

Chapter Eighteen

Equity Valuation Models

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Overview

- As our discussion of market efficiency indicated, finding undervalued securities will never be easy.
- Still, there are enough chinks in the armor of the EMH that the search for such securities should not be dismissed out of hand.
- Moreover, it is the ongoing search for mispriced securities that maintains a nearly efficient market.
- Even minor mispricing would allow a stock market analyst to earn his salary.

Overview

- This chapter describes the valuation models that stock market analysts use to uncover mispriced securities.
- These models presented are those used by *Fundamental analysts*, those analysts who use information concerning the current and prospective profitability of a company to assess its fair market value
- We start with a discussion of alternative measures of the value of a company.

Valuation by Comparables

- Purpose of fundamental analysis is to identify stocks that are mispriced relative to some measure of “true” or intrinsic value that can be derived from observable financial data
- Valuation ratios are commonly used to assess the valuation of one firm compared to others in the same industry
- The ratios can be either above or below the industry average, thus rigorous valuation models will be necessary to sort through these conflicting signals of value.

Financial Highlights of Microsoft

Table 18.1

Financial highlights for Microsoft Corporation and the software applications industry

Price per share	\$111.98	
Common shares outstanding (billion)	7.67	
Market capitalization (\$ billion)	\$858.6	
Latest 12 months		
Sales (\$ billion)	\$118.48	
EBITDA (\$ billion)	\$ 49.58	
Net income (\$ billion)	\$ 33.54	
Earnings per share	\$ 4.31	
Valuation	Microsoft	Industry Average
Price/Earnings	22.43	39.94
Price/Book	9.33	8.03
Price/Sales	7.25	6.42
PEG	1.76	1.99
Profitability		
ROE (%)	39.35	13.47
ROA (%)	9.44	
Operating profit margin (%)	32.83	21.35
Net profit margin (%)	28.31	10.45

Source: Microsoft data from finance.yahoo.com, February 28, 2019; industry data courtesy of Professor Aswath Damodaran, <http://pages.stern.nyu.edu/~adamodar/>.

Limitations of Book Value

- Book value is the *net worth* of the company as reported on the balance sheet.
- Shareholders are sometimes called “residual claimants”
 - The value of their stake is what is left over when the liabilities of the firm are subtracted from its assets.
 - Shareholders’ equity is this net worth.

Limitations of Book Value

- However, book values are based on historical cost, while market values measure the *current* values of assets and liabilities
 - E.g., the book value of an asset equals the original cost of acquisition less some adjustment for depreciation, even if the market price of that asset has changed over time.
- Market values generally will not match historical values

Limitations of Book Value

- Equally or even more important, many assets, such as the value of a good brand name or specialized expertise may not even be included on the financial statement but certainly may influence market price.
- Can book value represent a “floor” for the stock’s price?
 - There are always firms selling at a market price below book value.
 - A better measure of a floor for the stock price is the firm’s *liquidation value* per share.

Liquidation Value and Tobin's Q

- Net amount that could be realized by selling the assets of a firm after paying the debt is **liquidation value**
 - Good representation of a “floor” for the stock’s price
- Another measure of firm value is the *replacement cost* of assets less liabilities.
 - Some analysts believe the market value of the firm cannot remain for long too far above its replacement cost.
 - Because if it did, competitors would enter the market.
 - The resulting competitive pressure would drive down profits and the market value of all firms until they fell to replacement cost.

Liquidation Value and Tobin's Q

- The idea is popular among economists, and the ratio of market value of the firm to replacement cost is known as **Tobin's q**.
 - In the long run, the ratio tends towards 1
 - But the evidence is that this ratio can differ significantly from 1 for very long periods.
 - Although focusing on the balance sheet can give some useful information about a firm's liquidation value or its replacement cost, the analyst must usually turn to expected future cash flows for a better estimate of the firm's value as a going concern.

Intrinsic Value vs. Market Price

- We turn to the quantitative models that analysts use to value common stock based on forecasts of future earnings and dividends.
- The most popular model for assessing the value of a firm as a going concern starts from the observation that an investor in stock expects a return consisting of cash dividends and capital gains or losses.
- The return on a stock is composed of cash dividends and capital gains or losses

$$\text{Expected HPR} = E(r) = \frac{E(D_1) + [E(P_1) - P_0]}{P_0}$$

- The *expected* HPR may be more or less than the required rate of return

Intrinsic Value vs. Market Price

- What is the required rate of return?
 - The CAPM provides an estimate of the rate of return an investor can reasonably expect to earn given its risk as measure by beta.

$$k = r_f + \beta \left[E(r_M) - r_f \right]$$

- If the stock is priced correctly, expected return will equal required return.
 - An underpriced stock will provide an expected return greater than the required return.
- Of course, the goal of a security analyst is to find stocks that are mispriced.

Required Return

- Example:
 - Suppose that $r_f = 6\%$, $E(r_M) - r_f = 5\%$.
 - Suppose the beta of ABC is 1.2.
 - According to CAPM, the value of k is
$$k = 6\% + 1.2 * 5\% = 12\%$$
 - If the expected holding-period return exceeds the required rate of return (12%), the investor will want to include more of this stock in the portfolio than a passive strategy would indicate.

Intrinsic Value and Market Price

- Another way to see this is to compare the intrinsic value of a share to its market price.
- The **intrinsic value** (V_0) is the “true” value, defined as the present value of all cash payments (on a per share basis), including dividends and the proceeds from the ultimate sale of the stock, discounted at the appropriate risk-adjusted interest rate, k .
- $$V_0 = \frac{E[D_1] + E[P_1]}{1+k}$$
 - If intrinsic value > market value, the stock is considered undervalued and a good investment

Intrinsic Value and Market Price

- For ABC, using a 1-year investment horizon, an expected dividend per share of \$4 ($E(D_1)$) and a forecast that the stock can be sold at the end of the year at price $P_1 = \$52$,

$$V_0 = \frac{4 + 52}{1.12} = \$50$$

- Equivalently, at a price of \$50, the investor would derive a 12% rate of return – just equal to the required rate of return.
- If the actual stock price is less than the intrinsic value, it provides better than a fair rate of return relative to its risk.
- Using CAPM terminology, ABC is a positive-alpha stock, and investors will want to buy more of it than would following a passive strategy.

Intrinsic Value and Market Price

- Trading signal
 - Intrinsic value $>$ Market price \rightarrow Buy
 - Intrinsic value $<$ Market price \rightarrow Sell
 - Intrinsic value $=$ Market price \rightarrow Hold
- In equilibrium, the market price will reflect the intrinsic value estimates of all market participants.
- This means the individual investor whose V_0 estimate differs from the market price, P_0 , in effect must disagree with some or all of the consensus estimates of $E(D_1)$, $E(P_1)$, or k .
- A common term for the consensus value of the required rate of return, k , is the **market capitalization rate**.

Exercise

- You expect the price of IBX stock to be \$59.77 per share a year from now. Its current market price is \$50, and you expect it to pay a dividend one year from now of \$2.15 per share.
 - a. What is the total holding-period return?
 - b. If the stock has a beta of 1.15, the risk-free rate is 6% per year, and the expected rate of return on the market portfolio is 14% per year, what is the required rate of return on IBX stock?
 - c. What is the intrinsic value of IBX stock, and how does it compare to the current market price?

Dividend Discount Models (DDM)

- We will use the simpler notation P_1 instead of $E(P_1)$ to avoid clutter.
- $$V_0 = \frac{D_1 + P_1}{1 + k}$$
- Keep in mind, though, that future prices and dividends are unknown, and we are dealing with expected, not certain, values.

Dividend Discount Models (DDM)

- $V_0 = \frac{D_1 + P_1}{1+k}$
- Although this year's dividends are fairly predictable given a company's history, you might ask how we can estimate P_1 , the year-end price.
- We know that the year-end intrinsic value V_1 will be
- $V_1 = \frac{D_2 + P_2}{1+k}$

Dividend Discount Models (DDM)

- $V_0 = \frac{D_1 + P_1}{1+k}$
- $V_1 = \frac{D_2 + P_2}{1+k}$
- If we assume the stock will be selling for its intrinsic value next year, then $V_1 = P_1$, and we have
- $V_0 = \frac{D_1}{1+k} + \frac{D_2 + P_2}{(1+k)^2}$

Dividend Discount Models (DDM)

$$V_0 = \frac{D_1}{1+k} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \dots$$

- V_0 = current value
- D_t = dividend at time t
- k = required rate of return
- DDM says V_0 = the present value of all expected future dividends

Constant Growth DDM

(1 of 2)

$$V_0 = \frac{D_0(1+g)}{k-g} = \frac{D_1}{k-g}$$

- V_0 = current value
- D_t = dividend at time t
- k = appropriate risk-adjusted interest rate
- g = dividend growth rate

Constant Growth DDM

(2 of 2)

- A stock just paid an annual dividend of \$3/share
- Dividend is expected to grow at 8% indefinitely
- Market capitalization rate is 14%

$$V_0 = \frac{D_1}{k - g} = \frac{\$3.24}{.14 - .08} = \$54$$

DDM Implications

- The constant-growth rate DDM implies that a stock's value will be greater:
 1. The larger its expected dividend per share
 2. The lower the market capitalization rate, k
 3. The higher the expected growth rate of dividends
- The stock price is expected to grow at the same rate as dividends

$$P_1 = \frac{D_2}{k - g} = \frac{D_1(1 + g)}{k - g} = \frac{D_1}{k - g} (1 + g) = P_0(1 + g)$$

Discounted Cash Flow (DCF) Formula

- The expected holding-period return for a stock is

$$E(r) = \text{Dividend yield} + \text{Capital gains yield}$$

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

- This equation is known as *discounted cash flow (DCF)* formula.
- This formula allows us to infer the market capitalization rate of a stock k :
 1. If the stock is selling at its intrinsic value, then $E(r) = k$, implying that $k = \frac{D_1}{P_0} + g$.
 2. By observing the dividend yield, D_1/P_0 , and estimating the growth rate of dividends, we can compute k .

Stock Prices and Investment Opportunities

- Consider two companies, Cash Cow and Growth Prospects, each with expected earnings in the coming year of \$5 per share. Suppose the market capitalization rate is $k = 12.5\%$
 - If Cash Cow pays out all of its earnings as dividends, maintaining a perpetual dividend flow of \$5 per share, it would be valued at _____ per share.
 - If Growth Prospects engages an investment with return of 15%, it chooses a lower **dividend payout ratio** of 40%, maintaining a **plowback ratio** (b) at 60%. Suppose Growth Prospects starts with plant and equipment of \$100 million and 3m shares of stock outstanding.
 - With a fixed return on investment or equity (ROE) of 15%, the reinvested earnings will be _____. The value of the assets will increase by _____.
 - The **sustainable growth rate** is $g = \text{ROE} \times b =$ _____.
 - If the stock price equals its intrinsic value, it should sell at _____.

Dividend Growth for Two Earnings Reinvestment Policies

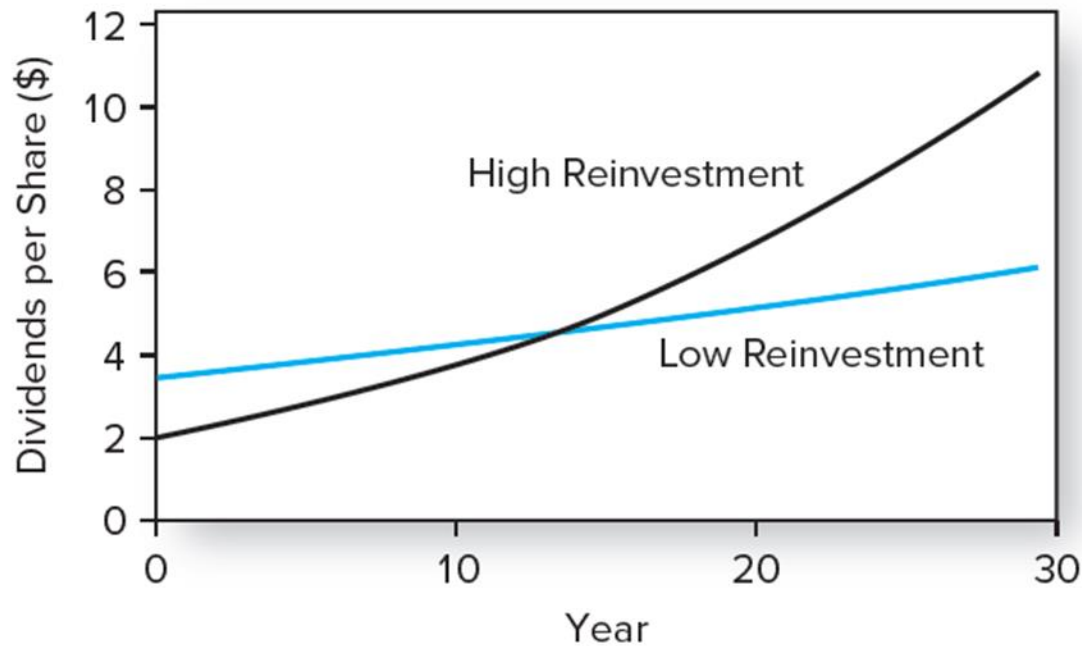


Figure 18.1 Dividend growth for two earnings reinvestment policies

Present Value of Growth Opportunities

- When Growth Prospects pursued a no-growth policy and paid out all earnings as dividends, the stock price was only \$40.
- When it decided to reduce current dividends and reinvest some of its earnings in new investments, its stock price increased.
- So the investment opportunities have positive net present value, and the value of the firm rises by the NPV of these investment opportunities.

Present Value of Growth Opportunities

- **Present value of growth opportunities (PVGO)** is the net present value of a firm's future investments
- We can think of the value of the firm as the sum of the following:
 - Value of assets already in place (no-growth value)
 - Net present value of the future investments the firm will make, or PVGO

$$P_0 = \frac{E_1}{k} + PVGO$$

Life Cycles and Multistage Growth Models

Firms typically pass through life cycles with different dividend profiles.

Early Years

- Ample opportunities for profitable reinvestment in the company
- Payout ratios are low
- Growth is correspondingly rapid

Later Years

- Attractive opportunities for reinvestment may become harder to find
- Production capacity is enough to meet market demand
- Competitors enter the market
- Firms may choose to pay out a higher fraction of earnings as dividends

Two-stage DDM

- To value companies with temporarily high growth, analysts use a multistage version of the dividend discount model.
- The combined present value of dividends in the initial high-growth period is calculated first.
- Then, once the firm is projected to settle down to a steady-growth phase, the constant-growth DDM is applied to value the remaining stream of dividends.

Example for two-stage DDM

- Assume Rio's grows rapidly in the near term, with dividends rising from \$3.12 in 2022 to \$3.90 in 2025:

2022	2023	2024	2025
\$3.12	\$3.38	\$3.64	\$3.90

- Assume the dividend growth rate levels off in 2025, dividend payout ratio is 60% and ROE is 18.5%. So the long-term growth rate will be
- $$g = ROE \times b = 18.5\% \times (1 - .60) = 7.4\%$$

Example for two-stage DDM

- Suppose that Rio's beta is 1.3, the risk-free rate on long-term Treasury bonds is 2.8%, and the market risk premium is 8%. The market capitalization rate is obtained from CAPM:

$$k = r_f + \beta[E(r_M) - r_f] = 2.8\% + 1.3 \times 8\% = 13.2\%$$

- The forecast price at the end of 2025 is

$$P_{2025} = \frac{D_{2026}}{k - g} = \frac{D_{2025}(1 + g)}{k - g} = \frac{3.90(1.074)}{.132 - .074} = \$72.22$$

- Today's estimate of Rio's intrinsic value is

$$V_{2021} = \frac{D_{2022}}{1 + k} + \frac{D_{2023}}{(1 + k)^2} + \frac{D_{2024}}{(1 + k)^3} + \frac{D_{2025} + P_{2025}}{(1 + k)^4} = \$54.26$$

Price-Earnings Ratio and Growth Opportunities (1 of 3)

- The price-earnings multiple is the ratio of price per share to earnings per share, commonly called the P/E ratio.

$$\frac{P_0}{E_1} = \frac{1}{k} \left(1 + \frac{PVGO}{E/k} \right)$$

- The ratio of PVGO to E/k is equivalent to the component of firm value due to growth opportunities to the value reflecting assets already in place

Price-Earnings Ratio and Growth Opportunities (2 of 3)

- When $PVGO = 0$, $P_0 = E_1/k$
 - The stock is valued like a nongrowing perpetuity
- As PVGO becomes an increasingly dominant contributor to price, the P/E ratio can rise dramatically
- P/E ratio reflects the market's optimism concerning a firm's growth prospects

Price-Earnings Ratio and Growth Opportunities (3 of 3)

- P/E increases:
 - As ROE increases
 - As plowback, b , increases, if $ROE > k$
 - As plowback decreases, if $ROE < k$
 - As k decreases

$$\frac{P_0}{E_1} = \frac{1-b}{k - ROE \times b}$$

P/E Ratios and Stock Risk

- Holding all else equal, riskier stocks will have lower P/E multiples
- Riskier firms will have higher required rates of return, that is, higher values of k , which means the P/E multiple will be lower

$$\frac{P}{E} = \frac{1 - b}{k - g}$$

Pitfalls in P/E Analysis

- Denominator in the P/E ratio is accounting earnings, which are influenced somewhat by arbitrary accounting rules
 - **Earnings management**
 - Choices on GAAP
- Inflation
- Reported earnings fluctuate around the business cycle

P/E Ratios of the S&P 500 Index and Inflation

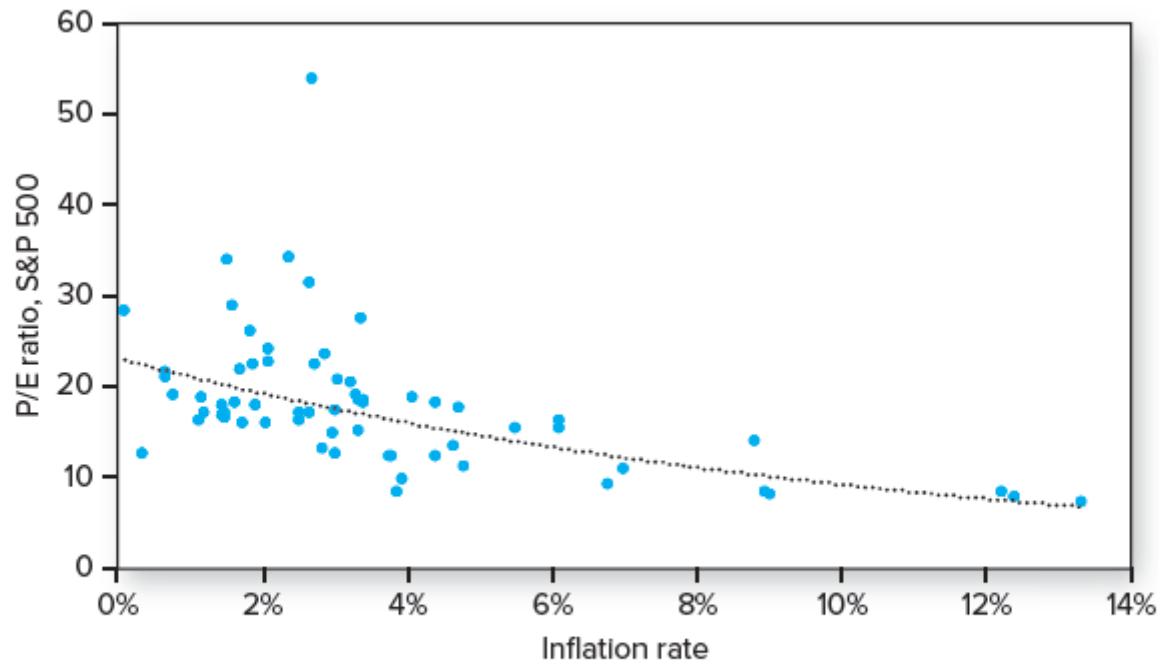


Figure 18.3 P/E ratio of the S&P 500 versus Inflation rate, 1955–2018.

Other Comparative Valuation Ratios

- Price-to-book ratio
 - Ratio of price per share divided by book value per share
- Price-to-cash-flow ratio
 - Cash flow is less affected by accounting decisions than are earnings
 - Ratio of price to cash flow per share
- Price-to-sales ratio
 - Useful for start-up firms that do not have earnings
 - Ratio of stock price to the annual sales per share

Market Valuation Statistics

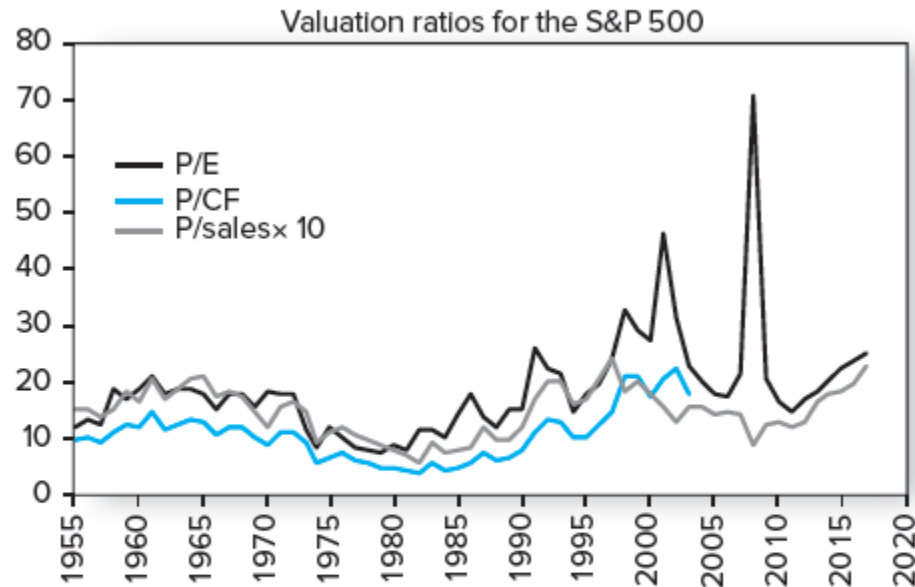


Figure 18.8 Valuation ratios for the S&P 500

Summary

- Intrinsic value and market price

- The return on a stock = dividend yield + capital gains yield

$$\text{Expected HPR} = E(r) = \frac{E(D_1) + [E(P_1) - P_0]}{P_0}$$

- The intrinsic value is the “true” value, according to a model
 - $IV > MV \rightarrow \text{Buy}$; $IV < MV \rightarrow \text{Sell}$; $IV = MV \rightarrow \text{Hold}$
- The _____ is a common term for the market consensus value of the required return on a stock.
 - A) dividend payout ratio
 - B) intrinsic value
 - C) market capitalization rate
 - D) plowback rate
 - E) None of the options are correct.

Summary

- Dividend discount models (DDM)

$$V_0 = \frac{D_1}{1+k} + \frac{D_2}{(1+k)^2} + \frac{D_3}{(1+k)^3} + \dots$$

- Constant growth DDM

$$V_0 = \frac{D_0(1+g)}{k-g} = \frac{D_1}{k-g}$$

- Sustainable growth rate/dividend growth rate: g
- Plowback ratio/earnings retention ratio: b
- Dividend payout ratio: $1 - b$
- $g = \text{ROE} \times b$

Summary

- Dividend discount models (DDM) (cont'd)
 - Present value of growth opportunities (PVGO): net present value of a firm's future investments

$$P_0 = \frac{E_1}{k} + PVGO$$

- Growth enhances company value only if $ROE > k$
- Two-stage DDM: allows for an initial high-growth period before the firm settles down to a sustainable growth trajectory

Summary

- Price-Earnings ratio

$$\frac{P_0}{E_1} = \frac{1}{k} \left(1 + \frac{PVGO}{E/k} \right)$$

- The P/E ratio is a useful measure of the market's assessment of the firm's growth opportunities
- For constant-growth DDM

$$\frac{P_0}{E_1} = \frac{1-b}{k - ROE \times b}$$

- P/E increases
 - As ROE _____
 - As b increases if _____; as b decreases if _____
 - As k _____

Exercise

- A firm pays a current dividend of \$1.00 which is expected to grow at a rate of 5% indefinitely. If current value of the firms shares is \$35.00, what is the required return applicable to the investment?

Exercise

- Tri-coat Paints has a current market value of \$41 per share with earnings of \$3.64. What is the present value of its growth opportunities (PVGO) if the required return is 9%?

Exercise

- The current time is 0. ABC company reinvests 50% of total earnings and has a return on equity (ROE) of 10%. The current market price of ABC stock is \$100. At the end of year 1, ABC Company will pay annual dividend of \$2 per share.
 - (1). What is the dividend growth rate? If market value equals to intrinsic value, what is the required rate of return, or market capitalization rate?
 - (2). Calculate the earning per share in year 1 and present value of growth opportunities (PVGO).
 - (3). Suppose ABC Company changes to reinvest 80% of its earnings in the next 4 years. From Year 5 and afterwards, it will pay out 50% of earnings again. Give the dividends and earnings per share for Year 1, 2, 3, 4, and 5.
 - (4). Continuing the problem in (3), calculate the forecast price at the end of Year 4 and the estimate of intrinsic value today.