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# FINA 1082 Financial Management

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# Introduction to Business Finance

- Overview of the Finance discipline
- The time value of money
- Compare simple interest to compounded interest
- Compute the future value of a single cash flow
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- Net Present Value

# What is Finance?

**Finance** is the study of how individuals, businesses and institutions acquire, spend and manage financial resources

- **Major areas of Finance**

- Investment analysis and management
- Corporate Finance
- Capital markets and Financial Institutions
- International Finance
- Personal finance
- Real Estate Finance

**This subject provides an introduction to Investment Analysis and Corporate Finance**

# Overview of Business Finance

- The study of Finance is related to the corporate objective of maximizing shareholder wealth
- Our focus is on financial decision making...
  - **Individuals/Investors**
    - Financial Security Valuation: Earnings and Dividend models
    - Portfolios and Risk Diversification: Portfolio Analysis
    - Determination of Security Prices and Rates of Return: Capital Asset Pricing Model and Arbitrage Pricing Model
    - Using Financial Derivatives: Futures, Forwards and Options
  - **Financial Managers**
    - Investment Decisions: Capital Budgeting Analysis
    - Financing Decisions: Capital Structure and Dividend Policies
  - ....and the interaction among these decisions

# This Subject

**Investment Analysis** is mainly concerned with **where** and **how** to invest

- Valuation of stocks, bonds and derivatives
- Portfolio Diversification
- Asset Pricing and Market efficiency
- These topics are covered in the first half of this course

**Corporate Finance** is mainly concerned with the **decisions** of **managers**

- Capital Budgeting – **What** investments to make
- Capital Structure – **How** to finance these investments
- Dividend Policy – **What** to payout to Shareholders
- These topics are covered in the second half of this subject

# Why Study Finance

- To make informed economic decisions
- To better manage existing financial resources and accumulate wealth over time
- To be successful in the business world you need to have an understanding of finance.



# The Time Value of Money

Would you prefer to have \$1 million now or \$1 million 10 years from now?

Of course, **we would all prefer the money now!**

This illustrates that there is an inherent monetary value attached to time.

## What is The Time Value of Money?

A dollar received today is worth more than a dollar received tomorrow

- This is because a dollar received today **can be invested to earn interest**
- The amount of interest earned **depends on the rate of return** that can be earned on the investment

Time value of money **quantifies** the value of a dollar through time

# Uses of Time Value of Money

Time Value of Money, or TVM, is a concept that is used in all aspects of finance including:

- Bond valuation
- Stock valuation
- Accept/reject decisions for project management
- Financial analysis of firms
- **And many others!**

# Introduction to Financial Mathematics

## Simple Interest

The value of a cash flow is calculated without including any accrued interest to the principal

**Example:** If you invest \$1,000 at 8% p.a. earning simple interest for 5 years what amount will you have in your account at the end of that time period?

Interest earned in each of the five years =  $1000 \times 0.08 = \$80$

Interest earned in over five years =  $1000 \times (5 \times 0.08) = \$400$

Future value at the end of year 5 =  $1000 + 400 = \$1,400$

Future value at the end of year 5 =  $1000 \times (1 + 5 \times 0.08) = \$1,400$

Future value (Simple interest):  $S_n = P_0 \times (1 + n \times i)$

Present value (Simple interest):  $P_0 = \frac{S_n}{(1+n \times i)}$

# Simple Versus Compounded Interest

## Compound Interest

Interest accrued is added to the principal

The value of a cash flow is calculated based on the principal and interest accrued

**Example:** If you invest \$1,000 at 8% p.a. earning compounded interest for 5 years what amount will you have in your account at the end of that time period?

Future value at the end of year 1  $= 1000 \times (1.08) = \$1,080.00$

Future value at the end of year 2  $= 1080 \times (1.08) = \$1,166.40$

Future value at the end of year 5  $= 1000 \times (1.08)^5 = \$1,469.33$

The difference of **\$69.33** ( $= 1469.33 - 1400.00$ ) is due to the compounding of interest

# Simple Versus Compounded Interest

Amount Invested \$1,000

Interest Rate 8%

End of year	Simple Interest	Compounded Interest	Difference
1	\$1,080.00	\$1,080.00	\$0.00
2	\$1,160.00	\$1,166.40	\$6.40
3	\$1,240.00	\$1,259.71	\$19.71
4	\$1,320.00	\$1,360.49	\$40.49
5	\$1,400.00	\$1,469.33	\$69.33
20	\$2,600.00	\$4,660.96	\$2,060.96
50	\$5,000.00	\$46,901.61	\$41,901.61
100	\$9,000.00	\$2,199,761.26	\$2,190,761.26

## Future Value of a Single Cash Flow

The future value (or sum) at  $i\%$  p.a. of  $\$P_0$  today is the dollar value to which it grows at the end of time period  $n$

$$S_n = P_0 \times (1 + i)^n$$



*Cash flows occur at the end of the period*

## Future Value of a Single Cash Flow

The future value at  $r\%$  p.a. of  $\$P_0$  today is the dollar value to which it grows at the end of time  $n$

$$FVIF_{r,n} = \$1(1 + r)^n$$

FVIF is short for Future Value Interest Factor



*Cash flows occur at the end of the period*

# Future Value of a Single Cash Flow

**Example:** You decide to invest \$1,000 for different time periods. What is the future value of this \$1,000 in 5, 20 and 100 years at an interest rate of (a) 4% and (b) 6%?

At  $i = 4\%$  p.a.

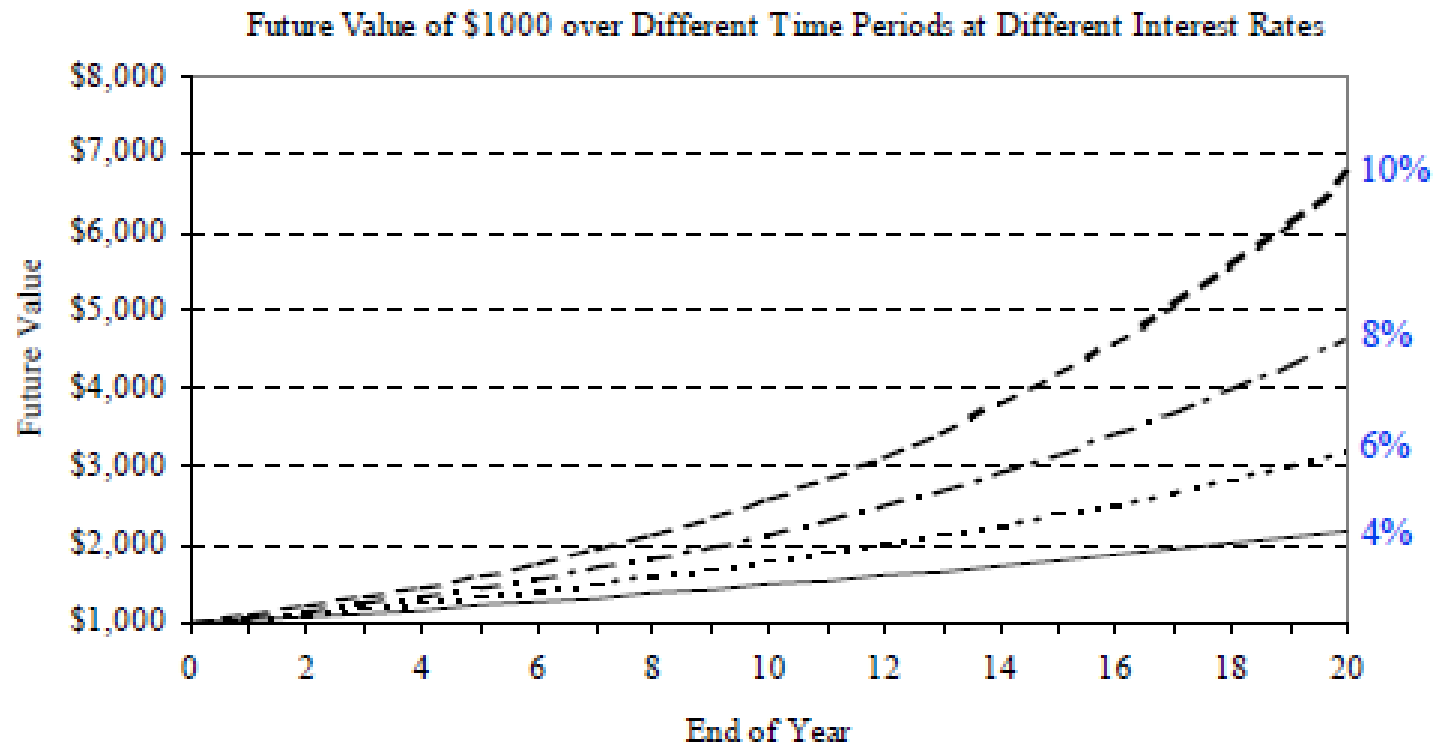
$$\begin{aligned} S_5 &= 1000 \times (1.04)^5 &= \$1,217 \\ S_{20} &= 1000 \times (1.04)^{20} &= \$2,191 \\ S_{100} &= 1000 \times (1.04)^{100} &= \$50,505 \end{aligned}$$

At  $i = 6\%$  p.a.

$$\begin{aligned} S_5 &= 1000 \times (1.06)^5 &= \$1,338 \\ S_{20} &= 1000 \times (1.06)^{20} &= \$3,207 \\ S_{100} &= 1000 \times (1.06)^{100} &= \$339,302 \end{aligned}$$



# Future Value of a Single Cash Flow



# Future Value of a Single Cash Flow

The future value of a cash flow depends on the following factors:

- The time period,  $n$ 
  - Future value increases as  $n$  increases
- The interest rate,  $i$ 
  - Future value increases as  $i$  increases
- The method of calculating interest
  - Future value increases as the compounding interval increases (more on this later).

## Present Value of a Single Cash Flow

The present value ( $P_0$ ) at  $i\%$  p.a. of  $\$S_n$  at the end of time  $n$  is the amount which invested today would grow to  $\$S_n$  in time  $n$

$$P_0 = S_n / (1 + i)^n = S_n \times (1 + i)^{-n}$$



*Cash flows occur at the end of the period*

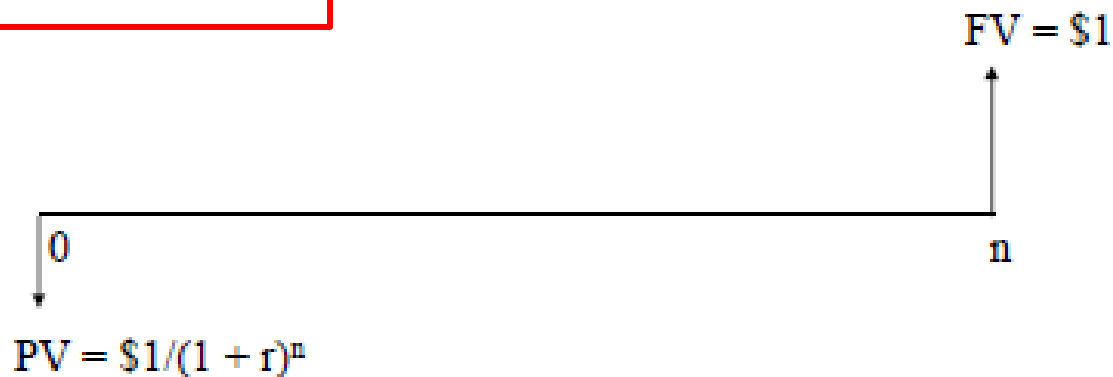
## Present Value of a Single Cash Flow

The present value (PV) at  $r\%$  p.a. of \$1 at the end of time  $n$  is the amount which invested now would grow to \$1 in time  $n$

$$PVIF_{r,n} = \$1/(1 + r)^n = \$1(1 + r)^{-n}$$

PVIF is the short for Present Value Interest Factor

Note:  $PVIF_{r,n} = 1/FVIF_{r,n}$



*Cash flows occur at the end of the period*

# Present Value of a Single Cash Flow

**Example:** If you needed \$10,000 in (a) five years, (b) ten and (c) twenty years how much would you need to save and invest today if the interest rates were (a) 4% and (b) 6%?

**The present value of \$10,000 in five years**

At 4% p.a.,  $P_0 = 10000/(1.04)^5 = \$8,219.27$

At 6% p.a.,  $P_0 = 10000/(1.06)^5 = \$7,472.58$

**The present value of \$10,000 in ten years**

At 4% p.a.,  $P_0 = 10000/(1.04)^{10} = \$6,755.64$

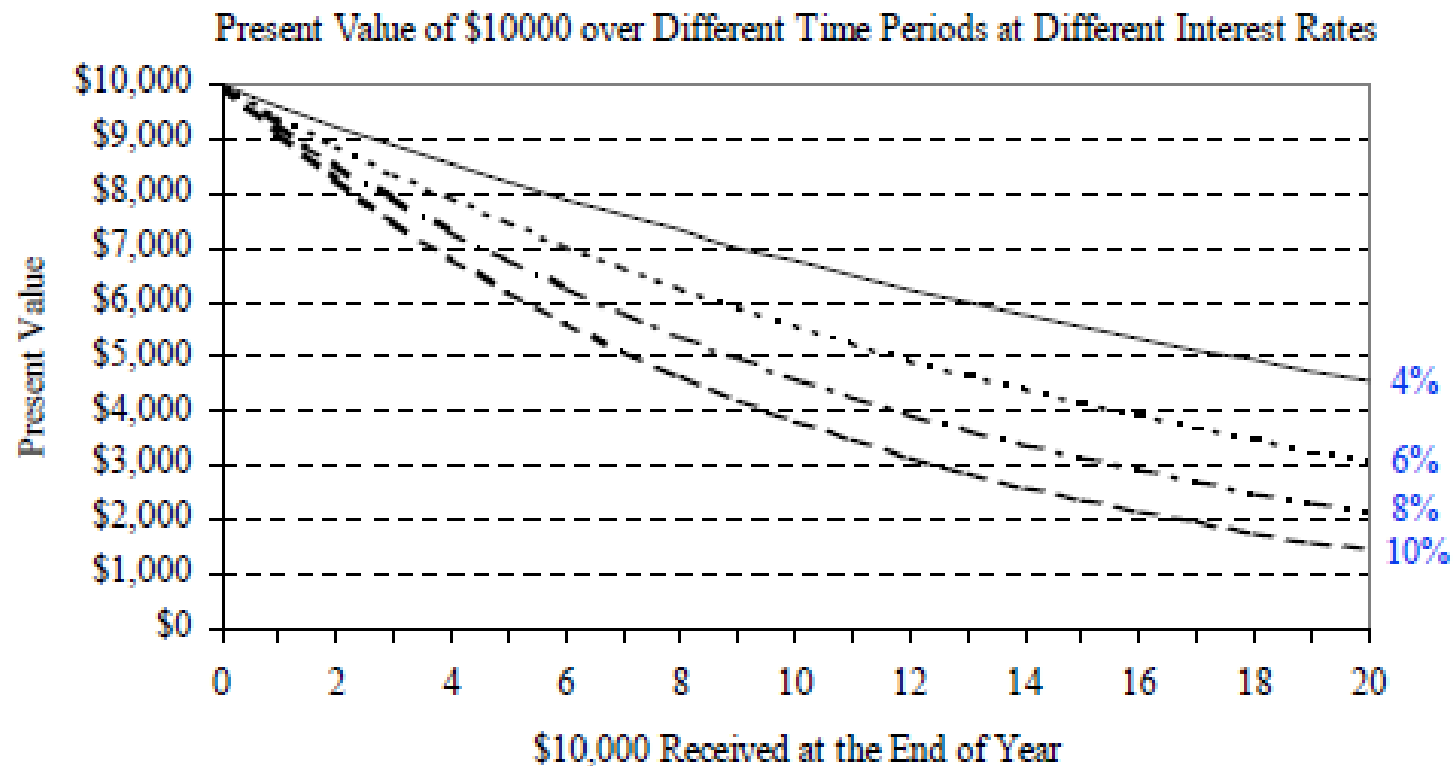
At 6% p.a.,  $P_0 = 10000/(1.06)^{10} = \$5,583.95$

**The present value of \$10,000 in twenty years**

At 4% p.a.,  $P_0 = 10000/(1.04)^{20} = \$4,563.87$

At 6% p.a.,  $P_0 = 10000/(1.06)^{20} = \$3,118.05$

# Present Value of a Single Cash Flow



# Factors Influencing Present and Future Values

The present and future values of a cash flow depend on the following factors

## The time period, $n$

- Future value increases as  $n$  increases
- Present value decreases as  $n$  increases

## The interest rate, $i$

- Future value increases as  $i$  increases
- Present value decreases as  $i$  increases

## The method of calculating interest

- Future value increases as the compounding interval increases
- Present value decreases as the compounding interval increases

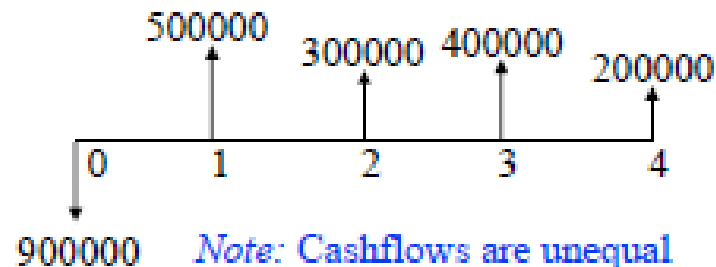
# Net Present Value

Net Present Value (NPV) is defined as the present value (PV) of cash inflows **minus** the present value of cash outflows

$$\text{NPV} = \text{PV}(\text{Cash inflows}) - \text{PV}(\text{Cash outflows})$$

**Class Exercise 1:** Your company is considering investing \$900,000 in a project that is expected to yield the following net cash flows over its four-year life. Assume that the company uses an interest rate of 12% p.a. to evaluate its investments. Should your company make this investment?

<i>Year 1</i>	<i>Year 2</i>	<i>Year 3</i>	<i>Year 4</i>
\$500,000	\$300,000	\$400,000	\$200,000





# Answer to Class Exercise 1

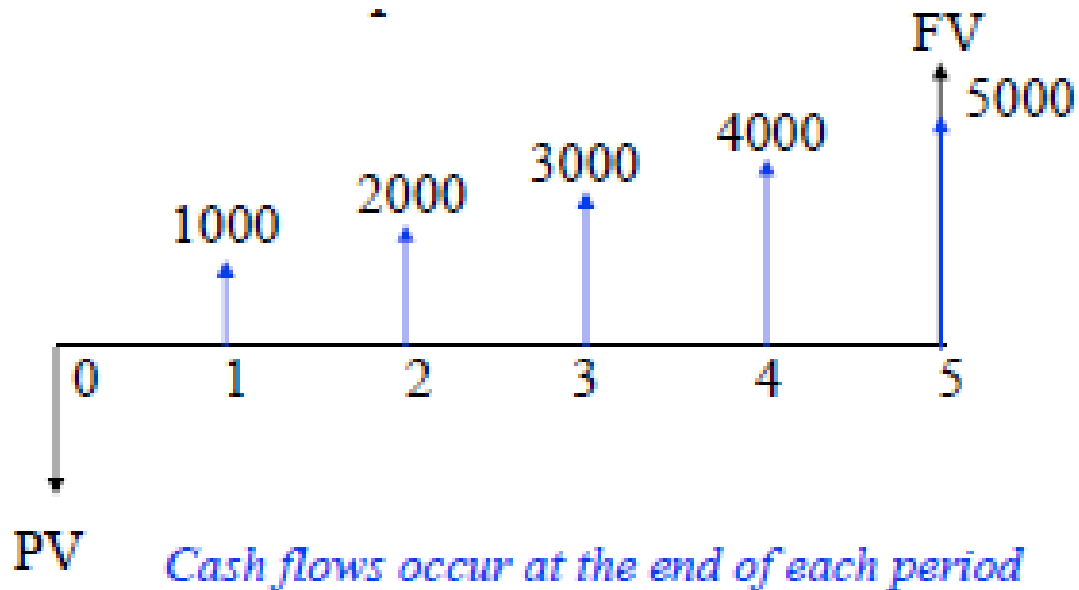
Need to look at whether

$$PV(\text{Cash Inflows}) > PV(\text{Cash Outflows})$$

- Net Present Value =  $PV(\text{Cash Inflows}) - PV(\text{Cash Outflows})$ 
  - Accept project if  $NPV > 0$
  - Reject project if  $NPV < 0$
  - Point of indifference where  $NPV = 0$
- $PV(\text{Cash Inflows}) = 500000/1.12 + 300000/1.12^2 + 400000/1.12^3 + 200000/1.12^4 = \$1,097,402$
- $PV(\text{Cash Outflows}) = \$900,000$
- Net Present Value,  $NPV = \$1,097,402 - \$900,000 = \$197,402 > 0$

## Valuing Unequal Cash Flows

**Class Exercise 2:** You decide to invest \$1,000 at the end of year 1 and then an additional \$1,000 at the end of every year for five years. What is the future value of these cash flows at the end of five years? What equivalent lump-sum amount could you invest today to get this future amount? Assume an interest rate of 10% p.a.



## Answer to Class Exercise 2

To get the total future (present) value of different cash flows occurring at different time periods compute their individual future (present) values and then add across

- Future value of cash flows at the end of five years
  - $FV_5 = 1000 \times (1.10)^4 + 2000 \times (1.10)^3 + 3000 \times (1.10)^2 + 4000 \times (1.10) + 5000$
  - $FV_5 = \$17,156.10$
- Equivalent single amount that could be invested today to get this future amount

- $PV_0 = 1000/(1.10) + 2000/(1.10)^2 + 3000/(1.10)^3 + 4000/(1.10)^4 + 5000/(1.10)^5 = \$10,652.59$

--or equivalently--

- $PV_0 = FV_5 / (1.10)^5 = 17156.10 / (1.10)^5 = \$10,652.59$

## Purpose of the Capital Market

Firms and individuals use the capital markets for long-term investments

Primary reason that individuals and firms choose to borrow long-term is to reduce the risk that interest rates will rise before they pay off their debt.

## Capital Market Participants

**Primary users:** federal and local governments and corporations

**Largest purchasers:** households. Frequently, individuals and households deposit funds in financial institutions that use the funds to purchase capital market instruments such as bonds or stock

# Capital Market Trading

Occurs in either **primary market** or the **secondary market**

**Primary market:** where new issues of stocks and bonds are introduced. Investment funds, corporations, and individual investors can all purchase securities offered in the primary market. (*IPO – initial public offering*).

**Secondary market:** where the sale of previously issued securities takes place, and it is important because most investors plan to sell long-term bonds before they reach maturity.

## Types of Bonds

- **Bonds** are **Securities** that represent a debt owned by the issuer to the investor.
- **Bonds obligate** the issuer to pay a specified amount at a given date, generally with periodic payments
- **The par, face, or maturity value of the bond** is the amount that the issuer must pay at maturity
- **The coupon rate** is the rate of interest that the issuer must pay

- This rate is **usually fixed for the duration** of the bond and does not fluctuate with market interest rates,
- If the repayment terms of a bond are not met, the holder of a bond has a claim on assets of the issuer

**Par or Face Value** - The amount of money that is paid to the bondholders at maturity. For most bonds this amount is \$1,000. It also generally represents the amount of money borrowed by the bond issuer.

**Coupon Rate** -The coupon rate, which is generally fixed, determines the periodic coupon or interest payments. It is expressed as a percentage of the bond's face value. It also represents the interest cost of the bond to the issuer.

**Coupon Payments** - The coupon payments represent the periodic interest payments from the bond issuer to the bondholder. The annual coupon payment is calculated by multiplying the coupon rate by the bond's face value. Since most bonds pay interest semiannually, generally one half of the annual coupon is paid to the bondholders every six months.

**Maturity Date** - The maturity date represents the date on which the bond matures, *i.e.*, the date on which the face value is repaid. The last coupon payment is also paid on the maturity date.

**Original Maturity** - The time from when the bond was issued until its maturity date.

**Remaining Maturity** - The time currently remaining until the maturity date.

**Call Date** - For bonds **which are callable**, *i.e.*, bonds which can be redeemed by the issuer prior to maturity, the call date represents the earliest date at which the bond can be called.

**Call Price** - The amount of money the issuer has to pay to call a callable bond (there is a premium for calling the bond early). When a bond first becomes callable, *i.e.*, on the call date, the call price is often set to equal the face value plus one year's interest.

**Required Return** - The rate of return that investors currently require on a bond.

**Yield to Maturity** - The rate of return that an investor would earn if he bought the bond at its current market price and held it until maturity. Alternatively, it represents the discount rate which equates the discounted value of a bond's future cash flows to its current market price.

**Yield to Call** - The rate of return that an investor would earn if he bought a callable bond at its current market price and held it until the call date given that the bond was called on the call date.



**Current Yield:** yield of the bond at the **current moment**. It is equal to the annual interest payment divided by the bond's price. It does not reflect the total return over the life of the bond. In particular, it takes no account of **reinvestment risk** (the uncertainty about the rate at which future cashflows can be reinvested) or the fact that bonds usually **mature at par value**, which can be an important component of a bond's return.

**At discount:**  $\text{YTM} > \text{current yield} > \text{coupon yield}$

**At Premium:**  $\text{coupon yield} > \text{current yield} > \text{YTM}$

**At Par:**  $\text{YTM} = \text{current yield} = \text{coupon yield}$ .

### Treasury Securities

Type	Maturity
Treasury Bill	Less than 1 year
Treasury Note	1 to 10 years
Treasury Bond	10 to 20 years

# The Valuation Principle

The price of a security **today** is the present value of all future expected cash flows discounted at the “appropriate” required rate of return (or discount rate)

The valuation variables are

1. Current price
2. Future expected cash flows - Face value and/or coupons
3. Yield or required rate of return

The valuation problem is to

1. Estimate the price; given the future cash flows and required rate of return, or
2. Estimate the required rate of return; given the future cash flows and price

# Valuing Discount Securities

The face value ( $P_n$ ) is promised at a pre-specified date – no other payment promised

Interest earned is “implicit” in the difference between the face value and current market price,  $P_0$

**Examples:** Treasury Bills, Commercial Paper, Bank Bills. Face value is typically \$100,000 or its multiple

The price is computed as the present value at a specified yield

The interest factor for maturity less than 1 year is:

Interest rate factor = (Time to maturity/365)  $\times$   $r$  =  $(n/365) \times r$

**Example:** Consider two Treasury bills, each with a face value of \$100,000 and maturing in 180 and 90 days, respectively. Assume the yield is 6% p.a. What are their prices today? What happens to T-bill prices as they approach maturity?

# Valuing Discount Securities

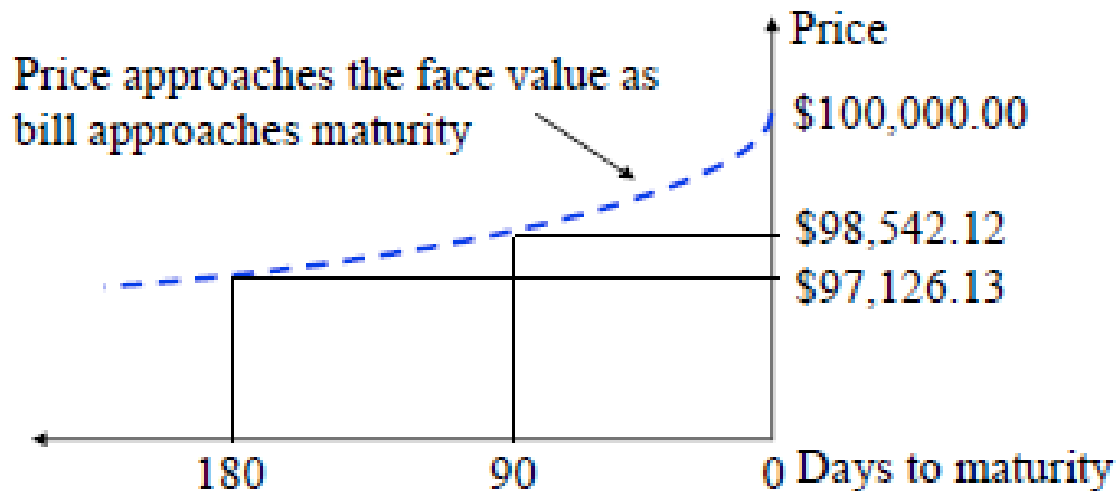
## Pricing the 180 day T-bill

Interest rate factor =  $(n/365) \times r = (180/365) \times 0.06 = 2.959\%$

Price =  $100,000 / [1 + 0.02959] = \$97,126.13$

## Pricing the 90 day T-bill

Price =  $100,000 / [1 + (90/365) \times 0.06] = \$98,542.12$



# Valuing Discount Securities

## Effective annual return (re) on the 180 day T-bill

The effective annual return computation assumes that you invest in a 180 day T-bill and then roll over your investment for another 180 days

$$re = (1 + (180/365)0.06)^{365/180} - 1 = 6.09\%$$

## Effective annual return on the 90 day T-bill

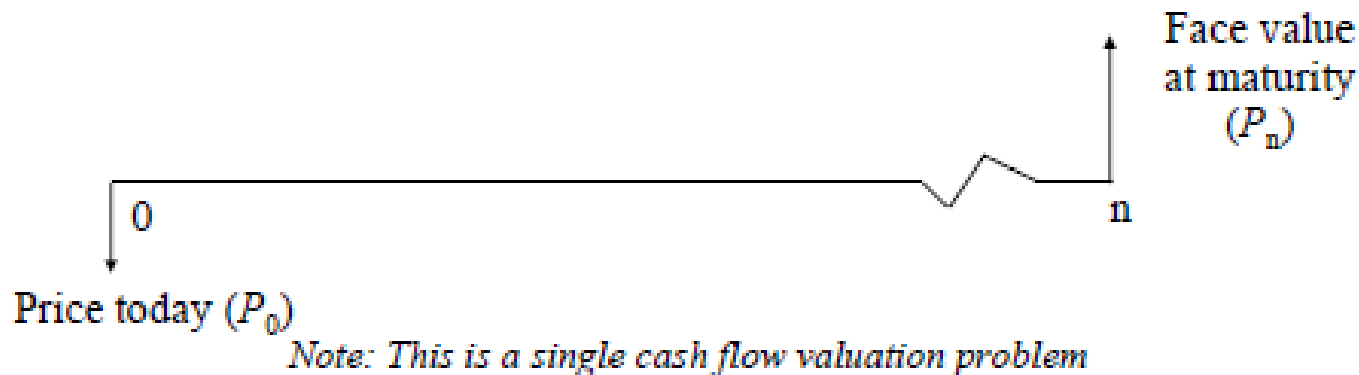
The effective annual return computation assumes that you invest in a 90 day T-bill and then roll over your investment for three more 90 day periods

$$re = (1 + (90/365)0.06)^{365/90} - 1 = 6.14\%$$

# Zero Coupon Securities

Zero coupon bonds are long-term securities paying the face value at maturity

- No coupon or interest payment made
- Issued at deep discount to face value
- Return earned is based on the appreciation in bond's value (price) over time



## Pricing Zero Coupon Securities

**Example:** Consider a zero coupon bond which matures in 5 years with a face value of \$1,000

- a) If the bond has a yield to maturity of 8% what price should it be selling for today?
- b) Suppose interest rates change suddenly and the price of these bonds rises to \$700. What has happened to the yield to maturity of the bonds and why?

Given:  $P_n = \$1,000$ ,  $n = 5$  years, and  $k_d = \text{YTM} = 8\%$

a)  $P_0 = 1000/1.085 = \$680.58$

- b) The price has risen so you'd expect the YTM to be lower

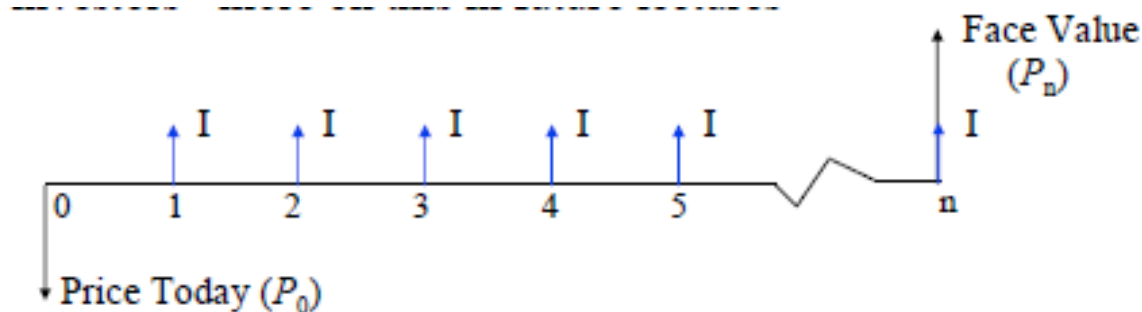
New price,  $P_0 = 700 = 1000/(1 + k_d^*)^5$

$$k_d^* = (1000/700)^{1/5} - 1 = 7.39\% \text{ or } 7.4\%$$

Note: Prices and yields are inversely related

# Coupon Paying Securities

- Fixed coupon payment, typically every six months
  - Non coupon paying bonds called zero coupon bonds
- Repayment of face value at maturity
- Typically issued at face value
  - Examples: Treasury bonds, corporate bonds
- Market price depends on the rate of return required by investors - more on this in future lectures



*Note: This is a single cash flow plus annuity valuation problem*



# Pricing a Bond

Equal to the present value of the expected cash flows from the financial instrument. Determining the price requires:

- An estimate of the **expected cash flows**
- An estimate of the **appropriate required yield**

The price of the bond is the present value of the cash flows, it is determined by adding these two present values:

- i) The present value of the semi-annual coupon payments
- ii) The present value of the par or maturity value at the maturity date

$$P = \frac{C}{(1+r)} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \dots + \frac{C}{(1+r)^n} + \frac{M}{(1+r)^n}$$

$$P = \sum_{t=1}^n \frac{C}{(1+r)^t} + \frac{M}{(1+r)^n}$$

P = Price

n = number of periods (nr of years times 2, if semi-annual)

C = semi-annual coupon payment

r = periodic interest rate (required annual yield divided by 2, if semi-annual)

t = time period when payment is to be received

Because the semi-annual coupon payments are equivalent to an ordinary annuity, applying the equation for the present value of an ordinary annuity gives the present value of the coupon payments:

$$C \left[ \frac{1 - \frac{1}{(1+r)^n}}{r} \right]$$

Consider a 20 year 10% coupon bond with a par value of \$1,000. The required yield on this bond is 11%.

$$\$50 \left[ \frac{1 - \frac{1}{(1+0.055)^{40}}}{0.055} \right] = \$802.31$$

The PV of the par or maturity value of \$1,000 received 40 six-month periods from now discounted at 5.5%, is \$117.46, as follows:

$$\frac{\$1,000}{(1.055)^{40}} = \frac{\$1,000}{8.51332} = \$117.46$$

Price = PV coupon payments + PV of par (maturity value)

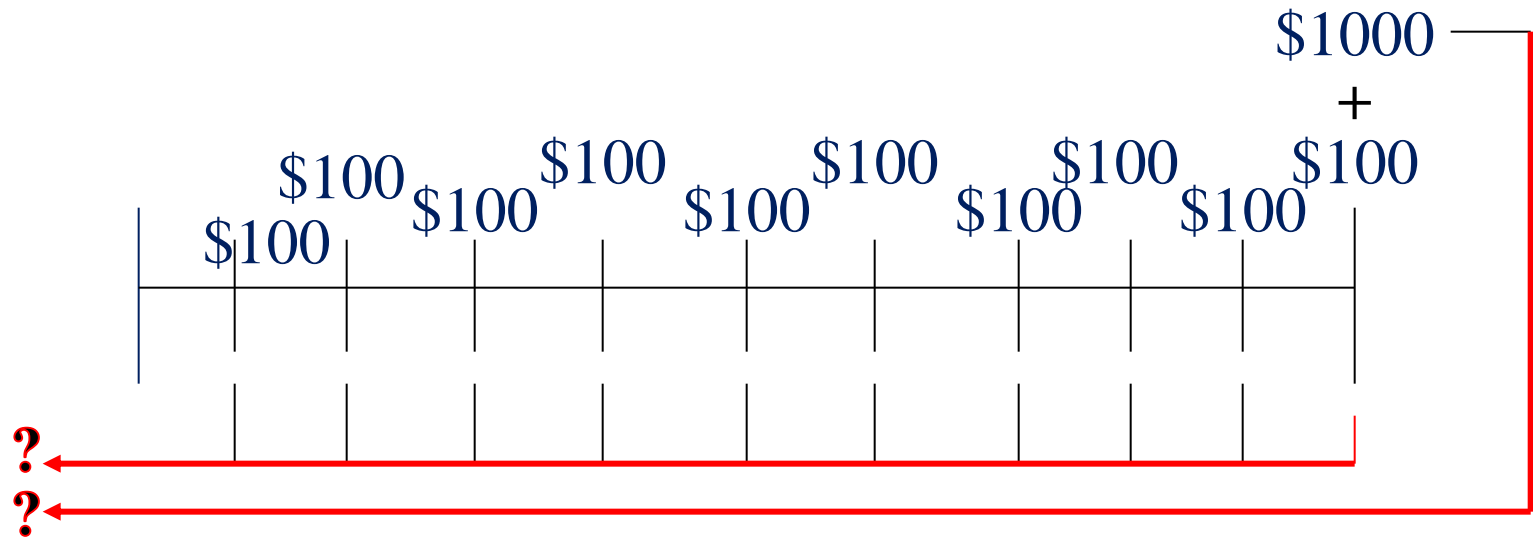
$$\text{\textcolor{red}{\$802.31 + \$117.46 = \$919.77}}$$

Suppose that, instead of an 11% required yield, the required yield is 6.8%.

**Price of the bond: \$1,347.04**

## Example

Assume an investor buys a 10-year bond from the KLM corporation on January 1, 2003. The bond has a face value of \$1000 and pays an annual 10% coupon. The current market rate of return is 12%. Calculate the price of this bond today.



First, find the value of the coupon stream

Remember to follow the same approach you use in time value of money calculations.

You can find the PV of a cash flow stream

$$\begin{aligned} PV = & \frac{\$100}{(1+0.12)^1} + \frac{\$100}{(1+0.12)^2} + \frac{\$100}{(1+0.12)^3} + \frac{\$100}{(1+0.12)^4} + \frac{\$100}{(1+0.12)^5} + \\ & \frac{\$100}{(1+0.12)^6} + \frac{\$100}{(1+0.12)^7} + \frac{\$100}{(1+0.12)^8} + \frac{\$100}{(1+0.12)^9} + \frac{\$100}{(1+0.12)^{10}} \end{aligned}$$

Or, you can find the PV of an annuity

$$PVA = \$100 \times \frac{1 - (1+0.12)^{-10}}{0.12}$$

$$PV = \$565.02$$

Find the PV of the face value

$$PV = \frac{CF_t}{(1+r)^t}$$

$$PV = \frac{\$1,000}{(1.12)^{10}} = \$321.97$$

Add the two values together to get the total PV

$$\$565.02 + \$321.97 = \$886.99$$

## Yield to Maturity

Interest rate that equates the present value of cash flows received from a debt instrument with its value today.

Is the **yield promised by the bondholder on the assumption that the bond will be held to maturity**, that all coupon and principal payments will be made and coupon payments are reinvested at the bond's promised yield at the same rate as invested. **It is a measurement of the return of the bond**. This technique in theory allows investors to calculate the fair value of different financial instruments. The YTM is almost always given in terms of **annual effective rate**.

The calculation of YTM is identical to the calculation of internal rate of return.

If a bond's current yield is less than its YTM, then the bond is selling at a discount.  
If a bond's current yield is more than its YTM, then the bond is selling at a premium.

If a bond's current yield is equal to its YTM, then the bond is selling at par.



**Yields to Maturity on a 10% Coupon rate Bond Maturing in 10 years  
(Face Value = \$ 1,000)**

<b>Price of Bond (4)</b>	<b>Yield to Maturity</b>
1200	7.13
1100	8.48
1000	10.00
900	11.75
800	13.81

1. When the coupon bond is priced at its face value, the YTM equals the coupon rate
2. The price of a coupon bond and the YTM are negatively related; that is, as the YTM rises, the price of the bond falls. If the YTM falls, the price of the bond rises
3. The YTM is greater than the coupon rate when the bond price is below its face value

## Variants of Yield to Maturity

Given that many bonds have different characteristics, there are some variants of YTM:

- **Yield to Call:** when a bond is callable (can be repurchased by the issuer before the maturity), the market looks also to the Yield to Call, which is the same calculation of the YTM, but assumes that the bond will be called, so the cash flow is shortened.
- **Yield to Put:** same as Yield to Call, but when the bond holder has the option to sell the bond back to the issuer at a fixed price on specified date.
- **Yield to Worst:** when a bond is callable, "*puttable*" or has other features, the yield to worst is the lowest yield of Yield to Maturity, Yield to Call, Yield to Put, and others.