

Corporate Finance, Module 3, “Value of Common Stocks” (Chapter 4)

Overview and Concepts; Problem Formats

(The attached PDF file has better formatting.)

Module 3 values common stock by a discounted cash flow procedure, showing the methods that are used throughout the rest of the course.

Investments courses cover practical and theoretical aspects of stock trading. Brealey and Myers emphasize the concepts, not the details. The final exam covers the major concepts; see the *formulas* posting for the items to focus on. Know the basic facts, such as the difference between the *primary market* and the *secondary market*. The final exam does not test details of the New York stock exchange.

Stocks can be valued in three ways:

- *The present value of future dividends*: given next year’s dividend and the dividend growth rate, we can calculate the stock price.
- *The present value of free cash flow*: given the return on equity and the payout ratio, we can calculate the stock price.
- *The present value of current earnings plus the present value of growth opportunities*.

The methods are equivalent; the method to use depends on the inputs. In practice, none of these methods is used. The value of common stocks is the market value, not a theoretical value determined by an analyst. Instead, we use these methods to derive the capitalization rate, the dividend growth rate, or the present value of growth opportunities from the stock price.

On the final exam, you may be asked to derive the stock price, the capitalization rate, the dividend growth rate, the present value of growth opportunities, or some other variable. The problems are straight-forward; review the practice problems for this module.

Some final exam questions test relations. For example, if the capitalization rate increases but nothing else changes, does the stock price increase or decrease? If the payout ratio increases but the stock price does not change, has the capitalization rate increased or decreased?

Method 1: Present Value of Future Dividends

If we know the stream of future dividends $\{D_1, D_2, \dots\}$ and the discount rate r (called the capitalization rate when applied to stocks), the stock price is

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t}$$

Many subscripts in this text refer to time (or years). D_0 means this year’s dividend; D_1 means next year’s dividend.

Question: Is this a theorem, an assumption, an axiom, or a definition?

Answer: It is a combination. The capitalization rate is not observed; it is the internal rate of return that satisfies this equation. Given a stream of dividends and a stock price, we solve for the capitalization rate. If the dividend stream does not change and the stock price increases, we assume the capitalization rate has decreased, perhaps because the stock has become less risky or the risk-free interest rate has decreased.

But the expected dividend stream, the stock's systematic risk, and the market risk premium are not observable either. This formula is the assumed relation of the elements. Empirical evidence may support the formula, but it is not provable.

Exercise 3.1: Present Value

A firm will pay dividends of \$7.50 a share in one year and \$7.80 a share in 2 years, after which its stock will sell for \$120. If the market capitalization rate is 10%, what is the current stock price?

(To simplify the problems, we say "a firm will pay ..." or "a firm's stock will trade at ..." We mean that "analysts expect a firm to pay ..." or "expect a firm's stock to trade at ...")

Solution 3.1: The stock price is $\$7.50 / 1.10 + (\$7.80 + \$120.00) / 1.10^2 = \112.44 .

We rarely know the stream of dividends from now to eternity, and we surely don't know the stock price two years from now. But if we know the *expected growth rate of dividends* (g), we can show that $P_0 = D_1 / (r - g)$.

Exercise 3.2: Dividend Growth

A firm will pay a dividend of \$5.40 next year after which dividends will grow at 7% a year. What stock price is implied by a market capitalization rate of 12%?

Solution 3.2: Current price = $P_0 = \$5.40 / (12\% - 7\%) = \108.00

Method 2: Present Value of Free Cash Flow

If we know the earnings per share (the return on equity) and the payout ratio, we can derive the dividend yield and the dividend growth rate.

The payout ratio is the part of earnings that is paid out in dividends; the plow-back ratio is the part of earnings that is reinvested in the firm. If the return on equity (ROE) is 15%, and the firm pays out 60% of earnings as dividends, the dividend yield is $15\% \times 60\% = 9\%$. The rest of the earnings, or $15\% \times (1 - 60\%) = 6\%$, are plowed back into the firm, so the equity, earnings, and dividends all grow by 6%.

The final exam may give the book equity, the return on book equity, the payout ratio, and the market capitalization rate, and ask you to find the market value of the stock.

Exercise 3.3: Book Equity and Market Value

A stock has book equity of \$80 per share, a return on book equity of 20%, a payout ratio of 60%, and a market capitalization rate of 15%. What is the market value of the shares?

Solution 3.3:

- The earnings next year are $\$80 \times 20\% = \16 .
- The dividend is $\$16 \times 60\% = \9.60 .
- The plow-back ratio is $1 - 60\% = 40\%$.
- The dividend growth rate is $20\% \times 40\% = 8\%$.
- The stock price is $\$9.60 / (15\% - 8\%) = \137.14 .

Some exam questions ask you to derive the stock price from the capitalization rate; other problems ask you to derive the market capitalization rate from the stock price.

Exercise 3.4: Market Capitalization Rate

A firm will pay a dividend of \$5.40 next year after which dividends will grow at 7% a year. What market capitalization rate is implied by a stock price of \$80?

Solution 3.4: $r = D_1 / P_0 + g = \$5.40 / \$80 + 7\% = 13.75\%$.

Method 3: Present value of growth opportunities

We examine three cases: (i) all earnings paid as dividends; (ii) some earnings retained but the return on equity equals the opportunity cost of capital; (iii) some earnings retained and invested in positive net present value projects.

Case (i): If all earnings are paid as dividends, the firm does not grow. The dividends are a perpetuity with a constant payment. The stock price $P_0 = D_1 / r = E_1 / r$. (D_1 is next year's dividend; E_1 is next year's earnings; r is the market capitalization rate.)

Case (ii) If some earnings are retained but the ROE is the same as the capitalization rate, the stock price remains E_1 / r . If p is the payout ratio, the dividend is $E_1 \times p$, and the dividend growth rate is $r \times (1 - p)$, since the ROE = r . The stock price is

$$P_0 = D_1 / (r - g) = (E_1 \times p) / [r - r \times (1 - p)] = E_1 / r.$$

Case (iii) If some earnings are retained and the return on equity is *not* the same as the market capitalization rate, the stock price is $(E_1 / r) + \text{present value of growth opportunities}$.

Question: Let me make sure I understand: if the return on equity exceeds the opportunity cost of capital, then if the firm retains more earnings, its stock price rises.

Answer: This is true if the capitalization rate does not depend on the payout ratio. But a firm that retains more earnings may be riskier, so its capitalization rate may rise. In addition, different marginal tax rates apply to stockholder dividends and capital gains, and changes in dividends may have information content that changes the market stock price. The modules on capital structure explain the empirical relation of dividends and stock price.

Exercise 3.5: Present value of growth opportunities

A firm's share price is \$30, and next year's earnings will be \$3 per share. What is the present value of growth opportunities if investors require a return of (a) 12% or (b) 15%?

Solution 3.5: The stock price *with* growth opportunities is \$30. The stock price *without* growth opportunities is $\$3.00 / 12\% = \25.00 at a 12% capitalization rate and $\$3.00 / 15\% = \20.00 at a 15% rate. The present value of growth opportunities is $\$30 - \$25 = \$5$ at a 12% rate and $\$30 - \$20 = \$10$ at a 15% rate.

As you review these problems, make sure you know the formulas. Focus on the intuition. In this exercise, why is the present value of growth opportunities positive? *Answer:* the value of a perpetual (non-growing) dividend stream is less than the stock price. Similarly, why does an increase in the capitalization rate raise the present value of growth opportunities? *Answer:* a higher capitalization rate means a lower value of the perpetual (non-growing) dividend stream.

Exercise 3.6: Price-Earnings Ratios

- Firm Y pays out 20% of its earnings and has a 15% return on equity.
- Firm Z pays out 80% of its earnings and has a 25% return on equity.

Each firm's earnings next year are \$10.

- A. What is next year's dividend for each firm?
- B. What is the dividend growth rate for each firm?
- C. At an 15% capitalization rate, what is the stock price for each firm?
- D. At a 20% capitalization rate, what is the stock price for each firm?

Solution 3.6:

<i>Firm</i>	E_1	<i>Payout</i>	D_1	<i>Plowback</i>	<i>ROE</i>	<i>Growth Rate</i>
Y	\$10	20%	\$2	80%	15%	12%
Z	\$10	80%	\$8	20%	25%	5%

- *Firm Y*: The earnings next year are \$10 and the payout ratio is 20%, so the dividend next year is $\$10 \times 20\% = \2 . The plowback ratio is $1 - 20\% = 80\%$ and the ROE is 15%, so the dividend growth rate is $80\% \times 15\% = 12\%$.
- *Firm Z*: The earnings next year are \$10 and the payout ratio is 80%, so the dividend next year is $\$10 \times 20\% = \8 . The plowback ratio is $1 - 80\% = 20\%$ and the ROE is 25%, so the dividend growth rate is $20\% \times 25\% = 5\%$.

At a 15% market capitalization rate, the stock prices are

- *Firm Y*: $\$2 / (15\% - 12\%) = \66.67
- *Firm Z*: $\$8 / (15\% - 5\%) = \80.00

At a 20% market capitalization rate, the stock prices are

- *Firm Y*: $\$2 / (20\% - 12\%) = \25.00
- *Firm Z*: $\$8 / (20\% - 5\%) = \53.33