3. Stocks

1. True or False? Briefly explain (or qualify) your answers.

    (a) The present value of a share of common stock is an increasing function of the future growth rate of earnings per share.

2. True or false? Briefly explain (or qualify) your answers.

    (a) In principle, the market price of a share of stock equals the discounted value of the stream of future earnings per share.

3. True, false or "it depends" (give a brief explanation):

    (a) Present value is good to value only traded assets since the discount rate comes from returns on traded assets.

    (b) Growth stocks should either have growing dividends or earnings.

4. True, false or "it depends" (give a brief explanation): Managers should maximize the firm's current market value, but only when maximization does not create unacceptable risks for shareholders.

5. True, false or "it depends" (give a brief explanation): The DDM (Dividend Discount Model or the DCF Valuation model) works only for firms with a dividend history.

6. True or false. Briefly explain your answer in each case.

    (a) Growth stocks usually have growing dividends.

7. True, false or "it depends"? Briefly explain or qualify your answer.

    (a) A company that has not made a profit since its IPO (initial public offering) cannot possibly be a growth stock.

8. True, false (give a brief explanation):

    (a) Firms with higher than average plow back ratios are growth companies.

    (b) Small stocks earn higher average returns because their returns are more volatile.

9. True or false (give a brief explanation): The price of a stock equals the present value of expected future earnings per share.

10. True or false (give a brief explanation): Within an industry, holding business risk and financial leverage constant, differences in firms' P/Es depend only on differences in rates of asset growth.

11. MetaTrend Corp. earns a book rate of return (ROE) of 12%. It reinvests one-half its earnings and pays out the other half as cash dividends. The nominal cost of capital is 12%.

   (a) Given this ROE and dividend payout ratio, what is the growth rate of Meta-Trends earnings and dividends?

   (b) Assume this growth rate is expected to continue in perpetuity. What is the present value of MetaTrend shares? Assume that book value per share is $10.

   (c) What does your answer to (b) assume about the timing of dividend payments? Explain briefly.

   (d) Your calculation in (b) assumes a nominal cost of capital and a nominal growth rate. Restate the cost of capital and growth rate in real (inflation-adjusted) terms and recompute the present value of MetaTrend shares. Show that the present value does not change.

   (e) Suppose MetaTrend decides to pay out all its earnings as cash dividends. Therefore it does not grow. What is the change, if any, in MetaTrends stock price? Why?

12. Consider the following three stocks.

   (a) Stock Q is expected to pay a dividend of $2.20 per share forever – no growth or decline.

   (b) Stock R will pay a dividend of $1.40 next year. Dividends are expected to grow at 3% per year forever.

   (c) Stock S is recovering from several years of losses, during which its dividend was cut to $.50 per year. The now-profitable company is expected to increase dividends by $.50 per year for four years (DIV1 = $1.00, DIV2 = $1.50, DIV3 = $2.00, DIV4 = $2.50). Thereafter dividends are not expected to grow or decline.

   The cost of capital is 9.5%. How much is each stock worth today (ex-dividend)?

13. Northern Co. expects to pay a dividend of $1 per share next year, which will grow at 10% for the following 5 years. Afterwards, the growth becomes 2%. The cost of capital for Northern Co. is 8%. What is today's share price of Northern Co.?

14. Company iTV's earnings per share are expected to be $5 next year and to grow at 8% per year indefinitely. The firm's cost of capital is 10%. The firm's payout ratio will stay at 30%.

   (a) What is iTV's share price?

   (b) Is iTV a growth company? Explain.

15. Company ABC's earnings per share this year are $5. ABC's earnings are expected to grow at rate g every year. The return that investors expect on ABC is 10%. ABC's current stock price is $80. ABC's payout ratio is 0.4.

   (a) Determine g.

(b) Determine the present value of ABC's growth opportunities.

16. Company ABC has a book value of $100 per share. Investors demand an expected return of 10%.

   (a) For the next three years, the return on equity (ROE) will be 15% and the payout ratio will be 0.3. After year 3, the ROE will drop to 10% and the payout ratio increase to 0.6. What is the stock value per share today? What are ABC's price to earnings ratios (P/E) for the next 4 years?

   (b) Re-do part (a) if the payout ratio in the next three years increases to 0.6 and all the other assumptions remain the same as in part (a)). Is the price lower or higher than the price in part (a) and by how much?

   (c) Re-do part (a) if the payout ratio after three years increases to 0.9 and all the other assumptions remain the same as in part (a). Is the price lower or higher than the price in part (a) and by how much?

   (d) Explain the changes in share price in part (b) and (c)

17. You remain skeptical about some of the assumptions in 15.401. For example, if the DCF (discounted cash-flow formula) is correct, how could the stock market fall by 23% on October 19, 1987?

   Try to convince yourself (and us) that such an event is possible even in a world of efficient markets; all you need is only a slight change of expectations.

   [HINT: Recall the dividend discount model: $P_0 = D_1/(r-g)$. Explain what each variable of the formula means. Now put some reasonable numbers for the right-hand side variables for the case of S&P 500: say $D_1 = 20$, $r=12\%$ and $g=10\%$. Taking each variable in turn in the right-hand side of the equation, and holding constant the other variables in the right-hand side of the equation, estimate how much it should change to cause a 23% drop in P_0. Is this just a slight change? Briefly explain your answer.]

18. Digital Organics has been growing at a rate of 6 percent per year and is expected to continue to do so indefinitely. The next dividend is expected to be $5 per share.

   (a) If the market expects a 10 percent rate of return on Digital Organics, at what price must it be selling?

   (b) Next year Digital Organics earnings per share will be $8. What part of Digital Organicss value is due to assets in place, and what part to growth opportunities?

19. The SM Group expects to pay a dividend of $4.50 per share one year from now. After this payment, the annual dividend is expected to grow (in perpetuity) in real terms at 4% per year. The appropriate nominal discount rate for valuing the dividends is 9.5% per year. Inflation is expected to be 2% per year. Given these assumptions, what is the present value of the stream of future dividends paid by SM Group stock?

20. Company Ts current return on equity (ROE) is 16%. It pays out one-quarter of earnings as cash dividends (payout ratio = .25). Current book value per share is $35.

The company has 5 million shares outstanding.

Assume that ROE and payout ratio stay constant for the next four years. After that, competition forces ROE down to 10% and the company increases the payout ratio to 60%. The company does not plan to issue or retire shares. The cost of capital is 9.5%.

(a) What is stock T worth?

(b) How much of stock Ts value is attributable to growth opportunities (PVGO)?

21. Now suppose the management of company T decides to increase the dividend payout ratio to 60% starting next year, at the same time maintaining the investment and growth rates that you calculated in answering pervious question. The company will cover any cash shortfall by issuing additional shares.

(a) How many additional shares will Company T have to issue next year?

(b) What is the effect on the (ex-dividend) value of stock T today?

You can assume that the stock issue is made immediately after the dividend at year 1. The company can take out a short-term loan if necessary to cover the additional dividend at year 1.

22. Company XYZ is expected to pay a dividend of $5 a year from now. This dividend is expected to grow at 10% for the next two years and at 5% forever after. The return that investors expect on XYZ is 12%. XYZ's payout ratio is 0.3.

(a) Determine XYZ's stock price.

(b) Determine XYZ's PVGO.

(c) Determine XYZ's P/E ratio.

(d) What will be the P/E ratio of XYZ in one year from now?

(e) To see how sensitive your conclusions are to the assumption about discount rates, re-compute your answers to previous questions assuming that the required rate of return on XYZ is either 10% or 14%.

23. Firm XYZ has two lines of business, organized as two divisions, A and B. Division A generates a risk-free cash flow. It will produce $2 million in free cash flow next year and it will grow at 2% each year thereafter forever. The second line of business, run by Division B, is risky. It expects to generate a cash flow of $2 million next year and will grow at a rate of 4%. Currently, the total market value of XYZ is $87 million. The term structure of interest rate is flat at 5%.

(a) What is the cost of capital for the second line of business?

(b) Assume the company comes across a new technology that can improve the Division B's profitability. It requires an initial investment of $5 million and will increase next year's cash flow by $0.8 million as well as future cash flows at so that their growth rate stays at 4%. If the management decides to take on this new technology, what will the market value of XYZ now be?

24. Unigene Labs has existing assets that generate an EPS of $5 per year, which is expected to remain constant if the firm does not invest except to maintain existing assets. Unigene is all-equity financed and its stock has a beta of 1.2. You estimate the cost of capital for the company's at 13.6%.

Next year (year 1), the firm has the opportunity to invest $3 per share to launch a new product, which will increase its EPS earnings by $0.80 per year permanently, starting the year after (year 2). The earnings from this product are less correlated witn the market and therefore it will have a cost of capital of 6%.

(a) What would be stock price and the price-to-earnings ratio at time zero if the firm did not plan to launch the new product?

(b) What would be stock price and the price-to-earnings ratio at time zero if the firm did plan to launch the new product?

25. PDQ Corp. is earning EPS of $3.00 this year, 15% of book value per share (BVPS) of $20.00. The company's sales revenues are expanding at 10% per year, and assets and BVPS will grow proportionally. But growth of revenues and assets will drop to 5% per year after year 5.

(a) Assume earnings will continue to be 15% of BVPS. What is PDQ stock worth? The cost of capital is 12%.

26. Company Us earnings and dividends have been growing at a steady 15% per year. You are confident that the growth will continue for at least one more year, but the growth is not sustainable for the long run. Eventually the company's growth rate will drop below 10%. The current price is $62, and next year dividend is forecasted at $.50 per share.

A security analyst forecasts the expected rate of return over the next year as:

$$r = \frac{DIV_1}{P_0} + g = \frac{0.5}{62} + 0.15 = 15.8\%$$

Explain why 15.8% is an upward-biased forecast of next year rate of return.

27. Consider a company XYZ. As of today, it has 1,000,000 shares of stock outstanding, trading at $50 per share and no debt. Assume that tomorrow the company decides, unexpectedly, to invest in a new project, which requires an initial investment of $10,000,000 today and is expected to produce a growing stream of cash flows, starting from $1,200,000 in one year from now and growing at 3% per year. The cost of capital for the new project is estimated at 12%. These new investment plans are not yet known. The company decides to finance the new project by issuing equity. It would like to issue just enough shares to raise the necessary $10,000,000 for the initial investment.

(a) How many shares should the company issue?

(b) What will be the share price after the new project is adopted?

(c) How would your answer change if the investment in the new project was not

unexpected, but rather was well known to the market a month in advance?

28. Your rich aunt has died. Her will gives you ownership of 5,000 shares of Plum Creek Timber Company, currently trading at $22 per share. But various legal complications will delay distribution of your aunt's shares to you until October 2008.

    Plum Creek now pays an annual dividend of $1.40 per share. Assume for simplicity that the next dividend will be paid in September 2008, just before you will receive the shares. (Therefore you will not receive the next dividend.) In the past Plum Creeks dividend has increased by 3% per year. This is a reasonable long-term trend, but security analysts are pessimistic for the immediate future. They forecast no growth in earnings and dividends for the next 3 years.

    Plum Creek is a relatively safe security. Investors are content with an 8% expected rate of return.

    A bank offers to buy the shares from you for $18.50 per share paid immediately. (The bank would pay $18.50 per share now and receive the shares next October.) Is this a fair offer?

29. Chucky Cheese has a cost of capital of 9% per year. Its expected EPS next year is $5.00. The firm plans to plow back 40% of its earnings for new investments in the following years. The ROE on the new investments is 12%.

    (a) Calculate the share price and the P/E ratio of this firm.

    (b) If the plowback ratio increases, will the P/E ratio increase, decrease or remain unaffected? State any assumptions you make and give a brief justification.

    (c) Given your answer to b), what will be your advice to this firm on its dividend policy?

30. iDoc, a health service company, is expected to generate $1 in earnings per share next year and in the years to follow, from its existing assets. It plans to announce a new program to expand its business. This new program will increase its plow back ratio from zero to 50% next year. The return on equity for the new investments will be 12%. The expansion is expected to continue forever at the same rate. The cost of capital is 10%.

    (a) What is the expected dividend next year and its future growth under the new program?

    (b) What is the change in iDoc's stock price in response the announcement?

    (c) Is iDoc a growth company? What is its P/E ratio before and after the announcement?

31. MW Co. expects earnings of $1.25 per share next year, out of which $0.50 will be paid out as dividends. Earnings and dividends are expected to grow at a constant rate g each year afterwards. MW shares are now traded at $20. The cost of capital for MW Co. is 10%.

(a) What is the expected growth rate of earnings g?

(b) What is the ROE for MW?

(c) Is MW a growth company? Justify your answer.

32. Fast Track, a local bus company providing direct service between New York and Boston, had after-tax earnings of \$2.5 million in the past year (year 0) and expected the same earnings forever. An investment bank had valued Fast Track at \$20 million. Now by allowing passengers to book online, Fast Track expects its after-tax earnings to grow at 2.5% per year, starting this year (year 1). How much would the value of Fast Track increase by this change? (Assume the cost of capital stays the same.)

33. Dragon and Tiger Island (DTI), an online game company, expects next year's after tax earnings to be \$20 per share. Its business is still expanding. It plows back 80% of its earnings. The ROE on its new investments is 15%. Its cost of capital is 12.5%.

(a) What is the share price of DTI? What is its PVGO?

(b) Suppose that a new competitor comes in and cuts DTI's ROE to 12%. How would this impact DTI's investment decisions and its share price? Explain why.

34. The dividend yield for shares of the Union Pacific Railroad is 1.9%. Security analysts are forecasting rapid growth in Union Pacific's earnings per share (EPS), about 12.7% per year for the next three years. Does that imply an expected rate of return of 1.9 + 12.7 = 14.6%? Explain.

35. The Northern Company is a utility company with existing assets that generates an EPS (earnings per share) of \$5. If the firm only maintains existing assets, EPS is expected to remain constant at \$5 a year. However, next year, the Northern Company has the opportunity to invest \$3 per share to develop a new electricity generator using solar energy. The development of the new generator will be completed next year. This investment is expected to generate a return (ROE) of 20% per year forever. The cost of capital is 10%. What will be the Northern Companys share price if it decides to develop the new generator? Use the back of this page if needed to complete your answer.

36. BetaTrend is an exact match for MetaTrend except for one thing: it generates a continuous stream of earnings and dividends. Thus it generates earnings in a continuous stream at 12% per year, starting immediately, and pays out half of earnings as dividends. What is the present value of BetaTrend stock? The annually compounded cost of capital is 12%.

3. Stocks Solutions

1. (a) UNCERTAIN/FALSE

    We can increase the present value of a share of common stock with a new investment only if $ROE > r$, where r is a discount rate (capitalization rate)

    If a new investment results in $ROE < r$, the price of the stock will decline even though earnings could be higher. Many students missed this point.

2. (a) False: the market value of a share of stock equals the discounted value of the stream of future dividends per share. It "works" with earnings if and only if PVGO = 0, and the plowback ratio = 0.

3. (a) False. The discount rate on one asset is determined by its risk characteristics.

    (b) False. A growth company has investment opportunities with expected return higher than the required rate of return. However, earnings may not be growing. For example, the firm could be investing heavily, leading to lower current earnings and dividend.

4. False. The goal of a manager should always be to maximize the market value of the firm. The firm's risk will be reflected in its market value and shareholders can always unload any undesirable risk in the market. (Caveat: It could be true if shareholders can't sell or have blocked access to financial markets like in private firms).

5. False. DDM use future dividend for discounting, so it works even with firms that have not paid dividends in the past.

6. (a) Growth stocks are stock of companies that have access to growth opportunities, where investment opportunities earn expected returns higher than the required rate of return on capital, or when PVGO > 0. A stock with growing dividends may not be a growth stock. A growth stock may be a stock with DPS growing slower than the required rate of return.

    Comment: to get a full credit, its not enough just to mention that growth stock dont usually have rapidly growing dividends. Many students said that growth stocks have DPS growing slower than the required rate of return. This is not necessarily true.

7. (a) False: To be a growth stock, its PVGO must be positive. It can have a positive PVGO, and yet not have made a profit since its IPO.
    OR
    Depends: If its PVGO is also non-positive, it is not a growth stock.

8. (a) False. A growth company has ROE greater than r, its cost of capital.

    (b) False. Higher volatility are not necessarily associated with higher returns as part of the volatility may be due to idiosyncratic risks.

9. False. The price of a stock equals the present value of all expected future dividends per share, discounted at the appropriate rate.

10. No. P = E/r + PVGO. So a higher P/E ratio may just mean higher PVGO.

11. (a) $g = ROE \times b = 12\% \times 0.5 = 6\%$. It is the same for both earnings and dividends.

(b) $P = \frac{D_1}{r-g} == \frac{BVPS \times ROE \times p}{r-g} = \frac{\$0.6}{12\%-6\%} = \$10$

(c) We have assumed that the first payment of dividend happens at the end of the current year.

(d) $P = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \cdots$. Note that $D_t = BVPS_t \times ROE_t \times p$, where p is the payout ratio. If all the quantities are restated in real terms, we will have a higher discount rate in the denominator of the DCF. But the BVPS will also be higher by the same factor so they will cancel out and the price won't change. We have assumed that the inflation will affect the assets and the discount factor in the same way here.

(e) No change. The price will remain as \$10/share as the ROE of the firm is the same as its cost of capital, i.e. it does not have access to any growth opportunities so the PVGO=0.

12. Price of Qs stock $= \$2.2/9.5\% = \$23.16$

Price of Rs stock $= \$1.4/(9.5\%\text{-}3\%) = \$21.54$

Price of Ss stock $= 1/(1+9.5\%) + 1.5/(1+9.5\%)^2 + 2/(1+9.5\%)^3 + 2.5/9.5\%/(1+9.5\%)^3 = \$23.73$

13. PV_0 of the first 5 years $= \frac{1}{1.08} + \frac{1.1}{1.08^2} + \frac{1.1^2}{1.08^3} + \frac{1.1^3}{1.08^4} + \frac{1.1^4}{1.08^5} = 4.8043$.
PV_0 of all dividends after the first 5 years $= \frac{1}{1.08^5}\frac{1.1^5 \times 1.02}{0.08-0.02} = 16.9395$.
$P_0 = 4.8043 + 16.9395 = 21.7438$.

14. (a) $p_0 = \frac{D_1}{r-g} = \frac{\$5 \cdot 0.3}{0.1-0.08} = \$75$.

(b) Yes, it has growth opportunities, and b > 0. $PVGO = p_0 - \frac{E_1}{r} = \$75 - \frac{\$5}{0.1} = \$25$.

15. (a) g solves $\frac{5 \times 0.4 \times (1+g)}{0.10-g} = 80$; $g = 0.073171$.

(b) $PVGO = 80 - \frac{5}{0.1} = 30$.

16. The growth rate of dividend after year 4 is $g_2 = 0.10 \cdot (1 - 0.6) = 0.04$.

The following tables give answers to part (a) (b) and (c). We see that today's price in part (a) is the same as that in part (c), but higher than that in part (b). The reason is that the ROE after year 4 is the same as the cost of capital (both at 0.10). Therefore, after year 4, it does not matter what the payout ratio is, and the price will remains the same. However, since from year 1 to year 3, the ROE is higher than cost of capital, a increase in payout ratio will reduce the growth rate of earnings (and dividends), therefore, the price in part (b) is lower.

Year	BVPS0	EPS	DivPS	BVPS1	Price	P/E
0	-	-	-	100.000	113.698	-
1	100.000	15.000	4.500	110.500	120.568	7.274
2	110.500	16.575	4.972	122.103	127.653	6.970
3	122.103	18.315	5.495	134.923	134.923	10.000
4	134.923	13.492	8.095	140.320	140.320	10.000

Payout Ration for the first three years is 0.3000, and is 0.600 after year 4.

Year	BVPS0	EPS	DivPS	BVPS1	Price	P/E
0	-	-	-	100.000	113.147	-
1	100.000	15.000	9.000	106.000	115.461	7.262
2	106.000	15.900	9.540	112.360	117.467	6.970
3	112.360	16.854	10.112	119.102	119.102	10.000
4	119.102	11.910	7.146	123.866	123.866	10.000

Payout Ration for the first three years is 0.6000, and is 0.600 after year 4.

Year	BVPS0	EPS	DivPS	BVPS1	Price	P/E
0	-	-	-	100.000	113.698	-
1	100.000	15.000	4.500	110.500	120.568	7.274
2	110.500	16.575	4.972	122.103	127.653	6.970
3	122.103	18.315	5.495	134.923	134.923	10.000
4	134.923	13.492	12.143	136.272	136.272	10.000

Payout Ration for the first three years is 0.3000, and is 0.900 after year 4.

17. $P_0 = D_1/(r - g)$

where,

P_0 = current price

D_1 = expected dividend next period

r = cost of equity or market capitalization rate

g = expected growth rate in dividends

In this example, we have $20/(0.12 - 0.10) = 1000$

A 23% drop in P_0 will cause it to drop from 1000 to 770. This can be caused by a 23% drop in the estimate of D_1 (from 20 to 15.4), or it can be caused by a 5% increase in the estimate of the cost of equity (from 12% to 12.6%), or it can be caused by a 6% decrease in the estimate of the expected growth rate in dividends (from 10% to 9.4%).

Though the first possibility is not a slight change, the last two possibilities are. (5 points)

18. (a) $P = \frac{D_1}{r-g} = \frac{\$5}{10\% - 6\%} = \$125$

(b) $P = \frac{EPS_1}{r} + PVGO = \frac{\$8}{10\%} + PVGO \rightarrow PVGO = \$45$

19. First, calculate the nominal growth rate:

$1 + g = (1.04)(1.02)$ so $g = .0608$

$PV = \frac{4.5}{0.095 - 0.0608} = \$131.58$

20. The table below summerizes the calculations:

Year	1	2	3	4	5
BB BVPS	$35.00	$39.20	$43.90	$49.17	$55.07
Investment	$ 4.20	$ 4.70	$ 5.27	$ 5.90	$ 2.20
EB BVPS	$39.20	$43.90	$49.17	$55.07	$57.28
EPS	$ 5.60	$ 6.27	$ 7.02	$ 7.87	$ 5.51
DPS	$ 1.40	$ 1.57	$ 1.76	$ 1.97	$ 3.30
PV(DPS)	$ 1.28	$ 1.31	$ 1.34	$ 1.37	
PV(TV)	$41.79				
Total share price	$47.08				
ROE	16%	16%	16%	16%	10%
g	12%	12%	12%	12%	4%
Payout Ratio	25%	25%	25%	25%	60%
Plowback Ratio	75%	75%	75%	75%	40%
Cost of Capital	9.50%				
PVGO	$(11.87)				

If we calculate PVGO as $Price - EPS/r$, we obtain a negative PVGO. How come that PVGO is negative while ROE > cost of capital at any time? Because the ROE on current assets decreases over time, which means that, by taking current ROE, we overestimate the value of assets in place. So, calculate an average ROE from now to the infinite = 10%*35 = 3.5 Value of assets in place = 3.5/0.095 = $36.84 "real" PVGO = $47.08 - $36.84 = $10.24

21. The table below summerizes the calculations:

Year	1	2	3	4	5

Year	1	2	3	4	5
BB BVPS	$35.00	$39.20	$43.90	$49.17	$55.07
Investment	$ 4.20	$ 4.70	$ 5.27	$ 5.90	$ 2.20
EB BVPS	$39.20	$43.90	$49.17	$55.07	$57.28
EPS	$ 5.60	$ 6.27	$ 7.02	$ 7.87	$ 5.51
DPS	$ 3.36	$ 3.76	$ 4.21	$ 4.72	$ 3.30
Net cash needed	$ 1.96	$ 2.20	$ 2.46	$ 2.75	$ -
PV(DPS)	$ 3.07	$ 3.14	$ 3.21	$ 3.28	
PV(TV)	$41.79				
Total share price	$54.49				

ROE	16%	16%	16%	16%	10%
G	12%	12%	12%	12%	4%
payout ratio	60%	60%	60%	60%	60%
plowback ratio	75%	75%	75%	75%	40%
cost of capital	9.5%				

PVGO = $(4.46)

At end of year 1, the company needs $1.96 per share of additional cash, or $9,800,000. At the new price of $54.49 per share, this represents 179,850 shares to be issued at t=1. The only effect on the ex-dividend price per share today comes from the change in the payout policy, which increases the price per share from $47.08 to $54.49. Dividend policy does not create value. What creates value is that the company gets money at 9.5% and invests it at 10%.

Once the company announces this measure, its market cap goes up to 5,000,000*54.49. Once it announces it will issue shares at the fair price to cover the additional cash needs, the new price per share becomes 5,000,000*(54.49+1.96)/(5,000,000+179,850)= $54.49!

The reason why this issue does not impact the price today is that is is done at the fair market value of the share, and every dollar invested shows up either as growth or as dividend.

22. (a) $P = \frac{5}{1.12} + \frac{5\times1.1}{1.12^2} + \frac{5\times1.1^2}{1.12^3} + \frac{1}{1.12^3}\frac{5\times1.1^2\times1.05}{0.12-0.05} = 77.75.$

(b) $\text{PVGO} = 77.75 - \frac{5/0.3}{0.12} = -61.14.$

(c) $\text{P/E} = \frac{77.75}{5/0.3} = 4.6650.$

(d) $P_1 = \frac{5\times1.1}{1.12} + \frac{5\times1.1^2}{1.12^2} + \frac{1}{1.12^2}\frac{5\times1.1^2\times1.05}{0.12-0.05} = 82.08.$
$E_2 = 5.5/0.3 = 18.33.$
$\text{P/E}_1 = \frac{82.08}{18.33} = 4.4770.$

23. (a) We compute the market value for the two division separately. For division A, the cash flow is risk-free, so we need to use the treasury rate to discount. The PV of the division A is

$$PV_A = \frac{\$2m}{0.05 - 0.02} = \$66.667m. \tag{2}$$

The PV of division B is the difference between the currently market value of the whole firm and the PV of division A:

$$PV_B = PV - PV_A = \$87m - \$66.667 = \$20.3333m. \tag{3}$$

The cost of capital for division B is

$$r_B = \frac{E_B}{PV_B} + g_B = \frac{\$2m}{\$20.333m} + 0.04 = 0.138. \tag{4}$$

(b) The NPV of the new project is

$$NPV = -\$5m + \frac{0.8}{r_B - g_B} = -\$5m + \frac{0.8}{0.138 - 0.04} = \$3.133m. \tag{5}$$

So the new market value of the firm is $\$87m + \$3.133m = \$90.133m$.

24. (a) $P = \frac{5}{0.136} = \$36.76$; hence $\frac{P}{E} = 7.35$

(b) The present value of the growth opportunity is -3 + 0.8/0.06 = 10.33 as of year 1.

$$P = \$36.76 + \frac{10.33}{1.06} = \$46.51$$

and,

$$\frac{P}{E} = 9.30$$

25. (a) $P_0 = \frac{3.30}{1.12} + \frac{3.63}{1.12^2} + \frac{3.99}{1.12^3} + \frac{4.39}{1.12^4} + \frac{4.83}{1.12^5} + \frac{1}{1.12^5} \cdot \left(\frac{5.07}{0.12 - 0.05}\right) = 55.34$

26. The analyst uses a constant growth one-stage DCF model: $P_0 = DIV_1/(r - g)$

But the growth rate is actually going to decline over the next years. The analyst should use a two-stage DCF analysis to value the company; assuming constant growth rate leads to overestimating the cost of capital. For example, if we assume that growth rate stays at 16% next year, but falls at 10% starting year 2, then the right discount rate is r such as $\$62 = 0.5/(1 + r) + 0.55/(r - 0.1)/(1 + r)$ which leads to $r = 10.81\%$

(c) MW Co. is a growth company since ROE on its new investments (12.5%) is higher than the cost of capital (10%), and b > 0.

32. From the original valuation, we can find r = EPS/P = 12.5%
Now if the earnings grow forever at 2.5%, then the new value is
EPS1/(r-g) = 2.5*(1+2.5%)/(12.5%-2.5%) = 25.625 million
So the value of the company will increase by 5.625 million
*Here we assumed the company always payout all the earnings as dividend.

33. (a) g = ROE*b = 12%. Therefore, price = D1/(r-g) = 4/(12.5%-12%) = 800. PVGO = 800 -$20/12.5% = 640

(b) As ROE < r, the company should stop expanding. Then its value will be $160 ($20 per year forever).

34. No. EPS is only growing at 12.7% for the next three years, not forever. The expected rate of return can only increase by less than that amount. In addition, there may be a cost to the rapid growth (e.g. part of the current earnings may be retained), so the rate of return is lowered further.

35. We will calculate the price of the stock a year from today. At that point, the firm can either not take the project or if it does, the project will reduce the current EPS by $3 but as a result the EPS moving forward will be higher by $3 \times 20\% = \$0.6$.

In the first case, the price is the PV of the perpetuity of $5 discounted at 10%. So $P = \$55$ (note that the first earning is at time zero, but this is more of less a timing assumption and other assumption as long as clearly markes would be valid as well).

In the second case, the price is $2 plus the PV of a perpetuity of $5.6 starting in 1 year discounted at 10%. So price will be $P = \$58$

36. We assume that dividends are paid continuously and discounting is also done continuously. We will divide each year into N parts each with length of $1/N$. Assume dividend is paid at the end of each little time section. Fix a time horizon T and let's calculate the PV:

$$PV(0,T) = \sum_{i=0}^{TN} \left[\left(\frac{0.6}{N} \left(1 + \frac{0.06}{N} \right)^i \right) \left(1 + \frac{0.12}{N} \right)^{-i} \right]$$

$$= \sum_{i=0}^{TN} \left[\left(\frac{0.6}{N} \left(1 + \frac{0.06}{N} \right)^{N\frac{i}{N}} \right) \left(1 + \frac{0.12}{N} \right)^{N\frac{-i}{N}} \right]$$

Now, taking the limit at $N \to \infty$ and usign the trick that $e^{rt} = \lim_{n \to \infty} (1 + r/n)^{nt}$, we

get:

$$
\begin{aligned}
PV(0,T) &= \int_0^T 0.6e^{0.06t}e^{-0.12t}\,dt \\
&= \int_0^T 0.6e^{-0.06t}\,dt \\
&= \frac{0.6}{-0.06}(e^{-.06T}-1)
\end{aligned}
$$

Now as $T \to \infty$ the PV become equal to \$10. So the combination of continously paying dividend, continous compounding and contimous growth cancel each other out and we have the same PV.