Understanding Interest Rates

Chapter 4 of Mishkin

Credit Market Instruments (1)

1. ***Simple loan***: The loan that must be repaid at the maturity date, along with an additional payment for the interest.
2. ***Fixed-payment loan***: The loan that must be repaid by a fixed amount every period.

Credit Market Instruments (2)

3. ***Coupon bond***: Pays the owner a fixed interest payment every year until the maturity date, when the par value (or face value) is repaid.
4. ***Discount bond***: Has discounted price and repays the par value at its maturity date (***zero-coupon bond***).

Measuring Interest Rates (1)

- In economics, the *yield to maturity* is the most accurate measure of *interest rates*.
- To measure (or calculate) these interest rates, we need to know the concept of ***present value***.
- Many operations in financial institutions and financial markets use this concept.

Measuring Interest Rates (2)

- 1 baht at different time has different value.
- The formular is based on the concept of compound interest:

$$(1+i)^n PV = FV$$

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

where *n* is the number of years, and *i* is the interest rate.

Measuring Interest Rates (3)

- For a ***simple loan***, we apply the concept of present value directly.

$$(1+i)^n PV = FV$$

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

$$1+i = \left(\frac{FV}{PV}\right)^{(1/n)}$$

$$i = \left(\frac{FV}{PV}\right)^{(1/n)} - 1$$

Measuring Interest Rates (4)

- For a ***fixed-payment loan***, we need a computer program, e.g. Ms Excel.
- We want to find the interest rate *i* that solves:

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

where *LV* = loan value

FP = fixed payment

Measuring Interest Rates (5)

- For a ***coupon bond***, we also need a computer program.
- We want to find the interest rate *i* that solves:

$$P = \frac{C}{1+i} + \frac{C}{(1+i)^2} + \cdots + \frac{C}{(1+i)^n} + \frac{F}{(1+i)^n}$$

where P = price of the bond

C = yearly payment

F = face value.

Measuring Interest Rates (6)

- For a ***discounted bond***, like simple loan, we apply the concept of present value directly.

$$i = \left(\frac{FV}{PV}\right)^{(1/n)} - 1$$

Relationship between bond price and interest rate

Table 1 Yields to Maturity on a 10%-Coupon-Rate Bond Maturing in Ten Years (Face Value = $1,000)

Price of Bond ($)	Yield to Maturity (%)
1,200	7.13
1,100	8.48
1,000	10.00
900	11.75
800	13.81

Three Interesting Facts in Table 1

1. When bond is at par, yield equals coupon rate.
2. Price and yield are negatively related.
3. Yield greater than coupon rate when bond price is below par value.

Some interesting facts

- With compound interest at 10 percent, you can double your saving in 7-8 years. Let's try saving 100,000 baht for 15 years.
- How much do you want before you retire?
- How about an insurance program?

Interest Rate Vs Returns (1)

- Recall that our interest rate is the ***yield-to-maturity***.
- If you do not hold an asset to its maturity date, ***rate of return*** on the asset may *not* be equal to the interest rate.

$$RETURN = i + g$$

where g is the capital gains (or losses).

Interest Rate Vs Returns (2)

Table 2 One-Year Returns on Different-Maturity 10%-Coupon-Rate Bonds When Interest Rates Rise from 10% to 20%

(1) Years to Maturity When Bond Is Purchased	(2) Initial Current Yield (%)	(3) Initial Price ($)	(4) Price Next Year* ($)	(5) Rate of Capital Gain (%)	(6) Rate of Return (2 + 5) (%)
30	10	1,000	503	−49.7	−39.7
20	10	1,000	516	−48.4	−38.4
10	10	1,000	597	−40.3	−30.3
5	10	1,000	741	−25.9	−15.9
2	10	1,000	917	−8.3	+1.7
1	10	1,000	1,000	0.0	+10.0

*Calculated using Equation 3.

Interest Rate Vs Returns (3)

Key Findings from Table 2

1. Bond whose return = yield is bond that maturity = holding period
2. For bonds with maturity > holding period, $i\uparrow$ $P\downarrow$ implying capital loss
3. Longer is maturity, greater is % price change associated with interest rate change
4. Longer is maturity, more return changes with change in interest rate
5. Bond with high initial interest rate can still have negative return if $i\uparrow$

Interest Rate Vs Returns (4)

Conclusion from Table 2 Analysis

1. Prices and returns more volatile for long-term bonds because have higher interest-rate risk
2. No interest-rate risk for any bond whose maturity equals holding period

Nominal Interest Rate Vs Real Interest Rate (1)

Real Interest Rate is the interest rate that is adjusted for expected change in price level.

$$i_r = i - \pi^e$$

where i_r is the real interest rate,
π^e is the expected inflation.

Nominal Interest Rate Vs Real Interest Rate (2)

Real Interest Rate can be thought of as interest rate in term of goods and services (real term).

- It more accurately reflects true cost of borrowing.
- When real rate is low, greater incentives to borrow and less to lend