**Review of Bond Basics**

There are three types of bonds we will concern ourselves with

1. Fixed payment Bonds

This is an annuity

Payments consist of both principal and interest

Amortization

Same dollar amount is paid every month (period)

Works as an annuity

Typical for car loans and mortgages

PVA = 

Example: Take out a $200,000 mortgage with a 30-yr. 6.0% fixed-rate mortgage:

$200,000 =   = 

C = $1,199.10 = monthly mortgage payment

In Excel, you are solving for the payment.

End of first month: Original Principal = $200,000

 Interest due = 6%/12 = .5% = .005

 .005 · $200,000 = $1,000

 You pay $1,199.10

 Interest 1,000.00

 Princ. $ 199.10

End of second month: New Princ. = $200,000 - $199.10 = $199,800.90

 Int. Due = .005 x $199,800.90 = $999.00

 You pay $1,199.10

 Interest 999.00

 Princ. $ 200.10

For 30 years, each month, the interest decreases and the principle increases. On the last month, you pay off all the principle with only a few dollars of interest.

View the amortization schedule in Excel on our class website to see this.

1. Coupon Bond

Pays interest semi-annually till maturity

Pays principal at maturity

The forward-looking interest rate is called the yield

YTM = the annual interest rate that equates the bond’s price with the PV of its cash flows.

Price = C  + FV/(1+r)t

Example: Price a $10,000 bond with a coupon rate of 7% YTM of 5%, and 8 yrs till maturity.

= 

= $11,305.50

If we have the price but not the yield, we can solve for the yield:

Example: A bond with 10 yrs to maturity has an 8% coupon rate and sells at $1,100. What is its YTM?

1,100 = 40  + 1,000/(1+r)20

r = .0331 = 3.31% = semi-annual interest rate

YTM = 3.31% x 2 = 6.62%. We typically carry it out to the nearest basis point.

Note that price and yield are **jointly determined**.

The Effective Annual Rate (EAR) is (1+ .0331)2 – 1 = 6.73% (note it’s higher than YTM). The YTM is similar to an APR calculation – it doesn’t consider compounding within the year. But still – it is typically used when working with bonds.

1. Discount Bond

Also called a zero coupon bond

Purchase price is determined as a discount from the face value

PV = FV

 (1+r)t

**Example**: $10,000 Discount Bond matures in 5 yrs and currently sells for $6,000.

 6,000 = 10,000

 (1+r)10

Bond-Equivalent Yield (BEY is the same concept as YTM) is always two times the semiannual yield

r = semiannual yield (note there are 10 semiannual Periods)

 r = .05241

 BEY = 10.482%

Remember that the YTM (BEY) is the return you will receive if you hold the bond to maturity and you are able to reinvest the coupon payments at that rate. If you sell it early, your return may be higher or lower. If you don’t reinvest all the coupon payments exactly at the YTM, your return may be higher or lower.

A bond’s price and its yield move in opposite directions

Bonds sell at Par, a Premium, or a Discount

The prices of all bonds converge to par at maturity

**Example**: You bought this 7% 10 year bond after 2 years for $11,305.50 with a Yield to maturity of 5%. What is it worth in 3 years if interest rates don’t change further?

\_\_\_\_\_\_\_\_\_\_\_\_\_11,305.50\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_maturity

0 4 10 20

Price = 10,875.20

Bid – Price at which someone (who is quoting the price) will buy a particular bond

Ask – Price at which someone (who is quoting the price) will sell a particular bond

The Bid-Ask Spread is a measure of a bond’s liquidity

On-the-run bond – The most recently issued bond of its type

Off-the-run bond – Another bond of its type has been issued more recently

**Risks Associated with Bonds**

1. Interest Rate Risk – the risk of a change in price caused by changes in interest rates. This is measured by a bond’s duration, and we’ll discuss it extensively.
2. Reinvestment Risk – the flip side of interest rate risk. If your holding period does not match the timing of the cash flows, this is the risk that you cannot reinvest your cash flows at the same interest rate. This applies to reinvestment of coupon payments as well as reinvesting the face value at the bond’s maturity.

Interest rate risk and reinvestment risk work in opposite directions - ↑ int. rates is bad for int. rate risk but good for reinv. risk. ↓ int. rates is good for int. rate risk but bad for reinv. risk.

1. Default Risk (aka Credit Risk) – the risk that the borrower will not be able to make the promised payments, either on time or in full.

Credit Rating Agencies:

Moody’s

Standard & Poor’s

Fitch

Credit Spread – the difference in yields between an obligation subject to default risk and an otherwise identical, default-free security. U.S. Treasuries are typically considered to be default-free.

The appropriate spreads for risky bonds change over time as market conditions and the risk aversion and perceptions of investors change.

1. Liquidity Risk – the risk that the owner of the bond will not be able to quickly convert it to cash without experiencing a loss of value.

Financial assets exhibiting high liquidity are often priced higher than otherwise similar assets or, conversely, they have lower yields.

One indication of high liquidity is a very narrow bid-ask spread quoted by a dealer on a financial security.

On-the-run bonds are more expensive and therefor have a lower yield than their seasoned counterparts because they are more liquid.

1. Cash Flow Risk – the risk that the cash flows might vary in amounts and timing – such as the risk of being called

Embedded Options:

Call Provision – Callable Bond

Conversion Provision – Convertible Bond

Put provision – Putable Bond

Callable Bond:

Issuer can alter the maturity

Call Premium = call price – par value

Convertible Bond:

Bondholder owns a call on common stock. The value of the call is added to the bond’s value

Bondholder can convert bond to “x” shares of common stock.

Note that this is a benefit for the bondholder and thus increases the price while decreasing the yield.

Putable Bond:

Bondholder can redeem bond for par value at any time or at certain dates

1. Inflation Risk – the risk that the stated cash flows may lose purchasing power.

You get nominal payments. What will their real value be?

TIPS don’t have this risk

**Government Bonds** - Prices are often quoted in 32nds.

 Example: 105:28 or 105-28 = 105 28/32 % of face value

 = 105.875% of face value

 For $1 million bond = $1,058,750

**Types of Fixed Income Securities**

1. Treasuries (any developed sovereign nation – we will typically use the U.S.)
2. Agency Securities
3. Corporate Securities
4. Mortgage Backed Securities
5. Municipal Bonds

Yield Curve – A graph of the term structure of interest rates.

 A plot of YTM and maturity of a class of bonds (usually Treasuries)

<https://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/Historic-Yield-Data-Visualization.aspx>

Bonds are typically priced off of Treasuries, which are default-risk free

You find a treasury bond with the same coupon and maturity (same CF patterns) and add a premium for:

Credit Risk

Call Risk

Liquidity Risk

**Some Additional Bond Terms**

Bond Indenture: Legal document outlining agreement between bond issuer and bondholders

Sinking Fund: Company makes annual payments to trustee for purpose of repaying the

 bond.

Protective Covenant: Contained in bond indenture.

 Limits what borrower can do.

 Protects lenders

 Can be negative or positive covenant