

CHAPTER 2: Bonds

Did You Know?

Some bonds, like municipal bonds, offer tax exemptions that can bolster your long-term earnings.²

There are as many different ways to invest as there are flavors of ice cream, but most people in the U.S. can reach their goals through three main investment options: bonds, stocks, and funds. The next chapters will cover the basics of each, beginning with **bonds**.

Bond Basics

- Large companies and governments often need to borrow large sums of money in order to conduct business. Instead of taking out a loan from a bank, they can issue (i.e., sell) bonds. Investment banks and institutions typically purchase corporate bonds; individuals are more likely to invest in government bonds.
- Bonds are like IOUs: when a **bondholder** purchases a bond, they are essentially lending the **issuer** money.
- Each bond has a set **face value** (also called the **par value**). Assuming you purchase a bond when it is new, this is also the price you will pay.
- After a pre-set period of time, usually anywhere from five to 30 years, the bond matures, and you get your initial investment back. (There are also **callable bonds** that can be repaid prior to maturity by the issuer.)
- In the meantime, as payment for your loan, you receive interest, also known as **coupon payments**. The interest is paid at set intervals, often twice a year, and at a consistent annual rate, known as the bond's **coupon rate**. Your total **earnings** after the bond matures, relative to your investment, is known as the **yield to maturity**.

Let's say the Metropolis Corporation wants to build a solar farm, which will cost them \$2 million, so they issue 10-year bonds for \$10,000 each, with a coupon rate of 7%. You purchase a bond at the face value of \$10,000. The corporation issues you a **certificate** detailing the face value (\$10,000), **maturity date** (10 years from now), and coupon rate (7%). The interest is paid twice a year. This means that every six months for the next 10 years, you will receive a \$350 coupon payment. Then, at the end of 10 years, you will get your original \$10,000 investment back. Your total earnings of \$7,000 equal a 7% yield to maturity.

² www.sec.gov/investor/alerts/municipalbonds.htm



Secondary Bond Sales

There are two ways to invest in bonds: the first is simply to purchase the bonds on the **primary market** and collect the interest, as in the example above. In this case, the price you pay is typically the face value, and the yield to maturity is the same as the coupon rate.

The second way to invest in bonds is to buy or sell them sometime after their original offering, on what's known as a **secondary market**. In this case, the bond's price may be different from its face value. In order to understand why, let's look at how secondary bonds are priced.

Keep in mind that once a bond is issued, its coupon rate and coupon payments are set. But coupon rates for new bonds change from year to year based on the economy. A bond issued next year is likely to have a different coupon rate — higher or lower — than a nearly identical bond issued this year. But when investors buy secondary bonds, they expect the same yield that a current bond would offer; otherwise, they would only buy new bonds. To accommodate this, the price of secondary bonds is adjusted.

To see how this works, let's go back to our earlier example. Imagine that after two years, you need to sell your Metropolis bond. But coupon rates have fallen, so new 10-year \$10,000 bonds from Metropolis are being issued at a rate of 6% instead of 7%. How much is your two-year-old bond worth now? Here's how to find out:

1. First, calculate the **discount factor** for a new bond using the current coupon rate, compounded semi-annually. The discount factor equals the present value of your investment (\$10,000) divided by the future value of your investment after each interest payment. This data is in column F of the chart below.

2. Next, calculate the **present value** for each of the payments remaining on your two-year-old bond by multiplying each payment amount by its corresponding discount factor. Remember that the final payment will include your initial investment of \$10,000. This data is in column H below.

3. Add up the present value of all the remaining payments for the total present value of your two-year-old bond. This would be the current **fair market price** for your bond – \$10,628.05.

| A | B | C | D | E | F | G | H |
|-----------------------------------|-----------------------------------|-------------------|-------------------|----------------|-----------------|-----------------|----------------------------------|
| Semi-Annual Payments over 8 years | Current Coupon Rate (semi-annual) | Beginning Balance | Interest Payments | Ending Balance | Discount Factor | Coupon Payments | Present Value of Coupon Payments |
| 1 | 3.00% | \$10,000.00 | \$300.00 | \$10,300.00 | 0.9709 | \$350.00 | \$339.82 |
| 2 | 3.00% | \$10,300.00 | \$309.00 | \$10,609.00 | 0.9426 | \$350.00 | \$329.91 |
| 3 | 3.00% | \$10,609.00 | \$318.27 | \$10,927.27 | 0.9151 | \$350.00 | \$320.29 |
| 4 | 3.00% | \$10,927.27 | \$327.82 | \$11,255.09 | 0.8885 | \$350.00 | \$310.97 |
| 5 | 3.00% | \$11,255.09 | \$337.65 | \$11,592.74 | 0.8626 | \$350.00 | \$301.91 |
| 6 | 3.00% | \$11,592.74 | \$347.78 | \$11,940.52 | 0.8375 | \$350.00 | \$293.13 |
| 7 | 3.00% | \$11,940.52 | \$358.22 | \$12,298.74 | 0.8131 | \$350.00 | \$284.59 |
| 8 | 3.00% | \$12,298.74 | \$368.96 | \$12,667.70 | 0.7894 | \$350.00 | \$276.29 |
| 9 | 3.00% | \$12,667.70 | \$380.03 | \$13,047.73 | 0.7664 | \$350.00 | \$268.24 |
| 10 | 3.00% | \$13,047.73 | \$391.43 | \$13,439.16 | 0.7441 | \$350.00 | \$260.44 |
| 11 | 3.00% | \$13,439.16 | \$403.17 | \$13,842.33 | 0.7224 | \$350.00 | \$252.84 |
| 12 | 3.00% | \$13,842.33 | \$415.27 | \$14,257.60 | 0.7014 | \$350.00 | \$245.49 |
| 13 | 3.00% | \$14,257.60 | \$427.73 | \$14,685.33 | 0.6810 | \$350.00 | \$238.35 |
| 14 | 3.00% | \$14,685.33 | \$440.56 | \$15,125.89 | 0.6611 | \$350.00 | \$231.39 |
| 15 | 3.00% | \$15,125.89 | \$453.78 | \$15,579.67 | 0.6419 | \$350.00 | \$224.67 |
| 16 (includes face value) | 3.00% | \$15,579.67 | \$467.39 | \$16,047.06 | 0.6232 | \$10,350.00 | \$6,450.12 |
| Total | | | | | | \$15,600.00 | \$10,628.05 |



Bond yield to maturity is critically important to the traders who make up the secondary market for all U.S. government and corporate bonds. Bonds offered for sale are quoted in terms of yields, and bond prices are derived from the quoted yields by means of the present value method described above.

When you purchased your Metropolis Corporation bond, the yield to maturity was simply 7% – the same as the coupon rate – because the bond was purchased at par value and held from initial offering to maturity. For bonds purchased on the secondary market, yield also includes the difference between the price paid and the face value payment the bondholder will receive in the end, whether it is a gain or loss. When you sold your bond after two years, the yield to maturity was 6%, and the price of \$10,628.05 was derived to reach it.

As you can see, when the interest rates went down, the price for the previously issued bond went up. Why? Simply because of competition – if you can earn more interest for longer on a new bond, why would you spend the same amount of money for a bond with lower earnings?

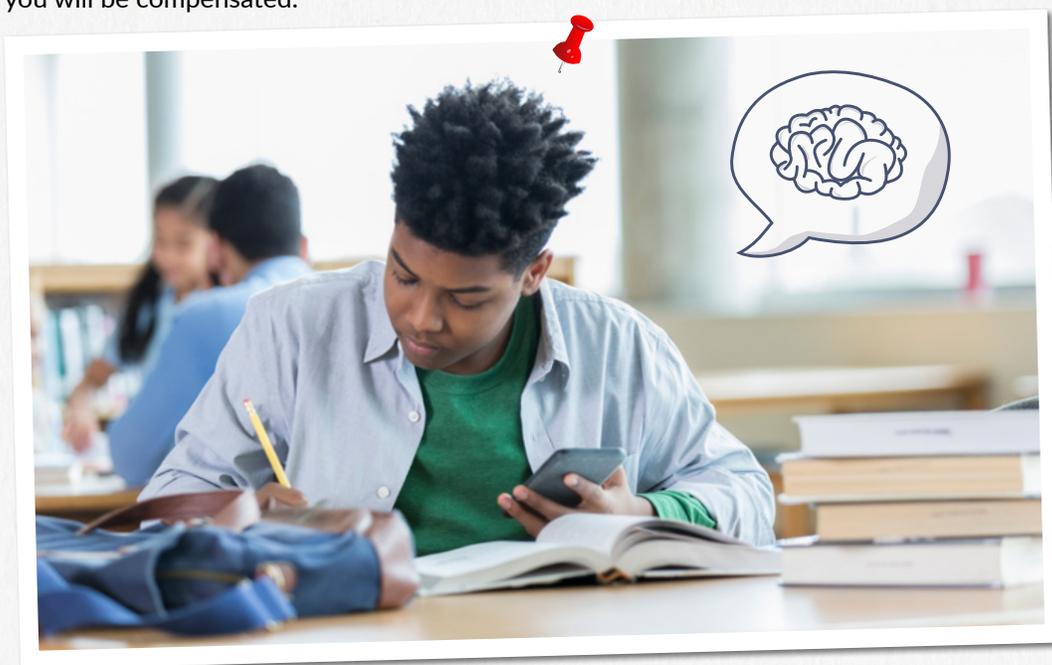
Bonds and Risk

Bonds are typically considered a lower-risk investment, because the returns are steady and predictable. On the flip side, they offer minimal growth. This is true when the bond issuer is stable, like the U.S. government, which is unlikely to **default**. Some corporate bonds are riskier but may be secured by **collateral**, which means that if the bond issuer goes bankrupt, you will be compensated.

There are bonds, however, that offer higher rates of return, but also come with a corresponding higher level of risk. These are known as **high-yield bonds**, and are issued by companies with low credit scores. (This is just like when consumers have low credit scores, and their interest rates are higher because they are more likely to default.) To help investors identify how risky a bond is, there are independent rating agencies that grade them. For example, the agency Standard & Poor's grade scale runs from AAA, AA, and A down to D. A grade of AAA indicates that a bond is very safe, while a grade of C indicates that a bond issuer is highly speculative and a grade of D indicates that the bond is in default.

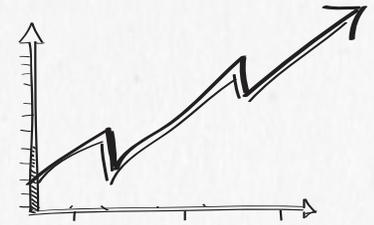
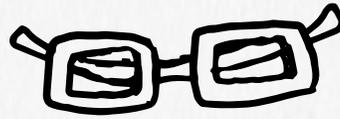
The other area of risk for bonds is **market fluctuation**. In our example above, we compared two bonds that matched almost exactly in terms of coupon rate, face value, maturity term, and credit rating. In the real world, there seldom exists such a perfect match. Instead, a trader who wants to price an old bond will evaluate a number of other bonds with similar maturity dates and credit ratings, and use them collectively to determine an appropriate yield to maturity.

In this manner, bond traders make the market for all bonds. Traders' collective activities (in response to economic news and to the demand for various bonds) result in interest rates going up and down from trade to trade and day to day. Such fluctuations in bond yields tend to be greater from day to day than from trade to trade, and greater from week to week than from day to day.



Activity 1

BOND BASICS



PART 1: THE PRIMARY BOND MARKET

In January, you purchase a \$10,000 bond with an annual coupon rate of 7.00% and a maturity date in 10 years. Use a calculator to complete this chart, then answer the questions below.

| Payment Dates | Face Value | Coupon Rate | Coupon Payment | Cumulative Payments |
|---------------------------------------|-------------|-------------|----------------|---------------------|
| January Year 1 (purchase) | \$10,000.00 | 3.50% | 0 | 0 |
| July Year 1 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| January Year 2 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| July Year 2 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| January Year 3 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| July Year 3 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| January Year 4 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| July Year 4 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| January Year 5 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| July Year 5 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| January Year 6 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| July Year 6 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| January Year 7 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| July Year 7 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| January Year 8 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| July Year 8 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| January Year 9 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| July Year 9 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| January Year 10 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| July Year 10 | \$10,000.00 | 3.50% | \$350.00 | \$ |
| January Year 11 (includes face value) | \$10,000.00 | 3.50% | \$10,350.00 | \$ |

- How do you calculate the coupon payment amounts? Describe the mathematical steps for doing this or the formula you would use. _____

- How much money will you make each year from this investment? \$ _____
- Over the life of the bond, what will be your total earnings? \$ _____
- Use the yield to maturity calculator at investinganswers.com/calculators/yield/yield-maturity-ytm-calculator-2081 to find out your yield to maturity over the life of the bond. _____%
- Do you think this is a wise investment? Why or why not? _____

Activity 1

BOND BASICS

PART 2: THE SECONDARY BOND MARKET



Two years after your initial purchase, you would like to purchase another \$10,000 bond. Coupon rates have gone up to 9%, but you would like the bond that you purchase to mature at the same time as the bond you already have, so you don't want to buy a new bond. What can you expect to pay on the secondary market for the same bond that you purchased two years ago, with a coupon rate of 7%? Complete this chart using a calculator to find your answer.

| Semi-Annual Payments (8 Years) | Current Coupon Rate (9%) | Beginning Balance | Interest Payment | Ending Balance | Discount Factor | Coupon Payments | Present Value of Coupon Payments |
|--------------------------------|--------------------------|-------------------|------------------|----------------|-----------------|-----------------|----------------------------------|
| 1 | 4.50% | \$10,000.00 | \$450.00 | \$ | | \$ | \$ |
| 2 | 4.50% | \$ | \$ | \$ | | \$ | \$ |
| 3 | 4.50% | \$ | \$ | \$ | | \$ | \$ |
| 4 | 4.50% | \$ | \$ | \$ | | \$ | \$ |
| 5 | 4.50% | \$ | \$ | \$ | | \$ | \$ |
| 6 | 4.50% | \$ | \$ | \$ | | \$ | \$ |
| 7 | 4.50% | \$ | \$ | \$ | | \$ | \$ |
| 8 | 4.50% | \$ | \$ | \$ | | \$ | \$ |
| 9 | 4.50% | \$ | \$ | \$ | | \$ | \$ |
| 10 | 4.50% | \$ | \$ | \$ | | \$ | \$ |
| 11 | 4.50% | \$ | \$ | \$ | | \$ | \$ |
| 12 | 4.50% | \$ | \$ | \$ | | \$ | \$ |
| 13 | 4.50% | \$ | \$ | \$ | | \$ | \$ |
| 14 | 4.50% | \$ | \$ | \$ | | \$ | \$ |
| 15 | 4.50% | \$ | \$ | \$ | | \$ | \$ |
| 16 (includes face value) | 4.50% | \$ | \$ | \$ | | \$ | \$ |
| Total | | | | | | \$ | \$ |

- How much do you expect to pay for the secondary market bond? \$ _____
- How much will you earn each year on the bond? \$ _____
- How much will this add up to over the course of the bond's eight year life? \$ _____
- Factoring in what you paid for the secondary market bond, what will be your total earnings?

| Total coupon payments plus face value | - Amount paid for bond | = Total earnings |
|---------------------------------------|------------------------|------------------|
| \$ | -\$ | =\$ |

- Use the yield to maturity calculator at investinganswers.com/calculators/yield/yield-maturity-ytm-calculator-2081 to find out your yield to maturity over the life of the secondary market bond.
Yield to maturity: _____%
- What are the benefits of purchasing a secondary market bond with a lower coupon rate compared to purchasing a bond on the primary market with a higher coupon rate?

Activity 2

BUILDING A BOND PORTFOLIO

Assume that loved ones have purchased primary market bonds for you on your birthday with the intent that when they mature you will be able to use them to pay some of your college expenses. The chart below shows the face value of each bond, the year it was purchased, the coupon rate, and the maturity date. Use a calculator to complete the chart, then answer the questions below.



| Face Value of Bond | Date of Purchase | Coupon Rate | Maturity Date | Total Coupon Payments |
|--------------------|------------------|-------------|---------------|-----------------------|
| \$5,000 | 2010 | 7.50% | 10 years | \$ |
| \$1,000 | 2011 | 6.80% | 10 years | \$ |
| \$5,000 | 2012 | 5.00% | 10 years | \$ |
| \$10,000 | 2014 | 6.50% | 5 years | \$ |
| \$1,000 | 2015 | 7.00% | 5 years | \$ |
| Combined Total | | | | \$ |

1. What will be the total amount earned in coupon payments on all of the bonds together? \$ _____
2. Using the coupon rates on the chart, what can you assume about the price of the 2010 and 2011 bonds if you had sold them on the secondary market in 2012? Explain.

3. Which bond earns the most in coupon payments at maturity? Why?

4. Based on what you have learned about bonds, do you think you would consider them as an investment choice? Why or why not?

