Chapter 4
Bonds and Their Valuation
ANSWERS TO END-OF-CHAPTER QUESTIONS

4-1 a. A bond is a promissory note issued by a business or a governmental unit. Treasury bonds, sometimes referred to as government bonds, are issued by the Federal government and are not exposed to default risk. Corporate bonds are issued by corporations and are exposed to default risk. Different corporate bonds have different levels of default risk, depending on the issuing company's characteristics and on the terms of the specific bond. Municipal bonds are issued by state and local governments. The interest earned on most municipal bonds is exempt from federal taxes, and also from state taxes if the holder is a resident of the issuing state. Foreign bonds are issued by foreign governments or foreign corporations. These bonds are not only exposed to default risk, but are also exposed to an additional risk if the bonds are denominated in a currency other than that of the investor's home currency.

b. The par value is the nominal or face value of a stock or bond. The par value of a bond generally represents the amount of money that the firm borrows and promises to repay at some future date. The par value of a bond is often $1,000, but can be $5,000 or more. The maturity date is the date when the bond's par value is repaid to the bondholder. Maturity dates generally range from 10 to 40 years from the time of issue. A call provision may be written into a bond contract, giving the issuer the right to redeem the bonds under specific conditions prior to the normal maturity date. A bond's coupon, or coupon payment, is the dollar amount of interest paid to each bondholder on the interest payment dates. The coupon is so named because bonds used to have dated coupons attached to them which investors could tear off and redeem on the interest payment dates. The coupon interest rate is the stated rate of interest on a bond.

c. In some cases, a bond's coupon payment may vary over time. These bonds are called floating rate bonds. Floating rate debt is popular with investors because the market value of the debt is stabilized. It is advantageous to corporations because firms can issue long-term debt without committing themselves to paying a historically high interest rate for the entire life of the loan. Zero coupon bonds pay no coupons at all, but are offered at a substantial discount below their par values and hence provide capital appreciation rather than interest income. In general, any bond originally offered at a price signifi-cantly below its par value is called an original issue discount bond (OID).

d. Most bonds contain a call provision, which gives the issuing corporation the right to call the bonds for redemption. The call provision generally states that if the bonds are called, the company must pay the bondholders an amount greater than the par value, a call premium. Redeemable bonds give investors the right to sell the bonds back to the corporation at a price that is usually close to the par value. If interest rates rise, investors can redeem the bonds and reinvest at the higher rates. A sinking fund provision facilitates the orderly retirement of a bond issue. This can be achieved in one of two ways: The company can call in for redemption (at par value) a certain percentage of bonds each year. The company may buy the required amount of bonds on the open market.

e. Convertible bonds are securities that are convertible into shares of common stock, at a fixed price, at the option of the bondholder. Bonds issued with warrants are similar to convertibles. Warrants are options which permit the holder to buy stock for a stated price, thereby providing a capital gain if the stock price rises. Income bonds pay interest only if the interest is earned. These securities cannot bankrupt a company, but from an investor's standpoint they are riskier than "regular" bonds. The interest rate of an indexed, or purchasing power, bond is based on an inflation index such as the consumer price index (CPI), so the interest paid rises automatically when the inflation rate rises, thus protecting the bondholders against inflation.

f. Bond prices and interest rates are inversely related; that is, they tend to move in the opposite direction from one another. A fixed-rate bond will sell at par when its coupon interest rate is equal to the going rate of interest, r_d. When the going rate of interest is above the coupon rate, a fixed-rate bond will sell at a "discount" below its par value. If current interest rates are below the coupon rate, a fixed-rate bond will sell at a "premium" above its par value.

g. The current yield on a bond is the annual coupon payment divided by the current market price. YTM, or yield to maturity, is the rate of interest earned on a bond if it is held to maturity. Yield to call (YTC) is the rate of interest earned on a bond if it is called. If current interest rates are well below an outstanding callable bond's coupon rate, the YTC may be a more relevant estimate of expected return than the YTM, since the bond is likely to be called.

h. The shorter the maturity of the bond, the greater the risk of a decrease in interest rates. The risk of a decline in income due to a drop in interest rates is called reinvestment rate risk. Interest rates fluctuate over time, and people or firms who invest in bonds are exposed to risk from changing interest rates, or interest rate risk. The longer the maturity of the bond, the greater the exposure to interest rate risk. Interest rate risk relates to the value of the bonds in a portfolio, while reinvestment rate risk relates to the income the portfolio produces. No fixed-rate bond can be considered totally riskless. Bond portfolio managers try to balance these two risks, but some risk always exists in any bond. Another important risk associated with bonds is default risk. If the issuer defaults, investors receive less than the promised return on the bond. Default risk is influenced by both the financial strength of the issuer and the terms of the bond contract, especially whether collateral has been pledged to secure the bond. The greater the default risk, the higher the bond's yield to maturity.

i. Corporations can influence the default risk of their bonds by changing the type of bonds they issue. Under a mortgage bond, the corporation pledges certain assets as security for the bond. All such bonds are written subject to an indenture, which is a legal document that spells out in detail the rights of both the bondholders and the corporation. A debenture is an unsecured bond, and as such, it provides no lien against specific property as security for the obligation. Debenture holders are, therefore, general creditors whose claims are protected by property not otherwise pledged. Subordinated debentures have claims on assets, in the event of bankruptcy, only after senior debt as named in the subordinated debt's indenture has been paid off. Subordinated debentures may be subordinated to designated notes payable or to all other debt.

j. A development bond is a tax-exempt bond sold by state and local governments whose proceeds are made available to corporations for specific uses deemed (by Congress) to be in the public interest. Municipalities can insure their bonds, in which an insurance company guarantees to pay the coupon and principal payments should the issuer default. This reduces the risk to investors who are willing to accept a lower coupon rate for an insured bond issue vis-a-vis an uninsured issue. Bond issues are normally assigned quality ratings by major rating agencies, such as Moody's Investors Service and Standard & Poor's Corporation. These ratings reflect the probability that a bond will go into default. Aaa (Moody's) and AAA (S&P) are the highest ratings. Rating assignments are based on qualitative and quantitative factors including the firm's debt/assets ratio, current ratio, and coverage ratios. Because a bond's rating is an indicator of its default risk, the rating has a direct, measurable influence on the bond's interest rate and the firm's cost of debt capital. Junk bonds are high-risk, high-yield bonds issued to finance leveraged buyouts, mergers, or troubled companies. Most bonds are purchased by institutional investors rather than individuals, and many institutions are restricted to investment grade bonds, securities with ratings of Baa/BBB or above.

4-2 False. Short-term bond prices are less sensitive than long-term bond prices to interest rate changes because funds invested in short-term bonds can be reinvested at the new interest rate sooner than funds tied up in long-term bonds.

4-3 The price of the bond will fall and its YTM will rise if interest rates rise. If the bond still has a long term to maturity, its YTM will reflect long-term rates. Of course, the bond's *price* will be less affected by a change in interest rates if it has been outstanding a long time and matures shortly. While this is true, it should be noted that the YTM will increase only for buyers who purchase the bond after the change in interest rates and not for buyers who purchased previous to the change. If the bond is purchased and held to maturity, the bondholder's YTM will not change, regardless of what happens to interest rates.

4-4 If interest rates decline significantly, the values of callable bonds will not rise by as much as those of bonds without the call provision. It is likely that the bonds would be called by the issuer before maturity, so that the issuer can take advantage of the new, lower rates.

4-5 From the corporation's viewpoint, one important factor in establishing a sinking fund is that its own bonds generally have a higher yield than do government bonds; hence, the company saves more interest by retiring its own bonds than it could earn by buying government bonds. This factor causes firms to favor the second procedure. Investors also would prefer the annual retirement procedure if they thought that interest rates were more likely to rise than to fall, but they would prefer the government bond purchases program if they thought rates were likely to fall. In addition, bondholders recognize that, under the government bond purchase scheme, each bondholder would be entitled to a given amount of cash from the liquidation of the sinking fund if the firm should go into default, whereas under the annual retirement plan, some of the holders would receive a cash benefit while others would benefit only indirectly from the fact that there would be fewer bonds outstanding.

On balance, investors seem to have little reason for choosing one method over the other, while the annual retirement method is clearly more beneficial to the firm. The consequence has been a pronounced trend toward annual retirement and away from the accumulation scheme.

SOLUTIONS TO END-OF-CHAPTER PROBLEMS

4-1 With your financial calculator, enter the following:

N = 10; I = YTM = 9%; PMT = 0.08 × 1,000 = 80; FV = 1000; PV = V_B = ?
PV = $935.82.

Alternatively,

$V_B = \$80(PVIFA_{9\%,10}) + \$1,000(PVIF_{9\%,10})$
$= \$80((1- 1/1.09^{10})/0.09) + \$1,000(1/1.09^{10})$
$= \$80(6.4177) + \$1,000(0.4224)$
$= \$513.42 + \$422.40 = \$935.82.$

4-2 With your financial calculator, enter the following:

N = 12; PV = -850; PMT = 0.10 × 1,000 = 100; FV = 1000; I = YTM = ?
YTM = 12.48%.

4-3 With your financial calculator, enter the following to find YTM:

N = 10 × 2 = 20; PV = -1100; PMT = 0.08/2 × 1,000 = 40; FV = 1000; I = YTM = ?
YTM = 3.31% × 2 = 6.62%.

With your financial calculator, enter the following to find YTC:

N = 5 × 2 = 10; PV = -1100; PMT = 0.08/2 × 1,000 = 40; FV = 1050; I = YTC = ?
YTC = 3.24% × 2 = 6.49%.

4-4 With your financial calculator, enter the following to find the current value of the bonds, so you can then calculate their current yield:

N = 7; I = YTM = 8; PMT = 0.09 × 1,000 = 90; FV = 1000; PV = V_B = ?
PV = $1,052.06. Current yield = $90/$1,052.06 = 8.55%.

Alternatively,

$V_B = \$90(PVIFA_{8\%,7}) + \$1,000(PVIF_{8\%,7})$
$= \$90((1- 1/1.08^{7})/0.08) + \$1,000(1/1.08^{7})$
$= \$90(5.2064) + \$1,000(0.5835)$
$= \$468.58 + \$583.50 = \$1,052.08.$

Current yield = $90/$1,052.08 = 8.55%.

4-5 The problem asks you to find the price of a bond, given the following facts:

N = 16; I = 8.5/2 = 4.25; PMT = 45; FV = 1000.

With a financial calculator, solve for PV = $1,028.60

4-6 a. $V_B = PMT(PVIFA_{i,n}) + FV(PVIF_{i,n})$
$= PMT((1- 1/(1+i^n))/i) + FV(1/(1+i)^n)$

1. 5%: Bond L: $V_B = \$100(10.3797) + \$1,000(0.4810) = \$1,518.97.$
Bond S: $V_B = (\$100 + \$1,000)(0.9524) = \$1,047.64.$

2. 8%: Bond L: $V_B = \$100(8.5595) + \$1,000(0.3152) = \$1,171.15.$
Bond S: $V_B = (\$100 + \$1,000)(0.9259) = \$1,018.49.$

3. 12%: Bond L: $V_B = \$100(6.8109) + \$1,000(0.1827) = \$863.79.$
Bond S: $V_B = (\$100 + \$1,000)(0.8929) = \$982.19.$

Calculator solutions:

1. 5%: Bond L: Input N = 15, I = 5, PMT = 100, FV = 1000, PV = ?, PV = $1,518.98.
Bond S: Change N = 1, PV = ? PV = $1,047.62.

2. 8%: Bond L: From Bond S inputs, change N = 15 and I = 8, PV = ?, PV = $1,171.19.
Bond S: Change N = 1, PV = ? PV = $1,018.52.

3. 12%: Bond L: From Bond S inputs, change N = 15 and I = 12, PV = ? PV = $863.78.
Bond S: Change N = 1, PV = ? PV = $982.14.

b. Think about a bond that matures in one month. Its present value is influenced primarily by the maturity value, which will be received in only one month. Even if interest rates double, the price of the bond will still be close to $1,000. A one-year bond's value would fluctuate more than the one-month bond's value because of the difference in the timing of receipts. However, its value would still be fairly close to $1,000 even if interest rates doubled. A long-term bond paying semiannual coupons, on the other hand, will be dominated by distant receipts, receipts which are multiplied by $1/(1 + r_d/2)^t$, and if r_d increases, these multipliers will decrease significantly. Another way to view this problem is from an opportunity point of view. A one-month bond can be reinvested at the new rate very quickly, and hence the opportunity to invest at this new rate is not lost; however, the long-term bond locks in subnormal returns for a long period of time.

4-7 a. $V_B = \sum_{t=1}^{N} \frac{INT}{(1+r_d)^t} + \frac{M}{(1+r_d)^N} = INT(PVIFA_{r_d,N}) + M(PVIF_{r_d,N})$

= PMT((1- 1/(1+r_d^n))/r_d) + FV(1/(1+r_d)^n).

M = $1,000. INT = 0.09($1,000) = $90.

1. $829 = $90($PVIFA_{r_d,4}$) + $1,000($PVIF_{r_d,4}$)

$829= $90((1- 1/(1+$r_d^4$))/rd) + $1,000(1/(1+$r_d$)^4).

The YTM can be found by trial-and-error. If the YTM was 9 percent, the bond value would be its maturity value. Since the bond sells at a discount, the YTM must be greater than 9 percent. Let's try 10 percent.

At 10%, V_B = $90(3.1699) + $1,000(0.6830) = $285.29 + $683.00
= $968.29.

$968.29 > $829.00; therefore, the bond's YTM is greater than 10 percent.

Try 15 percent.

At 15%, V_B = $90(2.8550) + $1,000(0.5718) = $256.95 + $571.80
= $828.75.

Therefore, the bond's YTM is approximately 15 percent.

2. $1,104 = $90($PVIFA_{r_d,4}$) + $1,000($PVIF_{r_d,4}$) .

The bond is selling at a premium; therefore, the YTM must be below 9 percent. Try 6 percent.

At 6%, V_B = $90(3.4651) + $1,000(0.7921) = $311.86 + $792.10
= $1,103.96.

Therefore, when the bond is selling for $1,104, its YTM is approximately 6 percent.

Calculator solution:

1. Input N = 4, PV = -829, PMT = 90, FV = 1000, I = ? I = 14.99%.

2. Change PV = -1104, I = ? I = 6.00%.

b. Yes. At a price of $829, the yield to maturity, 15 percent, is greater than your required rate of return of 12 percent. If your required rate of return were 12 percent, you should be willing to buy the bond at any price below $908.86 (using the tables) and $908.88 (using a calculator).

4-8 $1,000 = $140(PVIFA$_{r_d,6}$) + $1,090(PVIF$_{r_d,6}$)

$1,000 = $140((1- 1/(1+$r_d$)^6))/$r_d$) + $1,090(1/(1+$r_d$)^6).

Try 18 percent:

$PV_{18\%}$ = $140(3.4976) + $1,090(0.3704) = $489.66 + $403.74 = $893.40.
18 percent is too high.

Try 15 percent:

$PV_{15\%}$ = $140(3.7845) + $1,090(0.4323) = $529.83 + $471.21 = $1,001.04.

15 percent is slightly low.

The rate of return is approximately 15.03 percent, found with a calculator using the following inputs.

N = 6; PV = -1000; PMT = 140; FV = 1090; I = ? Solve for I = 15.03%.

4-9 a. $1,100 = $60(PVIFA$_{r_d/2,20}$) + $1,000(PVIF$_{r_d2,20}$).

Using a financial calculator, input the following:

N = 20, PV = -1100, PMT = 60, FV = 1000, and solve for I = 5.1849%.

However, this is a periodic rate. The nominal annual rate = 5.1849%(2) = 10.3699% 10.37%.

b. The current yield = $120/$1,100 = 10.91%.

c. YTM = Current Yield + Capital Gains (Loss) Yield
10.37% = 10.91% + Capital Loss Yield
-0.54% = Capital Loss Yield.

d. $1,100 = $60(PVIFA$_{r_d/2,8}$) + $1,060(PVIF$_{r_d/2,8}$).

Using a financial calculator, input the following:

N = 8, PV = -1100, PMT = 60, FV = 1060, and solve for I = 5.0748%.

However, this is a periodic rate. The nominal annual rate = 5.0748%(2) = 10.1495% 10.15%.

4-10 The problem asks you to solve for the YTM, given the following facts:

N = 5, PMT = 80, and FV = 1000. In order to solve for I we need PV.

However, you are also given that the current yield is equal to 8.21%. Given this information, we can find PV.

Current yield = Annual interest/Current price
0.0821 = $80/PV
PV = $80/0.0821 = $974.42.

Now, solve for the YTM with a financial calculator:

N = 5, PV = -974.42, PMT = 80, and FV = 1000. Solve for I = YTM = 8.65%.

4-11 The problem asks you to solve for the current yield, given the following facts: N = 14, I = 10.5883/2 = 5.2942, PV = -1020, and FV = 1000. In order to solve for the current yield we need to find PMT. With a financial calculator, we find PMT = $55.00. However, because the bond is a semiannual coupon bond this amount needs to be multiplied by 2 to obtain the annual interest payment: $55.00(2) = $110.00. Finally, find the current yield as follows:

Current yield = Annual interest/Current Price = $110/$1,020 = 10.78%.

4-12 The bond is selling at a large premium, which means that its coupon rate is much higher than the going rate of interest. Therefore, the bond is likely to be called--it is more likely to be called than to remain outstanding until it matures. Thus, it will probably provide a return equal to the YTC rather than the YTM. So, there is no point in calculating the YTM--just calculate the YTC. Enter these values:

N = 10, PV = -1353.54, PMT = 70, FV = 1050, and then solve for I.

The periodic rate is 3.24 percent, so the nominal YTC is 2 x 3.24% = 6.47%. This would be close to the going rate, and it is about what the firm would have to pay on new bonds.

4-13 a. The bonds now have an 8-year, or a 16-semiannual period, maturity, and their value is calculated as follows:

$$V_B = \sum_{t=1}^{16} \frac{\$50}{(1.03)^t} + \frac{\$1,000}{(1.03)^{16}} = \$50(12.5611) + \$1,000(0.6232)$$

$$= \$628.06 + \$623.20 = \$1,251.26.$$

Calculator solution: Input N = 16, I = 3, PMT = 50, FV = 1000, PV = ? PV = $1,251.22.

b. $V_B = \$50(10.1059) + \$1,000(0.3936) = \$505.30 + \$393.60 = \$898.90.$

Calculator solution: Change inputs from Part a to I = 6, PV = ? PV = $898.94.

c. The price of the bond will decline toward $1,000, hitting $1,000 (plus accrued interest) at the maturity date 8 years (16 six-month periods) hence.

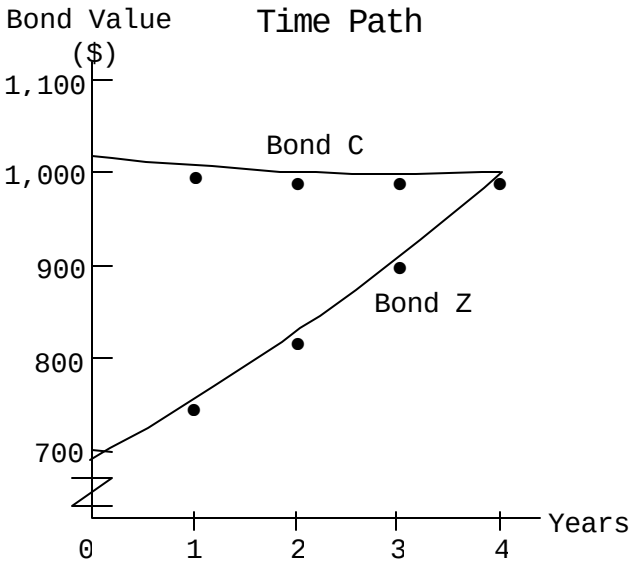
4-14

	Price at 8%	Price at 7%	Pctge. change
10-year, 10% annual coupon	$1,134.20	$1,210.71	6.75%
10-year zero	463.19	508.35	9.75
5-year zero	680.58	712.99	4.76
30-year zero	99.38	131.37	32.19
$100 perpetuity	1,250.00	1,428.57	14.29

4-15 a.

t	Price of Bond C	Price of Bond Z
0	$1,012.79	$ 693.04
1	1,010.02	759.57
2	1,006.98	832.49
3	1,003.65	912.41
4	1,000.00	1,000.00

b.

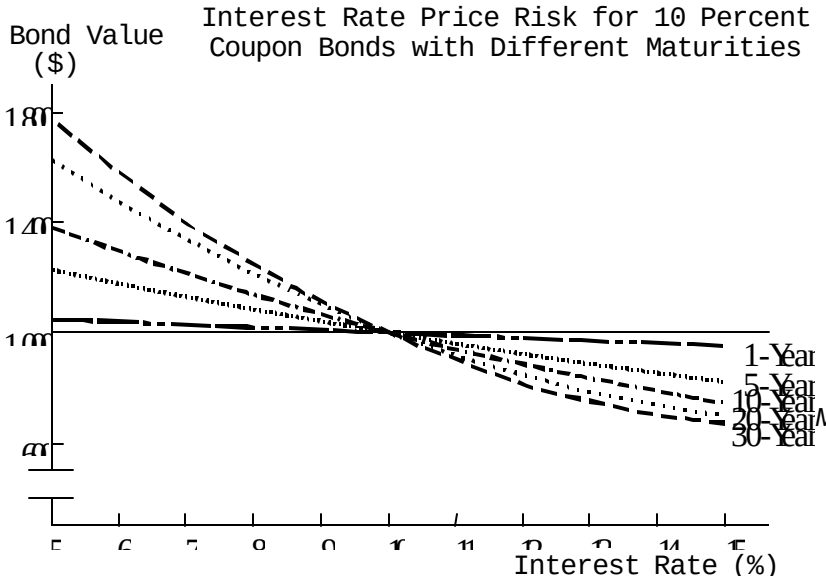


WHAT IS *INTEREST RATE (OR PRICE) RISK*? WHICH BOND HAS MORE INTEREST RATE RISK, AN ANNUAL PAYMENT 1-YEAR BOND OR A 10-YEAR BOND? WHY?

ANSWER: INTEREST RATE RISK, WHICH IS OFTEN JUST CALLED PRICE RISK, IS THE RISK THAT A BOND WILL LOSE VALUE AS THE RESULT OF AN INCREASE IN INTEREST RATES. EARLIER, WE DEVELOPED THE FOLLOWING VALUES FOR A 10 PERCENT, ANNUAL COUPON BOND:

	MATURITY			
r	1-YEAR	CHANGE	10-YEAR	CHANGE
5%	$1,048	4.8%	$1,386	38.6%
10	1,000		1,000	
15	956	4.4%	749	25.1%

A 5 PERCENTAGE POINT INCREASE IN r CAUSES THE VALUE OF THE 1-YEAR BOND TO DECLINE BY ONLY 4.8 PERCENT, BUT THE 10-YEAR BOND DECLINES IN VALUE BY MORE THAN 38 PERCENT. THUS, THE 10-YEAR BOND HAS MORE INTEREST RATE PRICE RISK.



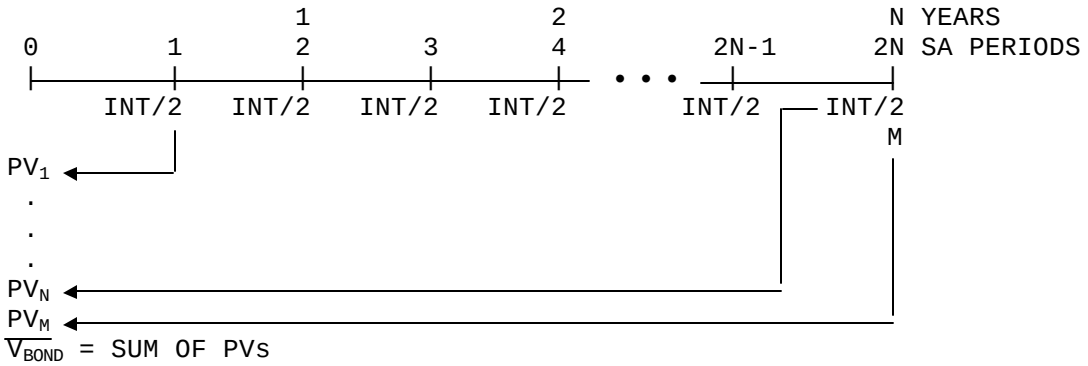
THE GRAPH ABOVE SHOWS THE RELATIONSHIP BETWEEN BOND VALUES AND INTEREST RATES FOR A 10 PERCENT, ANNUAL COUPON BOND WITH DIFFERENT MATURITIES. THE LONGER THE MATURITY, THE GREATER THE CHANGE IN VALUE FOR A GIVEN CHANGE IN INTEREST RATES, r_d.

H. WHAT IS REINVESTMENT RATE RISK? WHICH HAS MORE REINVESTMENT RATE RISK, A 1-YEAR BOND OR A 10-YEAR BOND?

ANSWER: INVESTMENT RATE RISK IS DEFINED AS THE RISK THAT CASH FLOWS (INTEREST PLUS PRINCIPAL REPAYMENTS) WILL HAVE TO BE REINVESTED IN THE FUTURE AT RATES LOWER THAN TODAY'S RATE. TO ILLUSTRATE, SUPPOSE YOU JUST WON THE LOTTERY AND NOW HAVE $500,000. YOU PLAN TO INVEST THE MONEY AND THEN LIVE ON THE INCOME FROM YOUR INVESTMENTS. SUPPOSE YOU BUY A 1-YEAR BOND WITH A YTM OF 10 PERCENT. YOUR INCOME WILL BE $50,000 DURING THE FIRST YEAR. THEN, AFTER 1 YEAR, YOU WILL RECEIVE YOUR $500,000 WHEN THE BOND MATURES, AND YOU WILL THEN HAVE TO REINVEST THIS AMOUNT. IF RATES HAVE FALLEN TO 3 PERCENT, THEN YOUR INCOME WILL FALL FROM $50,000 TO $15,000. ON THE OTHER HAND, HAD YOU BOUGHT 30-YEAR BONDS THAT YIELDED 10%, YOUR INCOME WOULD HAVE REMAINED CONSTANT AT $50,000 PER YEAR. CLEARLY, BUYING BONDS THAT HAVE SHORT MATURITIES CARRIES REINVESTMENT RATE RISK. NOTE THAT LONG MATURITY BONDS ALSO HAVE REINVESTMENT RATE RISK, BUT THE RISK APPLIES ONLY TO THE COUPON PAYMENTS, AND NOT TO THE PRINCIPAL AMOUNT. SINCE THE COUPON PAYMENTS ARE SIGNIFICANTLY LESS THAN THE PRINCIPAL AMOUNT, THE REINVESTMENT RATE RISK ON A LONG-TERM BOND IS SIGNIFICANTLY LESS THAN ON A SHORT-TERM BOND.

I. HOW DOES THE EQUATION FOR VALUING A BOND CHANGE IF SEMIANNUAL PAYMENTS ARE MADE? FIND THE VALUE OF A 10-YEAR, SEMIANNUAL PAYMENT, 10 PERCENT COUPON BOND IF NOMINAL r_d = 13%. (HINT: $PVIF_{6.5\%,20}$ = 0.2838 AND $PVIFA_{6.5\%,20}$ = 11.0185.)

ANSWER: IN REALITY, VIRTUALLY ALL BONDS ISSUED IN THE U.S. HAVE SEMIANNUAL COUPONS AND ARE VALUED USING THE SETUP SHOWN BELOW:



WE WOULD USE THIS EQUATION TO FIND THE BOND'S VALUE:

$$V_B = \sum_{t=1}^{2N} \frac{INT/2}{(1 + r_d/2)^t} + \frac{M}{(1 + r_d/2)^{2N}}.$$

THE PAYMENT STREAM CONSISTS OF AN ANNUITY OF 2N PAYMENTS PLUS A LUMP SUM EQUAL TO THE MATURITY VALUE.

TO FIND THE VALUE OF THE 10-YEAR, SEMIANNUAL PAYMENT BOND, SEMIANNUAL INTEREST = ANNUAL COUPON/2 = $100/2 = $50 AND N = 2 (YEARS TO MATURITY) = 2(10) = 20. TO FIND THE VALUE OF THE BOND WITH A FINANCIAL CALCULATOR, ENTER N = 20, $r_d/2$ = I = 5, PMT = 50, FV = 1000, AND THEN PRESS PV TO DETERMINE THE VALUE OF THE BOND. ITS VALUE IS $1,000.

YOU COULD THEN CHANGE r = i TO SEE WHAT HAPPENS TO THE BOND'S VALUE AS r CHANGES, AND PLOT THE VALUES--THE GRAPH WOULD LOOK LIKE THE ONE WE DEVELOPED EARLIER.

FOR EXAMPLE, IF r ROSE TO 13%, WE WOULD INPUT I = 6.5 RATHER THAN 5%, AND FIND THE 10-YEAR BOND'S VALUE TO BE $834.72. IF r FELL TO 7%, THEN INPUT I = 3.5 AND PRESS PV TO FIND THE BOND'S NEW VALUE, $1,213.19.

WE WOULD FIND THE VALUES WITH A FINANCIAL CALCULATOR, BUT THEY COULD ALSO BE FOUND WITH FORMULAS. THUS:

$$V_{10\text{-YEAR}} = \$50(PVIFA_{5\%,20}) + \$1{,}000(PVIF_{5\%,20})$$
$$= \$50\ ((1 - 1/(1+0.05)^{20})/0.065) + \$1{,}000\ (1/(1+0.05)^{20})$$
$$= \$50(12.4622) + \$1{,}000(0.37689) = \$623.11 + \$376.89 = \$1{,}000.00.$$

AT A 13 PERCENT REQUIRED RETURN:

$$V_{10\text{-YEAR}} = \$50(PVIFA_{6.5\%,20}) + \$1{,}000(PVIF_{6.5\%,20})$$
$$= \$50\ ((1 - 1/(1+0.065)^{20})/0.065) + \$1{,}000\ (1/(1+0.065)^{20})$$
$$= \$834.72.$$

AT A 7 PERCENT REQUIRED RETURN:

$V_{10\text{-YEAR}} = \$50(PVIFA_{3.5\%,20}) + \$1{,}000(PVIF_{3.5\%,20})$
$= \$50\ ((1- 1/(1+0.035)^{20})/0.035) + \$1{,}000\ (1/(1+0.035)^{20})$
$= \$1{,}213.19.$

J. SUPPOSE YOU COULD BUY, FOR $1,000, EITHER A 10 PERCENT, 10-YEAR, ANNUAL PAYMENT BOND OR A 10 PERCENT, 10-YEAR, SEMIANNUAL PAYMENT BOND. THEY ARE EQUALLY RISKY. WHICH WOULD YOU PREFER? IF $1,000 IS THE PROPER PRICE FOR THE SEMIANNUAL BOND, WHAT IS THE EQUILIBRIUM PRICE FOR THE ANNUAL PAYMENT BOND?

ANSWER: THE SEMIANNUAL PAYMENT BOND WOULD BE BETTER. ITS EAR WOULD BE:

$$EAR = \left(1 + \frac{r_{Nom}}{m}\right)^{m} - 1 = \left(1 + \frac{0.10}{2}\right)^{2} - 1 = 10.25\%.$$

AN EAR OF 10.25% IS CLEARLY BETTER THAN ONE OF 10.0%, WHICH IS WHAT THE ANNUAL PAYMENT BOND OFFERS. YOU, AND EVERYONE ELSE, WOULD PREFER IT.

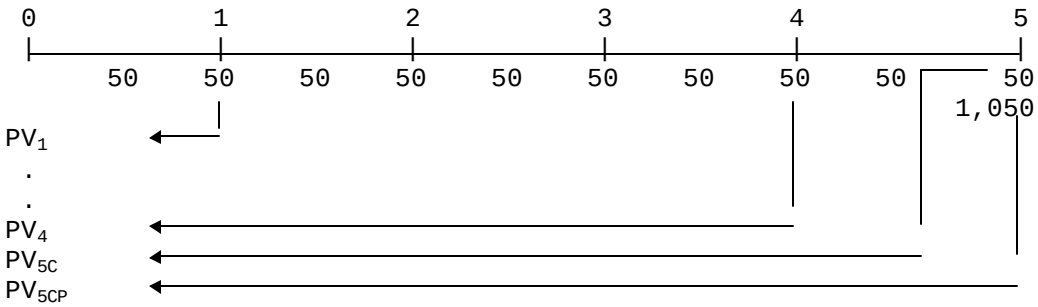
IF THE GOING RATE OF INTEREST ON SEMIANNUAL BONDS IS r_{Nom} = 10%, WITH AN EAR OF 10.25%, THEN IT WOULD NOT BE APPROPRIATE TO FIND THE VALUE OF THE ANNUAL PAYMENT BOND USING A 10% EAR. IF THE ANNUAL PAYMENT BOND WERE TRADED IN THE MARKET, ITS VALUE WOULD BE FOUND USING 10.25%, BECAUSE INVESTORS WOULD INSIST ON GETTING THE SAME EAR ON THE TWO BONDS, BECAUSE THEIR RISK IS THE SAME. THEREFORE, YOU COULD FIND THE VALUE OF THE ANNUAL PAYMENT BOND, USING 10.25%, WITH YOUR CALCULATOR. IT WOULD BE $984.80 VERSUS $1,000 FOR THE SEMIANNUAL PAYMENT BOND.

NOTE THAT, IF THE ANNUAL PAYMENT BOND WERE SELLING FOR $984.80 IN THE MARKET, ITS EAR WOULD BE 10.25%. THIS VALUE CAN BE FOUND BY ENTERING N = 10, PV = -984.80, PMT = 100, AND FV = 1000 INTO A FINANCIAL CALCULATOR AND THEN PRESSING THE r = i BUTTON TO FIND THE ANSWER, 10.25%. WITH THIS RATE, AND THE $984.80 PRICE, THE ANNUAL AND SEMIANNUAL PAYMENT BONDS WOULD BE IN EQUILIBRIUM--INVESTORS WOULD GET THE SAME RATE OF RETURN ON EITHER BOND, SO THERE WOULD NOT BE A TENDENCY TO SELL ONE AND BUY THE OTHER (AS THERE WOULD BE IF THEY WERE BOTH PRICED AT $1,000.)

K. SUPPOSE A 10-YEAR, 10 PERCENT, SEMIANNUAL COUPON BOND WITH A PAR VALUE OF $1,000 IS CURRENTLY SELLING FOR $1,135.90, PRODUCING A NOMINAL YIELD TO MATURITY OF 8 PERCENT. HOWEVER, THE BOND CAN BE CALLED AFTER 5 YEARS FOR A PRICE OF $1,050.

K. 1. WHAT IS THE BOND'S *NOMINAL YIELD TO CALL (YTC)*?

ANSWER: IF THE BOND WERE CALLED, BONDHOLDERS WOULD RECEIVE $1,050 AT THE END OF YEAR 5. THUS, THE TIME LINE WOULD LOOK LIKE THIS:



THE EASIEST WAY TO FIND THE YTC ON THIS BOND IS TO INPUT VALUES INTO YOUR CALCULATOR: N = 10; PV = -1135.90; PMT = 50; AND FV = 1050, WHICH IS THE PAR VALUE PLUS A CALL PREMIUM OF $50; AND THEN PRESS THE r = I BUTTON TO FIND I = 3.765%. HOWEVER, THIS IS THE 6-MONTH RATE, SO WE WOULD FIND THE NOMINAL RATE ON THE BOND AS FOLLOWS:

$$r_{Nom} = 2(3.765\%) = 7.5301\% \approx 7.5\%.$$

THIS 7.5% IS THE RATE BROKERS WOULD QUOTE IF YOU ASKED ABOUT BUYING THE BOND.

YOU COULD ALSO CALCULATE THE EAR ON THE BOND:

$$EAR = (1.03765)^2 - 1 = 7.672\%.$$

USUALLY, PEOPLE IN THE BOND BUSINESS JUST TALK ABOUT NOMINAL RATES, WHICH IS OK SO LONG AS ALL THE BONDS BEING COMPARED ARE ON A SEMIANNUAL PAYMENT BASIS. WHEN YOU START MAKING COMPARISONS AMONG INVESTMENTS WITH DIFFERENT PAYMENT PATTERNS, THOUGH, IT IS IMPORTANT TO CONVERT TO EARS.

K. 2. IF YOU BOUGHT THIS BOND, DO YOU THINK YOU WOULD BE MORE LIKELY TO EARN THE YTM OR THE YTC? WHY?

ANSWER: SINCE THE COUPON RATE IS 10% VERSUS YTC = r_d = 7.53%, IT WOULD PAY THE COMPANY TO CALL THE BOND, GET RID OF THE OBLIGATION TO PAY $100 PER YEAR IN INTEREST, AND SELL REPLACEMENT BONDS WHOSE INTEREST WOULD BE ONLY $75.30 PER YEAR. THEREFORE, IF INTEREST RATES REMAIN AT THE CURRENT LEVEL UNTIL THE CALL DATE, THE BOND WILL SURELY BE CALLED, SO INVESTORS SHOULD EXPECT TO EARN 7.53%. IN GENERAL, INVESTORS SHOULD EXPECT TO EARN THE YTC ON PREMIUM BONDS, BUT TO EARN THE YTM ON PAR AND DISCOUNT BONDS. (BOND BROKERS PUBLISH LISTS OF THE BONDS THEY HAVE FOR SALE; THEY QUOTE YTM OR YTC DEPENDING ON WHETHER THE BOND SELLS AT A PREMIUM OR A DISCOUNT.)

L. DISNEY'S BONDS WERE ISSUED WITH A YIELD TO MATURITY OF 7.5 PERCENT. DOES THE YIELD TO MATURITY REPRESENT THE PROMISED OR EXPECTED RETURN ON THE BOND?

ANSWER: THE YIELD TO MATURITY IS THE RATE OF RETURN EARNED ON A BOND IF IT IS HELD TO MATURITY. IT CAN BE VIEWED AS THE BOND'S PROMISED RATE OF RETURN, WHICH IS THE RETURN THAT INVESTORS WILL RECEIVE IF ALL THE PROMISED PAYMENTS ARE MADE. THE YIELD TO MATURITY EQUALS THE EXPECTED RATE OF RETURN ONLY IF (1) THE PROBABILITY OF DEFAULT IS ZERO AND (2) THE BOND CANNOT BE CALLED. FOR BONDS WHERE THERE IS SOME DEFAULT RISK, OR WHERE THE BOND MAY BE CALLED, THERE IS SOME PROBABILITY THAT THE PROMISED PAYMENTS TO MATURITY WILL NOT BE RECEIVED, IN WHICH CASE, THE PROMISED YIELD TO MATURITY WILL DIFFER FROM THE EXPECTED RETURN.

M. DISNEY'S BONDS WERE RATED AA- BY S&P. WOULD YOU CONSIDER THESE BONDS INVESTMENT GRADE OR JUNK BONDS?

ANSWER: THE DISNEY BONDS WOULD BE INVESTMENT GRADE BONDS. TRIPLE-A, DOUBLE-A, SINGLE-A, AND TRIPLE-B BONDS ARE CONSIDERED INVESTMENT GRADE. DOUBLE-B AND LOWER-RATED BONDS ARE CONSIDERED SPECULATIVE, OR JUNK BONDS, BECAUSE THEY HAVE A SIGNIFICANT PROBABILITY OF GOING INTO DEFAULT.

MANY FINANCIAL INSTITUTIONS ARE PROHIBITED FROM BUYING JUNK BONDS.

N. WHAT FACTORS DETERMINE A COMPANY'S BOND RATING?

ANSWER: BOND RATINGS ARE BASED ON BOTH QUALITATIVE AND QUANTITATIVE FACTORS, SOME OF WHICH ARE LISTED BELOW.

1. FINANCIAL PERFORMANCE--DETERMINED BY RATIOS SUCH AS THE DEBT, TIE, FCC, AND CURRENT RATIOS.

2. PROVISIONS IN THE BOND CONTRACT:
   A. SECURED VS. UNSECURED DEBT
   B. SENIOR VS. SUBORDINATED DEBT
   C. GUARANTEE PROVISIONS
   D. SINKING FUND PROVISIONS
   E. DEBT MATURITY

3. OTHER FACTORS:
   A. EARNINGS STABILITY
   B. REGULATORY ENVIRONMENT
   C. POTENTIAL PRODUCT LIABILITY
   D. ACCOUNTING POLICY

Q. IF THIS FIRM WERE TO DEFAULT ON THE BONDS, WOULD THE COMPANY BE IMMEDIATELY LIQUIDATED? WOULD THE BONDHOLDERS BE ASSURED OF RECEIVING ALL OF THEIR PROMISED PAYMENTS?

ANSWER: WHEN A BUSINESS BECOMES INSOLVENT, IT DOES NOT HAVE ENOUGH CASH TO MEET SCHEDULED INTEREST AND PRINCIPAL PAYMENTS. A DECISION MUST THEN BE MADE WHETHER TO DISSOLVE THE FIRM THROUGH LIQUIDATION OR TO PERMIT IT TO REORGANIZE AND THUS STAY ALIVE.

THE DECISION TO FORCE A FIRM TO LIQUIDATE OR TO PERMIT IT TO REORGANIZE DEPENDS ON WHETHER THE VALUE OF THE REORGANIZED FIRM IS LIKELY TO BE GREATER THAN THE VALUE OF THE FIRM'S ASSETS IF THEY WERE SOLD OFF PIECEMEAL. IN A REORGANIZATION, A COMMITTEE OF UNSECURED CREDITORS IS APPOINTED BY THE COURT TO NEGOTIATE WITH MANAGEMENT ON THE TERMS OF A POTENTIAL REORGANIZATION. THE REORGANIZATION PLAN MAY CALL FOR A RESTRUCTURING OF THE FIRM'S DEBT, IN WHICH CASE THE INTEREST RATE MAY BE REDUCED, THE TERM TO MATURITY LENGTHENED, OR SOME OF THE DEBT MAY BE EXCHANGED FOR EQUITY. THE POINT OF THE RESTRUCTURING IS TO REDUCE THE FINANCIAL CHARGES TO A LEVEL THAT THE FIRM'S CASH FLOWS CAN SUPPORT.

IF THE FIRM IS DEEMED TO BE TOO FAR GONE TO BE SAVED, IT WILL BE LIQUIDATED AND THE PRIORITY OF CLAIMS WOULD BE AS FOLLOWS:

1. SECURED CREDITORS.
2. TRUSTEE'S COSTS.
3. EXPENSES INCURRED AFTER BANKRUPTCY WAS FILED.
4. WAGES DUE WORKERS, UP TO A LIMIT OF $2,000 PER WORKER.
5. CLAIMS FOR UNPAID CONTRIBUTIONS TO EMPLOYEE BENEFIT PLANS.
6. UNSECURED CLAIMS FOR CUSTOMER DEPOSITS UP TO $900 PER CUSTOMER.
7. FEDERAL, STATE, AND LOCAL TAXES.
8. UNFUNDED PENSION PLAN LIABILITIES.
9. GENERAL UNSECURED CREDITORS.
10. PREFERRED STOCKHOLDERS, UP TO THE PAR VALUE OF THEIR STOCK.
11. COMMON STOCKHOLDERS, IF ANYTHING IS LEFT.

IF THE FIRM'S ASSETS ARE WORTH MORE "ALIVE" THAN "DEAD," THE COMPANY WOULD BE REORGANIZED. ITS BONDHOLDERS, HOWEVER, WOULD EXPECT TO TAKE A "HIT." THUS, THEY WOULD NOT EXPECT TO RECEIVE ALL THEIR PROMISED PAYMENTS. IF THE FIRM IS DEEMED TO BE TOO FAR GONE TO BE SAVED, IT WOULD BE LIQUIDATED.