Ross, et al Corp Fin

TABLE 16.6
Modigliani and Miller Summary

I. The No-Tax Case

A. Proposition I: The value of the firm levered (V_L) is equal to the value of the firm unlevered (V_U):

$$V_L = V_U$$

Implications of Proposition I:

1. A firm's capital structure is irrelevant.
2. A firm's weighted average cost of capital (WACC) is the same no matter what mixture of debt and equity is used to finance the firm.

B. Proposition II: The cost of equity, R_E, is:

$$R_E = R_A + (R_A - R_D) \times (D/E)$$

where R_A is the WACC, R_D is the cost of debt, and D/E is the debt–equity ratio.

Implications of Proposition II:

1. The cost of equity rises as the firm increases its use of debt financing.
2. The risk of the equity depends on two things: the riskiness of the firm's operations *(business risk)* and the degree of financial leverage *(financial risk)*. Business risk determines R_A; financial risk is determined by D/E.

II. The Tax Case

A. Proposition I with taxes: The value of the firm levered (V_L) is equal to the value of the firm unlevered (V_U) plus the present value of the interest tax shield:

$$V_L = V_U + T_C \times D$$

where T_C is the corporate tax rate and D is the amount of debt.

Implications of Proposition I:

1. Debt financing is highly advantageous, and, in the extreme, a firm's optimal capital structure is 100 percent debt.
2. A firm's weighted average cost of capital (WACC) decreases as the firm relies more heavily on debt financing.

B. Proposition II with taxes: The cost of equity, R_E, is:

$$R_E = R_U + (R_U - R_D) \times (D/E) \times (1 - T_C)$$

where R_U is the *unlevered cost of capital*—that is, the cost of capital for the firm if it has no debt. Unlike the case with Proposition I, the general implications of Proposition II are the same whether there are taxes or not.

we have included R_U, the unlevered cost of capital. In Figure 16.5, we have the debt–equity ratio on the horizontal axis. Notice how the WACC declines as the debt–equity ratio grows. This illustrates again that the more debt the firm uses, the lower is its WACC. Table 16.6 summarizes the key results of our analysis of the M&M propositions for future reference.

The Cost of Equity and the Value of the Firm — EXAMPLE 16.4

This is a comprehensive example that illustrates most of the points we have discussed thus far. You are given the following information for the Format Co.:

EBIT = $151.52
T_C = .34
D = $500
R_U = .20

The cost of debt capital is 10 percent. What is the value of Format's equity? What is the cost of equity capital for Format? What is the WACC?

This one's easier than it looks. Remember that all the cash flows are perpetuities. The value of the firm if it has no debt, V_U, is:

$$V_U = \frac{\text{EBIT} - \text{Taxes}}{R_U} = \frac{\text{EBIT} \times (1 - T_C)}{R_U}$$
$$= \frac{\$100}{.20}$$
$$= \$500$$

From M&M Proposition I with taxes, we know that the value of the firm with debt is:

$$V_L = V_U + T_C \times D$$
$$= \$500 + .34 \times 500$$
$$= \$670$$

Because the firm is worth \$670 total and the debt is worth \$500, the equity is worth \$170:

$$E = V_L - D$$
$$= \$670 - 500$$
$$= \$170$$

Based on M&M Proposition II with taxes, the cost of equity is:

$$R_E = R_U + (R_U - R_D) \times (D/E) \times (1 - T_C)$$
$$= .20 + (.20 - .10) \times (\$500/170) \times (1 - .34)$$
$$= 39.4\%$$

Finally, the WACC is:

$$\text{WACC} = (\$170/670) \times 39.4\% + (500/670) \times 10\% \times (1 - .34)$$
$$= 14.92\%$$

Notice that this is substantially lower than the cost of capital for the firm with no debt ($R_U = 20\%$), so debt financing is highly advantageous.

Concept Questions

16.4a What is the relationship between the value of an unlevered firm and the value of a levered firm once we consider the effect of corporate taxes?

16.4b If we consider only the effect of taxes, what is the optimal capital structure?

16.5 Bankruptcy Costs

One limiting factor affecting the amount of debt a firm might use comes in the form of *bankruptcy costs*. As the debt–equity ratio rises, so too does the probability that the firm will be unable to pay its bondholders what was promised to them. When this happens, ownership of the firm's assets is ultimately transferred from the stockholders to the bondholders.

In principle, a firm becomes bankrupt when the value of its assets equals the value of its debt. When this occurs, the value of equity is zero, and the stockholders turn over control of the firm to the bondholders. When this takes place, the bondholders hold assets whose value is exactly equal to what is owed on the debt. In a perfect world, there are no costs associated with this transfer of ownership, and the bondholders don't lose anything.