Financial Economics

Lecture 06. Valuation of Stocks

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AY22-23, SPRING

What is a stock/equity?

- How is a stock/equity different from a bond?
  - Is it an IOU?
  - Who gets paid first?
  - How are you paid back?
  - Does equity have a life?

A snap-shot

Assets	Liabilities
Real Assets	Equity/Stock Debt/Bonds

Outline

- The discounted dividend model
- Earning and investment opportunity
- Dividend policies

The discounted dividend model

- Valuation of bonds: certain cash flows
- Valuation of stocks: uncertain cash flows
- **Discounted cash flow (DCF)** approach: discounts the expected cash flows
  - Dividends paid to shareholders
  - Net cash flows from operations of the firm
- A **discounted dividend model (DDM)** is any model that computes the value of a share of a stock as the **present value of the expected future cash dividends**
  - An investor expects a return consisting of cash dividends and the change in price.

The discounted dividend model

$$
\begin{aligned}
P_0 &= \frac{D_1}{(1+k)^1} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \frac{D_4}{(1+k)^4} + \ldots \\
&= \frac{D_1}{(1+k)^1} + \frac{1}{(1+k)^1}\left\{\frac{D_2}{(1+k)^1} + \frac{D_3}{(1+k)^2} + \frac{D_4}{(1+k)^3} + \ldots\right\} \\
&= \frac{D_1}{(1+k)^1} + \frac{1}{(1+k)^1}\{P_1\} = \frac{D_1 + P_1}{1+k} \\
k &= \frac{D_1 + P_1 - P_0}{P_0}
\end{aligned}
$$

- P_0 is the stock value for now
- P_j is the stock value in year j
- D_j is the cash dividend in year j
- k is the required rate of return/expected rate of return/risk-adjusted discount rate/market capitalization rate on the stock

The discounted dividend model

- The price and dividend next year are expected prices, so
  - The expected rate of return in any period equals the market capitalization rate, k

$$k = \frac{D_1 + P_1 - P_0}{P_0}$$

  - This relationship tells you that **next year's expected dividend yield + the expected capital gain yield** is equal to the required rate of return

$$k = \frac{D_1 + P_1 - P_0}{P_0} = \frac{D_1}{P_0} + \frac{P_1 - P_0}{P_0}$$

  - Price is the present value of the expected dividend plus the end-of-year price discounted at the required rate of return

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

The discounted dividend model-Example

- ABC Stock
- Expected dividend per share $D_1 = \$5$
- Expected ex-dividend price at the end of the year $P_1 = \$110$
- Required rate of return $k = 15\%$
- What is the current price of ABC stock?

The discounted dividend model-Example

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- What is the current price of ABC stock?

- $P_0 = \frac{D_1 + P_1}{1+k} = \frac{\$5 + \$110}{1.15} = \$110$

The discounted dividend model

- Estimating next year's dividend is straightforward, but estimating next year's price appears to be much more difficult
- The problem is that next year's price is obtained (eventually) by estimating, and discounting, every future dividend

$$P_1 = \frac{D_2 + P_2}{1 + k}$$

$$P_0 = \frac{D_1 + P_1}{1 + k} = \frac{D_1 + \frac{D_2 + P_2}{1 + k}}{1 + k} = \frac{D_1}{1 + k} + \frac{D_2 + P_2}{(1 + k)^2}$$

$$P_0 = \frac{D_1}{1 + k} + \frac{D_2}{(1 + k)^2} + \cdots = \sum_{t=1}^{n} \frac{D_t}{(1 + k)^t} + \frac{P_t}{(1 + k)^n} = \sum_{t=1}^{\infty} \frac{D_t}{(1 + k)^t}$$

- The price of a share of stock is the present value of all expected future dividends per share, discounted at the market capitalization rate.

The constant-growth-rate DDM

$$P_0 = \frac{D_1}{1+k} + \frac{D_2}{(1+k)^2} + \cdots = \sum_{t=1}^{\infty} \frac{D_t}{(1+k)^t}$$

- Forecasts of an infinite number of future dividends are not very practical.
- We have to introduce a simplifying assumption that captures our understanding of dividend behavior
- A simplified assumption is that dividends will growth at a constant rate, g
  - a dividend in any future year is the dividend in the prior year times a constant growth factor $(1+g)$
  - $D_2 = D_1(1+g), D_3 = D_1(1+g)^2, \ldots, D_t = D_1(1+g)^{t-1}$
  - Example: the dividend of ABC stock grows at a constant rate of 10%

D_0	D_1	D_2	…
\$5	\$5.5	\$6.05	…

The constant-growth-rate DDM

$$P_0 = \frac{D_1}{1+k} + \frac{D_2}{(1+k)^2} + \cdots = \sum_{t=1}^{\infty} \frac{D_t}{(1+k)^t} = \sum_{t=1}^{\infty} \frac{D_1(1+g)^{t-1}}{(1+k)^t}$$

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

- Present value of a perpetual stream of dividends growing at a constant rate g.
  - If $g = 0$, then $P_0 = \frac{D_1}{k}$, present value of a level perpetuity
  - The higher the g, the higher the stock price
  - As $g \to k$, $P_0 \to \infty$
- Stock price grows at the same rate as dividends
  - $P_1 = \frac{D_2}{k-g} = \frac{D_1(1+g)}{k-g} = \frac{D_1}{k-g}(1+g) = P_1(1+g)$

The constant-growth-rate DDM - Example

- ABC Stock
- Expected dividend per share $D_1 = \$5$
- Dividends will growth at a constant rate, $g = 10\%$
- Required rate of return $k = 15\%$
- What is the current price of ABC stock?

The constant-growth-rate DDM - Example

- ABC Stock
- Expected dividend per share $D_1 = \$5$
- Dividends will grow at a constant rate, $g = 10\%$
- Required rate of return $k = 15\%$
- What is the current price of ABC stock?

- $P_0 = \frac{D_1}{k-g} = \frac{\$5}{15\%-10\%} = \$100$

The constant-growth-rate DDM - Example

- DEF Stock
- Expected dividend per share $D_1 = \$5$
- Dividends will be a constant, $g = 0\%$
- Required rate of return $k = 10\%$
- What is the current price of DEF stock?

The constant-growth-rate DDM - Example

- DEF Stock
- Expected dividend per share $D_1 = \$5$
- Dividends will be a constant, $g = 0\%$
- Required rate of return $k = 10\%$
- What is the current price of DEF stock?

- $P_0 = \frac{D_1}{k-g} = \frac{\$5}{10\%-0\%} = \$500$

Is forever really forever?

- Suppose DEF company is going to die in 30 years
- Expected dividend per share $D_1 = \$5$
- Dividends will be a constant, $g = 0\%$
- The required rate of return $k = 10\%$
- What is the current price of DEF stock?

- $P_0 = \frac{D_1}{1+k} + \frac{D_2}{(1+k)^2} + \cdots = \sum_{t=1}^{30} \frac{5}{(1+10\%)^t} = 47.13$

Outline

- The discounted dividend model
- Earning and investment opportunity
- Dividend policies

Earning and investment opportunity

- A second approach to DCF valuation focuses on *future earnings* and *investment opportunities*
- This focus, rather than the earlier dividend focus, concentrates the analyst's attention on the core business determinants of value

Earning and investment opportunity

- To simplify the analysis, suppose that no new shares are issued, and no taxes
  - $\boldsymbol{D}ividends_t = \boldsymbol{E}arnings_t - net\ new\ \boldsymbol{I}nvestment_t$
  - "$D_t = E_t - I_t$".
- Net new investment may be positive or negative
  - The loss of existing asset value may not always be compensated by new investment
- Earnings (per share) are net income after interest and tax
- The formula for valuing stock is

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+k)^t} = \sum_{t=1}^{\infty} \frac{E_t}{(1+k)^t} - \sum_{t=1}^{\infty} \frac{I_t}{(1+k)^t}$$

  - The value of a company is *not* equal to the present value of its expected earnings
  - The value of a company is equal to the present value of its expected earnings less the present value of the earnings reinvested in the firm

Earning and investment opportunity

- Partition the firm's value into two parts:
  - The PV of the current level of earnings projected into the future as perpetuity
  - The NPV of any future investment opportunities

$$P_0 = \frac{E_1}{k} + NPV\ of\ Future\ Investments$$

Example

- **Nogrowth** has a policy of no net new investments
  - This does not mean the firm does not invest in new plant and equipment--only that purchases match the loss of value of the existing assets (as measured by depreciation)
  - If we assume everything is in real terms, it is reasonable to assume that nogrowth will pay a constant dividend (say) $15/share each year
  - If the real capitalization rate is 15%, then the stock price of nogrowth is

$$P_0 = \frac{E_1}{k} = \frac{\$15}{15\%} = \$100$$

Example

- **Growthstock** initially has the same earnings as nogrowth, but reinvests 60% of its earnings each year into new investments that yield a real rate of return of 20% per year. The real capitalization rate is 15%.
  - That is, the first year dividend is $\mathrm{D}_1 = \$15 \times 40\% = \$6$
  - The other $\$15 \times 60\% = \$9$ per share is reinvested in the firm
- Although D_1 of Growthstock is lower than that of Nogrowth, but it grows over time at a rate of

  $g = Earnings\ retention\ rate \times Rate\ of\ Return\ on\ New\ Investments$
  $= 60\% \times 20\% = 12\%$
  - Earnings retention rate is the proportion of earnings that are reinvested
- Using the constant-growth-rate DDM
  - $P_0 = \frac{D_1}{k-g} = \frac{\$6}{15\%-12\%} = \$200$
  - $NPV\ of\ Future\ Investments = P_0 - \frac{E_1}{k} = \$200 - \$100 = \$100$

Observation

- The increase in the value of the stock is the consequence of reinvestment at a *higher rate of return* than the investor required rate of return
  - In Growthstock: reinvestment return 20%>required rate of return 15%
- What if the reinvestment return is 15%? In **Normalgrowth,** other things unchanged
  - $g = 60\% \times 15\% = 9\%$
  - $P_0 = \frac{D_1}{k-g} = \frac{\$6}{15\%-9\%} = \$100$
  - $NPV\ of\ Future\ Investments = 0$
  - In this case there is no increased value to the shareholders
    - Because reinvestment return 15%=required rate of return 15%

Reconsideration of the P/Es multiple approach

- Recall

$$P_0 = \frac{E_1}{k} + NPV\ of\ future\ investments$$

In terms of P/E

$$\frac{P_0}{E_1} = \frac{1}{k} + \frac{NPV of\ future\ investments}{E_1}$$

  - Firms with high PE ratios are then interpreted as having low capitalization rates or excellent future investment opportunities

Outline

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- Dividend policies

Does dividend policy affect shareholder wealth?

- Dividend policy of a corporation
  - The policy regarding paying out cash to its shareholders, *holding constant its investment and borrowing decisions*
- In a frictionless world where there are no taxes nor transaction costs, the dividend policy will have no affect on the wealth of stock holders
- We shall examine: tax, regulations, cost of external financing, and information content of dividends

Cash dividends and share repurchases

- A corporation may distribute cash
  - By paying dividends
    - All shareholders are paid the same per share
    - The stock price declines
  - By repurchasing its own stock
    - The company pays cash to buy shares of its stock in the stock market, thereby reducing the number of shares outstanding
    - Only shareholders choose to sell some of their shares will receive cash.
    - The stock price remains unchanged

Illustration: dividend payment

- The following table shows a simplified balance sheet of Cashrich co
- Assume
  - Number of shares outstanding = 500,000
  - Share price = $20

Assets		**Liab\Equ**	
Cash	2	Debt	2
Other	10	Equity	10
Total	12	Total	12

Illustration: cash dividend

- If Cashrich declares a dividend of $2 / share it will pay 500,000 * $2 = $1,000,000
  - The payment will reduce the market value of the shares by $1,000,000 to $20 * 500,000 - $1,000,000 = $9,000,000, so each share will be worth $9,000,000 / 500,000 = $18 / share
- Conclusion
  - # of shares outstanding: 500,000
  - Price per share: $18
  - Shareholders wealth is unchanged

Before

Assets		**Liab\Equ**	
Cash	2	Debt	2
Other	10	Equity	10
Total	12	Total	12

After

Assets		**Liab\Equ**	
Cash	1	Debt	2
Other	10	Equity	9
Total	11	Total	11

Illustration: share repurchase

- The company repurchases 50,000 shares at $20 per share = $1,000,000
  - The market value of the firm is now $10,000,000 less the loss of $1,000,000 cash, or $9,000,000
  - The number of shares outstanding is now 500,000 - 50,000 = 450,000
  - The share price is then $9,000,000/450,000 = $20
- Conclusion
  - # of shares outstanding: 450,000
  - Price per share: $20
  - Shareholders wealth is unchanged

Before

Assets		**Liab\Equ**	
Cash	2	Debt	2
Other	10	Equity	10
Total	12	Total	12

After

Assets		**Liab\Equ**	
Cash	1	Debt	2
Other	10	Equity	9
Total	11	Total	11

Stock dividends

- Corporations sometimes declare a *stock split* or distribute *stock dividends*
  - These activities do not distribute cash to the shareholders
  - They increase the number of issued shares but do not change the % of the company each shareholder owns
- They do not affect shareholder wealth

Illustration: stock split

- The company declares a two-for-one stock split
  - Each old share will be counted as two shares, and the number of shares outstanding is now 500,000 x 2 = 1,000,000
  - The market value is unaffected
  - The share price is then $10,000,000/1,000,000 = $10
- Conclusion
  - # of shares outstanding: 1,000,000
  - Price per share: $10
  - Shareholders wealth is unchanged

Before

Assets		**Liab\Equ**	
Cash	2	Debt	2
Other	10	Equity	10
Total	12	Total	12

After

Assets		**Liab\Equ**	
Cash	2	Debt	2
Other	10	Equity	10
Total	12	Total	12

Illustration: stock dividend

- The company declares a one-share of stock dividend per share
  - Each old share will be counted as two shares, and the number of shares outstanding is now 500,000 x 2 = 1,000,000
  - The market value is unaffected
  - The share price is then $10,000,000/1,000,000 = $10
- Conclusion
  - # of shares outstanding: 1,000,000
  - Price per share: $10
  - Shareholders wealth is unchanged

Before

Assets		**Liab\Equ**	
Cash	2	Debt	2
Other	10	Equity	10
Total	12	Total	12

After

Assets		**Liab\Equ**	
Cash	2	Debt	2
Other	10	Equity	10
Total	12	Total	12

Does dividend policy affect shareholder wealth?

- In a frictionless environment,
  - Modigliani and miller theory: there are no costs of issuing new shares of stock, nor costs of repurchasing existing shares, a firm's dividend policy can have no effect on the wealth of current shareholders

The real world: Tax shelter

- share repurchase
  - Smart co has had a good year, and is considering repurchasing some outstanding stock in order to prevent some of its shareholders paying personal income tax on the dividend
  - There are restrictions on this kind of practice in many countries
- retaining surplus cash
  - Smart co has had a good year, but is considering not declaring a dividend
  - Smart co doesn't need the cash, but holding cash tax shelters the shareholders
    - IRS rules provide huge penalties for this kind of activity

The real world: Cost of external funding

- Pay to intermediaries
  - The investment bankers who intermediate the sale of new shares to outside investors have to be paid, and it is the firm's current shareholders who bear the cost.
- Asymmetric information
  - The management is concerned that the investment community does not understand its business
    - It has decided to finance projects using cheaper *retained earnings* rather than issuing more stock at a discount from its "true" market value
- Signaling
  - The management of trip co has had a single bad year, but has decided not to reduce its dividend
    - Reducing the dividend may send a signal to the investment community saying "the fundamentals of trip have changed: consider decreasing future dividend estimates and/or consider increasing the cost of capital to compensate for additional risk"