Cost of Capital

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In this document, I will attempt to explain how to analyze the cost of capital of a project by taking into account risk and financing, using concepts such as Unlevered Cost of Capital, Unlevered Beta, Net Debt, and the WACC. Initially, we will assume that the project is financed solely with equity; debt will be introduced at a later stage. Mathematical examples will also be provided to enable a deeper understanding of these topics.

1 Unlevered Cost of Capital

The Unlevered Cost of Capital represents the expected return required by investors for a company with no debt, financed entirely through equity. It is expressed by the following formula:

$$r_u = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D$$

Where:

- E and D are the total market values of equity and debt, respectively.
- r_E and r_D represent the cost of equity and the cost of debt, respectively.

1.2 Beta unlevered

Recall that Beta is the slope coefficient of the regression between the returns of the security and the returns of the market. However, the Beta derived in this way is the Levered Beta, which reflects the overall riskiness of the firm, including its capital structure. If we want to isolate the operational (business) risk, we need to compute the Unlevered Beta.. The asset beta of the firm (also known as the Unlevered Beta) can therefore be obtained as follows:

$$\beta_u = \frac{E}{E+D} \beta_E + \frac{D}{E+D} \beta_D$$

or:

$$\beta_U = \frac{\beta_E}{1 + (1-T) \cdot \frac{D}{E}}$$

1.3 Example

Let us imagine that Company X is considering establishing a new business unit. The company has a market capitalization of $100 billion and a Beta of 0.60. It also has an outstanding bond issuance of $20 billion, rated A, with a yield of 3%. The risk-free rate is 2%, and the market risk premium is 7%. The unlevered cost of capital amounts to:

$$r_u = \frac{100}{100+20}6.2\% + \frac{20}{100+20}3\% = 5.66\%$$

While Beta is equal to:

$$\beta_u = \frac{100}{100+20}0.6 + \frac{20}{100+20}0 = 0.5$$

If we now compute r_u using the CAPM, we obtain a value of 5.5%. The difference between the two approaches lies in the assumptions: in the first case, we assumed that the return on debt was equal to the promised yield, while in the second case, we assumed that the debt had a beta of zero, and therefore, according to the CAPM, its return corresponds to the risk-free rate.

2 Risk and Financing Structure

Until now, we have evaluated the cost of capital for a project undertaken by an unlevered company. However, in reality, it is necessary to account for differences in both risk and financing structure. In the market, unlike the assumptions typically made in academic literature, there are imperfections—such as taxes—that play a fundamental role in the decisions of entrepreneurs and investors. We know that interest payments on debt are tax-deductible. Therefore, we can introduce τ_c, which represents the corporate tax rate. By financing its projects through debt, the company benefits from the tax deductibility of interest expenses. It is therefore necessary to use the after-tax cost of capital, known as the WACC (Weighted Average Cost of Capital), defined as follows:

$$r_{WACC} = \frac{E}{E+D}r_E + \frac{D}{E+D}r_D(1-\tau_c)$$

Given a target capital structure, the WACC can also be calculated as:

$$r_{WACC} = r_u - \frac{D}{E+D}r_D\tau_c$$

The WACC can therefore be interpreted as the unlevered cost of capital minus the tax shield benefit of debt.