4.5 –The given rates are continuously compounded, thus

4.8 – Duration relates the sensitivity in a change in the bond’s price due to a parallel change in interest rates. It can be used to estimate how a bond’s price will decrease as interest rates rise or increase as interest rates fall. The main limitation is that it is only useful for (a) parallel shifts (not twists) and (b) small changes in interest rates.

4.9 –

4.11 – To use , the rates must be continuously compounded. Otherwise, use:

4.12 –

Using Newton’s Method with x = 0.05:

The continuously compounded yield of the bond is 0.06407 = 6.407%. The yield assuming semi-annual compounding is 6.5106%

4.14 - The given rates are continuously compounded, thus

4.16 – The long position in two 4% coupon bonds results in a cash outflow of $160 and the short position in one 8% coupon bond results in a cash inflow of $90. The net cash outflow is therefore $70. In ten years, the long position results in an inflow of $200 and the short position results in an outflow of $100 for a net cashflow of $100. The interim coupons cancel out as the $4 semi-annual coupons received from the long are used to pay the $4 semi-annual coupons owed on the short. The 10-year zero rate can be calculated as:

4.22 – Calculate price as and duration as based on the following cash flows for an 8% bond paying interest at the end of each year:

|  |  |
| --- | --- |
| Time | Cash flow |
| 1 | 8 |
| 2 | 8 |
| 3 | 8 |
| 4 | 8 |
| 5 | 108 |

A decrease in yield of 0.2% will result in an increase in price of

Given a new yield of 10.8%, the price of the bond will be:

The change in price is which agrees with the calculation of duration to 4 decimal places.q

4.34

A)   
The six-month zero rate is calculated from the zero-coupon six-month bond as:

The twelve-month zero rate is calculated from the zero-coupon twelve-month bond as:

The eighteen-month zero rate is calculated by solving for the zero rate necessary to equal the cash flows to the price of the 18-month bond using the 6- and 12-month zero rates:

The twenty four-month zero rate is similarly calculated by solving for the rate necessary zero rate necessary to produce the price of the 24-month 8% coupon bond using 6-, 12-, and 18-month zero rates:

|  |  |
| --- | --- |
|  | Rate |
| T1 | 4.041% |
| T2 | 5.129% |
| T3 | 5.443% |
| T4 | 5.809% |

B) Forward rates are calculated as

C) Par yields are calculated by solving the semi-annual coupon necessary to create a bond whose price is 100:

Six Month:

Twelve Month:

Eighteen Month:

Twenty-four month:

D) The price of the two-year bond is calculated as:

The yield of the two-year bond is:

Use Newton’s Method with:

The yield of the bond is 5.7728%.