV of the par value. Notice this problem assumes a semiannual coupon. The price of the bond at each YTM will be:

a. $P = \$35(\{1 – [1/(1 + .035)]^{50} \} / .035) + \$1{,}000[1 / (1 + .035)^{50}]$
$P = \$1{,}000.00$
When the YTM and the coupon rate are equal, the bond will sell at par.

b. $P = \$35(\{1 – [1/(1 + .045)]^{50} \} / .045) + \$1{,}000[1 / (1 + .045)^{50}]$
$P = \$802.38$
When the YTM is greater than the coupon rate, the bond will sell at a discount.

c. $P = \$35(\{1 – [1/(1 + .025)]^{50} \} / .025) + \$1{,}000[1 / (1 + .025)^{50}]$
$P = \$1{,}283.62$
When the YTM is less than the coupon rate, the bond will sell at a premium.

We would like to introduce shorthand notation here. Rather than write (or type, as the case may be) the entire equation for the PV of a lump sum, or the PVA equation, it is common to abbreviate the equations as:

$PVIF_{R,t} = 1 / (1 + r)^t$

which stands for Present Value Interest Factor

$\text{PVIFA}_{R,t} = (\{1 – [1/(1 + r)]^t\} / r)$

which stands for Present Value Interest Factor of an Annuity

These abbreviations are short hand notation for the equations in which the interest rate and the number of periods are substituted into the equation and solved. We will use this shorthand notation in the remainder of the solutions key.

3. Here we are finding the YTM of a semiannual coupon bond. The bond price equation is:

$P = \$1,050 = \$39(\text{PVIFA}_{R\%,20}) + \$1,000(\text{PVIF}_{R\%,20})$

Since we cannot solve the equation directly for R, using a spreadsheet, a financial calculator, or trial and error, we find:

$R = 3.547\%$

Since the coupon payments are semiannual, this is the semiannual interest rate. The YTM is the APR of the bond, so:

$\text{YTM} = 2 \times 3.547\% = 7.09\%$

4. Here we need to find the coupon rate of the bond. All we need to do is to set up the bond pricing equation and solve for the coupon payment as follows:

$P = \$1,175 = C(\text{PVIFA}_{3.8\%,27}) + \$1,000(\text{PVIF}_{3.8\%,27})$

Solving for the coupon payment, we get:

$C = \$48.48$

Since this is the semiannual payment, the annual coupon payment is:

$2 \times \$48.48 = \$96.96$

And the coupon rate is the annual coupon payment divided by par value, so:

Coupon rate = \$96.96 / \$1,000 = .09696 or 9.70%

5. The price of any bond is the PV of the interest payment, plus the PV of the par value. The fact that the bond is denominated in euros is irrelevant. Notice this problem assumes an annual coupon. The price of the bond will be:

$P = €84(\{1 – [1/(1 + .076)]^{15}\} / .076) + €1,000[1 / (1 + .076)^{15}]$
$P = €1,070.18$

6. Here we are finding the YTM of an annual coupon bond. The fact that the bond is denominated in yen is irrelevant. The bond price equation is:

$$P = ¥87{,}000 = ¥5{,}400(\text{PVIFA}_{R\%,21}) + ¥100{,}000(\text{PVIF}_{R\%,21})$$

Since we cannot solve the equation directly for *R*, using a spreadsheet, a financial calculator, or trial and error, we find:

R = 6.56%

Since the coupon payments are annual, this is the yield to maturity.

7. The approximate relationship between nominal interest rates (R), real interest rates (r), and inflation (h) is:

$R = r + h$

Approximate r = .05 –.039 =.011 or 1.10%

The Fisher equation, which shows the exact relationship between nominal interest rates, real interest rates, and inflation is:

$(1 + R) = (1 + r)(1 + h)$

$(1 + .05) = (1 + r)(1 + .039)$

Exact $r = [(1 + .05) / (1 + .039)] – 1 = .0106$ or 1.06%

8. The Fisher equation, which shows the exact relationship between nominal interest rates, real interest rates, and inflation, is:

$(1 + R) = (1 + r)(1 + h)$

$R = (1 + .025)(1 + .047) – 1 = .0732$ or 7.32%

9. The Fisher equation, which shows the exact relationship between nominal interest rates, real interest rates, and inflation, is:

$(1 + R) = (1 + r)(1 + h)$

$h = [(1 + .17) / (1 + .11)] – 1 = .0541$ or 5.41%

10. The Fisher equation, which shows the exact relationship between nominal interest rates, real interest rates, and inflation, is:

$(1 + R) = (1 + r)(1 + h)$

$r = [(1 + .141) / (1.068)] – 1 = .0684$ or 6.84%