E216 : Economics of MONEY AND BANKING

Second grade

First term

Dr Doaa Akl Ahmed

Associate Professor of Economics

Benha University

Chapter 3

Understanding Interest Rates

Learning outcome

1. Explain the **present value concept** and the meaning of the term *interest rate.*
2. Present different ways of measuring the interest rate.
3. Distinguish between the four types of credit market instruments
4. Explain the difference between **nominal and real interest rates**.
5. Compute the yield to maturity for different credit market instruments.

1. Measuring interest rate

Present value

- A dollar paid to you one year from now is less valuable than a dollar paid to you today. **Why?**
- You can deposit a dollar in a savings account that earns interest and have more than a dollar in one year.
  - **After 1 year:** you will have $1 ×(1+i).

$100 Now	$100 year from now
interest rate = 10% **After 1 year:** $100 ×(1+10%)= 100+10=110	$100

1. Measuring interest rate

Some Basic Terminology

Principal*:* initial value of the loan.

Face value or **par value** is equal to a bond's price when it is first issued.

Cash flows are the cash payments to the holder of debt instruments.

Maturity date: is the date on which the principal amount of a bond or another debt instrument becomes due and is repaid to the investor.

1. Measuring interest rate

The simple loan: the lender provides the borrower with an amount of funds (called the ***principal***) that must be repaid to the lender at the ***maturity date***, along with an additional payment for the interest.

- Assume that you lend you friend a **simple loan** $100 for one year.
- You would require her to repay the principal of $100 in one year ***s*** time along with an additional payment for interest say, $10.
- Simple interest rate, ***i***, is:

$$i = \frac{\$10}{\$100} = 0.10 = 10\%$$

1. Measuring interest rate

$$cash\ flows = principal \times (1+i)^n$$
i : interest rate, n= maturity date

Let i = .10

In one year $100 X (1+ 0.10) = $110

In two years $110 X (1 + 0.10) = $121

or 100 X $(1 + 0.10)^2$

In three years $121 X (1 + 0.10) = $133

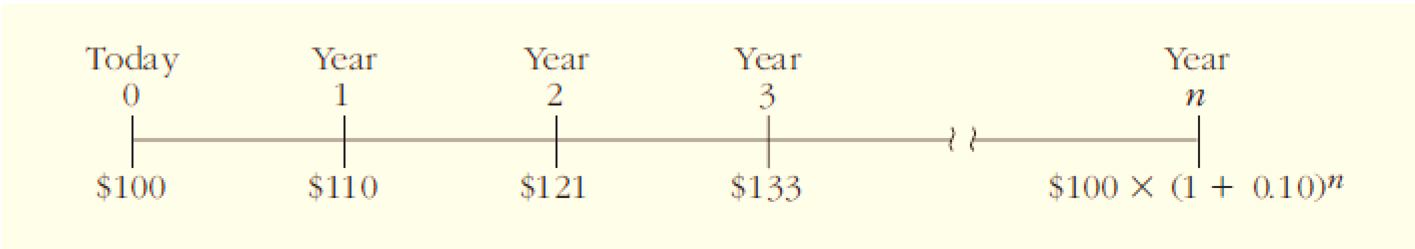
or 100 X $(1 + 0.10)^3$

In n years

$100 X $(1 + i)^n$

1. Measuring interest rate

- the following timeline shows the cash flows of n years:



- Having $100 today as having $110 a year from now or $121 two years from now (of course, as long as you are sure that the borrower will pay you back).

✓ This process is called **discounting the future.**

$$\text{PV} = \text{today's (present) value}$$
$$\text{CF} = \text{future cash flow (payment)}$$
$$i = \text{the interest rate}$$
$$\text{PV} = \frac{\text{CF}}{(1+i)^{n}}$$

2. Measuring present value

Example 1:

With an interest rate of 6 percent, the present value of $100 next year is approximately

A) $106.

B) $100.

C) $94.

D) $92.

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

CF= 100

i= 6%

n=1

$$PV = \frac{100}{(1+0.06)^1} = \frac{100}{1.06} = 94.3$$

2. Measuring present value

Example 2: What is the present value of $500.00 to be paid in two years if the interest rate is 5 percent?

A) $453.51
B) $500.00
C) $476.25
D) $550.00

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

CF= 500

i= 5%

n=2

$$PV = \frac{500}{(1+0.05)^2} = \frac{500}{1.1025} = 453.51$$

1. Measuring interest rate

- the ***yield to maturity*** is the most accurate measure of interest rates.
- **Yield to maturity (YTM):** is the total expected return of a bond if it is held until the end of its lifetime.
- Different debt instruments have very different cash payments to the holder (known as **cash flows**) with very different timing.

3.Four Types of Credit Market Instruments

- **Coupon Bond**
- **Fixed Payment Loan**
- **Simple Loan**
- **Discount Bond**
- These four types of instruments require payments at different times:

1. Simple loans and discount bonds **make payment only at their maturity dates.**
2. Fixed-payment loans and coupon bonds **have payments periodically until maturity.**

3.Four Types of Credit Market Instruments

- A **simple loan** the lender provides the borrower with an amount of funds (called the ***principal***) that must be repaid to the lender at the ***maturity date***, along with an additional payment for the interest.

$$\text{PV} = \text{today's (present) value}$$
$$\text{CF} = \text{future cash flow (payment)}$$
$$i = \text{the interest rate}$$
$$\text{PV} = \frac{\text{CF}}{(1+i)^n}$$

3.Four Types of Credit Market Instruments

A simple loan example:

If Pete borrows $100 from his sister and next year she wants $110 back from him, what is the yield to maturity on this loan?

The yield to maturity on the loan is 10%.

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

where

PV = amount borrowed = $100

CF = cash flow in one year = $110

n = number of years = 1

Solution

Thus

$$\$100 = \frac{\$110}{(1+i)}$$

$$(1+i)\,\$100 = \$110$$

$$(1+i) = \frac{\$110}{\$100}$$

$$i = 1.10 - 1 = 0.10 = 10\%$$

3.Four Types of Credit Market Instruments

- **Discount bond** (**a zero-coupon bond**): is bought at a price below its face value (at a discount), and the face value is repaid at the maturity date.
- no interest payments; **it just pays off the face value.**

For any one year discount bond

$$i = \frac{F - P}{P}$$

F = Face value of the discount bond

P = current price of the discount bond

$$i = \frac{1000 - 900}{900}$$

3.Four Types of Credit Market Instruments

- A **coupon bond** pays the owner of the bond a fixed interest payment (coupon payment) every year until the maturity date, when a specified final amount (**face value** or **par value**) is repaid.
- A coupon bond with $1000 face value, for example, might pay you a coupon payment of $100 per year for ten years and at the maturity date repay you the face value amount of $1000.

$$P = \frac{C}{1+i} + \frac{C}{(1+i)^2} + \frac{C}{(1+i)^3} + \ldots + \frac{C}{(1+i)^n} + \frac{F}{(1+i)^n}$$

where

P = price of coupon bond
C = yearly coupon payment
F = face value of the bond
n = years to maturity date

3.Four Types of Credit Market Instruments

- **Fixed-payment loan:** the lender provides the borrower with an amount of funds, which must be repaid by making the same payment every period (such as a month) consisting of part of the principal and interest for a set number of years.
  - *LV* = loan value
  - *FP* = fixed yearly payment
  - *n* = number of years until maturity

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

- The present value of the fixed-payment loan is calculated as the sum of the present values of all payments

4.Distinction between nominal and real interest rates

- **Nominal interest rate** makes no allowance for inflation
- **Real interest rate** is adjusted for changes in price level so it more accurately reflects the cost of borrowing.

$$r = i - \pi$$
$$r = real\ interestrate$$
$$i = nominal\ interest\ rate$$
$$\pi = inflation\ rate$$

Questions for review

1) The concept of _________ is based on the common-sense notion that a dollar paid to you in the future is less valuable to you than a dollar today.

A) present value
B) future value
C) interest
D) deflation

2) The present value of an expected future payment _________ as the interest rate increases.

A) falls
B) rises
C) is constant
D) is unaffected

Questions for review

5) A _________ pays the owner a fixed coupon payment every year until the maturity date, when the _________ value is repaid.
A) coupon bond; discount
B) discount bond; discount
C) coupon bond; face
D) discount bond; face

6) If a $5,000 coupon bond has a coupon rate of 13 percent, then the coupon payment every year is
A) $650.
B) $1,300.
C) $130.
D) $13.

Questions for review

3) An increase in the time to the promised future payment _________ the present value of the payment.
A) decreases
B) increases
C) has no effect on
D) is irrelevant to

4) To claim that a lottery winner who is to receive $1 million per year for twenty years has won $20 million ignores the process of
A) face value.
B) par value.
C) deflation.
D) discounting the future.

Questions for review

7) For a 3-year simple loan of $10,000 at 10 percent, the amount to be repaid is

A) $10,030.

B) $10,300.

C) $13,000.

D) $13,310.

8) The present value of a fixed-payment loan is calculated as the __________ of the present value of all cash flow payments.

A) sum

B) difference

C) multiple

D) log