

Examples 7

Math 210

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1 Callable Bonds

A *callable bond* is a bond with a range of dates at which redemption may occur.

Three equivalent rules for pricing callable bonds

1. The issuer will call the bond at the date that gives the issuer the greatest advantage.
2. This is the date that will give the investor pricing the bond the least advantage.
3. If an investor requires a yield equal to or greater than j , the investor must price the bond at each redemption date and choose the minimum price.

1.1 Constant Redemption Amount

If a callable bond has a constant redemption amount, the premium/discount formula

$$P = C + (Fr - Cj)a_{\overline{n}|j}$$

shows us what effect different values of n will have on the price.

If $P > C$ (Premium), a small n will decrease the price.

If $P < C$ (Discount), a large n will decrease the price.

An investor should assume that the bond issuer will redeem the bond at the time that makes the price as small as possible. This is the term-to-maturity that the investor should use when pricing the bond. A bond that is callable at its face value is said to be callable at par.

Example 1

A 100 face value bond with 10% semiannual coupons can be called at par in 5 years, called at par in 10 years, or it will mature at par in 15 years. Find the appropriate price if the investor

1. requires a minimum yield of 8%.
2. requires a minimum yield of 12%.
3. requires a minimum yield of 10%.

1. If investors charge 8% for new money lent to the issuer, the issuer will redeem the bond as soon as possible and refinance their debt with a new bond that requires 8% coupons. This will reduce the issuer's coupons from 5 to 4 per coupon period. Thus the price of this bond is

$$100v_{.04}^{10} + 5a_{\overline{10}|.04} = \mathbf{108.11}$$

2. If investors charge 12% for new money lent to the issuer, the issuer will keep the 10% bonds for as long as possible. When the 10% bonds are redeemed, the issuer will have to refinance their debt with 12% bonds, and the coupons will increase from 5 to 6 per coupon period. The issuer will put this increase off as long as possible. Thus the price of this bond is

$$100v_{.06}^{30} + 5a_{\overline{30}|.06} = \mathbf{86.24}$$

3. In this situation, the bond is priced at par, 100, no matter what the redemption date is. Investors can't be certain when the issuer will redeem this bond, but they will still price the bond at **100**.

1.2 Varying Redemption Amounts

Often, if the bond is called early, the redemption value will not be the same as the redemption value at full maturity. If the call redemption value is larger than the maturity redemption value, the difference is called a call premium. For example, if a \$100 bond matures in 10 years at par, but can be redeemed after 5 years for \$104, the call premium at time 5 is \$4.

To see an example of how an investor can price a callable bond with varying redemption values, see Broverman example 4.6.