## **CHAPTER 4**

### The Value of Common Stocks

## **Answers to Problem Sets**

 1. a. True

 b. True

 2. Investors who buy stocks may get their return from capital gains as well as dividends. But the future stock price always depends on subsequent dividends. There is no inconsistency.

 3. P0 = (5 + 110)/1.08 = $106.48

 4. r = 5/40 = .125.

 5. P0 = 10/(.08 - .05) = $333.33.

 6. By year 5, earnings will grow to $18.23 per share. Forecasted price per share at

 year 4 is 18.23/.08 = $227.91.

 **

 7. 15/.08 + PVGO = 333.33; therefore PVGO = $145.83.

 8. Z’s forecasted dividends and prices grow as follows:

 

 Calculate the expected rates of return:

 From year 0 to 1: ​ 

 From year 1 to 2: 

 From year 2 to 3: ​  

 Double expects 8% in each of the first 2 years. Triple expects 8% in each of the

 first 3 years.

 9. a. False

 b. True.

10. PVGO = 0, and EPS1 equals the average future earnings the firm could generate

 under no-growth policy.

11. Free cash flow is the amount of cash thrown off by a business after all

 investments necessary for growth. In our simple examples, free cash flow equals

 operating cash flow minus capital expenditure. Free cash flow can be negative if

 investments are large.

12. The value at the end of a forecast period. Horizon value can be estimated

 using the constant-growth DCF formula or by using price–earnings or market–

 book ratios for similar companies.

13. If PVGO = 0 at the horizon date H, horizon value = earnings forecasted for H +

 1 divided by r.

14. Newspaper exercise, answers will vary

15.

|  |  |  |
| --- | --- | --- |
|  | Expected Future Values | Present Values |
| Horizon Period (H) | Dividend (DIVt ) | Price(Pt ) | Cumulative Dividends | Future Price | Total |
| 0 |  | 100.00 |  | 100.00 | 100.00 |
| 1 | 10.00 | 105.00 | 8.70 | 91.30 | 100.00 |
| 2 | 10.50 | 110.25 | 16.64 | 83.36 | 100.00 |
| 3 | 11.03 | 115.76 | 23.88 | 76.12 | 100.00 |
| 4 | 11.58 | 121.55 | 30.50 | 69.50 | 100.00 |
| 10 | 15.51 | 162.89 | 59.74 | 40.26 | 100.00 |
| 20 | 25.27 | 265.33 | 83.79 | 16.21 | 100.00 |
| 50 | 109.21 | 1,146.74 | 98.94 | 1.06 | 100.00 |
| 100 | 1,252.39 | 13,150.13 | 99.99 | 0.01 | 100.00 |

Assumptions

1. Dividends increase at 5% per year compounded.
2. Capitalization rate is 15%.

16. 







At a capitalization rate of 10%, Stock C is the most valuable.

For a capitalization rate of 7%, the calculations are similar.

The results are:

PA = $142.86

PB = $166.67

PC = $156.48

Therefore, Stock B is the most valuable.

17. a. 

b. First, compute the real discount rate as follows:

(1 + rnominal) = (1 + rreal) × (1 + inflation rate)

1.095 = (1 + rreal) × 1.0275

(1 + rreal) = (1.095/1.0275) – 1 = .0657 = 6.57%

In real terms, g = 0. Therefore:



18. a. Plowback ratio = 1 – payout ratio = 1.0 – 0.5 = 0.5

Dividend growth rate = g= Plowback ratio × ROE = 0.5 × 0.14 = 0.07

Next, compute EPS0 as follows:

ROE = EPS0 /Book equity per share

0.14 = EPS0 /$50 ⇒ EPS0 = $7.00

Therefore: DIV0 = payout ratio × EPS0 = 0.5 × $7.00 = $3.50

EPS and dividends for subsequent years are:

|  |  |  |
| --- | --- | --- |
| Year | EPS | DIV |
| 0 | $7.00 | $7.00 × 0.5 = $3.50 |
| 1 | $7.00 × 1.07 = $7.4900  | $7.4900 × 0.5 = $3.50 × 1.07 = $3.7450 |
| 2 | $7.00 × 1.072 = $8.0143  | $8.0143 × 0.5 = $3.50 × 1.072 = $4.0072 |
| 3 | $7.00 × 1.073 = $8.5753 | $8.5753 × 0.5 = $3.50 × 1.073 = $4.2877 |
| 4 | $7.00 × 1.074 = $9.1756 | $9.1756 × 0.5 = $3.50 × 1.074 = $4.5878 |
| 5 | $7.00 × 1.074 × 1.023 = $9.3866 | $9.3866 × 0.5 = $3.50 × 1.074 × 1.023 = $4.6933 |

EPS and dividends for year 5 and subsequent years grow at 2.3% per year, as indicated by the following calculation:

Dividend growth rate = g = Plowback ratio × ROE = (1 – 0.08) × 0.115 = 0.023

b. 



The last term in the above calculation is dependent on the payout ratio and the growth rate after year 4.

19. a. 

b. g = Plowback ratio × ROE = (1 − 0.5) × 0.12 = 0.06 = 6.0%

The stated payout ratio and ROE are inconsistent with the security analysts’ forecasts. With g = 6.0% (and assuming r remains at 11.75%) then:



20. The security analyst’s forecast is wrong because it assumes a perpetual constant growth rate of 15% when, in fact, growth will continue for two years at this rate and then there will be no further growth in EPS or dividends. The value of the company’s stock is the present value of the expected dividend of $2.30 to be paid in 2020 plus the present value of the perpetuity of $2.65 beginning in 2021. Therefore, the actual expected rate of return is the solution for r in the following equation:



Solving algebraically (using the quadratic formula) or by trial and error, we find that: r = 0.1201= 12.01%

21. a. An Incorrect Application. Hotshot Semiconductor’s earnings and dividends have grown by 30 percent per year since the firm’s founding ten years ago. Current stock price is $100, and next year’s dividend is projected at $1.25. Thus:



This is *wrong* because the formula assumes perpetual growth; it is not possible for Hotshot to grow at 30 percent per year forever.

A Correct Application. The formula might be correctly applied to the Old Faithful Railroad, which has been growing at a steady 5 percent rate for decades. Its EPS1 = $10, DIV1 = $5, and P0 = $100. Thus:



Even here, you should be careful not to blindly project past growth into the future. If Old Faithful hauls coal, an energy crisis could turn it into a growth stock.

b. An Incorrect Application. Hotshot has current earnings of $5.00 per share. Thus:



This is too low to be realistic. The reason P0 is so high relative to earnings is not that r is low, but rather that Hotshot is endowed with valuable growth opportunities. Suppose PVGO = $60:





Therefore, r = 12.5%

A Correct Application. Unfortunately, Old Faithful has run out of valuable growth opportunities. Since PVGO = 0:





Therefore, r = 10.0%

22. 

Therefore:





The statement in the question implies the following:



Rearranging, we have:



1. NPVα < NPVβ, everything else equal.
2. (rα - 0.15) > (rβ - 0.08), everything else equal.
3. , everything else equal.
4. , everything else equal.

23. a. Growth-Tech’s stock price should be:



1. The horizon value contributes:



1. Without PVGO, P3 would equal earnings for year 4 capitalized at 12 percent:



Therefore: PVGO = $31.00 – $20.75 = $10.25

1. The PVGO of $10.25 is lost at year 3. Therefore, the current stock price of $23.81 will decrease by:



The new stock price will be: $23.81 – $7.30 = $16.51

24. a. Here we can apply the standard growing perpetuity formula with DIV1 = $4, g = 0.04 and P0 = $100:



The $4 dividend is 60 percent of earnings. Thus:

EPS1 = 4/0.6 = $6.67

Also:





PVGO = $16.63

1. DIV1 will decrease to: 0.20 × 6.67 = $1.33

However, by plowing back 80 percent of earnings, CSI will grow by 8 percent per year for five years. Thus:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7, 8 . . . |
| DIVt | 1.33 | 1.44 | 1.55 | 1.68 | 1.81 | 5.88 | Continued  |
|  |  |  |  |  |  |  | growth at |
| EPSt | 6.67 | 7.20 | 7.78 | 8.40 | 9.07 | 9.80 | 4 percent |

Note that DIV6 increases sharply as the firm switches back to a 60 percent payout policy. Forecasted stock price in year 5 is:



Therefore, CSI’s stock price will increase to:



25. a. First, we use the following Excel spreadsheet to compute net income (or dividends) for 2009 through 2013:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **2009** | **2010** | **2011** | **2012** | **2013** |
| Production (million barrels) | 1.8000 | 1.6740 | 1.5568 | 1.4478 | 1.3465 |
| Price of oil/barrel | 65 | 60 | 55 | 50 | 52.5 |
| Costs/barrel | 25 | 25 | 25 | 25 | 25 |
|  |  |  |  |  |  |
| Revenue | 117,000,000 | 100,440,000 | 85,625,100 | 72,392,130 | 70,690,915 |
| Expenses | 45,000,000 | 41,850,000 | 38,920,500 | 36,196,065 | 33,662,340 |
| Net Income (= Dividends) | 72,000,000 | 58,590,000 | 46,704,600 | 36,196,065 | 37,028,574 |

Next, we compute the present value of the dividends to be paid in 2010, 2011 and 2012:

$121,012,624

The present value of dividends to be paid in 2013 and subsequent years can be computed by recognizing that both revenues and expenses can be treated as growing perpetuities. Since production will decrease 7%

per year while costs per barrel remain constant, the growth rate of expenses is: –7.0%

To compute the growth rate of revenues, we use the fact that production decreases 7% per year while the price of oil increases 5% per year, so that the growth rate of revenues is:

[1.05 × (1 – 0.07)] – 1 = –0.0235 = –2.35%

Therefore, the present value (in 2012) of revenues beginning in 2013 is:



Similarly, the present value (in 2012) of expenses beginning in 2013 is:



Subtracting these present values gives the present value (in 2012) of net income, and then discounting back three years to 2009, we find that the present value of dividends paid in 2013 and subsequent years is: $318,477,671

The total value of the company is:

$121,012,624 + $318,477,671 = $439,490,295

Since there are 7,000,000 shares outstanding, the present value per share is:

$439,490,295 / 7,000,000 = $62.78

b. EPS2009 = $72,000,000/7,000,000 = $10.29

EPS/P = $10.29/$62.78 = 0.164

26. [Note: In this problem, the long-term growth rate, in year 9 and all later years, should be 8%.]

The free cash flow for years 1 through 10 is computed in the following table:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **Year** |  |  |  |  |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| Asset value | 10.00 | 12.00 | 14.40 | 17.28 | 20.74 | 23.12 | 25.66 | 28.36 | 30.63 | 33.08 |
| Earnings | 1.20 | 1.44 | 1.73 | 2.07 | 2.49 | 2.77 | 3.08 | 3.40 | 3.68 | 3.97 |
| Investment | 2.00 | 2.40 | 2.88 | 3.46 | 2.38 | 2.54 | 2.69 | 2.27 | 2.45 | 2.65 |
| Free cash flow | -0.80 | -0.96 | -1.15 | -1.38 | 0.10 | 0.23 | 0.38 | 1.13 | 1.23 | 1.32 |
| Earnings growthfrom previousperiod | 20.0% | 20.0% | 20.0% | 20.0% | 20.0% | 11.5% | 11.0% | 10.5% | 8.0% | 8.0% |

Computing the present value of the free cash flows, following the approach from Section 4.5, we find that the present value of the free cash flows occurring in years 1 through 7 is:

-$2.94

The present value of the growing perpetuity that begins in year 8 is:



Therefore, the present value of the business is:

-$2.94 + $29.10 = $26.16 million

27. From the equation given in the problem, it follows that:



Consider three cases:

ROE < r ⇒ (P0/BVPS) < 1

ROE = r ⇒ (P0/BVPS) = 1

ROE > r ⇒ (P0/BVPS) > 1

Thus, as ROE increases, the price-to-book ratio also increases, and, when ROE = r, price-to-book equals one.

28. Assume the portfolio value given, $100 million, is the value as of the end of the first year. Then, assuming constant growth, the value of the contract is given by the first payment (0.5 percent of portfolio value) divided by (r – g). Also:

r = dividend yield + growth rate

Hence:

r – growth rate = dividend yield = 0.05 = 5.0%

Thus, the value of the contract, V, is:



For stocks with a 4 percent yield:

r – growth rate = dividend yield = 0.04 = 4.0%

Thus, the value of the contract, V, is:



29. If existing stockholders buy newly issued shares to cover the $3.6 million financing requirement, then the value of Concatco equals the discounted value of the cash flows (as computed in Section 4.5): $18.8 million.

Since the existing stockholders own 1 million shares, the value per share is $18.80.

Now suppose instead that the $3.6 million comes from new investors, who buy shares each year at a fair price. Since the new investors buy shares at a fair price, the value of the existing stockholders’ shares must remain at $18.8 million. Since existing stockholders expect to earn 10% on their investment, the expected value of their shares in year 6 is:

$18.8 million × (1.10) 6 = $33.39 million

The total value of the firm in year 6 is:

$1.59 million / (0.10 – 0.06) = $39.75 million

Compensation to new stockholders in year 6 is:

$39.75 million – $33.39 million = $6.36 million

Since existing stockholders own 1 million shares, then in year 6, new stockholders will own:

($6.36 million / $33.39 million) × 1,000,000 = 190,300 shares

Share price in year 6 equals:

$39.75 million / 1.1903 million = $33.39