Lecture 5

Stock Valuation

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How Stockholders Can Receive Cash Return

- If you buy a share of stock, you can receive cash in two ways.
  - The company pays *dividends* (cash paid out of earnings).
  - You *sell* your *shares*, either to another investor in the market (secondary market) or back to the company (when a firm repurchases shares).

- As with bonds, the value of the stock is the *present value* of these expected cash flows.

Dividend Characteristics

- Firms are *not required* to pay dividends to their shareholders.
- The decision to pay a dividend rests in the hands of the *Board of Directors* of the corporation.
- Dividends are NOT a liability of the firm until a dividend has been declared by the Board.
- Consequently, a firm cannot go bankrupt for not declaring dividends.
- Dividend payments are not considered a business expense, therefore, they are *not tax deductible*.

Lecture Outline

- Stock Valuation
  - General Model
  - Special Cases
    - Constant Dividend
    - Constant Dividend Growth
    - Supernormal Growth
- Dividend Growth
  - Where Dividend Growth Comes From?
- Market Structure
  - Stock market vs. Bond Market

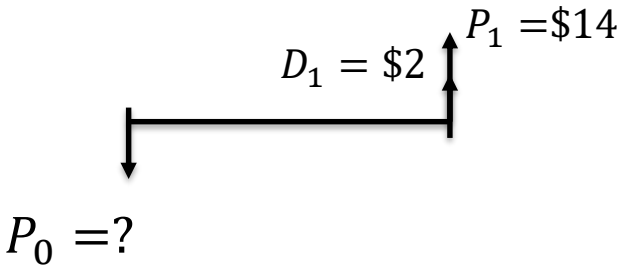
One-Period Example

Suppose you are thinking of purchasing the stock of Moore Oil, Inc.

- You expect it to pay a $2 dividend in one year, and you believe that you can sell the stock for $14 at that time.
- If you require a return of 20% on investments of this risk, what is the maximum you would be willing to pay?

Solution

The maximum amount you are willing to pay is the present value of the expected cash flows



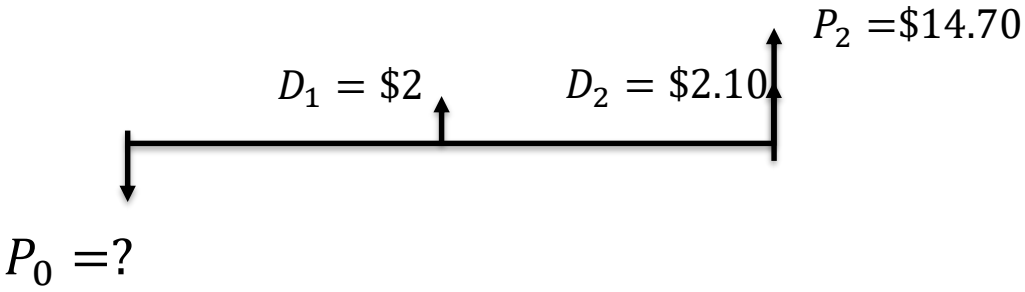
$$P_0 = \frac{\$2 + \$14}{(1 + 0.2)} = \$13.33$$

Two-Period Example

Now, what if you decide to hold the stock for two years?

- In addition to the dividend in one year, you expect a dividend of $2.10 in two years and a stock price of $14.70 at the end of year 2.
- Now how much would you be willing to pay?

Solution



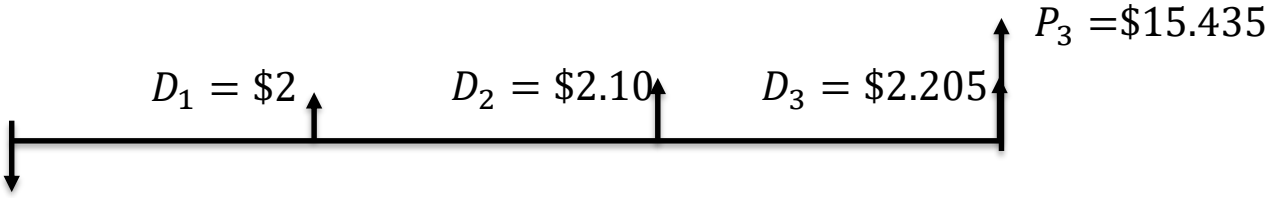
$$P_0 = \frac{\$2}{(1+0.2)} + \frac{\$2.10 + \$14.70}{(1+0.2)^2} = \$13.33$$

Three-Period Example

Finally, what if you decide to hold the stock for three years?

- In addition to the dividends at the end of years 1 and 2, you expect to receive a dividend of $2.205 at the end of year 3 and the stock price is expected to be $15.435.
- Now how much would you be willing to pay?

Solution



$P_0 = ?$

$$P_0 = \frac{\$2}{(1+0.2)} + \frac{\$2.10}{(1+0.2)^2} + \frac{\$2.205 + \$15.435}{(1+0.2)^3} = \$13.33$$

Developing the Model

- You could continue to push back the year in which you will sell the stock

- You would find that the price of the stock is really just the *present value of <u>all</u> expected future dividends*

$$P_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \frac{D_4}{(1+r)^4} + \frac{D_5}{(1+r)^5} + \cdots$$

  - D_t is the dividend payment at time *t*, and r is the required return

- So, how can we estimate all future dividend payments?

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Estimating Dividends: Special Cases

Constant dividend

- The firm will pay a constant dividend forever
- The price is computed using the perpetuity formula

Constant dividend growth

- The firm will increase the dividend by a constant *percent* every period
- The price is computed using the growing perpetuity model

Supernormal growth

- Dividend growth is not consistent initially, but settles down to constant growth eventually
- The price is computed using a multistage model

Case 1: Constant Dividend

If constant dividends are expected at regular intervals forever, then this is a perpetuity and the present value of expected future dividends can be found using the *perpetuity formula*

$$P_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \frac{D_4}{(1+r)^4} + \frac{D_5}{(1+r)^5} + \cdots$$
$$= \frac{D}{(1+r)^1} + \frac{D}{(1+r)^2} + \frac{D}{(1+r)^3} + \frac{D}{(1+r)^4} + \frac{D}{(1+r)^5} + \cdots = \frac{D}{r}$$

- Suppose stock is expected to pay a \$0.50 dividend every quarter and the required return is 10% with quarterly compounding. What is the price?

$$P_0 = \frac{D}{r} = \frac{\$0.50}{10\%/4} = 20$$

Case 2: Constant Dividend Growth

If dividends are expected to grow at a constant rate per period, then this is a growing perpetuity and the present value of expected future dividends can be found using the *growing perpetuity formula*

$$P_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \frac{D_4}{(1+r)^4} + \frac{D_5}{(1+r)^5} + \cdots$$

- $D_1 = D_0 \times (1+g)$
- $D_2 = D_1 \times (1+g) = D_0 \times (1+g)^2$
- $D_3 = D_2 \times (1+g) = D_0 \times (1+g)^3$
- …

$$P_0 = \frac{D_1}{r-g}$$

Dividend Growth Model (DGM)

Note:

- D_1 is the dividend at the end of the first period (the next dividend)
- Limitation: need $r > g$ for the model to work

Constant Dividend Growth Example

Example 1: Suppose Big D, Inc., just paid a dividend of $0.50 per share. It is expected to increase its dividend by 2% per year. If the market requires a return of 15% on assets of this risk, how much should the stock be selling for?

Solution:

$$P_0 = \frac{D_1}{r-g} = \frac{D_0 \times (1+g)}{r-g} = \frac{\$0.50 \times (1+0.02)}{0.15-0.02} = 3.92$$

Constant Dividend Growth Example

Example 2: Gordon Growth Company is expected to pay a dividend of $4 next period, and dividends are expected to grow at 6% per year. The required return is 16%.

a) What is the current price?

b) What is the price expected to be in year 4?

c) What is the stock price growth rate given the change in price during the four year period?

Constant Dividend Growth Example

Example 2: Gordon Growth Company is expected to pay a dividend of $4 next period, and dividends are expected to grow at 6% per year. The required return is 16%.

a) What is the current price?

Remember that we already have the dividend expected next year, so we do not multiply the dividend by $1 + g$

$$P_0 = \frac{D_1}{r - g} = \frac{\$4}{0.16 - 0.06} = \$40$$

Constant Dividend Growth Example

Example 2: Gordon Growth Company is expected to pay a dividend of $4 next period, and dividends are expected to grow at 6% per year. The required return is 16%.

b) What is the price expected to be in year 4?

$$P_4 = \frac{D_5}{r-g} = \frac{D_4 \times (1+g)}{r-g} = \frac{D_1 \times (1+g)^4}{r-g} = \frac{\$4 \times (1+0.06)^4}{0.16-0.06} = \$50.50$$

Constant Dividend Growth Example

Example 2: Gordon Growth Company is expected to pay a dividend of $4 next period, and dividends are expected to grow at 6% per year. The required return is 16%.

c) What is the stock price growth rate given the change in price during the four year period?

$P_4 = P_0 \times (1+G)^4$ where *G* is the growth rate for stock prices

$$50.50 = 40 \times (1+G)^4$$

$$G = 6\%$$

Note: price is assumed to grow at the same constant rate as the dividend in the dividend growth model

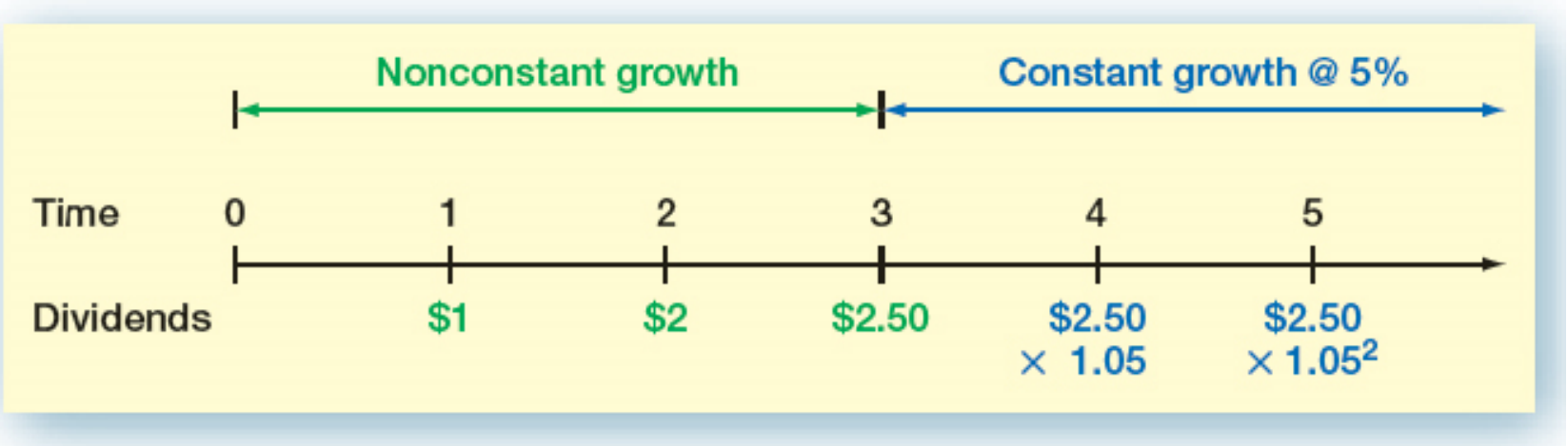
Case 3: Non-Constant Dividend Growth

Supernormal growth refers to the case that a stock is expected to have higher than normal growth in dividend payments for some period in the future. After this supernormal growth the dividend is expected to go back to a normal with a constant growth.

As always, the value of the stock is the present value of all the future dividends

Non-Constant Dividend Growth Example

Suppose you have come up with the following dividend forecasts. After the third year, the dividend will grow at a constant rate of 5% per year. The required return is 10%. What is the value of stock today?



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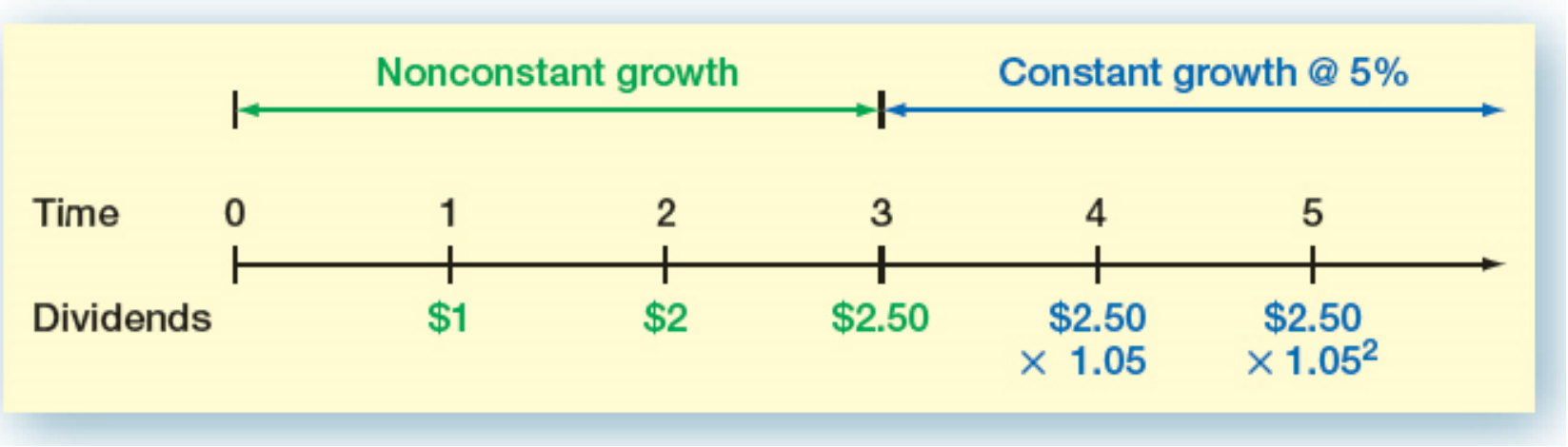

The price in three years is

$$P_3 = \frac{D_4}{r-g} = \frac{D_3 \times (1+g)}{r-g} = \frac{\$2.5 \times (1+0.05)}{10\% - 5\%} = \$52.50$$

The value of stock today is

- $P_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \frac{P_3}{(1+r)^3} = \frac{\$1}{1.10} + \frac{\$2}{1.10^2} + \frac{\$2.5}{1.10^3} + \frac{\$52.50}{1.10^3} = \$43.88$

Using DGM to Find Required Return

Dividend Growth Model:

$$P_0 = \frac{D_1}{r - g}$$

Rearrange and solve for *r*

$$r = \frac{D_1}{P_0} + g$$

dividend yield capital gains yield

Dividend yield: a stock's expected cash dividend divided by its current price.

Capital gains yield: the dividend growth rate, or the stock price growth rate

Find Required Return Example

Suppose a firm's stock is selling for $10.50. It just paid a $1 dividend, and dividends are expected to grow at 5% per year.

a) What is the required return?

$$r = \frac{D_1}{P_0} + g = \frac{D_0 \times (1+g)}{P_0} + g = \frac{\$1 \times (1+0.05)}{\$10.50} + 5\% = 15\%$$

b) What is the dividend yield?

$$\frac{D_1}{P_0} = \frac{\$1 \times (1+0.05)}{\$10.50} = 10\%$$

c) What is the capital gains yield?

$$g = 5\%$$

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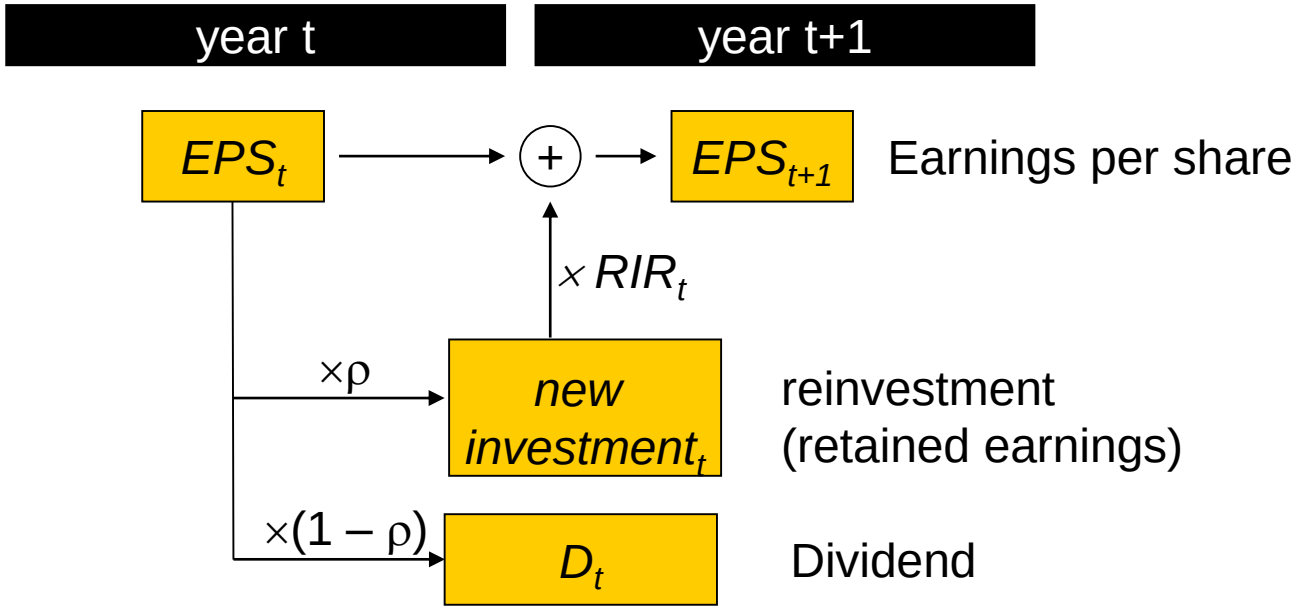
Where Dividend Growth Comes From?



- *retention rate* ρ
  percentage of earnings "ploughed back" to the firm
- *pay-out ratio* $(1-\rho)$
  percentage of earnings paid out as dividends
- *return on reinvestment (RIR)*
  change in earnings $(E_{t+1} - E_t)$ = reinvestment$_t \times$ RIR$_t$

Estimating Dividend Growth

Dividend growth:

$$\begin{matrix}\text{Earnings} \\ \text{next} \\ \text{year}\end{matrix} = \begin{matrix}\text{Earnings} \\ \text{this} \\ \text{year}\end{matrix} + \begin{matrix}\text{Retained} \\ \text{earnings} \\ \text{this year}\end{matrix} \times \begin{matrix}\text{Return on} \\ \text{reinvestment}\end{matrix}$$

Divide all the way across by "Earnings this year"

$$\frac{\begin{matrix}\text{Earnings} \\ \text{next} \\ \text{year}\end{matrix}}{\text{Earnings this year}} = \frac{\begin{matrix}\text{Earnings} \\ \text{this} \\ \text{year}\end{matrix}}{\text{Earnings this year}} + \left(\frac{\begin{matrix}\text{Retained} \\ \text{earnings} \\ \text{this year}\end{matrix}}{\text{Earnings this year}} \right) \times \begin{matrix}\text{Return on} \\ \text{reinvestment}\end{matrix}$$

This implies:

1 + Earnings growth rate = 1 + Retention rate × Return on reinvestment

Estimating Dividend Growth

The previous slide shows

1 + earnings growth rate = 1 + retention rate × return on reinvestment

Since $D_t = EPS_t \times (1 - \rho)$ for any *t*, and the dividend pay-out rate $(1 - \rho)$ is invariant, **dividend and earnings grow at the same rate**.

Thus,

$$g = \rho \times RIR$$

Dividend growth depends on two factors:

1. the retention rate ρ

2. return on reinvestment (RIR)

Trade-off: Invest more or Pay out more?

- To increase its share price, should the firm cut dividend and invest more, or cut investment and pay out more?

- Rule of thumb: the firm should retain earnings to invest more only if *RIR* > *r,* that is, return on reinvestment exceeds the firm's required rate of return

Example: Retain vs. Reinvestment

West-Coast Business Software (WBS) just reported a total net income of $24 million. The firm has 10 million shares outstanding. Analysts expect that WBS can sustain a long-run return on reinvestment (RIR) of 15%. The firm's required rate of return is 12%.

a) What are the firm's earnings per share (EPS)? Suppose WBS pays all of its earnings as dividends. What is the value of the firm's stock?

b) Suppose WBS pays a dividend of $0.80 per share. What is the pay-out ratio? what is the expected rate of dividend growth? What is the value of the firm's stock?

b) How would the answer to part b) change if the long-run return on reinvestment (RIR) is only 9%?

Example: Retain vs. Reinvestment

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a) What are the firm's earnings per share (EPS)? Suppose WBS pays all of its earnings as dividends. What is the value of the firm's stock?

Solution:

As the firm has total earnings of $24 million and 10 million shares, the EPS are $2.40. A firm paying out all its earnings as dividends has a retention ratio ρ of zero and a growth ratio g of zero.

Hence, the stock price is

$$P_0 = \frac{D_1}{r-g} = \frac{(1+g)\times D_0}{r-g} = \frac{(1+g)\times EPS_0 \times (1-\rho)}{r-g} = \frac{EPS_0}{r} = \frac{\$2.4}{0.12}$$

$$= \$20$$

Example: Retain vs. Reinvestment

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b) Suppose WBS pays a dividend of $0.80 per share. What is the pay-out ratio? what is the expected rate of dividend growth? What is the value of the firm's stock?

Solution:

- As the firm has a EPS are $2.40, the pay-out ratio is $1-\rho = \frac{\$0.80}{\$2.40} = \frac{1}{3}$
- Growth rate g = (Retention Ratio) $\times$ RIR = $\rho \times$ RIR = 2/3 $\times$ 15% = 10%
- Consequently, the stock price would increase to
- $P_0 = \frac{D_1}{r-g} = \frac{(1+g)\times D_0}{r-g} = \frac{(1+g)\times EPS_0\times(1-\rho)}{r-g} = \frac{(1+10\%)\times\$0.80}{12\%-10\%} = \$44$

Example: Retain vs. Reinvestment

West-Coast Business Software (WBS) just reported a total net income of $24 million. The firm has 10 million shares outstanding. Analysts expect that WBS can sustain a long-run return on reinvestment (RIR) of 15%. The firm's required rate of return is 12%.

c) How would the answer to part b) change if the long-run return on reinvestment (RIR) is only 9%?

Solution:

- If RIR is only 9%, growth rate g = (Retention Ratio) $\times$ RIR = $\rho \times$ RIR = 2/3 $\times$ 9% = 6%
- The stock price would be
- $P_0 = \frac{D_1}{r-g} = \frac{(1+g)\times D_0}{r-g} = \frac{(1+g)\times EPS_0\times(1-\rho)}{r-g} = \frac{(1+6\%)\times \$0.80}{12\%-6\%} = \$14.13$

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Stock Quote

Apple Inc. (AAPL)

Bid is the price that a buyer is willing to pay for the security

- the *highest bid* is displayed here

Ask is the price that a seller is willing to receive for the security

- the *lowest ask* is displayed here

Previous Close	153.39	Market Cap	784.55B
Open	152.02	Beta	1.43
Bid	151.96 x 100	PE Ratio (TTM)	17.24
Ask	152.09 x 800	EPS (TTM)	8.81
Day's Range	150.56 - 152.27	Earnings Date	Oct 23, 2017 - Oct 27, 2017
52 Week Range	104.08 - 164.94	Dividend & Yield	2.52 (1.64%)
Volume	46,645,443	Ex-Dividend Date	2017-08-10
Avg. Volume	27,652,121	1y Target Est	172.69

(Source Yahoo! Finance)

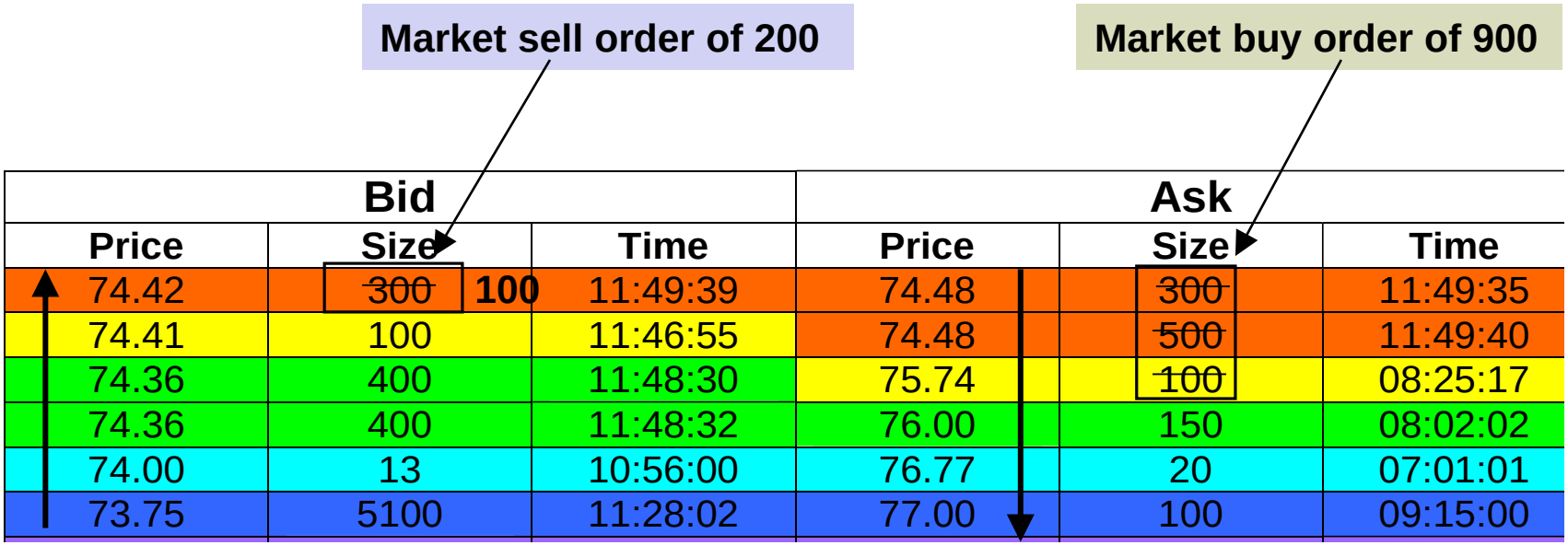
Common Types of Orders

- Market orders:
  - no price indication: “instruction to trade a quantity at the best price currently available in the market”
  - Pro: quick (orders are executed immediately)
  - Con: may get worse price (market orders pay the bid-ask spread)
  - E.g. “buy 100 shares of MSFT at the prevailing market price”

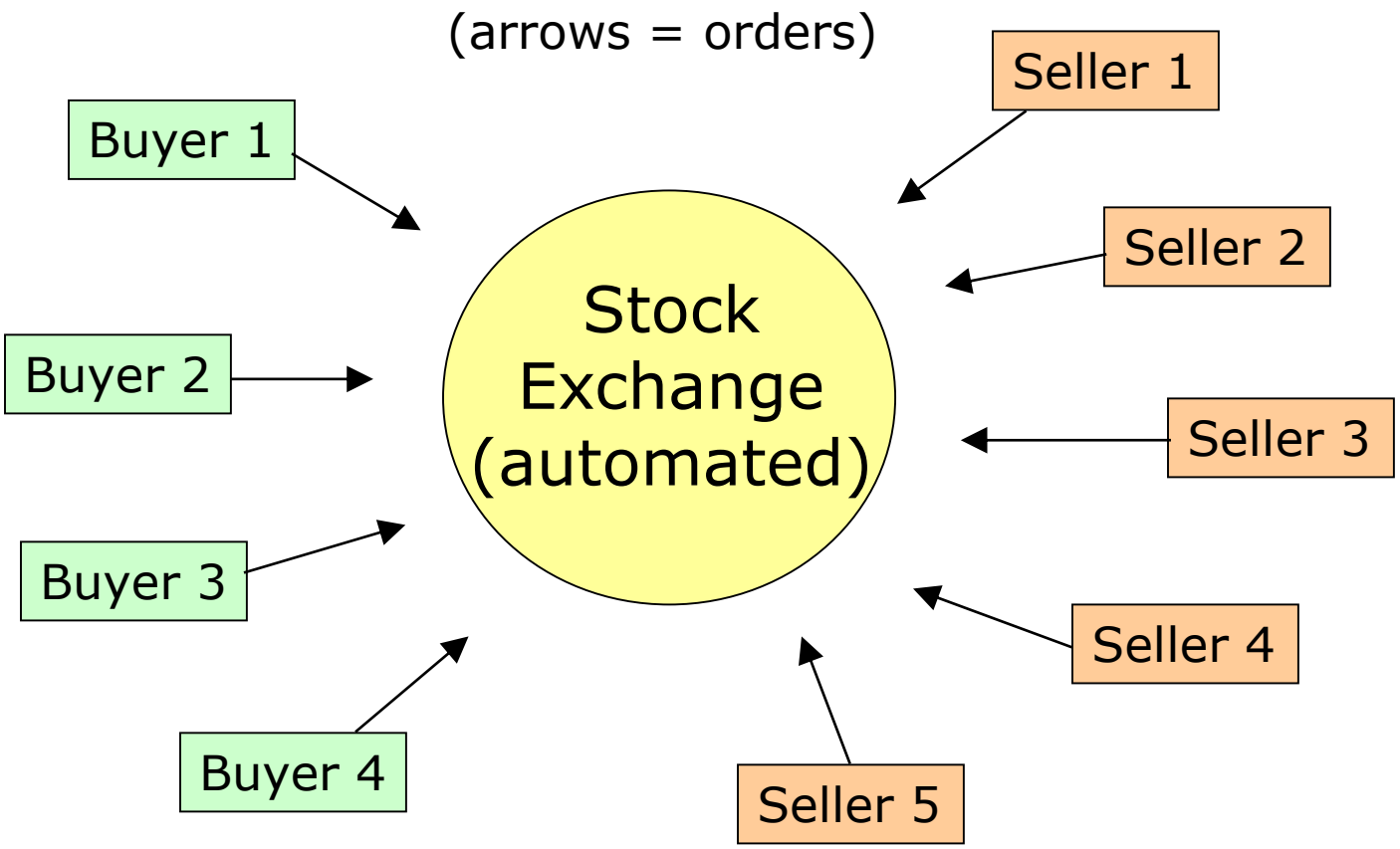
- Limit orders:
  - price indication: “instruction to trade at best price available if it is no worse than specified *limit price*”
  - Pro: may get good price for trade
  - Con: may not execute (execution risk)
  - E.g. “buy 100 shares of MSFT for no more than $30/share”

Stock Market Limit Order Book

- Limit order book: A record of *unexecuted* bids and asks that are waiting to be executed
- The execution sequence of limit orders follows *price-time priority* rule:
  - Limit orders offering best prices get executed first
  - For limit orders at the same price, limit orders are executed in the order which they are submitted

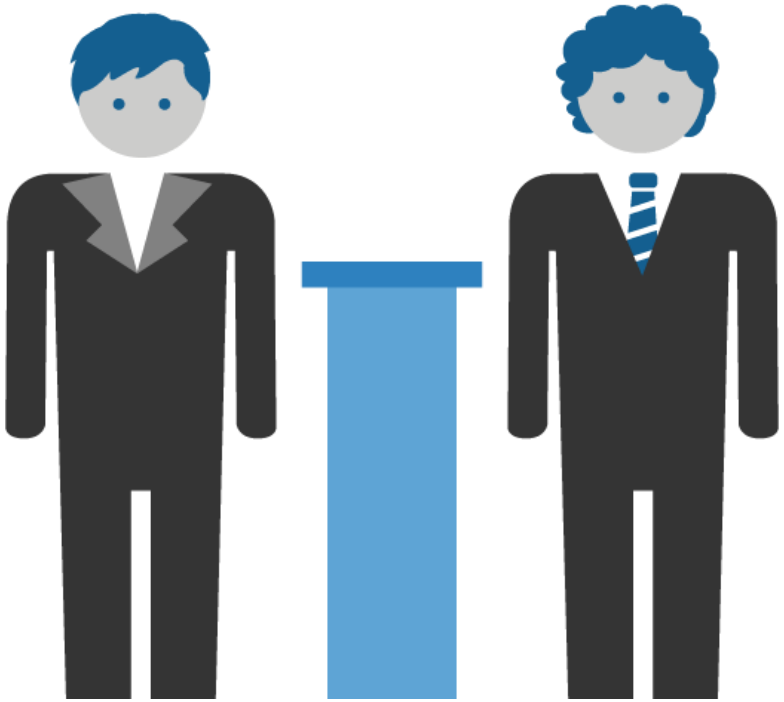


Stock Market

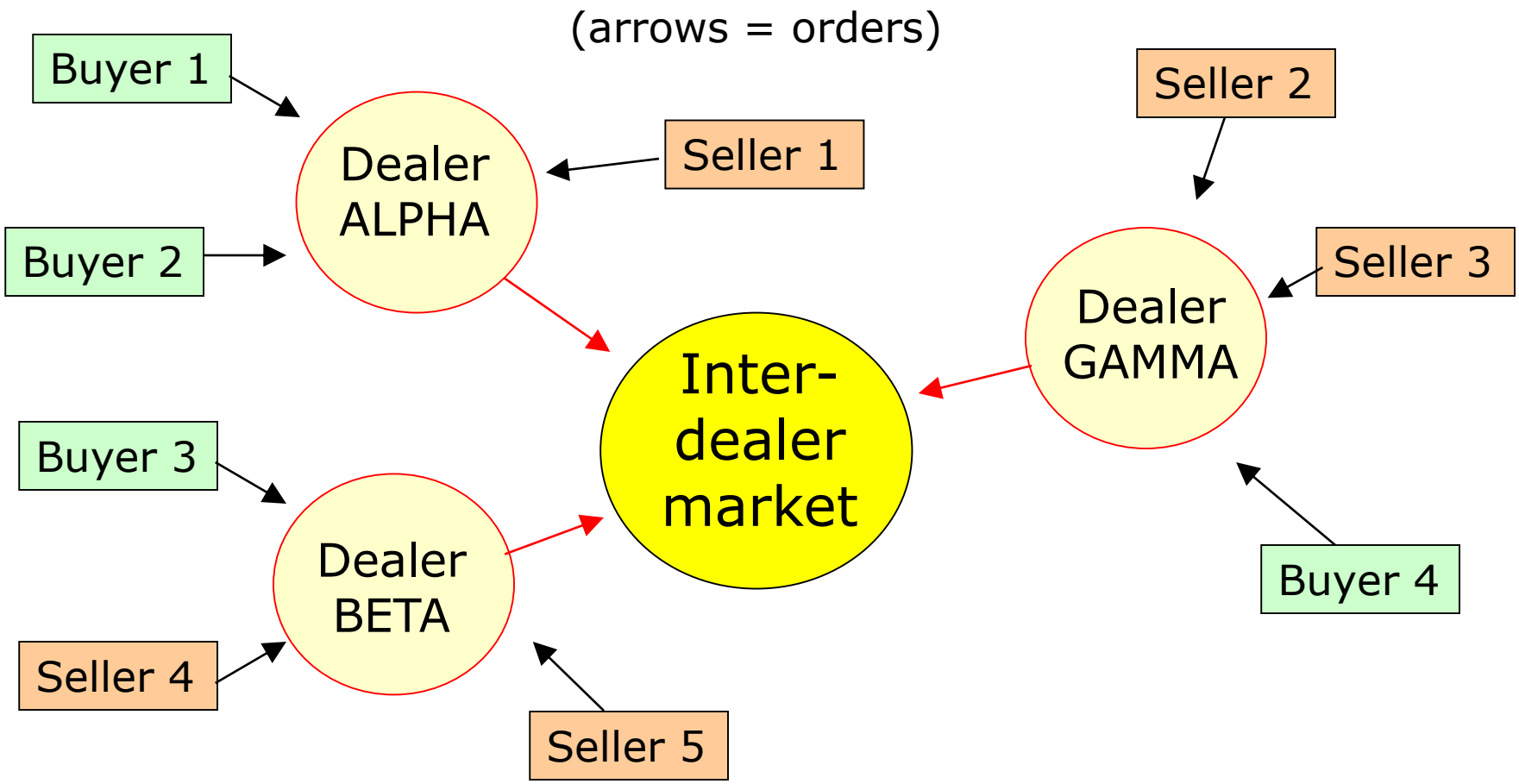


Bond Market: OTC Market

- Bonds are traded *over-the-counter (OTC)*: customers place orders with dealers (who post bid and ask quotes and trade on own account)



Bond Market


(arrows = orders)
Buyer 1
Buyer 2
Buyer 3
Seller 4
Dealer ALPHA
Dealer BETA
Seller 1
Seller 5
Inter-dealer market
Dealer GAMMA
Seller 2
Seller 3
Buyer 4

Comparison

- **Stock Market**
  - Centralized
  - Transparent
  - Standardized securities

- **Bond Market**
  - Decentralized
  - Less transparent
  - Non-standardized securities

Summary

- Stock value is the present value of the expected cash flows
  - Constant Dividend
  - Constant Dividend Growth
  - Supernormal Growth

- Dividend growth depends on *the retention rate ρ and return on reinvestment (RIR)*

- Stocks are traded in stock exchanges and bonds are traded in over-the-counter markets

Exam

- Midterm Exam
  - October 21(Thursday), Regular Lecture Hours. Sino LT2
- Final Exam
  - December 2 (Thursday), Regular Lecture Hours. Sino LT2
- Both midterm and final exams are closed-book exams. You can bring one (financial or scientific) calculator as well as one A4-size sheet of paper (with any notes/formulas you wish to write/print/photocopy on the front and back).