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Valuation of Securities: Stocks

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Features of Common Stock

- Voting rights (Cumulative vs. Straight)
- Proxy voting
- Classes of stock
- Other rights
 - Share proportionally in declared dividends
 - Share proportionally in remaining assets during liquidation
 - Preemptive right – first shot at new stock issue to maintain proportional ownership if desired

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Features of Preferred Stock

- Dividends
 - Stated dividend must be paid before dividends can be paid to common stockholders.
 - Dividends are not a liability of the firm, and preferred dividends can be deferred indefinitely.
 - Most preferred dividends are cumulative – any missed preferred dividends have to be paid before common dividends can be paid.
- Preferred stock generally does not carry voting rights.

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The Stock Markets

- Dealers vs. Brokers
- New York Stock Exchange (NYSE)
 - Largest stock market in the world
 - Members
 - Own seats on the exchange
 - Commission brokers
 - Specialists
 - Floor brokers
 - Floor traders
 - Operations
 - Floor activity

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NASDAQ

- Not a physical exchange – computer-based quotation system
- Multiple market makers
- Electronic Communications Networks
- Three levels of information
 - Level 1 – median quotes, registered representatives
 - Level 2 – view quotes, brokers & dealers
 - Level 3 – view and update quotes, dealers only
- Large portion of technology stocks

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Stock Market Reporting

| 52 WEEKS | | | | YLD | | VOL | NET | |
|----------|-------|-------------|------|-----|----|------|-------|-----|
| HI | LO | STOCKSYM | DIV | % | PE | 100s | CLOSE | CHG |
| 25.72 | 18.12 | Gap Inc GPS | 0.18 | 0.8 | 18 | 3996 | 21.35 | ... |

Gap has been as high as \$25.72 in the last year.

Gap has been as low as \$18.12 in the last year.

Gap pays a dividend of 18 cents/share.

Given the current price, the dividend yield is .8%.

Given the current price, the PE ratio is 18 times earnings.

Gap ended trading at \$21.35, which is unchanged from yesterday.

3,996,100 shares traded hands in the last day's trading.

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Valuing Stock

- Valuing a firm's equity involves the same ideas introduced for valuing a firm's debt instruments
- To value a firm's stock
 1. Determine the expected cash flows
 2. Calculate the present value of the cash flows
- Valuing stock, however, is more complicated than valuing bonds because the cash flows are not contractually specified or fixed.

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Cash Flow

A stock's cash flow consists of:

- Stream of dividend payments received during ownership of stock
- The sale price for the stock upon deciding to sell

Note:

- The dividend stream may continue indefinitely
- The dividend stream may be finite
- The dividend stream may change over time
- There may be no dividend stream

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Valuation of Stocks

Let's calculate the rate of return for holding a stock for one period (**holding period return**). Define:

P_0 = today's price of the stock

P_1 = next year's price

D_1 = next year's dividend

$$HPR = r = [P_1 + D_1 - P_0]/P_0 = [P_1 - P_0]/P_0 + D_1/P_0$$

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Valuation of Stocks

$$r = [P_1 - P_0]/P_0 + D_1/P_0$$

Rewrite in terms of P_0 :

$$P_0 = D_1/(1+r) + P_1/(1+r)$$

Today's price equals the present value of next year's dividend plus the present value of next year's price.

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Example

- $P_0 = 100$, $P_1 = 110$, $D_1 = 5$. Solve for r :

$$r = \frac{110 - 100}{100} + \frac{5}{100} \\ = 0.10 + 0.05 = 0.15$$

Given r , P_1 , and $D_1 = 5$ now solve for P_0

$$P_0 = \frac{5}{1.15} + \frac{110}{1.15} = 100$$

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Valuation of Stocks continued

$$P_0 = D_1/(1+r) + P_1/(1+r)$$

Similarly, we can write next year's price as a function of the dividend in year 2 and the year 2 price of the stock:

$$P_1 = D_2/(1+r) + P_2/(1+r)$$

Substituting for P_1 :

$$P_0 = D_1/(1+r) + [D_2/(1+r) + P_2/(1+r)]/(1+r) \\ P_0 = D_1/(1+r) + D_2/(1+r)^2 + P_2/(1+r)^2$$

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Example

- $r = 0.15, P_0 = 100, P_2 = 121, D_1 = 5, D_2 = 5.5$

$$P_0 = \frac{5}{1.15} + \frac{5.5}{(1.15)^2} + \frac{121}{(1.15)^2} = 100$$

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Valuation of Stocks, continued

$$P_0 = D_1/(1+r) + D_2/(1+r)^2 + P_2/(1+r)^2$$

This equation is recursive, upon further substitution we can eventually arrive at the following expression:

$$P_0 = D_1/(1+r) + D_2/(1+r)^2 + \dots + D_T/(1+r)^T + \dots$$

$$P_0 = \sum D_t/(1+r)^t \quad \text{for } t = 1 \text{ to } \infty$$

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Dividend Growth Models

- For a given discount rate r , stock prices will differ based on the firm dividends.
- The stock price is determined by how the firm dividends evolve.
- Typical assumptions are
 - No growth in dividends
 - Constant dividend growth

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Dividend Growth Models

- No growth in dividends:** $D_1 = D_2 = \dots = D$
 $P_0 = \sum D/(1+r)^t$ for $t = 1$ to ∞
 Note the right hand side is a perpetuity, such that:
 $P_0 = D/r$
- Constant dividend growth:** $D_1 = D; D_2 = D(1+g); D_3 = D(1+g)^2; \dots$
 $P_0 = \sum D(1+g)^{t-1}/(1+r)^t$ for $t = 1$ to ∞
 Note the right hand side is a growing perpetuity, such that:
 $P_0 = D/(r-g)$ (for $r > g$)

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Numerical Examples

- $D_1 = 5, g = 0.10, r = 0.15$

$$\text{No growth: } P_0 = \frac{D_1}{r} = \frac{5}{0.15} = 33.33$$

$$\text{Constant growth: } P_0 = \frac{D_1}{(r-g)} = \frac{5}{0.05} = 100$$

Comparative Statics

- What happens to the stock price when the dividend growth rate changes?

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

$$\frac{dP}{dg} = -(r-g)^{-2} D_1 \cdot (-1)$$

$$= (r-g)^{-1} P$$

$$\Rightarrow \frac{dP}{P} \approx (r-g)^{-1} dg$$

Numerical Example

- $D_1 = 5, r = 0.15, g_0 = 0.10, g_1 = 0.11$

$$\frac{dP}{P} \approx (r-g)^{-1} dg$$

$$= \frac{0.01}{(0.15-0.10)} = \frac{0.01}{0.05} = 0.2$$

$$= 20\%$$

Determining the Dividend Growth Rate

Q: What determines whether a firm will grow or issue increased dividends?

- A firm can either *retain* or *payout* earnings.
- Dividends represent earnings that are paid out.
- Retained earnings are those earnings not paid out as dividends that the firm plows back into the business.
- Investing retained earnings *may* provide growth opportunities for the firm.

Determining the Dividend Growth Rate

- Investing retained earnings will improve firm value (stock price) only if they are invested in projects with positive Net Present Value; i.e., *the return to the retained earnings (return on equity) must exceed the market discount rate.*
- Investing retained earnings in positive NPV projects, all else constant, will allow dividends to grow and the stock price to increase.

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Determining the Dividend Growth Rate

If a firm elects to pay a lower dividend, and reinvest the funds, the stock price may increase because future dividends may be higher.

Payout Ratio - Fraction of earnings paid out as dividends

Plowback Ratio - Fraction of earnings retained by the firm. Also called the *retention ratio* (RR)

Note: Payout Ratio + Plowback Ratio = 1
=> Payout Ratio = 1 - RR

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Determining the Dividend Growth Rate

Growth in dividends can be derived from applying the return on equity to the percentage of earnings plowed back into operations:

Dividend growth = g

= return on equity * plowback ratio

= $ROE * RR$

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Example

A company forecasts to pay a \$8.33 dividend next year, which represents 100% of its earnings. This will provide investors with a 15% expected return. Suppose, instead, the company decides to plow back 40% of the earnings at the firm's current return on equity of 25%. What is the value of the stock before and after the plowback decision?

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Stock price with no reinvestment of earnings:

$$D = EPS = \$8.33$$

$$P_0 = \frac{D}{r} = \frac{EPS}{r} = \frac{\$8.33}{0.15} = \$55.56$$

Where EPS = earnings per share

$P_0 = \$55.56 =$ no dividend growth stock price

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Stock price with no reinvestment of earnings:

- With a fixed dividend forever, the stock price stays fixed at 55.56 (no capital gains)
- The market rate of return on the stock is the dividend yield

$$r = \frac{D}{P_0} = \frac{\$8.33}{\$55.56} = 0.15$$

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Stock price after investment of retained earnings:

$$g = ROE \times RR = 0.25 \times 0.40 = 0.10$$

$$D = (1 - RR) \times EPS = 0.60 \times \$8.33 = \$5.00$$

$$P_0 = \frac{D}{r - g} = \frac{\$5.00}{0.15 - 0.10} = \frac{\$5.00}{0.05} = \$100$$

$P_0 = \$100 =$ stock price with growing dividends

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If the company did not plowback some earnings, the stock price would remain at \$55.56. With the plowback, the price rose to \$100.00.

The difference between these two numbers is called the *Present Value of Growth Opportunities* (PVGO)

$$PVGO = \$100 - \$55.56 = \$44.44$$

$$= P - \frac{EPS}{r}$$

$$\Rightarrow P = \frac{EPS}{r} + PVGO$$

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Result: $PVGO = 0$ if $ROE = r =$ market capitalization rate of stock

- $EPS = \$8.33, r = 0.15, ROE = 0.15$

$$g = ROE \times RR = 0.15 \times 0.40 = 0.06$$

$$D = (1 - RR) \times EPS = 0.60 \times \$8.33 = \$5.00$$

$$P_0 = \frac{D}{r - g} = \frac{\$5.00}{0.15 - 0.06} = \frac{\$5.00}{0.09} = \$55.56$$

$$PVGO = \$55.56 - \$55.56 = 0$$

Valuing Firms with No Dividends or Earnings

- How do you value firms that do not issue dividends?
- How do you value firms with negative or zero earnings (e.g., start-up companies, internet firms during recent market boom)?
- A general formulation is:

$$P_0 = EPS_1/r + PVGO$$
- If $EPS_1 = 0$ then $P_0 = PVGO$
- Arguably, $PVGO$ s were severely overstated during tech boom years

NPVGO for Growth and Income Stocks

| Stock | P_0 | EPS | r | $PVGO = \frac{P_0 - EPS_1/r}{r}$ | $PVGO/P$ |
|-------------------------------------|-------|------|------|----------------------------------|----------|
| Income Stock (Dividend paying) | | | | | |
| Exxon | 42.29 | 2.13 | .072 | 12.71 | .30 |
| Kellogg | 29 | 1.42 | .056 | 3.64 | .13 |
| Growth Stock (Small or no dividend) | | | | | |
| Amazon | 8.88 | -.30 | .24 | 10.13 | 1.14 |
| Dell | 23.66 | .76 | .22 | 20.20 | .85 |

Comparing Different Stocks

- One way that investors and analysts compare different stocks is to look at Price/Earnings ratios or P/EPS :

$$\text{Recall: } P_0 = EPS_1/r + PVGO$$

$$\text{Dividing through by } EPS_1 \text{ gives}$$

$$P_0/ EPS_1 = 1/r + PVGO/ EPS_1$$
- The Price/Earnings ratio for different companies will differ based on their the ratio of growth opportunities to their ability to take advantage of the opportunities

Why Do Stock Prices Change?

From our valuation models:

- Changes in dividends
- Changes in dividend growth rates
- Changes in PVGOs
- Changes in relevant discount rate

Why Do Stock Prices Change?

- From market equilibrium, demand for stock = supply of stock:
- Increases or decreases in demand (investor sentiment; expectations)
- Increases or decreases in supply (corporate finance: share buybacks, secondary offerings, stock splits, etc.)