Stock Valuation

Corporate Structure

- Most firms in the US are organized as limited liability corporations.
- There is no one that "owns" the firm and who is liable if the firm's actions cause harm.
- The corporation is a "black-box" which generates cash flows.
- The corporation is defined by:
  - The contracts or rules that govern the **distribution** of the firms cash flows
  - The contracts or rules that govern its **control rights**

The Value of a Corporation

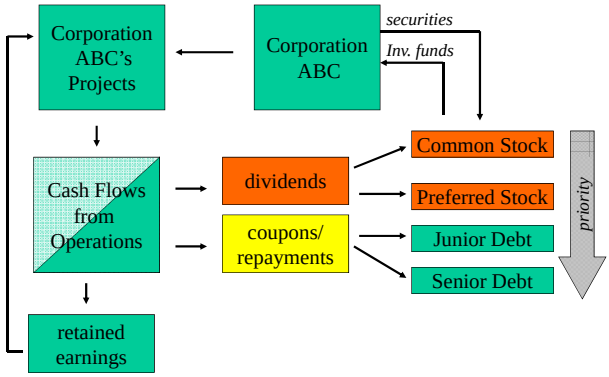
- A corporation's **Capital Structure** is the set of securities it has issued to raise funds
- The typical securities are
  - Senior debt, Junior debt, Preferred stock & Common stock.
- The value of each of these securities is given by the PV of the share of the future cash flows that they will receive.
- The value of the corporation is the PV of all future cash flows generated by its assets. Which equals the sum of the values of all of its securities.
- For example the value of firm ABC would be

$$V(ABC) = V(\text{Senior Debt}) + V(\text{Junior Debt}) + V(\text{Preferred Stock}) + V(\text{Common Stock})$$

Priority in the Division of Cash Flows

- Senior and Junior Debt are often coupon bonds
- Senior debt has the highest **priority**: if the firm has to liquidate, the senior debtholders have the first claim on the firm's assets.
- Preferred Stock is paid a fixed, pre-specified dividend.
- Common stock dividend can only be paid when the debtholders and preferred stock holders have been paid.
- When firms earn more profits than are necessary to pay the debt and preferred dividends, then all the **residual** goes to the stockholders (the **residual claimants**)

The Flow of Funds in a Public Corporation



What about control rights?

- Common stock holders (or equity holders) are the residual claimholders, they also have the residual control rights.
- Major issues are decided by equity holders based on a one-share one-vote system.
- Less important issues are decided by the board of directors, whose members are elected by the common stock holders.
- The management, appointed by the board, is obligated to act in the best interest of share holders.
- Debt holders have the control right spelled out in the **bond covenants** (or US Bankruptcy Code)
- The bond covenants specify that the control of the firm reverts to the bond holders in the event that the firm does not pay a coupon or principal payment on its debt or violates a debt covenant.

Stock Prices and Earnings: Historical Perspective (Shiller 2005)

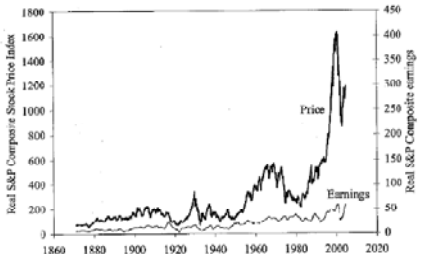


Figure 1.1
Stock Prices and Earnings, 1871–2005
Real (inflation-corrected) S&P Composite Stock Price Index, monthly, January 1871 through January 2005 (upper curve), and real S&P Composite earnings (lower curve), January 1871 to September 2004. *Source:* Author's calculations using data from S&P Statistical Service; U.S. Bureau of Labor Statistics; Cowles and associates, *Common Stock Indexes*; and Warren and Pearson, *Gold and Prices*. See also note 3.

Calculating firm value: Firm ABC's debt has 20,000 coupon bonds outstanding. These bonds are currently trading at a price of $10,000/bond. In addition, there are 12M shares of ABC outstanding, currently trading at a price of $12/share. What is present value of ABC's future cash flows according to the market?

The total **Market Value** of ABC's debt is:

$$20{,}000 \text{ bonds} \times \$10{,}000/\text{bond} = \$200\text{M}$$

The total market value of ABC's stock is:

$$12 \text{ M shares} \times \$12/\text{share} = \$144\text{M}$$

The total market value of ABC and the PV of future cash flows is:

$$\$200\text{M} + \$144\text{M} = \$344\text{M}$$

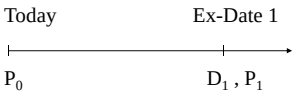
Common Stock Dividends

Terminology: The process of paying dividends involves four key dates

- **Announcement Date**: when the firm publicly announces the date and the amount of the dividend.
- **Ex-Date**: if buy the share before, you will receive the dividend (the share is sold **cum-dividend**). If you buy on or after, you will not receive the dividend (the share is sold **ex-dividend**).
- **Record Date**: when the company checks its records to see who to send the dividend checks to.
- **Payment Date**: when the firm actually pays the dividend (a week or so after the record date).

At open on the ex-date the price falls by (approximately) the amount of the dividend – if it did not, there would be an arbitrage opportunity.

Dividends and Capital Gains



Calculating the return on common stock

- The owner of common stock earns returns in two ways
  - Price appreciation or **Capital Gains**
  - **Dividends**
- Between time 0 and time 1 the total return on a common stock is:

$$r_{0,1} = \underbrace{\frac{P_1 - P_0}{P_0}}_{\text{Capital Gains Return}} + \underbrace{\frac{D_1}{P_0}}_{\text{Dividend Return}}$$

Example: (*General Motors)* On January 22, 2002, GM closed at $48.48 per share. On January 21, 2003, GM was trading at $37.55 pre share. During that time, GM paid a $2 dividend (just prior to January 21, 2003).

- If you had held GM over this period, what would your total return have been?
- What part of your return was due to the dividend, and what part to the capital gain?
- What was GM's dividend yield on January 22, 2002.

$$r_{0,1} = \underbrace{\frac{\$37.55 - \$48.48}{\$48.48}}_{-22\%} + \underbrace{\frac{\$2}{\$48.48}}_{+4\%} = -18\%$$

$$\text{dividend yield} = \frac{D_1}{P_0} = \frac{\$2}{\$48.48} = 4\%$$

Example: Actually, GM paid quarterly dividends of $0.50 on:

(1) February 12, 2002 (P = $50.77)
(2) May 15, 2002 (P=$66.40)
(3) August 14, 2002 (P=$45.71)
(4) November 12, 2002 (P=$33.95)

All of the above prices are the first *ex-dividend* price. Calculate the total return from holding GM over this year if all dividends are reinvested into GM's stock.

$$r_{Jan,Feb} = \frac{50.77 + 0.5 - 48.48}{48.48} = 6\%$$

$$r_{Feb,May} = \frac{66.40 + 0.5 - 50.77}{50.77} = 31.77\%$$

$$r_{May,Aug} = \frac{45.71 + 0.5 - 66.40}{66.40} = -30\%$$

Example: Actually, GM paid quarterly dividends of $0.50 on:

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(2) May 15, 2002 (P=$66.40)
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(4) November 12, 2002 (P=$33.95)

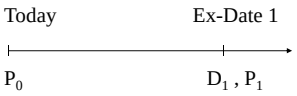
$$r_{\text{Aug, Nov}} = \frac{33.95 + 0.5 - 45.71}{45.71} = -25\%$$

$$r_{\text{Nov, Jan}} = \frac{37.55 - 33.95}{33.95} = 11\%$$

$$1 + r_{\text{Jan 2002, Jan 2003}} = (1.06)(1.318)(0.70)(0.75)(1.11) = 0.814$$

$$\Rightarrow r_{\text{Jan 2002, Jan 2003}} = -18.58\%$$

Stock Valuation



Notation:

- P_0 is the current price per share of the stock today (t=0) of firm "ABC"
- $E(P_1)$ is the expected ex-dividend price to be in one year
- $E(D_1)$ is the expected dividend to be paid in one year
- r* is the return investors expect to earn on stocks comparable in risk to the stock of firm "ABC" over this period.

Example: If the expected price $E(P_1)$=$50, the expected dividend $E(D_1)$=$5 and the investors expected return is r*=0.10 then the price must be…

$$10\% = \frac{50 + 5 - P_0}{P_0} \Rightarrow P_0 = \frac{50 + 5}{1.10} = \$50$$

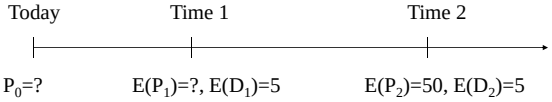
What if the price of ABC were $49.50? Then you could earn return….

$$r = \frac{50 + 5 - 49.50}{49.50} \Rightarrow r = 11\%$$

Investors would rush to sell the other comparable stocks and buy ABC, pushing the price up to $50

Where do we get $E(P_1)$????

P_0= PV of all future dividends



We can find out the price at time 1 by using the price at time 2…

$$P_1 = \frac{50 + 5}{1.10} = \$50$$

Now that we have the price at time 1 we can find the current price…

$$P_0 = \frac{E(P_1) + E(D_1)}{1 + r^*} = \frac{\left(\frac{E(P_2) + E(D_2)}{1 + r^*}\right) + E(D_1)}{1 + r^*} = \frac{E(D_1)}{1 + r^*} + \frac{E(D_2)}{(1 + r^*)^2} + \frac{E(P_2)}{(1 + r^*)^2} = \$50$$

If we continue this forever…

Using the price at Time N, P_N….

$$P_0 = \sum_{i=1}^{N} \frac{D_i}{(1+r^*)^i} + \frac{P_N}{(1+r^*)^N}$$

Taking N to infinity gives us the formula,

$$P_0 = \sum_{i=1}^{\infty} \frac{D_i}{(1+r^*)^i}$$

So … the current price is the PV of all future dividends.

The Gordon Growth Model

Assumptions:

- The share price is the PV of all future dividends
- Dividends are paid yearly. The next dividend is one year from now and is expected to be D_1
- Dividends are expected to grow at rate g forever.
- r* (the expected return on comparable firms) will remain constant at r where r > g (r is called **discount rate**, **cost of capital** and **market capitalization rate**).

Under these assumptions the current share price is the PV of a growing perpetuity:

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

Example: ABC is expected to pay a $5 dividend in one year. Thereafter dividends are expected to **grow at a rate of 5%** per year indefinitely. The appropriate discount rate for ABC is 10%. What should ABC's price be?

$$P_0 = \frac{D_1}{r-g} = \frac{\$5}{0.10-0.05} = \$100$$

What if g = 9%?

$$P_0 = \frac{D_1}{r-g} = \frac{\$5}{0.10-0.09} = \$500$$

What if g = 1%?

$$P_0 = \frac{D_1}{r-g} = \frac{\$5}{0.09} = \$56$$

The Dividend Yield

We can rearrange the Gordon Growth Model equation to give the expected return on a stock as a function of the dividend yield and growth rate.

$$P_0 = \frac{D_1}{r-g} \Rightarrow r-g = \frac{D_1}{P_1}$$

$$\Rightarrow r = g + \frac{D_1}{P_1}$$

The expected return on a stock equals the dividend yield plus the dividend growth rate.

Example: As of January, 2003, the expected dividend yields of GM and Microsoft were 5.33% and 0.29%, respectively. Assuming that investors' expected returns of 12% on both Microsoft and GM, and assuming a constant dividend growth rate, what "g" were investors expecting for the two firms?

$$r = g + \frac{D_1}{P_1} \Rightarrow g = r - \frac{D_1}{P_1}$$

Microsoft growth $g = 0.12 - 0.0029 = 11.71\%$

GM growth $g = 0.12 - 0.0533 = 6.67\%$