Session 2: Understanding Risk I: The risk in bonds

Test

1. Assume that you buy a default free government bond with a coupon rate of 2\% and a maturity of 20 years, at face value. Assuming that interest rates increase to 3\% over the course of the year following your purchase. What will your return on the government bond be for that year?
   a. 2\%. It is default free.
   b. 3\%, since that it is the new interest rate
   c. More than 3\%, since interest rates went up
   d. Less than 2\%, since interest rates went up

   Computational bonus: Assuming that coupons are paid annually, compute the annual return on the bond for the year you held it.

2. The duration of a bond measures its interest rate sensitivity, with higher duration reflecting more sensitivity to interest rate changes. Which of the following bonds has the lowest duration?
   a. A 10-year, 5\% coupon bond
   b. A 20-year, 5\% coupon bond
   c. A 10-year, 2\% coupon bond
   d. A 20-year, 2\% coupon bond

   Computational bonus: Estimate the duration of the bond with the lowest and highest durations on this list.

3. You are considering investing in a BBB-rated corporate bond with a 10-year maturity and a 5\% coupon rate (with annual coupons). Assuming that the bond rating is appropriate given the default risk of the company, that the risk free rate is 3\% and the default spread for BBB rated corporate bonds is 2.5\%, which of the following would you expect to see as the price of the bond?
   a. The bond should trade at face value
   b. The bond should trade at a premium over face value
   c. The bond should trade at a discount on face value
   d. Impossible to tell without more information

   Computational bonus: Estimate the price of this corporate bond.

4. Ratings agencies assign bond ratings to companies, with the ratings usually ranging from AAA(Aaa) for the safest companies to D for companies in default. What are the inputs into these ratings?
   a. The volatility in a company’s earnings
   b. The amount of debt that the company carries
   c. The interest payments on that debt
   d. The level of a company’s earnings
   e. All of the above
Solutions

1. Assume that you buy a default free government bond with a coupon rate of 2% and a maturity of 20 years, at face value. Assuming that interest rates increase to 3% over the course of the year following your purchase. What will your return on the government bond be for that year?
   a. 2%. It is default free.
   b. 3%, since that it is the new interest rate
   c. More than 3%, since interest rates went up
   **d. Less than 2%, since interest rates went up**

   **Computational bonus:** Assuming that coupons are paid annually, compute the annual return on the bond for the year you held it.

   **Explanation:** Less than 2%. The rise in interest rates will cause the bond price to drop. 
   New price for the bond \( (n=19, \text{Coupon rate}=2\%, r =3\%) = PV @ 3\% \text{ of } \$20 \text{ in coupons every year for } 19 \text{ years } + PV \text{ of } \$1000 \text{ at the end of } 19 \text{ years } = \$856.76 \)
   Price change on bond = \( \frac{(856.76-1000)}{1000} = -14.33\% \)
   Return on bond = \(-14.33\% + 2\% = -12.33\%\)

2. The duration of a bond measures its interest rate sensitivity, with higher duration reflecting more sensitivity to interest rate changes. Which of the following bonds has the lowest duration?
   a. A 10-year, 5% coupon bond
   b. A 20-year, 5% coupon bond
   c. A 10-year, 2% coupon bond
   **d. A 20-year, 2% coupon bond**

   **Computational bonus:** Estimate the duration of the bond with the lowest and highest durations on this list.

   **Explanation:** The duration should increase with maturity and should be higher for lower coupon bonds.

   To estimate the duration of these bonds, you need to assume a market interest rate. With a 4% interest rate:

   Duration of 10-year, 5% coupon bond (lowest duration) = 8.19 years
   Duration of 20-year, 2% coupon bond (highest duration) = 15.97 years

3. You are considering investing in a BBB-rated corporate bond with a 10-year maturity, and a 5% coupon rate (with annual coupons). Assuming that the bond rating is appropriate given the default risk of the company, that the risk free rate is 3% and the default spread for BBB rated corporate bonds is 2.5%, which of the following would you expect to see as the price of the bond?
   a. The bond should trade at face value
   b. The bond should trade at a premium over face value
   c. The bond should trade at a discount on face value
d. Impossible to tell without more information

**Computational bonus:** Estimate the price of this corporate bond.

**Explanation:** Adding the default spread to the risk free rate yields an interest rate of 5.5% for the bond. Since this is higher than the coupon rate of 5%, the bond has to trade at a discount.

Price of the bond (assuming annual coupons) = PV @5.5% of $50 a year for 10 years + PV of $1000 in 10 years at 5.5% = $962.31

4. Ratings agencies assign bond ratings to companies, with the ratings usually ranging from AAA (Aaa) for the safest companies to D for companies in default. What are the inputs into these ratings?
   a. The volatility in a company’s earnings
   b. The amount of debt that the company carries
   c. The interest payments on that debt
   d. The level of a company’s earnings
   e. **All of the above**

**Explanation:** The rating for a company should measure its default risk, which will be a function of all of these variables.