

**VALUING BONDS**

**Problem 1**

Semi-annual coupon = \$40  
 Maturity of the bond = 20  
 PV of Bond at 9% rate =  $\$40(PVA, 4.5\%, 40) + \$1000/1.045^{20} = \$ 907.99$   
 Present Value of Bond at 11% annual rate = \$ 759.31  
 Percentage Change in Price =  $(759/908)-1 = -16.38\%$   
 PV of Bond at 7% annual rate = \$ 1,106.78  
 Percentage Change in Price =  $(1107/908)-1 = 21.89\%$

**Problem 2**

Semi-annual coupon = \$37.50  
 Maturity = 12 years  
 PV of Bond at 8% interest rate = \$ 961.88  
 Add accrued interest =  $\$ 37.50/1.08^{(1/4)} = \$ 36.79$   
 Value of Bond = \$ 998.67

**Problem 3**

Year (t)	Cash Flow	PV	PV * t
1	100	\$ 92.59	\$ 92.59
2	100	\$ 85.73	\$ 171.47
3	100	\$ 79.38	\$ 238.15
4	100	\$ 73.50	\$ 294.01
5	1100	\$ 748.64	\$ 3,743.21
		\$ 1,079.85	\$ 4,539.43

Duration =  $4539.43/1079.85 = 4.20$

**Problem 4**

Longer term bonds are more sensitive to changes in interest rates, because they have higher duration. Another way of putting this is that the largest cash flow on a longer term bond, i.e., the principal payment, occurs further out in the future. The present value effect is greater the further into the future a cash flow occurs.

The same reasoning applies for zero coupon versus coupon bonds. Zero coupon bonds have only one cash flow - the principal payment, whereas coupon bonds have cash flows over their lifetime.

### Problem 5

Expected Real Rate of Return =  $1.08/1.05 - 1 = 2.86\%$

The actual return may be different because the actual inflation rate might be higher than or lower than the expected rate.

### Problem 6

Maturity	Yield to Maturity
1 year	5.00%
2 years	5.50%
3 years	6.00%
4 years	6.50%
5 years	7.00%

a. Yield curve will have yields to maturity as spot interest rates.

b.

Maturity	Spot Rate
1	5.000%
2	$5.514\% : 100 = 5.5/1.05 + 105.5/(1+r)^2$
3	$6.041\% : 100 = 6/1.05 + 6/1.05514^2 + 106/(1+r)^3$
4	6.585%
5	7.152%

c.

Maturity	Forward Rate
1	5.000%
2	6.002% : $(1.055^2 - 1.05) - 1$
3	7.007% : $(1.06^3 / 1.055^2) - 1$
4	8.014%
5	9.024%

### Problem 7

The yield curve is driven by two variables - liquidity premiums (if any) and expectations about future interest rates. If investors expect interest rates to come down (either because inflation or real rates are anticipated to decrease), you can still have downward sloping

yield curves with positive liquidity premiums.

### Problem 8

No. For two reasons. First, given the higher default risk over the time period, I would have expected to make a higher return even after adjusting for the default rate. Second, the period under consideration is a fairly short one. It is entirely possible that a major crisis in a later period could wipe out much of the perceived excess returns from this period.

### Problem 9

- a. Conversion Ratio = \$ 30.00  
 Conversion Price =  $30 * 27 =$  \$ 810.00  
 b. Conversion Premium =  $1177 - 810 =$  \$ 367.00  
 Value of Straight Bond component =  $\$ 20 (PVA, 4\%, 40) + 1000/1.04^{40} =$  \$ 604.14  
 c. Value of Conversion Option =  $\$ 1177 - 610 =$  \$ 567.00

### Problem 10

a. Value of Conversion Option:

$S = \$15$ ;  $K = 1000/50 = \$20$ ;  $t=15$ ;  $r= 9\%$  (used riskless rate  $< 10\%$ ); Std Dev=0.4;

Value of Conversion Option =  $\$ 9.21 * 50 =$  \$ 460.50

(I assumed a 9% riskless rate, a zero dividend yield and allowed for dilution)

b. Value of Straight Bond =  $50 (PVA, 10\%, 15) + 1000/1.1^{15}$

= \$ 619.70

c. Total Value of Convertible Bond =  $\$ 460.5 + \$ 619.70$

= \$ 1,080.20

If issued at par, the company would be losing \$ 80 per convertible bond

d. Forced conversion would lower the value of these bonds.

### Problem 11

- a. False. Callable bonds will sell for less than non-callable bonds.  
 b. True.  
 c. True  
 d. False. The non-callable bond will be more sensitive.

### Problem 12

Yield to Maturity:  $45/(1+r/2)^{20} + 1000/(1+r/2)^{20} = 950$

Solving for r, YTM = 9.80%

Yield to Call:  $45/(1+r/2)^6 + 1100/(1+r/2)^6 = 950$

Solving for r, YTM = 13.90%

I would use the lower of the two numbers

**Problem 13**

- a. If investors wait too long to prepay, the actual returns will exceed the expected returns.
- b. If investors prepay when rational, the actual returns should equal expected returns.

**Problem 14**

- a. True
- b. True. It has less upside potential.
- c. False. It has less downside risk.
- d. True. It is less risky.