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Measuring *and* Managing the
Value of Companies

Updated
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Behavior

TIM KOLLER • MARC GOEDHART • DAVID WESSELS

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VALUATION

MEASURING AND MANAGING THE VALUE OF COMPANIES

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Tim Koller

Marc Goedhart

David Wessels



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The authors are all current or former consultants of McKinsey & Company's corporate finance practice. Collectively they have more than 50 years of experience in consulting and financial education.

McKinsey & Company is a management-consulting firm that helps leading corporations and organizations make distinctive, lasting, and substantial improvements in their performance. Over the past seven decades, the firm's primary objective has remained constant: to serve as an organization's most trusted external advisor on critical issues facing senior management. With consultants deployed from over 80 offices in more than 40 countries, McKinsey advises companies on strategic, operational, organizational, financial, and technological issues. The firm has extensive experience in all major industry sectors and primary functional areas, as well as in-depth expertise in high-priority areas for today's business leaders.

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yielded higher returns than other similarly rated securities. In other words, the yield on an AA-rated CDO was higher than an AA-rated corporate bond. But if these CDOs were rated the same as corporate bonds, why did they have higher yields? The answer, which we know from hindsight, is that they were riskier—and the market knew they were riskier, even if the rating agencies didn't. The market saw through the illusion.

RISK AND VALUE CREATION

A company's future cash flows are unknown and therefore risky, so to complete our discussion of value creation, we need to explain how risk affects value. Risk enters into valuation both through the company's cost of capital, which is the price of risk, and in the uncertainty surrounding future cash flows. Managers and investors need to pay particularly close attention to cash flow risks.

Price of Risk

The cost of capital is the price charged by investors for bearing the risk that the company's future cash flows may differ from what they anticipate when they make the investment. The cost of capital to a company equals the minimum return that investors expect to earn from investing in the company. That is why the terms *expected return to investors* and *cost of capital* are essentially the same. The cost of capital is also called the discount rate, because you discount future cash flows at this rate when calculating the present value of an investment, to reflect what you will have to pay investors.

The average cost of equity capital, or the price investors charged for their risk, in late 2009 for a large nonfinancial company was about 9 percent, and most large companies' costs of equity capital fell in the range of 8 to 10 percent. That range can seem narrow, given that it encompasses companies with predictable cash flows like Campbell Soup and highly volatile companies like Google. The range is small because investors purposely avoid putting all their eggs in one basket.

Stock market investors, especially institutional investors, typically have hundreds of different stocks in their portfolios; even the most concentrated investors have at least 50. As a result, their exposure to any single company is limited. Exhibit 2.9 shows what happens to the total risk of a portfolio of stocks as more shares are added to the portfolio. The total risk declines because companies' cash flows are not correlated. Some will increase when others decline.

One of the key insights of academic finance that has stood the test of time concerns the effect of diversification on the cost of capital. If diversification reduces risk to investors and it is not costly to diversify, then investors will not demand a return for any risks they take that they can easily eliminate through diversification. They require compensation only for risks they cannot diversify.

Why EV to EBITA, Not Price to Earnings?

Although widely reported, the price-to-earnings multiple has two major flaws. First, the P/E is affected by a company's capital structure, not just its operating performance. Second, unlike EBITA, net income is calculated after nonoperating items such as amortization of intangible assets and one-time gains and losses. Thus, a nonoperating loss, such as a noncash write-off, can significantly lower earnings, causing the P/E to be artificially high.

Throughout this book, we have focused on the drivers of operating performance—ROIC, growth, and free cash flow—because the traditional metrics, such as return on assets and return on equity, mix the effects of operations and capital structure. The same logic holds for multiples. Since P/Es mix capital structure and nonoperating items with expectations of operating performance, a comparison of P/Es is a less reliable guide to companies' relative value than a comparison of EV to EBITA.

To show how capital structure distorts the P/E, Exhibit 14.3 presents financial data for four companies, named A through D. Companies A and B trade at 10 times enterprise value to EBITA, and Companies C and D trade at 25 times enterprise value to EBITA. In each pair, the companies have different P/Es. Companies A and B differ only in how their business is financed, not in their operating performance. The same is true for Companies C and D.

Since Companies A and B trade at typical enterprise value multiples, the price-to-earnings ratio drops for the company with higher leverage. This is because the enterprise-value-to-EBITA ratio (\$1,000 million/\$100 million = 10 times) is lower than the ratio of debt value to interest expense (\$400 million/\$20 million = 20 times). Since the blend of debt (at 20 times) and pretax equity

EXHIBIT 14.3 **P/E Multiple Distorted by Capital Structure**

\$ million

	Company A	Company B	Company C	Company D
Income statement				
EBITA	100	100	100	100
Interest expense	—	(20)	—	(25)
Earnings before taxes	100	80	100	75
Taxes	(40)	(32)	(40)	(30)
Net income	60	48	60	45
Market values				
Debt	—	400	—	500
Equity	1,000	600	2,500	2,000
Enterprise value (EV)	1,000	1,000	2,500	2,500
Multiples (times)				
EV to EBITA	10.0	10.0	25.0	25.0
Price to earnings	16.7	12.5	41.7	44.4

Levering and Unlevering the Cost of Equity

In Chapter 6, we value a company using adjusted present value (APV). One key input for APV is the unlevered cost of equity. In this appendix, we derive various formulas that can be used to compute the unlevered cost of equity under different assumptions.

Chapter 10 details a second application for the unlevered cost of equity. To determine the cost of equity for use in a company's cost of capital, we do not use raw regression results (because of estimation error). Instead, we rely on an unlevered *industry* beta that is relevered to the company's target capital structure. To build an unlevered industry beta, we use techniques identical to those used for building the unlevered cost of equity. We discuss both in this appendix.

UNLEVERED COST OF EQUITY

Franco Modigliani and Merton Miller postulated that the market value of a company's economic assets, such as operating assets (V_u) and tax shields (V_{txa}), should equal the market value of its financial claims, such as debt (D) and equity (E):

$$V_u + V_{txa} = \text{Enterprise Value} = D + E \quad (\text{D.1})$$

A second result of Modigliani and Miller's work is that the total risk of the company's economic assets, operating and financial, must equal the total risk of the financial claims against those assets:

$$\frac{V_u}{V_u + V_{txa}}(k_u) + \frac{V_{txa}}{V_u + V_{txa}}(k_{txa}) = \frac{D}{D + E}(k_d) + \frac{E}{D + E}(k_e) \quad (\text{D.2})$$

where k_u = unlevered cost of equity
 k_{txa} = cost of capital for the company's interest tax shields
 k_d = cost of debt
 k_e = cost of equity

The four terms in this equation represent the proportional risk of operating assets, tax assets, debt, and equity, respectively.

Since the cost of operating assets (k_u) is unobservable, we must solve for it, using the equation's other inputs. The required return on tax shields (k_{txa}) also is unobservable. With two unknowns and only one equation, we must therefore impose additional restrictions to solve for k_u . If debt is a constant proportion of enterprise value (i.e., debt grows as the business grows), k_{txa} equals k_u . Imposing this restriction leads to the following equation:

$$\frac{V_u}{V_u + V_{txa}}(k_u) + \frac{V_{txa}}{V_u + V_{txa}}(k_u) = \frac{D}{D + E}(k_d) + \frac{E}{D + E}(k_e)$$

Combining terms on the left side generates an equation for the unlevered cost of equity when debt is a constant proportion of enterprise value:

$$k_u = \frac{D}{D + E}(k_d) + \frac{E}{D + E}(k_e) \quad (\text{D.3})$$

Since most companies manage their debt to value to stay within a particular range, we believe this formula and its resulting derivations are the most appropriate for standard valuation.

Unlevered Cost of Equity When k_{txa} Equals k_d

Some financial analysts set the required return on interest tax shields equal to the cost of debt. In this case, equation D.2 can be expressed as follows:

$$\frac{V_u}{V_u + V_{txa}}(k_u) + \frac{V_{txa}}{V_u + V_{txa}}(k_d) = \frac{D}{D + E}(k_d) + \frac{E}{D + E}(k_e)$$

To solve for k_u , multiply both sides by enterprise value:

$$V_u(k_u) + V_{txa}(k_d) = D(k_d) + E(k_e)$$

and move $V_{txa}(k_d)$ to the right side of the equation:

$$V_u(k_u) = (D - V_{txa})k_d + E(k_e)$$

EXHIBIT D.1 **Unlevered Cost of Equity**

	Dollar level of debt fluctuates	Dollar level of debt is constant
Tax shields have same risk as operating assets $k_{txa} = k_u$	$k_u = \frac{D}{D+E} k_d + \frac{E}{D+E} k_e$	$k_u = \frac{D}{D+E} k_d + \frac{E}{D+E} k_e$
Tax shields have same risk as debt $k_{txa} = k_d$	$k_u = \frac{D - V_{txa}}{D - V_{txa} + E} k_d + \frac{E}{D - V_{txa} + E} k_e$	$k_u = \frac{D(1 - T_m)}{D(1 - T_m) + E} k_d + \frac{E}{D(1 - T_m) + E} k_e$

Note: k_e = cost of equity
 k_d = cost of debt
 k_u = unlevered cost of equity
 k_{txa} = cost of capital for tax shields
 T_m = marginal tax rate
 D = debt
 E = equity
 V_{txa} = present value of tax shields

To eliminate V_u from the left side of the equation, rearrange equation D.1 to $V_u = D - V_{txa} + E$, and divide both sides by this value:

$$k_u = \frac{D - V_{txa}}{D - V_{txa} + E} (k_d) + \frac{E}{D - V_{txa} + E} (k_e) \quad (\text{D.4})$$

Equation D.4 mirrors equation D.2 closely. It differs from equation D.2 only in that the market value of debt is reduced by the present value of expected tax shields.

Exhibit D.1 summarizes four methods to estimate the unlevered cost of equity. The two formulas in the top row assume that the risk associated with interest tax shields (k_{txa}) equals the risk of operations (k_u). When this is true, whether debt is constant or expected to change, the formula remains the same.

The bottom-row formulas assume that the risk of interest tax shields equals the risk of debt. On the left, future debt can take on any value. On the right, an additional restriction is imposed that debt remains constant (in absolute terms, not as a percentage of enterprise value). In this case, the annual interest payment equals $D(k_d)$ and the annual tax shield equals $D(k_d)(T_m)$. Since tax shields are constant, they can be valued using a constant perpetuity:

$$\text{PV (Tax Shields)} = \frac{D(k_d)(T_m)}{k_d} = D(T_m)$$

Consequently, V_{txa} in the general formula (in the bottom left corner) is replaced with $D(T_m)$. The equation is simplified by combining D within the parentheses.

LEVERED COST OF EQUITY

In certain situations, you will have already estimated the unlevered cost of equity and need to relever the cost of equity to a new target structure. In this case, use equation D.2 to solve for the levered cost of equity, k_e :

$$\frac{V_u}{V_u + V_{txa}}(k_u) + \frac{V_{txa}}{V_u + V_{txa}}(k_{txa}) = \frac{D}{D + E}(k_d) + \frac{E}{D + E}(k_e)$$

Multiply both sides by enterprise value:

$$V_u(k_u) + V_{txa}(k_{txa}) = D(k_d) + E(k_e)$$

Next, subtract $D(k_d)$ from both sides of the equation:

$$V_u(k_u) - D(k_d) + V_{txa}(k_{txa}) = E(k_e)$$

and divide the entire equation by the market value of equity, E :

$$k_e = \frac{V_u}{E}(k_u) - \frac{D}{E}(k_d) + \frac{V_{txa}}{E}(k_{txa})$$

To eliminate V_u from the right side of the equation, rearrange equation D.1 to $V_u = D - V_{txa} + E$, and use this identity to replace V_u :

$$k_e = \frac{D - V_{txa} + E}{E}(k_u) - \frac{D}{E}(k_d) + \frac{V_{txa}}{E}(k_{txa})$$

Distribute the first fraction into its component parts:

$$k_e = \frac{D}{E}(k_u) - \frac{V_{txa}}{E}(k_u) + k_u - \frac{D}{E}(k_d) + \frac{V_{txa}}{E}(k_{txa}) \quad (\text{D.5})$$

Consolidating terms and rearranging leads to the *general equation* for the cost of equity:

$$k_e = k_u + \frac{D}{E}(k_u - k_d) - \frac{V_{txa}}{E}(k_u - k_{txa}) \quad (\text{D.6})$$

If debt is a constant proportion of enterprise value (i.e., debt grows as the business grows), k_u will equal k_{txa} . Consequently, the final term drops out:

$$k_e = k_u + \frac{D}{E}(k_u - k_d)$$

We believe this equation best represents the relationship between the levered cost of equity and the unlevered cost of equity.

Levered Cost of Equity When k_{txa} Equals k_d

The same analysis can be repeated under the assumption that the risk of interest tax shields equals the risk of debt. Rather than repeat the first few steps, we start with equation D.5:

$$k_e = \frac{D}{E}(k_u) - \frac{V_{txa}}{E}(k_u) + k_u - \frac{D}{E}(k_d) + \frac{V_{txa}}{E}(k_{txa})$$

To solve for k_e , we replace k_{txa} with k_d :

$$k_e = \frac{D}{E}(k_u) - \frac{V_{txa}}{E}(k_u) + k_u - \frac{D}{E}(k_d) + \frac{V_{txa}}{E}(k_d)$$

Consolidate like terms and reorder:

$$k_e = k_u + \frac{D - V_{txa}}{E}(k_u) - \frac{D - V_{txa}}{E}(k_d)$$

Finally, further simplify the equation by once again, combining like terms:

$$k_e = k_u + \frac{D - V_{txa}}{E}(k_u - k_d)$$

The resulting equation is the levered cost of equity for a company whose debt can take any value but whose interest tax shields have the same risk as the company's debt.

Exhibit D.2 summarizes the formulas that can be used to estimate the levered cost of equity. The top row in the exhibit contains formulas that assume k_{txa} equals k_u . The bottom row contains formulas that assume k_{txa} equals k_d . The formulas on the left side are flexible enough to handle any future capital structure but require valuing the tax shields separately. The formulas on the right side assume the dollar level of debt is fixed over time.

EXHIBIT D.2 Levered Cost of Equity

	Dollar level of debt fluctuates	Dollar level of debt is constant
Tax shields have same risk as operating assets $k_{txa} = k_u$	$k_e = k_u + \frac{D}{E}(k_u - k_d)$	$k_e = k_u + \frac{D}{E}(k_u - k_d)$
Tax shields have same risk as debt $k_{txa} = k_d$	$k_e = k_u + \frac{D - V_{txa}}{E}(k_u - k_d)$	$k_e = k_u + (1 - T_m)\frac{D}{E}(k_u - k_d)$

Note: k_e = cost of equity
 k_d = cost of debt
 k_u = unlevered cost of equity
 k_{txa} = cost of capital for tax shields
 T_m = marginal tax rate
 D = debt
 E = equity
 V_{txa} = present value of tax shields

LEVERED BETA

Similar to the cost of capital, the weighted average beta of a company's assets, both operating and financial, must equal the weighted average beta of its financial claims:

$$\frac{V_u}{V_u + V_{txa}}(\beta_u) + \frac{V_{txa}}{V_u + V_{txa}}(\beta_{txa}) = \frac{D}{D + E}(\beta_d) + \frac{E}{D + E}(\beta_e)$$

Since the form of this equation is identical to the cost of capital, we can rearrange the formula using the same process as previously described. Rather than repeat the analysis, we provide a summary of levered beta in Exhibit D.3. As expected, the first two columns are identical in form to Exhibit D.2, except that the beta (β) replaces the cost of capital (k).

By using beta, we can make one additional simplification. If debt is risk free, the beta of debt is 0, and β_d drops out. This allows us to convert the following general equation (when β_{txa} equals β_u):

$$\beta_e = \beta_u + \frac{D}{E}(\beta_u - \beta_d)$$

into the following:

$$\beta_e = \left(1 + \frac{D}{E}\right)\beta_u$$

EXHIBIT D.3 Levered Beta

	Dollar level of debt fluctuates	Dollar level of debt is constant and debt is risky	Debt is risk free ¹
Tax shields have same risk as operating assets $\beta_{txa} = \beta_u$	$\beta_e = \beta_u + \frac{D}{E} (\beta_u - \beta_d)$	$\beta_e = \beta_u + \frac{D}{E} (\beta_u - \beta_d)$	$\beta_e = \left(1 + \frac{D}{E}\right) \beta_u$
Tax shields have same risk as debt $\beta_{txa} = \beta_d$	$\beta_e = \beta_u + \frac{D - V_{txa}}{E} (\beta_u - \beta_d)$	$\beta_e = \beta_u + (1 - T_m) \frac{D}{E} (\beta_u - \beta_d)$	$\beta_e = \left[1 + (1 - T_m) \frac{D}{E}\right] \beta_u$

Note: β_e = beta of equity
 β_d = beta of debt
 β_u = unlevered beta of equity
 β_{txa} = beta of capital for tax shields
 T_m = marginal tax rate
 D = debt
 E = equity
 V_{txa} = present value of tax shields

¹ When $\beta_{txa} = \beta_u$, the resulting formula holds for all debt patterns, not just constant debt.

This last equation is an often-applied formula for levering (and unlevering) beta when the risk of interest tax shields (β_{txa}) equals the risk of operating assets (β_u) and the company's debt is risk free. For investment-grade companies, debt is near risk free, so any errors using this formula will be small. If the company is highly leveraged, however, errors can be large. In this situation, estimate the beta of debt, and use the more general version of the formula.