

The Weighted Average Cost of Capital

What Does "Cost of Capital" Mean?

"Cost of capital" is defined as "the opportunity cost of all capital invested in an enterprise."

Let's dissect this definition:

Opportunity cost is what you give up as a consequence of your decision to use a scarce resource in a particular way.

All capital invested is the total amount of cash invested into a business.

In an enterprise this refers to the fact that we are measuring the opportunity cost of all sources of capital which include debt and equity.

How Do We Calculate a Company's Weighted Average Cost of Capital?

We calculate a company's weighted average cost of capital using a 3 step process:

1. Cost of capital components. First, we calculate or infer the cost of each kind of capital that the enterprise uses, namely debt and equity.

A. Debt capital. The cost of debt capital is equivalent to actual or imputed interest rate on the company's debt, adjusted for the tax-deductibility of interest expenses. Specifically:

The after-tax cost of debt-capital = The Yield-to-Maturity on long-term debt x (1 minus the marginal tax rate in %)

We enter the marginal corporate tax rate in the worksheet "WACC."

B. Equity capital. Equity shareholders, unlike debt holders, do not demand an explicit return on their capital. However, equity shareholders do face an implicit opportunity cost for investing in a specific company, because they could invest in an alternative company with a similar risk profile. Thus, we infer the opportunity cost of equity capital.

We can do this by using the "Capital Asset Pricing Model" (CAPM). This model says that equity shareholders demand a minimum rate of return equal to the return from a risk-free investment plus a return for bearing extra risk. This extra risk is often called the "equity risk premium", and is equivalent to the risk premium of the market as a whole times a multiplier--called "beta"--that measures how risky a specific security is relative to the total market.

Thus, the cost of equity capital = Risk-Free Rate + (Beta times Market Risk Premium).

2. Capital structure. Next, we calculate the proportion that debt and equity capital contribute to the entire enterprise, using the market values of total debt and equity to reflect the investments on which those investors expect to earn a minimum return.

3. Weighting the components. Finally, we weight the cost of each kind of capital by the proportion that each contributes to the entire capital structure. This gives us the Weighted Average Cost of Capital (WACC), the average cost of each dollar of cash employed in the business.

Case Study: Gateway Construction Pty Ltd. (India)

To demonstrate how to calculate a company's cost of capital, we will use the Gateway case study.

1. Cost of capital components. Gateway draws upon two major sources of capital from the capital markets: debt and equity.

A. Cost of debt capital. Gateway had debt of \$8.5 million. Enter this figure in the appropriate cell of worksheet "WACC."

Our first step in calculating any company's cost of capital is to consult the relevant annual report. This document tells us that Gateway has two components to its total debt of \$8.5 million:

Regular debt.

Capital leases. Gateway also has "capital leases." A capital lease is a debt-like agreement in which a firm agrees to pay fixed amounts to someone who leases them land or equipment. \

Because there are two kinds of debt with different interest rates, we have to weight the different interest rates associated with each kind of debt by the relevant proportion of debt that each comprises. In this case, the weighted pre-tax cost of debt would be equivalent to 11.5%. Enter the pre-tax cost of debt in cell C5 of worksheet "WACC."

However, we are not done yet. We noted above that we have to adjust for the tax-deductibility of interest expenses, which lowers the cost of debt according to the following formula:

After-Tax Cost of Debt Capital = The Yield-to-Maturity on long-term debt x (1 minus the marginal tax rate)

Given Gateway's marginal tax rate of 30%, the company's after-tax cost of debt equates to 11.5% x (100% minus 30%), or 8.1%. We see this calculation in the worksheet "WACC."

Please note that in this example, we have used a company's actual cost of debt as a proxy for its marginal cost of long-term debt. A company's marginal cost of long-term debt may be better estimated by summing the risk-free rate and the "credit spread" that lenders would charge a company with a specific credit rating.

B. Cost of equity capital. We noted above that:

Cost of Equity Capital = Risk-Free Rate + (Beta times Market Risk Premium).

To calculate any company's cost of equity capital, we need to find a reliable source for each of these inputs:

1. Risk-free Rate. We suggest using the rate of return on long-term (ten-year) US government treasury bonds as a proxy for the risk-free rate. (Or German Bunds for Euros). We enter this data point in cell C4 of worksheet "WACC."

Sources for this include:

FT.com - the Financial Times web site
Reuters.com

2. Beta coefficient. We enter this data point in cell C8 of worksheet "WACC."

In this case we have selected the industry beta for "Building - Heavy Construction" from the the worksheet "Industry Betas, obtained from damodaran.com. Enter 1.66 for Gateway's beta.

There are a variety of sources available for obtaining the beta coefficient for a particular company.

Yahoo. Yahoo offers free beta estimates through its Company Profile service. Click here to see Gateway's Company Profile on Yahoo.

Bloomberg. Free beta estimates from Bloomberg can be accessed online. Bloomberg's estimate of Gateway's current beta can be accessed here.

Damodaran.com for industry betas - helpful for private companies and emerging markets

3. Equity Risk Premium. Forward looking approaches, as well as more recent historical data, suggest an equity risk premium in the 3 to 5 percent range. Additional factors can raise this, as noted below. We use an Equity Risk Premium estimate of 7.5% for this family-dominated Indian company. We enter this data point in cell C7 of worksheet "WACC."

In addition to the calculated risk premium, additional required return may be needed for:

- Private equity illiquidity risk
- Minority shareholding/corporate governance risk premium
- Country risk

For those interested in looking at historical equity risk premia, we refer you to the following online resources:

Ibbotson Associates. Ibbotson sells a report on historical risk premia over time on its website. The report can be purchased.

Aswath Damodaran. Valuation expert Professor Damodaran of NYU's Stern School of Business has published data as well as an informative article on equity risk premia that can be downloaded free of charge.

To continue with our Gateway case study, we used the following estimates for these three factors:

Risk-free rate of 4%.

Beta coefficient of 1.66.

Equity risk premium of 7.5%.

Using these estimates, Gateway's cost of equity capital = Risk-Free Rate + (Beta times Market Risk Premium). = $4.00\% + (1.66 \times 7.5\%)$, or 16.5%. We see this calculation in the results section of worksheet "WACC."

3. Weighting the components. Finally, we weight the cost of each kind of capital by the proportion that each kind of capital contributes to the entire enterprise. This gives us the Weighted Average Cost of Capital (WACC), the average cost of each dollar of cash employed in the business.

To review, Gateway's after-tax cost of debt is 8.1% and its cost of equity is 16.5%. The market value of Gateway's debt is equal to \$8.5 million and the market value of Gateway's equity is \$45 million. The value of equity can be obtained from the shares outstanding and share price in cells C12 and C13 in worksheet "WACC." Alternatively, for private companies, the value of the business may be computed using comparables or a valuation model.

Gateway's weighted average cost of capital is thus $8.1\% \times 15.9\% + 16.5\% \times 84.1\% = 15.1\%$. You can see this calculation in worksheet "WACC."

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Available as spreadsheet WACC_tutorial.xls on www.giddy.org

Acknowledgement: Adapted from <http://www.expectationsinvesting.com/spreadsheets/WACC.xls>

Inputs for WACC Calculation:

Risk free rate (%)	4.00%
Yield-to-Maturity of debt (%)	11.50%
Equity risk premium (%)	7.50%
Beta of equity	1.66
Corporate tax rate (%)	30%
Common shares (MM)	10.0
Share price (\$)	\$ 4.50
Market value of debt (\$, MM)	\$ 8.5

Weighted Average Cost of Capital (WACC) Calculation

Debt		Equity		Total	
Pre-tax cost of debt (%)	11.5%	Cost of equity (%)	16.5%		
After-tax cost of debt (%)	8.1%				
Market value of debt (\$, MM)	\$ 8.5	Market value of equity (\$, MM)	\$ 45.0	Enterprise Value (\$, MM)	\$ 53.5
Percent of enterprise value (%)	15.9%	Percent of enterprise value (%)	84.1%	Percent of enterprise value (%)	100.0%
Weighted Average Cost of Capital (WACC, %)				15.1%	