4.3: Bond Pricing

As stated above, the value of a bond is equal to the present value of the cash flows that the particular bond will pay. Bonds pay cash flows in two different ways. First, bonds pay a coupon payment. Typically, every six months the bondholder receives a coupon payment determined by the stated coupon rate. When bonds are issued, they state the coupon rate which typically (in this class we will assume always) remains fixed over the life of the bond. This is the percentage of par value that the bondholder will receive in annual interest payments (while technically different bonds may have different par values, most corporate bonds have a standard par value of $1000 which we will use as the standard for this class…**always assume the par value is $1000 unless specifically stated otherwise**). To calculate the amount the bondholder will receive every six months, just take the annual payment and divide by two. In addition to the coupon payment, at the end of the bonds life the bondholder will receive the par value ($1000). Sometimes this par value is referred to as maturity value or face value. Thus, to find the price (or value) of a bond (B0), we want to find the present value of the coupon payments and the par value.

> Consider the following example which we will walk through using the financial calculator. I want to purchase a bond that pays a 6% coupon and want to earn an 8% return on my investment. The bond has 20 years remaining until maturity. The first thing I need to do is figure out what my coupon payment is going to be.
> Annual Coupon ⇒ 0.06*$1000 = $60
> Semi-Annual (every 6 months) Coupon ⇒ $60/2 = $30

This tells me that I am going to receive an interest payment of $30 twice per year for each of the next 20 years **plus** at the end of the 20th year, I will receive $1000. This is my cash flow stream which must be discounted back to today at the 8% required return that I want to receive.

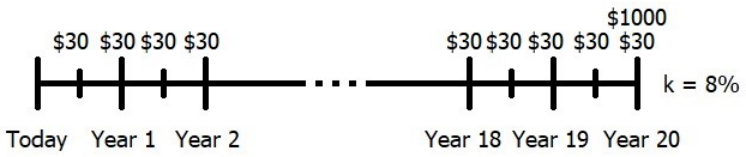

Figure 4.3.1: Example of bond pricing

Because I am receiving 2 coupon payments each year, I must be careful to set my calculator to 2 periods per year (and remember that now N represents the number of periods – 40 – instead of the number of years – 20.) This is done as follows:

Financial Calculator:

2 P/Y
40 N
8 I/YR
30 PMT
1000 FV
Compute PV ⇒ $802.07

In other words, if we require an 8% return on this bond we would be willing to pay no more than $802.07 to purchase it today.

Note that the PMT and the FV are both positive. They could also both be negative. The key is to recognize that they should both be the same sign. Why is this? From the perspective of the bondholder, we will RECEIVE both an annual cash flow (the coupon payment ⇒ PMT) and a single cash flow at maturity (the par value ⇒ FV). Since we receive these, they should be positive. If we took the perspective of the bond ISSUER, both of these would be payments and thus be negative. The key is that both the PMT and the FV are flowing in the same direction and thus must have the same sign

One thing that can be confusing with bonds is that there are two “rates” that are mentioned in bond pricing. The first is the coupon rate and the second is the discount rate. Note that the discount rate can take on many names — market rate of interest, interest rate, rate of return, required return and yield-to-maturity — they all mean the same thing. In order to avoid confusion, try to think of the coupon rate as a cash flow rather than a rate. The coupon rate tells us what our yearly payment will be. It is not a rate of return and it doesn’t change over time. The discount rate (market rate of interest, interest rate, rate of return, required return, and/or yield-to-

maturity) tells us what rate of return we want to earn on our investment in this bond. It can (and will) change over time — sometimes increasing and sometimes decreasing — depending on market conditions.

In practice, determining the discount rate is one of the most challenging aspects for a bond investor. It primarily depends on the perceived risk of the bond and the expected inflation rate that is anticipated over the life of the bond. Note that while there are ways to approximate both of these components, they both have a subjective aspect to them. Neither the actual risk of the bond nor the realized inflation rate that will occur over the life of the bond are known today. Therefore, these values are based on educated guesses from an individual's perspective. The market's yield-to-maturity (a measure we will discuss shortly) provides the consensus opinion of what the appropriate required return should be.

If the bond price is trading for more than its par value (bond price is greater than $1000), the bond is said to be trading for a **premium**. Alternatively, if the bond price is trading for less than its par value (bond price is less than $1000), the bond is said to be trading for a **discount**.

The premium or discount will diminish over time as the bond approaches maturity. This is because at maturity, the bond will be worth the $1000 par value. Therefore, assuming required returns (market rates of interest) stay constant until maturity, the bond price will follow the pattern in the graph below. In practice, the lines will not be as smooth as required returns (market rates of interest) tend to fluctuate over time.

Figure 4.3.2: Price of Bond Selling at Discount vs. Premium over Time

Source of Graph: Bogleheads

Video Bond Pricing