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DEPARTMENT OF ECONOMICS
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EC 247 Financial Instruments and Capital Markets

Class Exercise 5

These questions correspond to chapters 13 and 14 of the Frederic S. Mishkin and Stanley G. Eakins, *Financial Markets and Institutions*, 7th Edition, Pearson Prentice Hall, 2009.

Chapter 13 begins by defining stocks and distinguishing stocks, which represent ownership, from bonds, which represent no ownership of the company. There are two sources of return for investors in common stocks: a) dividends and b) changes in the stock prices, which account for capital gains or losses. The chapter explains how information is incorporated into stock prices and discusses the fundamental theories that underlie stock valuation. The analysis focuses on the one-period valuation model, the generalized dividend model, the Gordon growth model, and the P/E valuation method. Finally, a section related to the errors in valuation, outlines why it is so tricky to use the above models.

Questions 1 through 3 are based on different applications of the Gordon Growth model. There are two assumptions behind the Gordon growth model: a) dividends are assumed to grow at a constant rate (g), i.e. $Div_{t+1} = Div_t * (1+g)$, and b) that the growth rate of dividends is less than the required return on equity. This can be perceived as a reasonable assumption, because if the growth rate were faster than the required return, the firm would grow impossibly large in the long run.

According to the Gordon Growth model, the value of the stock today is given by the following formula:

$$P_0 = \frac{D_0 * (1+g)}{(1+k_e)} + \frac{D_0 * (1+g)^2}{(1+k_e)^2} + ... + \frac{D_0 * (1+g)^\infty}{(1+k_e)^\infty} \qquad (1)$$

Where:

P_0 = the current price of the stock. The zero subscript refers to time period zero, i.e. the present.

D_0 = the most recent dividend paid.

g = the expected growth rate in dividends.

k_e = the required return on an investment in equity.

Using some algebra which can be found on page 350 in the textbook, the above equation simplifies to:

$$P_0 = \frac{D_0 * (1+g)}{(k_e - g)} = \frac{D_1}{(k_e - g)} \qquad (2)$$

In question 1, we are given the most recent annual dividend paid per share, i.e. $D_0 = \$1.00$ per share, the constant growth rate of dividends, $g = 5\%$, and the

required return, $k_e = 12\%$. Since we are looking for the current price of the share i.e. P_0, we can directly apply equation (2) above where:

$$D_1 = D_0 * (1+g) = \$1.00 * (1+0.05) = \$1.05.$$

In question 2 we have a similar problem to solve, with the difference that we are not looking for the current price of the stock, but for the expected price of the stock next year i.e. P_1. We do know that the most recent annual dividend paid is $D_0 = \$1.10$ per share, that the dividend growth rate is $g = 3\%$ and finally that the required yield is $k_e = 8\%$. Since we are looking for the expected price of the stock next period, we have to update the Gordon Growth formula one period ahead. As a result, equation 2 will now become:

$$P_1 = \frac{D_1 * (1+g)}{(k_e - g)} = \frac{D_2}{(k_e - g)} \quad (3)$$

However, we first have to find D_1. This is calculated as following:

$$D_1 = D_0 * (1+g) = \$1.10 * (1+0.03) = \$1.133$$

In question 3, we are looking again for the current price of the stock, i.e. P_0 but now we have different growth rates for dividends. More specifically, dividends are expected to double for the first 4 years ($D_1 - D_4$) after which, they are expected to grow at a constant rate of $g = 1\%$ per year. As a result, we cannot directly apply the Growth formula, in order to find P_0. Instead, we have to calculate the first 4 dividends paid, which must then be discounted to the present at the required yield of $k_e = 13\%$. Given that we have calculated D_4 and knowing that from year 4 onwards dividends will grow indefinitely at a rate of 1%, we can then apply the Gordon Growth formula. This will provide the expected price of the stock four years from now. Since we are looking for the current price of the stock, we have to discount again into the present.

The first four dividends are calculated as following:

$$D_1 = D_0 * (1+g) = \$0.32 * (2) = \$0.64$$
$$D_2 = D_1 * (1+g) = \$0.64 * (2) = \$1.28$$
$$D_3 = D_2 * (1+g) = \$1.28 * (2) = \$2.56$$
$$D_4 = D_3 * (1+g) = \$2.56 * (2) = \$5.12$$

Then we can find the current price of the stock as follows:

$$P_0 = \frac{\$0.64}{(1+0.13)} + \frac{\$1.28}{(1+0.13)^2} + \frac{\$2.56}{(1+0.13)^3} + \frac{\$5.12}{(1+0.13)^4} + \frac{D_4 * (1+g)}{(k_e - g)} * \frac{1}{(1+0.13)^4} \quad (4)$$

Question 4 has to do with the price valuation method. The *price earnings ratio (PE)* is a widely watched measure of how much the market is willing to pay for $1.00 of earnings from the firms. This ratio can be used to estimate the value of the firm's stock. The formula used is given by:

$$\frac{P}{E} * E = P \tag{5}$$

Where $\frac{P}{E}$ the average industry PE and E the expected earnings per share. The price earnings valuation method is discussed on page 351 in the textbook.

SOLUTIONS

Question 1

Huskie Motor's just paid an annual dividend of $1.00 per share. Management has promised shareholders to increase dividends at a constant rate of 5%. If the required return is 12%, what is the current price per share?

Applying directly the Gordon Growth formula (equation 2 above) we get:

$$P_0 = \frac{D_0 * (1+g)}{(k_e - g)} = \frac{D_1}{(k_e - g)} = \frac{\$1.00 * (1+0.05)}{0.12 - 0.05} = \frac{\$1.05}{0.07} = \$15.00$$

Question 2

Gordon & Co.'s stock has just paid its annual dividend $1.10 per share. Analysts believe that Gordon will maintain its historic dividend growth rate of 3%. If the required return is 8%, what is the expected price of the stock next year?

Applying the Gordon Growth formula updated by one period (equation 3 above) we get:

$$P_1 = \frac{D_1 * (1+g)}{(k_e - g)} = \frac{D_2}{(k_e - g)} = \frac{\$1.133 * (1+0.03)}{0.08 - 0.03} = \frac{\$1.16699}{0.05} = \$23.34$$

Where: $D_1 = D_0 * (1+g) = \$1.10 * (1+0.03) = \$1.133$

Question 3

Macro Systems just paid an annual dividend of $0.32 per share. Its dividend is expected to double for the next four years (D_1 through D_4), after which it will grow at a more modest pace of 1% per year. If the required return is 13%, what is the current price?

Applying equation (4) above, we get:

$$P_0 = \frac{\$0.64}{(1+0.13)} + \frac{\$1.28}{(1+0.13)^2} + \frac{\$2.56}{(1+0.13)^3} + \frac{\$5.12}{(1+0.13)^4} + \frac{D_4 * (1+g)}{(k_e - g)} * \frac{1}{(1+0.13)^4}$$

$$P_0 = \frac{\$0.64}{(1+0.13)} + \frac{\$1.28}{(1+0.13)^2} + \frac{\$2.56}{(1+0.13)^3} + \frac{\$5.12}{(1+0.13)^4} + \frac{\$5.12 * (1+0.01)}{(0.13-0.01)} * \frac{1}{(1+0.13)^4} = \$32.91$$

Question 4

Analysts are projecting that CB Railways will have earnings per share of $3.90. If the average industry PE ratio is about 25, what is the current price of CB Railways?

Applying equation (5) above, we get:

$$\frac{P}{E} * E = 25 * \$3.90 = \$97.50$$

Question 5

Distinguish between conventional mortgage loans and insured mortgage loans.

Insured or government loans are explicitly guaranteed by the full faith and credit of the government. Insured mortgages are originated by banks or other mortgage lenders and are guaranteed either by the Federal Housing Administration (FHA) or by the Veterans Administration (VA). FHA insured loans are designated for borrowers who can afford low down payments and have low levels of income. VA guaranteed loans are made to veterans in order for them to receive favorable loan terms. The FHA and VA guarantee the bank making the loans against any losses.

In contrast, conventional mortgages have no explicit guarantee by the Federal government. They are obtained from conventional financing. Such loans, mat not be insured when originated, but may qualify to be insured when they are part of a pool of mortgages that backs a mortgage-backed security.

Question 6
Describe how the mortgage pass-through works.

The payments on a pool of mortgages are sent by the borrowers to a trustee, who then passes the payments through to holders of securities that are backed by the pass-through.

- **A good source of information related to conventional vs. insured loans and to mortgage pass through can be found in chapter 14 in the textbook and in chapters 22 and 23 in**:

Fabozzi F. Modigliani F. Jones F, *Foundations of Financial Markets and Institutions*, 4th Edition, Pearson Prentice Hall, 2010.

- **A good source of reading related to the secondary market for mortgages and the recent financial crisis is:**

Acharya V. Richardson M, *Restoring Financial Stability: How to Repair a Failed System*, John Wiley & Sons, 2009 (pages 57-82).

Students are only responsible for the material covered in the lecture and in the main textbook of the module.

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