THE COST OF CAPITAL –

A PRACTITIONER'S GUIDE

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Author's Note: This manual has been prepared as an educational reference on cost of capital concepts. Its purpose is to describe a broad array of cost of capital models and techniques. No cost of equity model or other concept is recommended or emphasized, nor is any procedure for employing any model recommended. Furthermore, no opinions or preferences are expressed by either the author or the Society of Utility And Regulatory Financial Analysts.

Dividend Yield

Several functional forms of the DCF method have been developed. They differ mainly in the way the dividend yield is calculated.

Continuous Model

This method assumes dividends are paid continuously at the current dividend rate. Its form is:

$$(8.7)\ K = \frac{D_o}{P_o} + g$$

where: K = cost of equity

D_o = annual dividends per share in period o (i.e., current DPS)

P_o = current stock price

g = constant growth rate in DPS in future

Annual Compounding Model

This method differs from the continuous model since it recognizes that dividends are paid in a discrete manner rather than in a continuous manner and the expected dividend rate is utilized. This form is:

$$(8.8)\ K = \frac{D_1}{P_o} + g$$

where: K = cost of equity

D_1 = annual dividends per share in period 1

P_o = current stock price

g = constant growth rate in DPS in future

This is sometimes alternately be stated as:

$$(8.9)\ K = \frac{D_o(1+g)}{P_o} + g$$

or

$$(8.10)\ K = \frac{d_1+d_2+d_3(1+g)+d_4(1+g)}{P_o} + g$$

where: d_i = quarterly dividends (and the quarterly dividend is projected to increase by the value of g in the quarter when the utility normally increases the dividend rate - the third quarter in the example here).

It should also be noted that the interpretation of the D_1 term is not universally accepted as a full year. Gordon, for example, has maintained that D_1 is the next quarterly dividend on an annualized basis (Gordon, 1974, 81).

The interpretation of D_1, or $D_o(1+g)$, can take two alternative forms. First, D_1 can be viewed as the dividends paid <u>during</u> the next period (Morin, 1984; Brealey and Myers, 1984; Reilly, 1985).

Second, D_1 can be viewed as the dividend rate at the <u>end</u> of the next period (Linke and Zumwalt, 1984; Brigham, 1989; Bonbright, Danielsen and Kammerschen, 1988). Gordon summarized this issue by concluding "the (end of period D_1) poses problems of implementation that are not worth the effort in view of the fact that (during period D_1) and (end of period D_1) typically differ by a very small amount" (Gordon, 1974, 81).

<u>Quarterly Compounding Model</u>

The annual compounding model can be further modified to recognize quarterly dividend payments. This form is:

$$(8.11)\, K = \frac{d_1(1+K)^{.75}+d_2(1+K)^{.50}+d_3(1+K)^{.25}+d_4}{P_o}+g$$

where:
- d_1 = dividends per share paid in first quarter
- d_2 = dividends per share paid in second quarter
- d_3 = dividends per share paid in third quarter
- d_4 = dividends per share paid in fourth quarter
- P_o = current stock price
- g = constant growth in DPS in future

Since "K" is in both sides of equation (8.11), it must be solved interactively.

Two alternative quarterly DCF models can be expressed as follows:

$$(8.12) \quad K = \frac{\sum_{q=1}^{4} D_{oq} (1+g) (1+K)^{1-[x+0.25(q-1)]}}{P_o} + g$$

and

$$(8.13) \quad K = \left[\frac{D_o (1+g)^{.25}}{P_o} + (1+g)^{.25}\right]^4 - 1 = \left[1 + \frac{D_o}{P_o}\right]^4 (1+g) - 1$$

Appendix 8.2 shows the derivation of these quarterly DCF formulas.

The quarterly DCF model can also be implemented by "compounding" the "g" factor, rather than the yield component. This will be described in the "Growth Rate" section of this chapter.

Semi-Annual Compounding Model

Another version of the DCF model represents a compromise between the annual compounding model and the continuous compounding model. This model is the semi-annual model and has also been referred to as the FERC model, since the Federal Energy Regulatory Commission utilized this version in its generic rate of return measure for electric utilities. This form is:

$$(8.14)\ K = \frac{D_o(1+0.5g)}{P_o} + g$$

where: D_o = dividends per share in period o (i.e., current DPS)

P_o = current stock price

g = constant growth rate in DPS in future

This DCF model recognizes the timing of dividend payments and dividend increases. If the investment is made between the time that a new dividend per share has been announced and the ex-dividend date, the expected yield will equal D_1/P_0 (i.e., continuous compounding model). If the investment is made after four quarterly dividends have been paid at the current rate and before a dividend increase is announced, the expected yield will equal D_1/P_0 or $D_0(1+G)/P_0$ (i.e., annual compounding model). There are actually five possible expected annual dividends to be received within one year depending on the timing of the investment. They are expressed in terms of D_0 as follows:

Number	Expected Annual Dividend
1	$4\ (D_0/4)$
2	$3\ (D_0/4) + [D_0(1-G)/4]$
3	$2\ (D_0/4) + 2\ [D_0(1+G)/4]$
4	$(D_0/4) + 3\ [D_0(1+G)/4]$
5	$4\ [D_0(1+G)/4]$

The sum of the five possible expected dividends is 10 $(D_0/4)$ + 10 $[D_0(1+G)/4]$ or 2.5 $[D_0(2+G)]$. The average expected annual dividend is equal to the sum of all possible annual dividends divided by five. The average expected annual dividend is .5 $[D_0(2+G)]$ or $D_0(1+.5G)$.

This formula can also be justified when a DCF is performed on a group of comparison companies. At any point during a twelve-month period, some companies will increase dividends during the next few weeks, others at some time much later during the next year, and the remainder spread rather uniformly over the year. Therefore, for any one-year period, the investor can expect, on average, dividends to increase at the midpoint of the year. The implication is that the current dividend must be adjusted by one-half the annual growth rate to arrive at the expected dividend payment during the first year.

An alternative formulation of the semi-annual compounding model is:

$$(8.15)\ K = \frac{D_0(1+n/4\ g)}{P_0} + g$$

where: D_0 = dividends per share in period 0

P_0 = current stock price

g = constant growth rate in DPS in future

n = number of quarters since last dividend increase (assuming annual increases in DPS take place during same quarter).

This model specifically recognizes the timing of dividends, as well as the timing of dividend increases.

Comparison of Yields in Various Models

Each of these four models produce somewhat different yield estimates. Table 8.1 shows a set of hypothetical input values which can be used to show the yields from each model.

Table 8.1
Input Values

Variable	Value
D_o	\$0.80
$d_1 = d_2 = d_3 = d_4$	\$0.20
P_o	\$10.00
g	5.00%

Use of these values results in the following yields:

Continuous Compounding Model

$$(8.7)\ Yield = \frac{D_o}{P_o} = \frac{\$.80}{\$10.00} = 8.00\%$$

Annual Compounding Model

$$(8.9)\quad Yield = \frac{D_o(1+g)}{P_o} = \frac{\$0.80(1.05)}{\$10.00} = 8.40\%$$

Quarterly Compounding Model

$$(8.11)\ Yield = \frac{d_1(1+K)^{.75}+d_2(1+K)^{.50}+d_3(1+K)^{.25}+d_4}{P_o} =$$

$$\frac{.20(1+K)^{75}+.20(1+K)^{50}+.20(1+K)^{25}+.20}{10} = 8.67\%$$

Semi-Annual Compounding Model

$$(8.14)\ Yield = \frac{D_o(1+0.5g)}{P_o} = \frac{\$.80(1.025)}{\$10.00} = 8.20\%$$

Annual Versus Quarterly Models

A frequent DCF issue in rate proceedings concerns whether it is appropriate to utilize the annual or quarterly versions of the DCF model. Advocates of the quarterly model maintain that the existence of quarterly payments of dividends (and investor recognition of these payments) requires that the quarterly model be employed in order to properly match the "D" and "P" components of dividend yield (Cicchetti and Makholm, 1987; Linke and Zumwalt, 1984; 1987; Cargill and Wendel, 1994). Advocates of the annual model maintain, on the other hand, that use of a quarterly model over-compensates investors because the ratemaking process (through the practice of monthly customer payments and use of average or year-end rate base) already recognizes this factor (Nyegaard, 1987; Rosenberg and Lafferty, 1988).

A third viewpoint is offered by Cicchetti, who maintains that the required return should be determined using a quarterly DCF model, but the effective rate of return should be adjusted to a nominal rate of return for use in determining revenue requirements (Cicchetti, 1989). This method is designed to recognize and balance the respective time value of money to investors (i.e., the quarterly receipt of dividends) and ratepayers (i.e., through the company's monthly accrual of earnings). A similar proposal is advocated by Siegel (1985) who maintains that quarterly DCF rates be determined and then discounted at the continuously compounded rate of return rather than the discrete, per period return.

Estimation of Yield Components

The previous analysis has identified three components which require input values. These are

D_o - current annual dividends per share

D_1 - dividends per share in period 1

P_o - current stock price.

The first term - D_o - is straightforward and represents the current annualized level of dividends per share. For example, if the current dividend per share rate is \$0.20, D_o is \$0.80 (\$0.20 X 4, reflecting four quarterly payments).

The second term - D_1 - can be determined in two alternative ways. First, as shown in equation (8.9), D_1 can be estimated by increasing D_o by the growth rate, or $D_1 = D_o(1+g)$. Second, analysts' forecasts of dividends per share for the next period can be utilized for D_1. Sources such as Value Line and Salomon Brothers provide annual dividends per share estimates for most public utilities.

The third term - P_o - is technically the current (spot) price of a utility's stock. Two basic approaches are normally used to estimate P_o: use of the latest closing price, or (2) use of an average of recent prices. Advocates of the use of the latest spot price note that the spot price reflects all known information about the company and its stock, and thus that the spot price is most consistent with the efficient market hypothesis, which is a basic assumption of the DCF approach. Therefore, the latest closing price is theoretically the best one to use.

On the other hand, advocates of average prices note that stocks are subject to random fluctuations as buy or sell orders flow in, so the price at any moment can represent a temporary disequilibrium. For this reason, they recommend the use of an average of recent prices.

Growth Rate

The growth rate component of the DCF equation - g - is usually the most crucial, and controversial, element in the use of this methodology. In estimating the appropriate growth rate, it is important to recognize two factors. First, the proper growth rate reflects the growth expectations of investors embodied in the price (i.e., yield component) of the company's stock. Analysts should recognize that individual investors have different expectations regarding growth and therefore no single indicator captures the growth expectations of all investors. Second, since the DCF model combines price (i.e., yield) and growth, the focus on growth expectations should target estimates of growth within a consistent time frame of the stock price contained in the yield component. Each of these factors relate to a "matching" of the yield and growth components of the DCF model.

An almost limitless array of techniques have been used in rate proceedings to estimate the constant growth rate component. Since the dividend discount model is technically concerned with growth in dividends, many methods are concerned directly with dividend growth. On the other hand, other methods examine factors other than dividend growth to estimate g. The objective of each of these