Chapter 6

Bonds, Bond Prices and the Determination of Interest Rates

McGraw-Hill/Irwin

Types of Loans

Four Types of Credit Instruments

1. Simple loan
2. Fixed-payment loan
3. Coupon bond
4. Discount (zero coupon) bond

Concept of Present Value

Simple loan of $1 at 10% interest

Year	1	2	3	n
	$1.10	$1.21	$1.33	$1x(1 + i)^n

PV of future $1 = $\frac{\$1}{(1+i)^n}$

Yield to Maturity: Loans

Yield to maturity = interest rate that equates today's value with present value of all future payments

1. Simple Loan (i = 10%)

$100 = $110/(1 + i) $\Rightarrow$

$$i = \frac{\$110 - \$100}{\$100} = \frac{\$10}{\$100} = 0.10 = 10\%$$ (simple i =yield to maturity)

2. Fixed Payment Loan (i = 12%) fully amortized loan

$$\$1000 = \frac{\$126}{(1+i)} + \frac{\$126}{(1+i)^2} + \frac{\$126}{(1+i)^3} + \ldots + \frac{\$126}{(1+i)^{25}}$$

$$LV = \frac{FP}{(1+i)} + \frac{FP}{(1+i)^2} + \frac{FP}{(1+i)^3} + \ldots + \frac{FP}{(1+i)^n}$$

Yield to Maturity: Bonds

3. Coupon Bond (Coupon Rate = 10% = C/F)

$$PV = \frac{\$100}{(1+i)} + \frac{\$100}{(1+i)^2} + \frac{\$100}{(1+i)^3} + \ldots + \frac{\$100}{(1+i)^{10}} + \frac{\$1000}{(1+i)^{10}}$$

$$PV = \frac{C}{(1+i)} + \frac{C}{(1+i)^2} + \frac{C}{(1+i)^3} + \ldots + \frac{C}{(1+i)^n} + \frac{Face\ Value}{(1+i)^n}$$

Consol: Fixed coupon payments of $C forever

$$PV = \frac{C}{i} \qquad i = \frac{C}{P}$$

4. Discount Bond (*PV* = $900, *FV* = $1000), one year (zero-coupon bond)

$$\$900 = \frac{\$1000}{(1+i)} \quad \Rightarrow$$

$$i = \frac{\$1000 - \$900}{\$900} = 0.111 = 11.1\%$$

$$i = \frac{FV - PV}{PV}$$

Bond Prices

Zero-coupon bonds, which promise a single future payment, such as a U.S. Treasury Bill.

Fixed payment loans, such as conventional mortgages.

Coupon Bonds, which make periodic interest payments and repay the principal at maturity. U.S. Treasury Bonds and most corporate bonds are coupon bonds.

Consols, which make periodic interest payments forever, never repaying the principal that was borrowed. (There aren't many examples of these.)

Bond Prices

Zero-Coupon Bonds or Discount Bonds

Price of a $100 face value zero-coupon bond

$$= \frac{\$100}{(1+i)^n}$$

Where i is the interest rate in decimal form and n is time until the payment is made in the same time units as the interest rate

Bond Prices

Zero-Coupon Bonds or Discount Bonds
Examples. Assume i=4%

Price of a One-Year Treasury Bill.

$$= \frac{100}{(1+0.04)} = \$96.15$$

Price of a Six-Month Treasury Bill

$$= \frac{100}{(1+0.04)^{1/2}} = \$98.06$$

Bond Prices

Zero-Coupon Bonds or Discount Bonds

Given n, the price of a bond and the interest rate move in opposite directions

Bond Prices

Fixed Payment Loans

Value of a Fixed Payment Loan =

$$\frac{FixedPayment}{(1+i)} + \frac{FixedPayment}{(1+i)^2} + \cdots + \frac{FixedPayment}{(1+i)^n}$$

Bond Prices

Coupon Bond

$$P_{CB} = \left[\frac{CouponPayment}{(1+i)^1} + \frac{CouponPayment}{(1+i)^2} + \ldots\ldots + \frac{CouponPayment}{(1+i)^n} \right] + \frac{FaceValue}{(1+i)^n}$$

Bond Prices

Consols

$$P_{Consol} = \frac{\text{Yearly Coupon Payment}}{i}$$

Bond Yields

Yield to Maturity

Price of One-Year 5 percent Coupon Bond = $\frac{\$5}{(1+i)} + \frac{\$100}{(1+i)}$

The value of i that solves this equation is the yield to maturity

Why does the nominal Interest Rate fluctuate?

Now, we know that there is a negative relation between Bond prices and the interest rate.

So why do bond prices change?
use supply and demand, i.e., the theory of asset demand, the supply and then the market equilibrium.

Asset market approach: based on stocks, not flows.

Bond Market and Interest Rates

One Year Zero-coupon (discount) Bond.

$$P = \frac{\$100}{1+i} \quad \text{or} \quad i = \frac{\$100 - P}{P}$$

Bond Market and Interest Rates

Bond Supply

- The Bond supply curve is the relationship between the price and the quantity of bonds people are willing to sell, all other things being equal.

Bond Market and Interest Rates

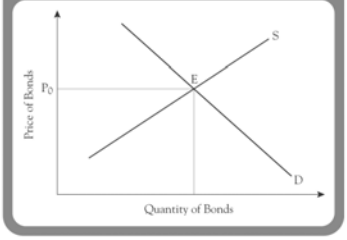
Bond Demand

- The bond demand curve is the relationship between the price and quantity of bonds that investors demand, all other things being equal. As the price falls, the reward for holding the bond rises, so the demand goes up

Bond Market and Interest Rates

Figure 6.2 Supply, Demand, and Equilibrium in the Bond Market

The supply of bonds from borrowers slopes up and the demand for bonds from lenders slopes down. Equilibrium in the bond market is determined by the intersection of supply and demand.



Equilibrium in the bond market is the point at which supply equals demand

Bond Market and Interest Rates

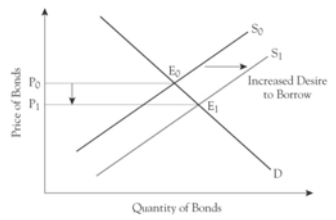
Table 6.3 Factors That Increase Bond Supply, Lower Bond Prices, and Raise Interest Rates

Change	Effect on Bond Supply, Bond Prices, and Interest Rates
An increase in the government's desired expenditure relative to its revenue	Bond supply shifts to the right, Bond prices ↓, and interest rates ↑
An improvement in general business conditions	Bond supply shifts to the right, Bond prices ↓, and interest rates ↑
An increase in expected inflation, reducing the real cost of repayment	Bond supply shifts to the right, Bond prices ↓, and interest rates ↑

Bond Market and Interest Rates

Figure 6.3 A Shift in the Supply of Bonds

When borrowers' desire for funds increases, the bond supply curve shifts to the right, lowering bond prices and raising interest rates.



Bond Market and Interest Rates

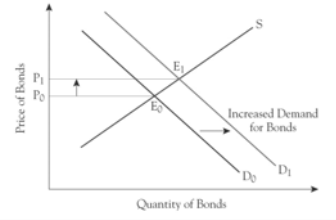
Table 6.4 Factors That Increase Bond Demand, Raise Bond Prices, and Lower Interest Rates

Change	Effect on Bond Demand
An increase in wealth increases demand for all assets, including bonds.	Bond demand shifts to the right, bond prices ↑, and interest rates ↓
A reduction in expected inflation makes bonds with fixed nominal payments more desirable.	Bond demand shifts to the right, bond prices ↑, and interest rates ↓
An increase in the expected return on the bond relative to the expected return on alternatives makes bonds more attractive.	Bond demand shifts to the right, bond prices ↑, and interest rates ↓
A decrease in the expected future interest rate makes bonds more attractive.	Bond demand shifts to the right, bond prices ↑, and interest rates ↓
A fall in the riskiness of the bond relative to the riskiness of alternatives makes bonds more attractive.	Bond demand shifts to the right, bond prices ↑, and interest rates ↓
An increase in the liquidity of the bond relative to the liquidity of alternatives makes bonds more attractive.	Bond demand shifts to the right, bond prices ↑, and interest rates ↓

Bond Market and Interest Rates

Figure 6.4 Shift in Bond Demand

When there is an increase in investors' willingness to hold bonds, the bond demand curve shifts to the right, increasing bond prices and reducing interest rates.



Bonds and Risk

Sources of Bond Risk

- Default Risk
- Inflation Risk
- Interest-Rate Risk

Chapter 6

End of Chapter