Equity Valuation Models

What is a share of stock worth?

Readings and practice problems

- 18.1 Valuation by comparables
- 18.2 Intrinsic value vs. market price
- 18.3 Dividend discount models
- Practice problems 4, 5, 7, 8 (except for the part of the question on the PE ratio), 11, 12.
Goals

- Construction of some measure of “true” or “intrinsic” value $V$ distinct from the market price $P$
  - Buy stocks that are priced “too low”
  - Sell (or short) stocks that are priced “too high”
- A framework that will allow us to deduce consensus beliefs and expectations from the market price.
  - “If XYZ is paying a dividend of $2 and the market price is $35, what must be the market’s expectations for dividend growth?”

Balance sheet methods

- Book value (BV) per share: $(BV \text{ of assets} - BV \text{ of liabilities})/\#\text{shares}$
- Book values often do not correspond to economic value.
  - Depreciated historical costs of assets
  - Intangibles, going concern value
- Liquidation value (per share)
- Replacement value (per share)
Intrinsic value

- Present value to the holder of all expected cash flows from the stock (dividends and eventual sale) computed using the holder’s estimate of the appropriate discount rate.
  - The discount rate is the interest rate used to compute the PV; also called the capitalization rate.

- Investors may have
  - Different expectations about the cash flows
  - Different estimates of the appropriate discount rate

→ Different intrinsic value calculations
Intrinsic value with a one-year holding period

- If I plan to hold the stock for one year, collect the (end-of-year) dividend and sell the stock, the PV calculation is:
  \[ V_0 = \frac{E_D_1 + E_P_1}{1 + k} \]

- where
  - \( E_P_1 \) is the expected price in one year
  - \( E_D_1 \) is the expected dividend in one year
  - \( k \) is the interest rate

- Get \( k \) from SML (Security Market Line)
- Get \( E_D_1 \) from security analysis; \( E_P_1 \) from ?

Dividend discount models

- The intrinsic value is computed assuming that the stock is never sold.
- The present value of the dividends we expect to receive is:
  \[ V_0 = \frac{D_1}{1 + k} + \frac{D_2}{(1 + k)^2} + \frac{D_3}{(1 + k)^3} + \ldots \]

- This calculation requires a forecast of dividends.
- Sometimes a security analyst will generate this forecast.
- Sometimes we use simplifying assumptions ...
The constant dividend growth model

- Assume that dividends grow at a constant compound growth rate $g$.
- If $g = 5\%$ and last year’s dividend was $D_0 = $2 then $D_1 = 2(1.05); D_2 = 2(1.05)^2$, ...
- In this case:
  \[ V_0 = \frac{D_1}{1 + k} + \frac{D_1(1 + g)}{(1 + k)^2} + \frac{D_1(1 + g)^2}{(1 + k)^3} + \ldots = \frac{D_1}{k - g} \]
- (Using the formula for the sum of a geometric series.)

Example

- Stock data
  - Last year’s dividend was $D_0 = 1.50$
  - The expected growth rate is $g = 8\%$
    - Next year’s expected dividend is $D_1 = 1.50 \times 1.08 = 1.62$
  - $\beta = 1.2$
- Market data
  - $r_f = 5\%; E r_M - r_f = 8\%$
  - From the SML: $k = 5\% + 1.2 \times 8\% = 14.6\%$
- $V = \frac{D_1}{k - g} = \frac{1.62}{0.146 - 0.08} = 24.55$
Instabilities

- If $k$ is only slightly larger than $g$, the model gives wild valuations
- Examples:
  - If $k = 10\%$ and $g = 8\%$, then $V_0 = 1.62/(0.10 - 0.08) = $81
  - If $k = 9\%$ and $g = 8\%$, then $V_0 = 1.62/(0.09 - 0.08) = $162
- We often have only rough estimates of $k$ and $g$, and they are close together.

AEP

- Stock data
  - Last year’s dividend was $D_0 = 1.88$
  - The expected growth rate is $g = 2\%$
    - Next year’s expected dividend is $D_1 = 1.88 \times 1.02 = 1.92$
  - $\beta = 0.47$
- Market data
  - $r_f = 1\%; \ E r_M - r_f = 8\%$
  - From the SML: $k = 1\% + 0.47 \times 8\% = 4.8\%$
- $V = \frac{D_1}{k-g} = \frac{1.92}{0.048-0.02} = 69.48$ (vs. 44.27, actual)
Problem

- Assume that
  - The market price ($44.27) represents the market’s estimate of intrinsic value.
  - $D_1 = 1.92$ and $k = 4.8\%$
- What must be the market’s estimate of $g$?
  \[
  44.27 = \frac{1.92}{0.048 - g} \Rightarrow g = \frac{1.92}{44.27} + 0.048 \\
  g \approx 0.5\%
  \]

The constant growth model over time

- What’s the intrinsic value at the end of year 1?
- $V_1 = \frac{D_2}{k-g} = \frac{D_1(1+g)}{k-g} = V_0(1 + g)$
- Intrinsic value grows at the same rate as dividends.
The holding period return

- Using the market price $P_0 = \frac{D_1}{k-g}$ can be rearranged to solve for $k$:
  - $k = \frac{D_1}{P_0} + g = \text{dividend yield} + \text{capital gains} = HPR$
- Historical note: this formula was often used to estimate $k$ before the CAPM and SML were accepted.

When $P_0 \neq V_0$

- The stock is either overvalued or undervalued relative to $V_0$.
  - $V_0$ is based on subjective expectations
- Will the price converge to (our) intrinsic value?
  - If we buy an “undervalued” stock, the convergence will give us extra return.
- Over what time period?
  - When will the market realize that we’re right?
Dividends vs. growth

- Earnings can be paid out as dividends or retained.
- Plowback or retention ratio, $b$
  - The proportion of earnings that is retained by the firm.
- Payout ratio (the proportion of earnings paid out as dividends), $1 - b$

Retention and value

- Recall: $V_0 = \frac{D_1}{k-g}$
- If we payout more as dividends, $D_1$ will increase.
- But future growth is being financed by retained earnings, so $g$ will decrease.
- To quantify the effect of retention we need to know the ROE (return on equity)
  - $ROE = \frac{Net\ Income}{Common\ equity}$
- Then $g = b \times ROE$
AEP:

**Company Financials** Fiscal Year Ended Dec. 31

<table>
<thead>
<tr>
<th>Per Share Data (U.S. $)</th>
<th>2012</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payout Ratio (1 - b)</td>
<td>72%</td>
<td>57%</td>
</tr>
<tr>
<td>% Return on Common Equity</td>
<td>8.4</td>
<td>10.7</td>
</tr>
</tbody>
</table>

- Implied $g = (1 - 0.72) \times 0.084 = 0.024 \ (2.4\%)
- vs. S&P estimate of 2%.

The Growth and No-Growth Components of Value

- If the firm pays out all of its earnings as dividends, then
  - $D_1 = E_1$
  - With no retained earnings, $g = 0$
  - $V_0 = \frac{D_1}{k-g} = \frac{E_1}{k} =$ the “no growth” value (NGV)
  - The present value of a perpetuity with payment $E_1$
- If actual market price is $P_0$, then we can compute the market’s estimate of the value of growth.
  - $P_0 = \frac{E_1}{k} + PVGO$
  - where PVGO is the present value of growth opportunities.
AEP:

- 2012 earnings: $E_0 = 2.60$
- $E_1 = 2.60 \times 1.02 = 2.65$
- $NGV = \frac{2.65}{0.048} = 55.25$
- At a market price of $44, the market is estimating:
  - $44 = $55.25 + PVGO \rightarrow PVGO \approx -11$

Problem (Partitioning Value)

- Given: $ROE = 20\%; b = 40\%; E_1 = $5.00;$
  - $D_1 = $3.00; $k = 15\%$
- What is $g$?
  - $b \times ROE = 0.4 \times 0.2 = 0.08$
  - $V_0 = \frac{3}{0.15 - 0.08} = \frac{3}{0.07} = 42.86$
- What is $V_0$?

- What are the growth and no-growth value components?
  - $6V = \frac{5}{0.15} = 33.33$
  - $42.86 - \frac{42.86}{33.33} = PVGO$
Value and retention

- $V_0$ depends on $b$
  - If $ROE > k$, increasing $b \rightarrow$ increase in $V_0$
  - If $ROE < k$, increasing $b \rightarrow$ decrease in $V_0$
- Retained earnings are invested on the shareholder’s behalf.
  - Are they getting their required rate of return?

Extra: multistage valuation models

- Allow the growth rate to change over time.
- The Bloomberg valuation model incorporates
  - A near-term (3-5 year) growth rate that might be very high or very low.
  - A maturity growth rate close to the projected long-run growth rate for the entire economy (2%-4%)
  - A period of transition between the two.
11. The FL Corporation's dividends per share are expected to grow indefinitely by 5% per year.

   a. If this year's year-end dividends is $8 and the market capitalization rate is 10% per year, what must the current stock price be according to the DDM?

   b. If the expected earnings per share are $12, what is the implied value of the ROE on future investment opportunities?

   c. How much is the market paying per share for growth opportunities (i.e., for an ROE on future investments that exceeds the market capitalization rate)?

\[
V = \frac{8}{.10 - .05} = \frac{8}{.05} = 160 \text{ /shr.}
\]

\[
\text{payout} = \frac{8}{12} = 67\%
\]

\[
.05 = .33 \times \text{ROE}
\]

\[
\text{ROE} = \frac{.05}{.33} = 15\%
\]

\[
\text{NGV} = \frac{12}{.10} = 120
\]

\[
\text{PVGO} = 40
\]
12. The stock of Nogro Corporation is currently selling for $10 per share. Earnings per share in the coming year are expected to be $2. The company has a policy of paying out 50% of its earnings each year in dividends. The rest is retained and invested in projects that earn a 20% rate of return per year. This situation is expected to continue indefinitely.
   a. Assuming the current market price of the stock reflects its intrinsic value as computed using the constant-growth DDM, what rate of return do Nogro’s investors require?
   b. By how much does its value exceed what it would be if all earnings were paid as dividends and nothing were reinvested?
   c. If Nogro were to cut its dividend payout ratio to 25%, what would happen to its stock price? What if Nogro eliminated the dividend?

For Problems 10 to 16: If the simple CAPM is valid, which of the following situations are possible? Explain. Consider each situation independently.

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<tbody>
<tr>
<td>Portfolio</td>
<td>Expected Return</td>
<td>Beta</td>
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<td>1.4</td>
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<tr>
<td>B</td>
<td>25</td>
<td>1.2</td>
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<tr>
<td>B</td>
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<tr>
<td>Market</td>
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<td>24</td>
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<tr>
<td>A</td>
<td>16</td>
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### Portfolio Performance

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<td>24</td>
</tr>
<tr>
<td>A</td>
<td>20</td>
<td>22</td>
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</tbody>
</table>

### Portfolio Analysis

- **Portfolio 13**
  - Risk-free: 10
  - Market: 18
  - A: 20

- **Portfolio 14**
  - Risk-free: 10
  - Market: 18
  - A: 16

- **Portfolio 15**
  - Risk-free: 10
  - Market: 18
  - A: 16

### Expected Returns and Beta Analysis

- **Expected Return Formula**: \( E_R = R_F + \beta \times (R_M - R_F) \)

- **Portfolio 13**
  - Risk-free: 10
  - Market: 18
  - A: 20
  - \( \beta = 2.4 \)
  - \( E_R = 10 + \frac{18 - 10}{2.4} \times 22 = 17.3\% \)

- **Portfolio 14**
  - Risk-free: 10
  - Market: 18
  - A: 16
  - \( \beta = 1.5 \)
  - \( E_R = 10 + (18 - 10) \times 1.5 = 22\% \)

- **Portfolio 15**
  - Risk-free: 10
  - Market: 18
  - A: 16
  - \( \beta = 0.9 \)
  - \( E_R = 10 + (18 - 10) \times 0.9 = 17.2\% \)

### Capital Market Line (CML)

- **CML Equation**: \( E_R = R_F + \beta \times (R_M - R_F) \)

- **Diagrams**
  - SML (Security Market Line)
  - CML (Capital Market Line)