Fundamentals of Investing

Twelfth Edition

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Measures of Yield and Return

LG4 In the bond market, investors focus as much on a bond's yield as on its price. As you have seen, the yield helps determine the price at which a bond trades, but it also measures the rate of return on the bond. When you can observe the price of a bond that is trading in the market, you can simply reverse the bond valuation process described above to solve for the bond's yield rather than its price. That gives you a pretty good idea of the return that you might earn if you purchased the bond at its current market price. Actually, there are 3 widely used metrics to assess the return on a bond: the current yield, the yield to maturity, and the yield to call (for bonds that are callable). We'll look at all 3 measures here, along with a concept known as the *expected return*, which measures the expected (or actual) rate of return earned over a specific holding period.

Current Yield

The **current yield** is the simplest of all bond return measures, but it also has the most limited application. This measure looks at just one source of return: a bond's annual interest income. In particular, it indicates the amount of current income a bond provides relative to its prevailing market price. The current yield equals:

Equation 11.5

$$\text{Current yield} = \frac{\text{Annual interest income}}{\text{Current market price of the bond}}$$

Example

An 8% bond would pay $80 per year in interest for every $1,000 of principal. However, if the bond was currently priced at $800, it would have a current yield of 10% ($80 ÷ $800 = 0.10). The current yield measures a bond's annual interest income, so it is of interest primarily to investors seeking high levels of current income, such as endowments or retirees.

Yield to Maturity

The **yield to maturity (YTM)** is the most important and most widely used measure of the return provided by a bond. It evaluates the bond's interest income and any gain or loss that results from differences between the price that an investor pays for a bond and the par value that the investor receives at maturity. The YTM takes into account all of the cash flow received over a bond's life. Also known as the **promised yield**, the YTM shows the fully compounded rate of return earned by an investor, given that the bond is held to maturity and all principal and interest payments are made in a prompt and timely fashion. In addition, the YTM calculation implicitly assumes that the investor can reinvest all the coupon payments at an interest rate equal to the bond's yield to maturity. This "reinvestment assumption" plays a vital role in the YTM, which we will discuss in more detail later in this chapter (see the section entitled Yield Properties).

The yield to maturity is used not only to gauge the return on a single issue but also to track the behavior of the market in general. In other words, market interest rates are basically a reflection of the average promised yields that exist in a given segment of the market. The yield to maturity provides valuable insights into an issue's investment merits that investors can use to assess the attractiveness of different bonds. Other things being equal, the higher the promised yield of an issue, the more attractive it is.

Although there are a couple of ways to compute the YTM, the best and most accurate procedure is derived directly from the bond valuation model described above. That is, you can use Equations 11.3 and 11.4 to determine the YTM for a bond. The difference is that now, instead of trying to determine the price of the bond, you know its price and are trying to find the discount rate that will equate the present value of the bond's cash flow (coupon and principal payments) to its current market price. This procedure may sound familiar. It's just like the internal rate of return measure described in Chapter 4. Indeed, the YTM is basically the internal rate of return on a bond. When you find that, you have the bond's yield to maturity.

Using Annual Compounding Finding yield to maturity is a matter of trial and error. In other words, you try different values for YTM until you find the one that solves the equation. Let's say you want to find the YTM for a 7.5% ($1,000 par value) annual-coupon-paying bond that has 15 years remaining to maturity and is currently trading in the market at $809.50. From Equation 11.3, we know that

$$BP_i = \$809.50 = \frac{\$75}{(1+r_i)^1} + \frac{\$75}{(1+r_i)^2} + \ldots + \frac{\$75}{(1+r_i)^{15}} + \frac{\$1{,}000}{(1+r_i)^{15}}$$

Notice that this bond sells below par (i.e., it sells at a discount). What do we know about the relationship between the required return on a bond and its coupon rate when the bond sells at a discount? Bonds sell at a discount when the required return (or yield to maturity) is higher than the coupon rate, so the yield to maturity on this bond must be higher than 7.5%.

Through trial and error, we might initially try a discount rate of 8% or 9% (or, since it sells at a discount, any value above the bond's coupon). Sooner or later, we'll try a discount rate of 10%. And look what happens at that point: Using Equation 11.3 to price this bond at a discount rate of 10%, we see that the price equals $809.85.

The computed price of $809.85 is reasonably close to the bond's current market price of $809.50. As a result, the 10% rate represents the yield to maturity on this bond. That is, 10% is the discount rate that leads to a computed bond price that's equal (or very close) to the bond's current market price. In this case, if you were to pay $809.50 for the bond and hold it to maturity, you would expect to earn a YTM of 10.0%. Doing trial and error by hand can be time consuming, so you can use a handheld calculator or computer software to calculate the YTM.

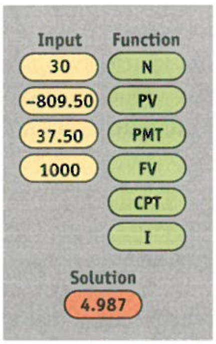
Input	Function
15	N
-809.50	PV
75	PMT
1000	FV
	CPT
	I
Solution	
10.00	

CALCULATOR USE For annual compounding, to find the YTM of a 15-year, 7.5% bond that is currently priced in the market at $809.50, use the keystrokes shown in the margin. The present value (*PV*) key represents the current market price of the bond, and all other keystrokes are as defined earlier.

Using Semiannual Compounding Given some fairly simple modifications, it's also possible to find the YTM using semiannual compounding. To do so, we cut the annual coupon and discount rate in half and double the number of periods to maturity. Returning to the 7.5%, 15-year bond, let's see what happens when you use Equation 11.4 and try an initial discount rate of 10%.

$$BP_i = \frac{\$75.00/2}{\left(1+\frac{0.10}{2}\right)^1} + \frac{\$75.00/2}{\left(1+\frac{0.10}{2}\right)^2} + \ldots + \frac{\$75.00/2}{\left(1+\frac{0.10}{2}\right)^{30}} + \frac{\$1{,}000}{\left(1+\frac{0.10}{2}\right)^{30}} = \$807.85$$

As you can see, a semiannual discount rate of 5% results in a computed bond value that's well short of the market price of $809.50. Given the inverse relationship between price and yield, it follows that if you need a higher price, you have to try a lower YTM (discount rate). Therefore, you know the semiannual yield on this bond has to be something less than 5%. By trial and error, you would determine that the yield to maturity on this bond is just a shade under 5% per half year—4.987% to be more precise. Remember, however, that this is the yield expressed over a 6-month period. The market convention is to simply state the annual yield as twice the semiannual yield. This practice produces what the market refers to as the **bond-equivalent yield.** Returning to the YTM problem started above, you know that the issue has a semiannual yield of 4.987%. According to the bond-equivalent yield convention, you double the semiannual rate to obtain the annual rate of return on this bond. Doing this results in an annualized yield to maturity (or promised yield) of 4.987% × 2 = 9.97%. This is the annual rate of return you will earn on the bond if you hold it to maturity.



CALCULATOR USE For semiannual compounding, to find the YTM of a 15-year, 7.5% bond that is currently priced in the market at $809.50, use the keystrokes shown here. As before, the *PV* key is the current market price of the bond, and all other keystrokes are as defined earlier. Remember that to find the bond-equivalent yield, you must double the computed value of *I*. That is, 4.987% × 2 = 9.974%.

Yield Properties Actually, in addition to holding the bond to maturity, there are several other critical assumptions embedded in any yield to maturity figure. The promised yield measure—whether computed with annual or semiannual compounding—is based on present value concepts and therefore contains important reinvestment assumptions. To be specific, the YTM calculation assumes that when each coupon payment arrives, you can reinvest it for the remainder of the bond's life at a rate that is equal to the YTM. When this assumption holds, the return that you earn over a bond's life is in fact equal to the YTM. In essence, the calculated yield to maturity figure is the return "promised" only so long as the issuer meets all interest and principal obligations on a timely basis and the investor reinvests all interest income at a rate equal to the computed promised yield. In our example above, you would need to reinvest each of the coupon payments and earn a 10% return on those reinvested funds. Failure to do so would result in a realized yield of less than the 10% YTM. If you made no attempt to reinvest the coupons, you would earn a realized yield over the 15-year investment horizon of just over 6.5%—far short of the 10% promised return. On the other hand, if you could reinvest coupons at a rate that exceeded 10%, the actual yield on your bond over the 15 years would be higher than its 10% YTM. The bottom line is that unless you are dealing with a zero-coupon bond, a significant portion of the bond's total return over time comes from reinvested coupons.

This reinvestment assumption was first introduced in Chapter 4, when we discussed the role that "interest on interest" plays in measuring investment returns. As we noted in that chapter, when we use present value–based measures of return, such as the YTM, there are actually 3 components of return: (1) coupon/interest income, (2) capital gains (or losses), and (3) interest on interest. Whereas current income and capital gains make up the profits from an investment, interest on interest is a measure of what *you* do with those profits. In the context of a bond's yield to maturity, the computed YTM defines the required, or minimum, reinvestment rate. Put your investment profits (i.e., interest income) to work at this rate and you'll earn a rate of return equal to YTM. This rule applies to any coupon-bearing bond—so long as there's an annual or semiannual flow of interest income, the reinvestment of that income and interest on interest are matters that you must deal with. Also, keep in mind that the bigger the coupon and/or the longer the maturity, the more important the reinvestment assumption. Indeed, for many long-term, high-coupon bond investments, interest on interest alone can account for well over half the cash flow.

Finding the Yield on a Zero You can also use the same procedures described above (Equation 11.3 with annual compounding or Equation 11.4 with semiannual compounding) to find the yield to maturity on a zero-coupon bond. The only difference is that you can ignore the coupon portion of the equation because it will, of course, equal 0. All you need to do to find the promised yield on a zero-coupon bond is to solve the following expression:

$$\text{Yield} = \left(\frac{\$1{,}000}{\text{Price}}\right)^{\frac{1}{N}} - 1$$

Example

Suppose that today you could buy a 15-year zero-coupon bond for $315. If you purchase the bond at that price and hold it to maturity, what is your YTM?

$$\text{Yield} = \left(\frac{\$1{,}000}{\$315}\right)^{\frac{1}{15}} - 1 = 0.08 = 8\%$$

The zero-coupon bond pays an annual compound return of 8%. Had we been using semiannual compounding, we'd use the same equation except we'd substitute 30 for 15 (because there are 30 semiannual periods in 15 years). The yield would change to 3.926% per half year, or 7.845% per year.

Input	Function
30	N
-315	PV
1000	FV
0	PMT
	CPT
	I
Solution	
3.926	

Calculator Use For semiannual compounding, to find the YTM of a 15-year zero-coupon bond that is currently priced in the market at $315, use the keystrokes shown in the margin. *PV* is the current market price of the bond, and all other keystrokes are as defined earlier. To find the bond-equivalent yield, double the computed value of *I*. That is, 3.926% × 2 = 7.85%.

Yield to Call

Bonds can be either noncallable or callable. Recall from Chapter 10 that a noncallable bond prohibits the issuer from calling the bond prior to maturity. Because such issues will remain outstanding to maturity, you can value them by using the standard yield to maturity measure. In contrast, a callable bond gives the issuer the right to retire the bond prematurely, so the issue may or may not remain outstanding to maturity. As a result, the YTM may not always provide a good measure of the return that you can expect if you purchase a callable bond. Instead, you should consider the impact of the bond being called away prior to maturity. A common way to do that is to use a measure known as the **yield to call (YTC)**, which shows the yield on a bond if the issue remains outstanding not to maturity but rather until its first (or some other specified) call date.

The YTC is commonly used with bonds that carry deferred-call provisions. Remember that such issues start out as noncallable bonds and then, after a call deferment period (of 5 to 10 years), become freely callable. Under these conditions, the YTC would measure the expected yield on a deferred-call bond assuming that the issue is retired at the end of the call deferment period (that is, when the bond first becomes freely callable). You can find the YTC by making two simple modifications to the standard YTM equation (Equation 11.3 or 11.4). First, define the length of the investment horizon (N) as the number of years to the first call date, not the number of years to maturity. Second, instead of using the bond's par value (\$1,000), use the bond's call price (which is stated in the indenture and is nearly always greater than the bond's par value).

For example, assume you want to find YTC on a 20-year, 10.5% deferred-call bond that is currently trading in the market at \$1,204, but has 5 years to go to first call (that is, before it becomes freely callable), at which time it can be called in at a price of \$1,085. Rather than using the bond's maturity of 20 years in the valuation equation (Equation 11.3 or 11.4), you use the number of years to first call (5 years), and rather than the bond's par value, \$1,000, you use the issue's call price, \$1,085. Note, however, you still use the bond's coupon (10.5%) and its current market price (\$1,204). Thus, for annual compounding, you would have:

Equation 11.6

$$BP_i = \$1{,}204 = \frac{\$105}{(1+r_i)^1} + \frac{\$105}{(1+r_i)^2} + \frac{\$105}{(1+r_i)^3} + \frac{\$105}{(1+r_i)^4} + \frac{\$105}{(1+r_i)^5} + \frac{\$1{,}085}{(1+r_i)^5}$$

Through trial and error, you could determine that at a discount rate of 7%, the present value of the future cash flows (coupons over the next 5 years, plus call price) will exactly (or very nearly) equal the bond's current market price of \$1,204.

Thus, the YTC on this bond is 7%. In contrast, the bond's YTM is 8.37%. In practice, bond investors normally compute both YTM and YTC for deferred-call bonds that are trading at a premium. They do this to find which yield is lower; the market convention is *to use the lower, more conservative measure of yield (YTM or YTC) as the appropriate indicator of the bond's return.* As a result, the premium bond in our example would be valued relative to its yield to call. The assumption is that because interest rates have dropped so much (the YTM is 2 percentage points below the coupon rate), it will be called in the first chance the issuer gets. However, the situation is totally different when this or any bond trades at a discount. Why? Because YTM on any discount bond, whether callable or not, will always be less than YTC. Thus, YTC is a totally irrelevant measure for discount bonds—it's used only with premium bonds.

Input	Function
5	N
-1204	PV
105	PMT
1085	FV
	CPT
	I
Solution	
7.00	

CALCULATOR USE For annual compounding, to find the YTC of a 20-year, 10.5% bond that is currently trading at \$1,204 but can be called in 5 years at a call price of \$1,085, use the keystrokes shown in the margin. In this computation, N is the number of years to first call date, and FV represents the bond's call price. All other keystrokes are as defined earlier.

Expected Return

Rather than just buying and holding bonds, some investors prefer to actively trade in and out of these securities over fairly short investment horizons. As a result, measures such as yield to maturity and yield to call have relatively little meaning, other than as indicators of the rate of return used to price the bond. These investors obviously need an alternative measure of return that they can use to assess the investment appeal of those bonds they intend to trade. Such an alternative measure is the **expected return**. It indicates the rate of return an investor can expect to earn by holding a bond over a period of time that's less than the life of the issue. (Expected return is also known as **realized yield** because it shows the return an investor would realize by trading in and out of bonds over short holding periods.)