Financial Economics
ECON2103

Lecture 2:
The Foundation of Financial Economics

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Introduction

- We will explore the concepts of dividends and the Gordon Growth Model. Understanding these concepts is crucial for investors, financial analysts, and anyone interested in evaluating the worth of a company.

Agenda

- Introduction
- Topic one: One-period Valuation Model
- Topic two: Dividend and Value of a Firm
- Topic three: Firm's Valuation
- Summary

Learning Objectives

- Understand the concept of dividends and their significance in valuing a firm.
- Comprehend the method used to value a firm.
- Learn the components and application of the Gordon Growth Model in determining the value of a firm.
- Explore how investment projects increase/decrease the value of a firm.
- Define the Rate of Return (ROI and ROA).

Topic one

One-period Valuation Model

Stock Valuation: Let's Start

- After a year, you will need to sell your investment to pay tuition.
- Suppose that you want to buy Intel Corp. stock.

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The One-Period Valuation Model

P_0 = the current price of the stock

P_1 =the sale price of the stock at the end of the first period

D_1 = the dividend paid at the end of year 1

k_e = the required return on investment in equity

$$P_0 = \frac{D_1}{1 + k_e} + \frac{P_1}{1 + k_e}$$

The value of any investment is calculated by computing the present value of all cash flows the investment will generate over its life.

By using the one-period valuation model,

- You would be satisfied to earn a 12% return.
- Intel is currently selling for $50 per share, and pays $0.16 per year in dividends.
- It is estimated that the stock will be selling for $60 in one year.
- Q1 - Should you buy a share of Intel Corp. stock?
- From the one-period valuation model,

$$P_0 = \frac{0.16}{1+0.12} + \frac{\$60}{1+0.12} = \$0.14 + \$53.57 = \$53.71$$

Instead

- Intel is currently selling for $60 per share, and it is estimated that the stock will be selling for $50 in one year.
- Q2 - Should you buy a share of Intel Corp. stock?
- From the one-period valuation model,

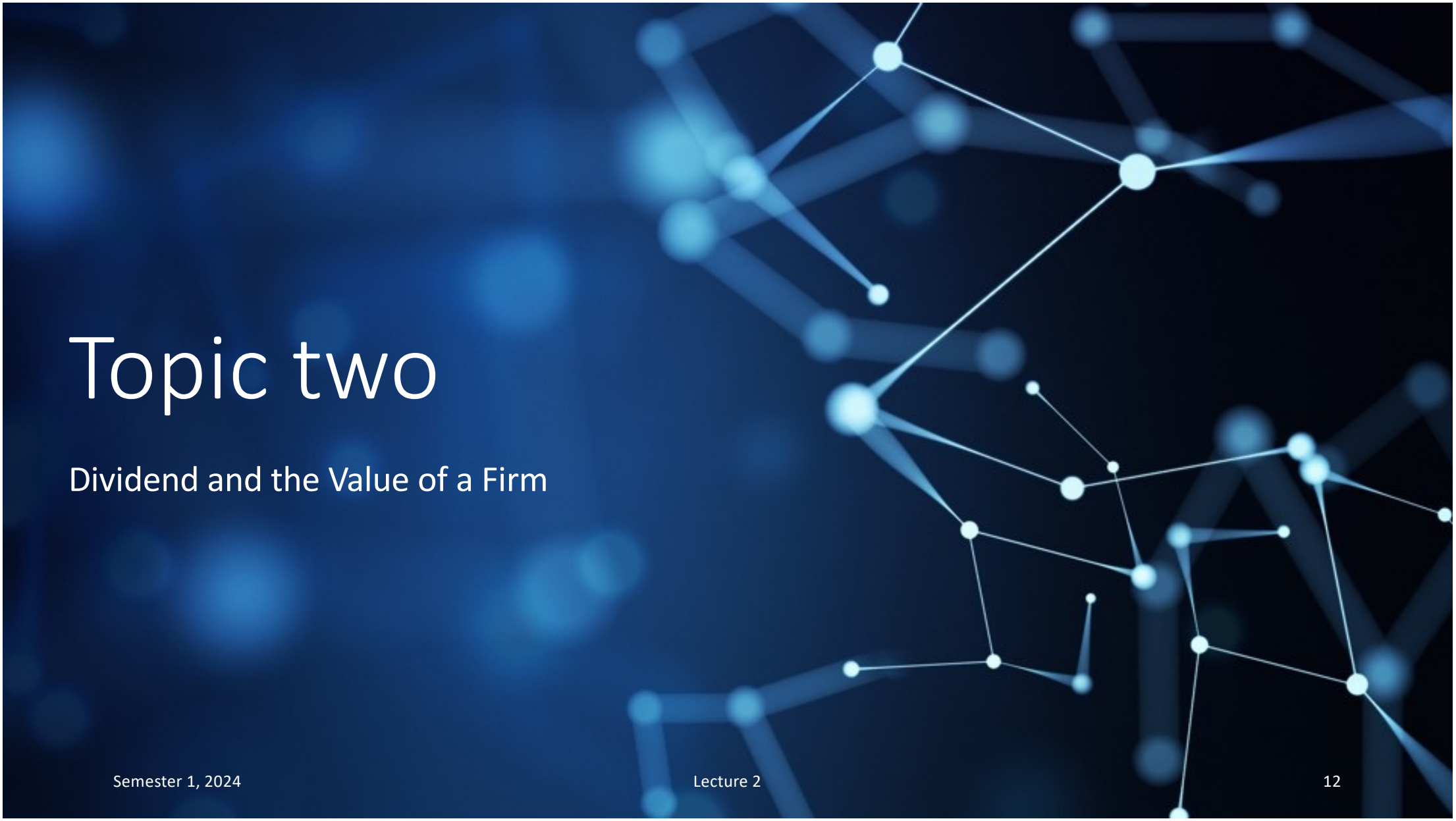
$$P_0 = \frac{0.16}{1 + 0.12} + \frac{\$50}{1 + 0.12} = \$0.14 + \$44.64 = \$44.78$$

Instead

- Intel is currently selling for $60 per share, and it is estimated that the stock will be selling for $50 in one year.
- From the one-period valuation model,

$$P_0 = \frac{0.16}{1 + 0.12} + \frac{\$50}{1 + 0.12} = \$0.14 + \$44.64 = \$44.78$$

- Because you buy it at $50, you may not want to buy it.



Topic two

Dividend and the Value of a Firm

Dividend

- At any point in time, the value of a firm to its stockholders is based on the firm's capacity to generate investor returns.
- This value may be determined by capitalizing either the dividends or the future earnings to which the original stockholders are entitled.
- Dividends are cash payments made by a corporation to its owners and the determination of their amount, if any, is solely at the discretion of the corporation's board of directors.

The Rate of Return: General Formula

- The rate of return from holding a security equals the sum of the capital gain on the security plus any cash payments divided by the initial purchase price of the security

$$R = \frac{P_{t+1} + C - P_t}{P_t}$$

- R: the rate of return on the security
- P_{t+1}: Price of the security at time $t + 1$, the end of the holding period
- P_t: Price of the security at time t, the beginning of the holding period
- C: cash payment (for example, dividend) made during the holding period

The Previous Example

- You would be satisfied to earn a 12% return.
- Intel is currently selling for $50 per share and pays $0.16 per year in dividends.
- It is estimated that the stock will be selling for $60 in one year.
- The Rate of Return?

$$R = \frac{\$0.16 + \$60 - \$50}{\$50} = \frac{\$10.16}{\$50} = 20.32\% > 12\%$$

ROI and ROA

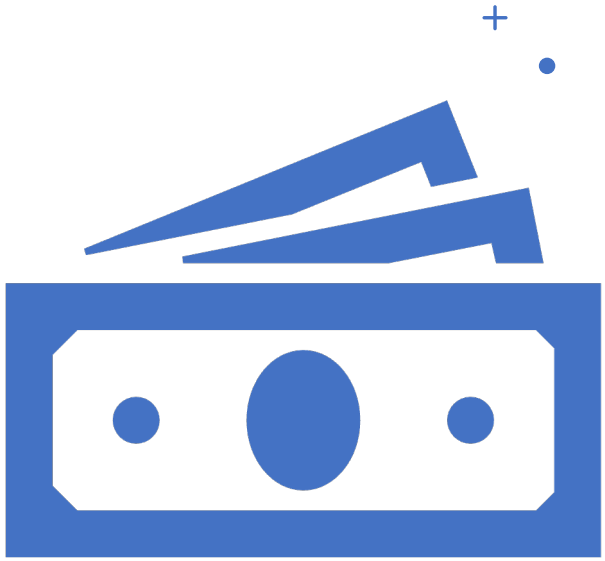
- ROI (Rate on investment) is generally defined as the ratio of net profit over the total cost of the investment.

$$ROI = \frac{Net\ Return}{Cost\ of\ Investment}$$

- ROA (Rate on assets) is generally defined as the ratio of return that the firm earns on its assets.

The Firm's Value and Dividends

- Consider the situation of a firm with initial resources equal to $*3,000*.
- That amount is assumed to be generated from previous operations.
- Optimal operation of the firm requires an investment of $*4,000*, so the firm needs $*1,000* in additional capital.
- The firm investment creates $*6,600* in time 2 cash flow that can be distributed to the various parties financing the operation (which we assume are only new stockholders).
- We assume the market rate of return required by investors is *10%*.



Example: The Firm's Value

- The value of the firm is equal to $5,000 because

Initial resources	$3,000
Time 1 investment	$4,000
Cash generated at time 2 by investment	$6,600
Market rate of return required	10%

Approach 1 (No Dividend)

- With no dividend being paid,

All initial resources invested	$3,000
Funds raised in the market at a cost of 10%	$1,000
Cost of funds obtained in the market (*0.1 X $1,000*)	$100
Available to original stockholders at time 2 *($6,600 - $1,000 - $100*)	$5,500

Thus, we compute $*5,500/1.1* = $*5,000*.

Approach 2 (With Dividend)

- When *$1,400* dividend is paid at time *1*, initial resources invested by original stockholders is *$3,000 - $1,400 = $1,600*.
- Suppose that funds raised in the market is *$2,400*.
- Cost of funds obtained in the market is *$2,400 X 10% = $240*.
- The available amount to original stock holders from time *2* flows is *$6,600 - $2,640 = $3,960*.

Example: The Firm's Value with Dividend

- The value of the firm is equal to $5,000 because

All initial resources invested	$1,600
Funds raised in the market at a cost of 10%	$1,000 + $1,400
Cost of funds obtained in the market (*0.1 X $2,400*)	$240
Available to original stockholders at time 2 *($6,600 - $2,400 - $240*)	$3,960

- Thus, we compute $1,400+$*3,960/1.1* = $*5,000*

Example: The Firm's Value

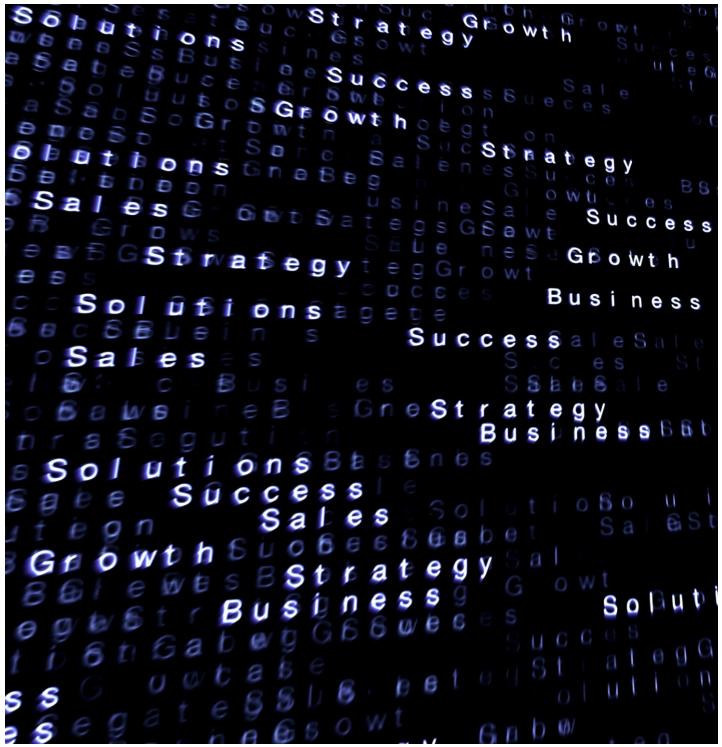
Both approaches conclude that the firm's value is *$5,000*.

The Value of Firm and Dividend

Maximizing Market Value

- Maximizing market value is equivalent to maximizing profits.
- I_1^*: the total amount invested in a firm at time *1*
- K_2: cash flow net of operating expenses at time *2*
- K_3: cash flow net of operating expenses at time *3*
- *r:* the market rate of interest in both periods.
- The firm's market value at time 1 is:

$$MV_1 = \frac{K_3}{(1+r)^2} + \frac{K_2}{1+r} - I_1^* \qquad (1)$$



Maximizing Market Value Continued

- In economics, depreciation is the gradual decrease in the economic value of the capital stock of a firm.
- (In accounting, it also considers the cost and lifespan of the asset.)
- Suppose that the outlays for investment I_1^* are all borrowed.
- Suppose a loan repayment schedule is established requiring payment of principal and interest in amounts I_2 and I_3 at times 2 and 3:

$$\frac{I_3}{(1+r)^2} + \frac{I_2}{1+r} = I_1^* \qquad (2)$$

- Then we can write

$$MV_1 = \frac{K_3}{(1+r)^2} - \frac{I_3}{(1+r)^2} + \frac{K_2}{1+r} - \frac{I_2}{1+r} \qquad (3)$$

To Conclude

- π_2 and π_3*:* economic profits in the two periods.
- Suppose the loan repayments are just equal to economic depreciation ($I_1^* = \frac{I_3}{(1+r)^2} + \frac{I_2}{1+r}$).
- Then net profit is cash flow minus depreciation.
- So, $K_2 - I_2 = \pi_2$ and $K_3 - I_3 = \pi_3$
- Then

$$MV_1 = \frac{\pi_3}{(1+r)^2} + \frac{\pi_2}{1+r}$$

Topic three

Firm's Valuation

A Valuation Model Based on Earnings

- $t = 1, 2$: time
- $s(t)$: the ex-dividend price of a share at time t
- $d(t)$: the dividend accruing to stockholders of record at time t
- r: the market interest rate from investing between $t = 1$ and $t = 2$
- In equilibrium, the price of a share at time 1 obeys the following condition (4.1):

$$s(1) = \frac{d(2) + s(2)}{1 + r}$$

A Valuation Model Based on Earnings

- $N(1)$: the number of shares outstanding at $t = 1$
- $V(1)$: the market value of the firm at $t = 1$
- Assume all funds are financed by the sale of common stock:

$$V(1) = N(1)s(1) = \frac{N(1)d(2) + N(1)s(2)}{1 + r}$$

- $V(2)$: the market value of the firm at $t = 2$
- $M(2)$: the number of new shares (if any) issued at at $t = 2$

$$V(2) = N(2)s(2) = [N(1) + M(2)]s(2)$$

$$\text{☞ } V(1) = \frac{N(1)d(2)+V(2)-M(2)s(2)}{1+r}$$

$$V(1) = \frac{N(1)d(2) + V(2) - M(2)s(2)}{1 + r}$$

- $N(1)d(2) = D(2)$: the entire dividend at $t = 2$
- The firm either invests or pays out funds as dividend
- $X(2)$: cash flow at $t = 2$
- $I(2)$: investment at $t = 2$
- Thus $M(2)s(2) + X(2) = D(2) + I(2) \quad (4.4)$
- Finally, we obtain (4.6):

$$V(1) = \frac{D(2) + V(2) - (D(2) + I(2) - X(2))}{1 + r} = \frac{V(2) - I(2) + X(2)}{1 + r}$$

A General Form

- $X(t)$: net cash earnings at time t
- $I(t)$: cost of new investments at time t
- Using (4.6),

$$V(1) = \frac{V(2) - I(2) + X(2)}{1+r} = \frac{V(3) - I(3) + X(3)}{(1+r)^2} + \frac{X(2) - I(2)}{1+r}$$
$$= \frac{V(4) - I(4) + X(4)}{(1+r)^3} + \frac{X(3) - I(3)}{(1+r)^2} + \frac{X(2) - I(2)}{1+r}$$

- So, we obtain:

$$V(1) = \sum_{t=1}^{\infty} \frac{X(t+1) - I(t+1)}{(1+r)^t} = N(1) \sum_{t=1}^{\infty} \frac{d(t+1)}{(1+r)^t}$$

A Growth Firm

- In a growth firm, the expanding assets generate returns in excess of the market rate of interest.
- Consider a firm that will exist for just one more period.
- $V^0(1)$: the market value of existing operations at $t = 1$
- $X^0(2)$: the earnings from existing operations of assets at $t = 2$
- r: the market interest rate between $t = 1$ and $t = 2$
- Then,

$$V^0(1) = \frac{X^0(2)}{1 + r}$$

A Growth Firm: Valuation

- Let r^* denote the internal rate of the new investments, which makes the present value of cash flows from an investment equal to the initial investment outlay.
- Thus, suppose that earnings can be augmented through additional investment according to

$$X(2) = X^0(2) + I(1)(1 + r^*).$$

- Then,

$$V(1) = \frac{X(2)}{1+r} - \frac{I(2)}{1+r} = \frac{X(2)}{1+r} - I(1) = \frac{X^0(2)+I(1)(1+r^*)}{1+r} - I(1)$$

  - Thus, $V(1) = \frac{X^0(2)+I(1)(r^*-r)}{1+r}$ (4.10)

A Growth Firm: Intuition

- $V(1) = \frac{X^0(2)+I(1)(r^*-r)}{1+r}$
- If $r^* = r$, then the firm's market value will not change.
- If $r^* > r$ and $I(1) > 0$, then the firm's assets are both growing and earning more than the market rate of interest, so that the value of the firm to the original stockholders increases accordingly.

iStock: PhonlamaiPhoto

Examples: Growth Firm

Q3

- The market interest rate (r) is 3% and the internal rate of the new investment (r^*) is 5%.
- Is this firm a growth firm?

Q4

- The market interest rate (r) is 5% and the internal rate of the new investment (r^*) is 3%.
- Is this firm a growth firm?

Examples: Growth Firm

- The market interest rate (r) is 3% and the internal rate of the new investment (r^*) is 5%.
- Is this firm a growth firm? – Yes!

- The market interest rate (r) is 5% and the internal rate of the new investment (r^*) is 3%.
- Is this firm a growth firm? – No!

The Generalized Dividend Valuation Model

- The value of stock today is the present value of all future cash flows.
- From $s(1) = \frac{d(2)+s(2)}{1+r}$, we see $s(2) = \frac{d(3)+s(3)}{1+r}$ and so forth.
- Then, $s(1) = \frac{d(2)}{1+r} + \frac{d(3)}{(1+r)^2} + \cdots + \frac{d(t)+s(t)}{(1+r)^{t-1}}$.
- If $d(t)$ is far in the future, it will not affect $s(1)$:

$$s(1) = \sum_{t=1}^{\infty} \frac{d(t)}{(1+r)^t}$$

- In this case, the present value of the stock is determined only by the present value of the future dividend stream.

The Gordon Growth Model

- We now examine the case of a firm whose assets grow continuously with the result that management increases dividends at the same rate over time.
- For analytical simplicity, we assume that the firm's earnings and dividends increase at the rate (g) for all future periods.
- This model is called the Gordon growth model.
- Remember: $s(1) = \frac{d(2)}{1+r} + \frac{d(3)}{(1+r)^2} + \cdots + \frac{d(t)+s(t)}{(1+r)^{t-1}}$.

The Value of a Share

- $s(1)$: the ex-dividend share price at time *1*
- $d(2)$: the dividend paid at time *2* to a stockholder of record at time *1*
- g: the dividend growth rate
- r: the market rate of interest.
- Note $s(1) = \frac{d(2)}{1+r} + \frac{d(2)(1+g)}{(1+r)^2} + \cdots + \frac{d(2)(1+g)^{t-2}+s(t)}{(1+r)^{t-1}}$.
- The value of a share is given by:

$$s(1) = \sum_{t=2}^{\infty} \frac{d(2)(1+g)^{t-2}}{(1+r)^{t-1}} \quad (4.11)$$

Infinite Series: Remember?

We want to study $S_n = a + a^2 + \cdots + a^n$.

$$\begin{aligned} S_n &= a + a^2 + \cdots + a^n \\ -\ aS_n &= \quad a^2 + a^3 + \cdots + a^{n+1} \end{aligned}$$

Thus $(1 - a)S_n = a - a^{n+1}$

Finally $S_n = \frac{(a - a^{n+1})}{1 - a}$

If $a < 1$, when $n \to \infty$, $S_n \to \frac{a}{1-a} = \frac{1}{1-a} - 1$

The Gordon Growth Model: Formula

- Equation (4.11) can be rewritten as:

$$s(1) = \sum_{t+2}^{\infty} \frac{d(2)(1+g)^{t-2}}{(1+r)^{t-1}} = \frac{d(2)}{1+g} \sum_{t+2}^{\infty} \left(\frac{1+g}{1+r}\right)^{t-1}$$

- Summing the infinite series (from the previous slide), we obtain:

$$s(1) = \frac{d(2)}{1+g}\left(\frac{1}{1-\left[\frac{1+g}{1+r}\right]} - 1\right)$$

- Then we obtain $s(1) = \frac{d(2)}{r-g}$ $\qquad (4.12)$

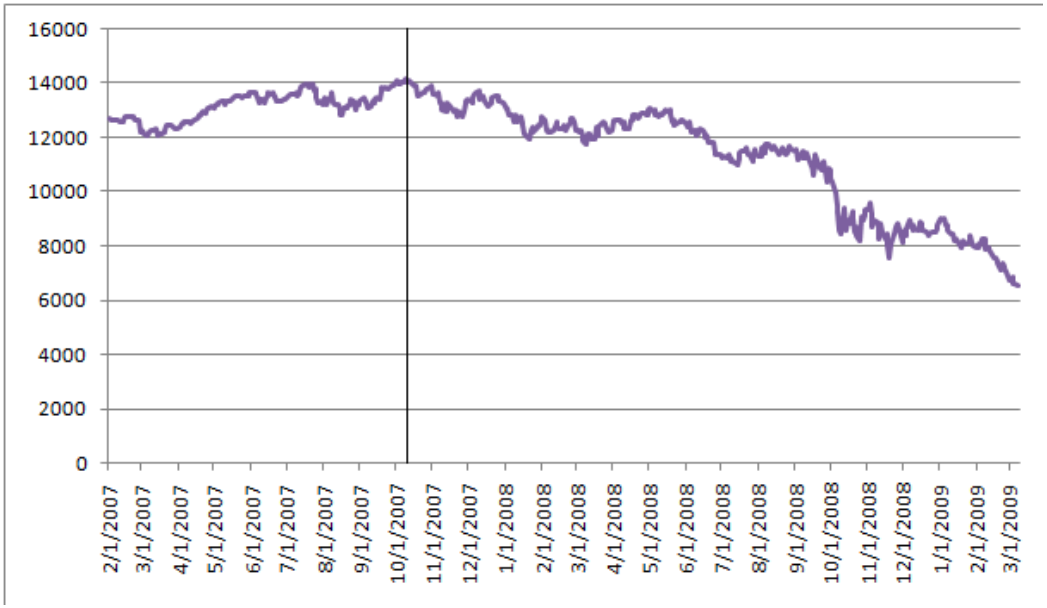
Application: The Global Financial Crisis and the Stock Market

- $s(1) = \frac{d(2)}{r-g}$
- The financial crisis that started in August 2007 led to one of the worst bear markets in 50 years.
- Downward revision of growth prospects: $\downarrow g \rightarrow \downarrow s(1)$
- The Gordon model predicts a drop in stock prices.

Application: The Global Financial Crisis and the Stock Market

- The financial crisis that started in August 2007 led to one of the worst bear markets in 50 years.
- Downward revision of growth prospects: $\downarrow g \rightarrow \downarrow s(1)$
- Gordon model predicts a drop in stock prices.

Figure: Dow Jones Industrial Average, 2007 – 2009



Source: *Kgrr | Wikipedia*

Summary

In this lecture, we have studied the concept of dividend, how to value a firm, and Gordon Growth model. Those are fundamental concepts in financial economics. Further we have studied how a manager should assess which project to be chosen.

Feedback for Topic 2

- https://padletuq.padlet.org/Shino/econ2103-shared-thoughts-topic-2-767jz0q35odqfdc5

Thank You

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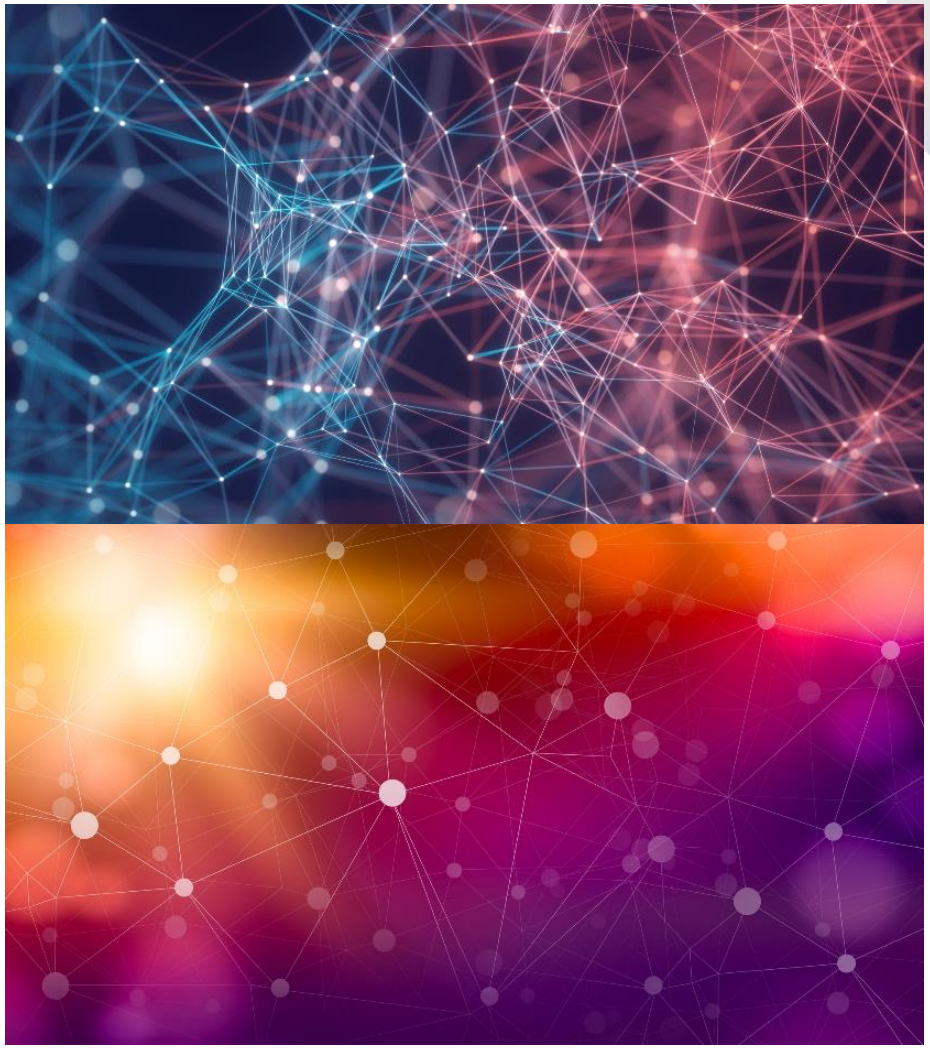

Source

- Chapter 4, “The Meaning of Interest Rates,” in “*The Economics of Money, Banking, and Financial Markets*,” by F. S. Mishkin, Pearson, Twelfth Edition.
- Chapter 7, “The Stock Market, the Theory of Rational Expectations, and the Efficient Market Hypothesis,” in “*The Economics of Money, Banking, and Financial Markets*,” by F. S. Mishkin, Pearson, Twelfth Edition.
- Chapter 4, “How Investors Value Firms,” in “*Financial Economics*,” by F. J. Fabozzi, E.H. Neave, and G. Zhou, Wiley.
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