Chapter 12
Equity Valuation

Value vs. Price

- What is value?
  - A numerical quantity determined by careful research and analysis

- What is price?
  - The cash that can be received if selling a stock in the market

- Can value and price be different?
  - Absolutely!
    - Heterogeneous valuations
    - Market inefficiency, transaction costs …
Dividend Discount Model (DDM)

- How does dividend discount model work?
  - DDM is about finding the *intrinsic value* of a stock by discounting cash flows that a company is expected to generate in the future.

- Two Critical Inputs:
  - Future cash flows (dividends and terminal value)
  - Market capitalization rate $k$ (cost of equity, required rate of return, or discount rate)
    - The cap rate depends on another model, e.g. CAPM

$$V_0 = \frac{E[D_1] + E[V_1]}{1 + k}$$

An Example of DDM

- Q: ABC is forecasted to pay $4 dividend at the year end, and have 12 month price target of $52. If $k = 12\%$, what is the stock *value* today?
Dividend Discount Model

- More General Setup
  - Convention: use ex-dividend value/price

\[
V_0 = \frac{E[D_1] + E[V_1]}{1 + k} = \frac{E[D_1]}{1 + k} + \frac{E[V_1]}{1 + k}
\]

\[
E[V_1] = \frac{E[D_1] + E[V_2]}{1 + k}
\]

\[
V_0 = \frac{E[D_1]}{1 + k} + \frac{E[D_2]}{(1 + k)^2} + \frac{E[D_3]}{(1 + k)^3} + \ldots
\]

\[
E[V_2] = \frac{E[D_2]}{1 + k} + \frac{E[V_3]}{1 + k}
\]

\[
V_0 = \frac{E[D_1]}{1 + k} + \frac{E[D_2]}{(1 + k)^2} + \frac{E[D_3]}{(1 + k)^3} + \ldots
\]

Dividend Discount Model

- Structured DDM
  - The general setup applies to any situation, but only if one knows the all intermediate dividends, and terminal value

- Constant Dividend Model
  - Assumption: \( D_1 = D_2 = D_2 = \ldots = D \)

\[
V_0 = \frac{D}{k}
\]

- Constant-Growth DDM (Gordon Model)
  - Assumption: \( D_1 = D_0 \times (1 + g); \ D_2 = D_1 \times (1 + g); \ldots D_{t+1} = D_t \times (1 + g) \)

\[
V_0 = \frac{D_0 \times (1 + g)}{k - g} = \frac{E[D_1]}{k - g}
\]
An Example of Constant Growth DDM

Q: If the market cap rate is 12%, what is the value of a stock which just paid a dividend of $3.81, and has an expected dividend growth rate of 5%?

\[ V_0 = \frac{D_0 \times (1 + g)}{k - g} = \frac{E[D_1]}{k - g} = \frac{3.81 \times (1 + 0.05)}{0.12 - 0.05} = 57.14 \]

Return Decomposition Under cg-DDM

The return is composed of dividend yield and capital gains

\[ V_0 = \frac{D_0 \times (1 + g)}{k - g} = \frac{E[D_1]}{k - g} \Rightarrow V_1 = \frac{D_1 \times (1 + g)}{k - g} = \frac{E[D_2]}{k - g} \]

\[ \frac{E[V_1]}{V_0} = \frac{E[D_2]}{E[D_1]} = 1 + g \]

- Expected capital gain under Gordon model same as dividend growth rate

\[ E[HPR] = \frac{E[V_1] + E[D_2] - V_0}{V_0} = \frac{E[D_1]}{V_0} + \frac{E[V_1] - V_0}{V_0} = \frac{E[D_2]}{V_0} + g = k \]
An Example of Return Decomposition

Q: IBM’s year-end dividend is expected to be $2.15, the growth rate will be 11.2% forever, and your required return is 15.2%
   - What is the intrinsic value now?
   - If the market is efficient, what’s the next year’s expected price?
   - If you buy it now and sell it after div. payment, what’s your expected capital gain, div. yield, and holding period return?

A: Applying the cg-DDM, we have
   - \( V_0 = \frac{2.15}{0.152 - 0.112} = $53.75 \)
   - \( \text{E}[P_1] = \text{E}[V_1] = V_0 \times (1+g) = $59.77 \)
   - Capital gains = 59.77 – 53.75 = 6.02; 6.02/53.75=11.2%
   - div yield = \( D_1/P_0 =4\% \)
   - Total return = 15.2% = Div. yield + Capital gain yield = required return (cap rate)

Multi-stage Growth DDM

Q: When is cg-DDM not applicable?
A: Two most obvious situations:
   - When expected dividends do not grow at a constant rate
   - When the growth rate is higher than required return in short term

Solution – Multi-stage growth model
   - Forecast the dividend at various stages of the future
   - Using cg-DDM to find value for the last stage
   - Move back to calculate the value using discounted cash flow analysis
An Example of Multistage Growth

- On the end of year 2000, the forecasts for Motorola are:
  - Next four years dividends: 0.17, 0.183, 0.197, & 0.21
  - The dividend growth rate thereafter: 12.74%
  - The required return: 13.8%

- Q: What is the value of Motorola's stock ($V_0$)?
- A: Year 2000 is time 0, and year 2004 is time 4.

$$V_4 = \frac{D_4 \times (1+g)}{k-g} = $22.34 \Rightarrow V_0 = \frac{D_1}{1+k} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \frac{D_4 + V_4}{(1+k)^4} = $13.8$$

- More Q:
  - If Motorola’s stock price was $33, was it over-valued?
  - What should be the value if the required return is 13.00%?

Source of Dividend Growth

- Retained earning can generate dividend growth
- Q: what will the dividend growth rate be if a company’s ROE is 14%, and it retains 91% of its earnings (i.e., 9% dividend payout ratio)
- A: assume the company’s current equity is 100
  - Earnings by the end of year = $100 \times 0.14 = $14
  - Pays $D_0 = 14 \times 0.09 = $1.26$ and retain $14 - $1.26 = $12.74$
  - The new equity base is $100 + $12.74 = $112.74$
  - Next year’s earning = $112.74 \times 0.14 = $15.78$
  - Pays $D_1 = 15.78 \times 0.09 = $1.42$, this is 12.74% higher than $D_0$
Source of Dividend Growth

- **Q:** What did we learn from the previous example?
- **A:** Growth can be internally generated from retained earnings
  
  \[ g = ROE \times b \]
  
  - ROE – return on equity
  - b – plowback ratio (earning retention ratio)

- Assumptions necessary to apply the growth rate from the above formula to cg-DDM
  - Constant ROE applies for all future investment
  - Constant payout ratio

- **Q:** Is dividend growth by retaining earnings *always* good?

Present Value of Growth Opportunity

- **Q:** CashCow and Growth Inc. share the following:
  \[ k = 12.5\%, \ E_1 = $5/shr. \] But, CashCow pays all earnings out as div while Growth Inc retains 60%.
  
  - What is the value and P/E ratio of CashCow if its ROE=10%?
  - CashCow: all earnings as dividend \( D_1 = E_1 = $5, \ g = 0. \)

  \[
  V_0 = \frac{D_1}{k-g} = \frac{5}{0.125-0} = $40 \Rightarrow \frac{P_0}{E_1} = \frac{V_0}{E_1} = \frac{40}{5} = 8
  \]

  - What are the value and P/E ratio of Growth Inc. if its ROE=15%?
  - Growth Inc: retains \( b = 60\% , \ D_1 = $2 (40\% \ of \ E_1) \)

  \[
  ROE = 15\% , \ g = ROE \times b = 9\% \]

  \[
  P_0 = \frac{D_1}{k-g} = \frac{2}{0.125-0.09} = $57.14 \Rightarrow \frac{P_0}{E_1} = \frac{V_0}{E_1} = \frac{57.14}{5} = 11.4
  \]
Present Value of Growth Opportunity

- Growth Inc. pays less today in dividend yet priced higher.
  - The premium comes from the growth opportunity
  - PVGO = Value with growth – value without growth
    \[ PVGO = P_0 - \frac{E_1}{E} = \$57.14 - \$40 = \$17.14 \]
- Q: Can Cashcow mimic the strategy of Growth Inc. (by reinvesting 60% earnings) to achieve a higher price?

Earnings and P/E Ratio

- Valuation based on comparing ratios
- P/E Ratio is often used in stock valuation
  \[ P_0 = \left( \frac{P_0}{E_{1,company}} \right) \times E_{1,company} = \left( \frac{P_0}{E_{1,PeerGroup}} \right) \times E_{1,company} \]
- Other Ratios of Common Interests:
  - price-book value ratios
  - price-cash flow ratios, and
  - Price-sales ratio in dot.com era
An Example of Valuation Based on P/E

- Q: BioG’s next year earning is expected to reach $2/shr, a diversified portfolio of similar companies has a P/E = 30, is BioG fairly valued at $80/shr?

- A: BioG’s fair value = 30×2 = $60.

- Conclusion
  - BioG is overvalued, or
  - P/E for BioG is higher because it may have higher PVGO

Wrap-up

- Buy undervalued and sell overvalued stocks
  - *Value* is only as good as the *model* in which it is derived and the *input* which goes into the model.

- DDM
  - Constant dividend vs. constant growth model
  - Dividend can be forecasted based on *earnings*, *fixed payout ratio* and *ROE*
  - Extension to multistage growth

- Earnings and P/E are useful in valuing stocks
  - P/E of *peer* group is often used in finding value for the company of interest.