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WACC and free cash flows: A simple adjustment for capitalized interest costs

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ABSTRACT

This paper shows how to value investment projects involving capitalization of interest costs by using the standard WACC method. Whenever capitalized interest costs do not immediately generate proportionate tax shields, one of the assumptions that justify the use of the after-tax weighted average cost-of-capital formula is violated. As an offset to this violation, the project's free cash flows have to be adjusted. We here derive and interpret a simple adjustment formula. A numerical illustration is provided.

1. Introduction

In this paper, we show how to value investment projects involving capitalization of interest costs with the standard WACC method. Discounting free cash flows[1] at an after-tax Weighted Average Cost of Capital (WACC) relies on the assumption that every year the interest cost immediately generates a proportionate tax shield. This assumption is in general not valid when some interest costs are not paid but capitalized. For instance, in many countries capitalized interest costs are depreciated according to the same rule as that applied to the project's capital expenditures, and they therefore generate deferred tax shields. Surprisingly enough, this issue has been so far ignored[2] by the corporate-finance literature, which results in the absence of a well-founded methodology for the treatment of capitalized interest in the context of project valuation. As a consequence, to the best of our knowledge, practitioners[3] do not adjust free cash flows for capitalized interest.

We here consider a firm that sets[4] a target debt-to-value ratio on the corporate scale, for all projects in the same risk class. The firm's WACC is calculated with this target debt ratio. Investment projects are valued by discounting their free cash flows at this WACC value. In practice, an "apparent loan[5]" – and its corresponding repayment schedule – may be attributed to a project involving high capital expenditures. Although contracted to finance the project considered, this loan is guaranteed by the firm, consolidated with other corporate-finance loans and included[6] in the calculation of the debt ratio targeted by the firm. When capital expenditures are spread

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1 The term "free cash flow" (also called "after-tax operating cash flow") refers to the cash flow of the project before any financial claims are paid. For tax purposes, the taxable income used is defined as the earnings before interest and taxes, which means that the free cash flow includes no interest tax shields.

2 Here we do not deal with accounting issues such as those studied by Bowen, Noreen, and Lacey (1981) and Peasnell (1993). A possible explanation for this absence of literature is that adjusting for capitalized interest will in general have a small impact on a project's value. However, the adjustment formula we propose is easy to apply and leads to a rigorous calculation of the project's value.

3 For example, the Asian Development Bank's guidelines – titled "Financial management and analysis of projects" – describe the free cash flows as "excluding any financing flows such as interest on debt and other financing charges during construction" (see http://www.adb.org/documents/guidelines/financial/part030402.asp).

4 Graham and Harvey (2001) report that about 80% of firms have some form of target debt-to-value ratio, and that the range around the target is tighter for larger firms.

5 This term is used by Pierru (2009) who mentions capital leases, subsidized loans and loans associated with oil and gas projects for fiscal purposes as other instances of apparent loans.

6 The project's actual contribution to the firm's debt capacity, equal to the firm's target debt ratio times the project's value, is likely to differ from the amount of this apparent loan. As emphasized by Pierru (2009), one should consider that the firm compensates a positive (negative) difference by issuing more (less) corporate bonds or by increasing (decreasing) the amount of another project's apparent loan.

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over several years, as is often the case for big projects, the repayment schedule of this apparent loan may involve capitalization of interest costs, for instance until the start of production. This is typically the case when debt covenants allow the payment of interest to begin only when the project starts to produce. Until this date, the interest costs produced every year are added to the outstanding loan amount (i.e., they are capitalized) and are, in general, subject to a special fiscal treatment.

As corporate-finance theory recommends, whenever debt financing is susceptible to have a special impact, we first derive a valuation formula within a standard Adjusted Present Value (APV) framework, by considering a Miles–Ezzell's world (1985) where interest costs are certain over one period. The resulting adjustment of free cash flows is then interpreted and discussed. For practical purposes, when the standard WACC method is used, a simple but consistent formula is proposed. A numerical illustration is given in the last section.

2. Valuation formula with an APV approach

Let us consider a firm expecting the free cash flow F_n in year n ($n \in \{0, 1, \ldots, T\}$). The firm's unlevered equity cost, relating to its operating risk, is ρ. All the debt, assumed free of default risk, is contracted at the risk-free interest rate r. According to the APV, the firm's value is equal to the present value of its free cash flows plus that of all tax shields generated by interest costs.

There are here two types of tax shield: those generated by interest payments and those generated by the depreciation of unpaid (i.e., capitalized) interest costs. We assume that the interest payments are deductible from the project's taxable income which is subject to the tax rate θ. On the other hand, capitalized interest costs are assumed to be depreciated. For ease of notation, we first assume[7] that interest costs are capitalized over 1 year only (in year 1) and paid from year 2 on. Let C be the portion of the firm's debt (contracted in year 0) whose interest costs rC in year 1 are capitalized. The amount of capitalized interest depreciated in year n ($n \in \{2, \ldots, T\}$) is denoted as $D_n(rC)$, with a resulting depreciation tax shield of $\theta D_n(rC)$.

The firm is assumed to target a debt-to-value ratio w at the corporate scale every year. We here follow the Miles–Ezzell analysis (1980, 1985): the current debt level, which is based on firm's current value, is known, so in the absence of default risk all the interest costs – including rC – at the end of year 1 are certain. We consequently consider that the depreciation tax shields $\theta D_n(rC)(n \in \{2, \ldots, T\})$ are also certain and should therefore be discounted at the rate r. This assumption is discussed later.

Every year n, the firm's value can therefore be broken down into a part V_n that is subject to the (operating) free cash flow risk and a part $\bar{V}_n$ relating to the risk-less capitalized interest depreciation tax shields. Targeting the debt ratio w therefore results in a linear debt policy[8] where in every year n ($n \in \{0, \ldots, T-1\}$) the firm's debt is the sum of:

- a component $\bar{B}_n$, equal to $w\bar{V}_n$, whose amount (and corresponding interest payment) is certain,
- a component B_n proportional to V_n, with $B_0 + C = wV_0$ and $B_n = wV_n$ ($n \in \{1, \ldots, T-1\}$), whose amount is, to some extent, exposed to the firm's operating risk.

Let us first compute V_0 which is equal to the present value of free cash flows F_n ($n \in \{1, \ldots, T\}$) plus the present value of the interest tax shields generated by B_n ($n \in \{0, \ldots, T-1\}$). In a Miles–Ezzell's world, due to the expectation revision process, the interest tax shields expected in year k are exposed to the operating risk during $k-1$ years. According to Miles and Ezzell (1985), in the absence of capitalized interest costs, we therefore have:

$$V_n = \sum_{k=n+1}^{T} \frac{F_k}{(1+\rho)^{k-n}} + \frac{\theta r B_{k-1}}{(1+r)(1+\rho)^{k-n-1}}, \quad n = 0, \ldots, T-1 \tag{1}$$

According to (1), V_n and V_{n+1} are linked by the following equation (with $V_T = 0$):

$$V_n = \frac{V_{n+1} + F_{n+1}}{1+\rho} + \frac{\theta r B_n}{1+r}, \quad n = 0, \ldots, T-1 \tag{2}$$

Since we have $B_n = wV_n$ ($n \in \{1, \ldots, T-1\}$) (2) gives:

$$V_n = \frac{V_{n+1} + F_{n+1}}{1 + \rho - w\theta r((1+\rho)/(1+r))}, \quad n = 1, \ldots, T-1 \tag{3}$$

By recurrence (3) immediately gives:

$$V_n = \sum_{k=n+1}^{T} \frac{F_k}{(1 + \rho - w\theta r((1+\rho)/(1+r)))^{k-n}} \tag{4}$$

The denominator in the right-hand side of (4) is the adjusted-discount-rate formula derived by Miles and Ezzell (1985) (see also Taggart (1991) and Brealey and Myers (2003)) for the firm's WACC. For ease of notation, let us denote this adjusted discount rate as i:

$$i = \rho - w\theta r \left(\frac{1+\rho}{1+r}\right) \tag{5}$$

By combining (4) and (5), we obtain:

$$V_1 = \sum_{k=2}^{T} \frac{F_k}{(1+i)^{k-1}} \tag{6}$$

Since we have: $B_0 + C = wV_0$ (2) gives in year 0:

$$V_0 = \frac{V_1 + F_1}{1+\rho} + \frac{\theta r(wV_0 - C)}{1+r} \tag{7}$$

By combining (7), (5) and (6), we finally have:

$$V_0 = -\frac{\theta r C}{1 + (1 - \theta w) r} + \sum_{n=1}^{T} \frac{F_n}{(1+i)^n} \tag{8}$$

Let us now determine $\bar{V}_0$ which is equal to the present value of the capitalized interest depreciation tax shields plus the present value of the interest tax shields generated by $\bar{B}_n$. As all these tax shields are risk-less, we have:

$$\bar{V}_0 = \frac{\theta r \bar{B}_0}{1+r} + \sum_{n=2}^{T} \frac{\theta D_n(rC) + \theta r \bar{B}_{n-1}}{(1+r)^n} \tag{9}$$

$$\bar{V}_n = \sum_{k=n+1}^{T} \frac{\theta D_k(rC) + \theta r \bar{B}_{k-1}}{(1+r)^{k-n}}, \quad n = 1, \ldots, T-1 \tag{10}$$

[7] This assumption is relaxed later in the paper.

[8] Ruback (2002) describes a linear debt policy as including a fixed component (whose outstanding amount is directly targeted and interest tax shield is therefore certain) and a proportional-to-value component (whose interest tax shield is subject to the firm's operating risk). Here $\bar{B}_n$ is equivalent to a fixed debt component since its amount is defined as proportional to the value of riskless cash flows.