Valuation errors with Non-Existent Interest Tax Shields

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NON-EXISTENT CREDITS AND INTEREST TAX SHIELDS

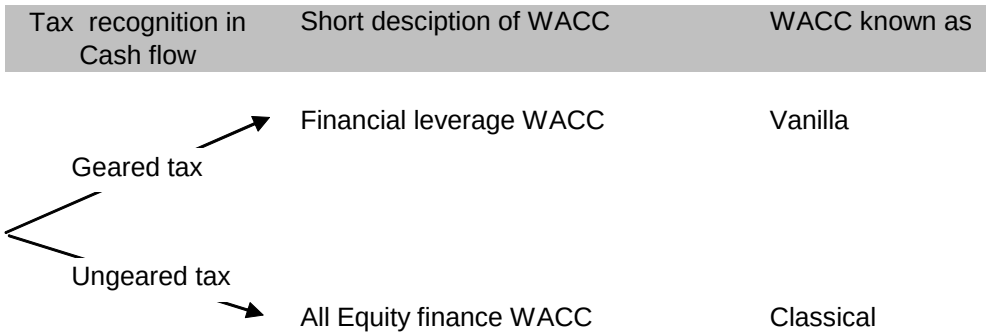
LOGIC

Tax shields on interest payments must exist before they can have any value. This might sound like the bleeding obvious but is amazing how the subtlety of a valuation exercise can lure the analyst into error. People often carefully model the proposed cash flows and get the timing of tax payments and depreciation deductions as accurate as they can. Then they effectively throw away much of this effort by valuing the project using a standard after-tax WACC. Usually the tax shield on debt interest is readily available which is consistent with the classical WACC method which values the shield as if it were *immediately* available. But, if the tax shield on debt is not available for some years due to little or no tax being paid, then the standard WACC approach is in error. For example, if the capital expense is so large that no tax is paid for many years, then there should be *no* tax term in the WACC formula. Large infrastructure projects suffer from this problem. The capital expense can be so large as to eliminate accounting profits and hence dividends for many years. No tax is paid so the tax shield on debt over those years is of no value within the company.

In equal manner, it is wrong to include franking credits in one of the imputation WACC formula if the credits are not immediately available to shareholders.

The classical tax system only required we know two WACCs. These depended on whether the tax amount recognised in the cash flow was the actual tax after recognising the effect of tax shields ("geared tax") or whether the tax was based on no financing shields (an All Equity tax or an "ungeared tax"). The following diagram depicts this choice.

Figure 1: Classical WACCs



The imputation tax system has complicated this process but fundamentally we still face the same decisions: do we recognise finance in the cash flow and/or credits or do we ignore the effect of finance? We will not pursue this issue here (we have done so elsewhere in our paper WACC_description.doc). The two valuation approaches are embodied in the following two formulae.

Just because a project is financed with debt, does not automatically mean there is a reduced tax payment induced by the tax deduction of interest payments (the interest tax shield, ITS). So we should not automatically perform a classic WACC valuation (or effective classical WACC valuation using effective tax after allowing for imputation). We have to establish first that there is an ITS before we include it in our valuations.

Table 1. Valuation approaches using WACC

Geared cash flow		**Vanilla WACC**
Cash Flow	X_O ! $T(X_O - X_D)$	Tax shield in the cash flow
WACC	$(1-g)R_E + gR_D$	

Un-geared cash flow		**Classical WACC**
Cash Flow	X_O ! TX_O	All Equity (i.e. ungeared) cash flow
WACC	$(1-g)R_E + g(1-T)R_D$	

The imputation case can be included in this framework if we substitute the effective tax rate after imputation in place of the statutory tax rate.

As usual, the notation we use is

Notation	*Item*
Xo	EBIT(FCF version where capex for replenishment or the annualized equivalent thereof exactly offsets the depreciation deduction)
Xd	Interest payment on debt
Xo-Xd	Profit before tax
T	Statutory Company Tax Rate
T.Xd	Interest Tax Shield on debt (ITS)
Xo-X_G	Net operating profit after tax (nopat)
Capex	Capital expensed (and book value)
	Rates
Re	Requited return on equity
Rd	Required return on debt
Ra	Required return on the asset (the WACC)
g	Gearing (D/V)
	Valuation
E	Market value of Equity
D	Market value of Debt
V	Total Enterprise value (at market)

The issue being addressed here is the presence of the tax term (1-T) in the classical WACC. The all-equity version of the valuation formula is

$$\text{NPV} = -\text{capex} + \sum \frac{X_{O,t}(1-T)}{\left((1-g)R_e + g(1-T)R_d\right)^t}$$

which means that the only place financing occurs is in the WACC as the explicit gearing, g, and implicitly in the costs of capital R_e and R_d. It does not occur in the cash flows and that is often its main attraction: we can value the asset without having to consider the impact of financing within the cash flows. It is all confined to the WACC term.

If we consider the cash flow definition for the vanilla WACC, we see that the only difference between them is that the vanilla WACC cash flow definition includes the ITS. That is, the expanded vanilla WACC cash flow is just

$$\begin{aligned}\text{cashflow(vanilla)} &= X_O - T(X_O - X_D)\\ &= X_O - TX_O + TX_D\\ &= \text{cashflow(classical)} + \text{ITS.}\end{aligned}$$

Because the ITS is included in the definition of the cash flow for the vanilla WACC, it is *not* included in the WACC. Equally, if there is no interest tax shield in the cash flow (it is formally included in the cash flow but it is zero) it is not included in the WACC. This is the source of the error: using a cash flow series that, at least for some periods, has no tax shield term but the tax shield term is always used in the WACC.

When we perform a valuation using the geared or vanilla WACC with the ITS in the cash flow, the formal valuation formula is

$$\text{NPV} = -\text{capex} + \sum \frac{X_{O,t} - TX_{o,t} + TX_{d,t}}{\left((1-g)R_e + gR_d\right)^t}$$

The error will be the most substantial when the gearing is the highest and the cost of debt the lowest. To see why, consider an artificial project that is almost 100% debt finance and near-perpetual no tax payment. The two asset valuations will be (approximately)

$$\text{NPV(classical)} = -\text{capex} + \frac{\$X_O}{(1-T)R_D}$$

$$\text{NPV(vanilla)} = -\text{capex} + \frac{\$X_O}{R_D}$$

and the asset values (before deducting capex) will differ by nearly 40% at the current company tax rate of 30% (ie 1/0.70).

This is clearly a highly artificial example and we will present a more realistic example below. However, the reduction or even absence of company tax is precisely what happens under an imputation tax system so tax shields are part or even fully illusory value in an imputation tax system such as we have had since 1987.

The most likely assets to be miss-priced by this error are the many infrastructure assets. As these are ones which also often have large capex they are likely candidates for having little taxable income for many years and so there is little or no tax to be shielded.

Whilst all the calculations herein are for the classical tax system, everything carries over to the imputation tax system if we just change the statutory rate (currently 30%) for the effective rate after imputation (19.5% on average across Australia).

A numerical example follows by comparing the All Equity and Vanilla valuations.

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Numerical Examples

This example is a long-life project with four years staggered construction and 50 years operation with a total life of 53 years.

The capital expense totals $2.2 billion in nominal dollars. The construction is spread over four years and is a turnkey contract. All construction risk resides with the builder so the cost of capital for the construction period is taken as the corporate cost of debt. The project is geared to 60% debt (based on total asset value at market, not book). The cost of debt is 7% and the cost of equity is 12%. The statutory tax rate is 30% and the effective after-imputation tax rate is 19.5%. The after-tax Vanilla WACC is 9% (0.4*12% + 0.6*7%) and the after-tax Effective Classical WACC is 8.18% (0.4*12% + 0.6*7%*(1-0.195)). The data are presented in Table 2.

Table2: Cost of Capital data

gearing	g	60%
Cost of debt (& construction)	Rd	7.00%
Risk free rate	Rf	5.60%
Cost of equity	Re	12.00%
Tax rate	T	30.00%
Gamma	gamma	0.35
Effective tax rate	Teff	19.50%
MRP		6.00%
After-tax EFFECTIVE CLASSICAL WACC	(1-g)Re +gRd(1-Teff)	**8.18%**
After-tax VANILLA WACC	(1-g)Re +gRd	**9.00%**

The cash flows for the project are presented in Table 3. All cash flows are assumed to be 30 June of the corresponding period. The valuation date is 30 June 2006. The capex payments are progress payments. The plant begins operating in 2006-07 as a final capex of $500 million is also incurred.

The large capital expense creates deferral of taxation payments in the first four years of operation. The depreciation expense exceeds the operating income in the first two years and the carry-forward of losses further delays taxable profits for another two years. This impact is included in both the All Equity and the Vanilla valuations. However, the large debt component of the financing also causes there to be a deferral of taxation for many years. This is ignored in the All Equity valuation in which this financing impact is meant to be picked up in the tax term of the Effective Classical WACC. The Vanilla WACC, in contrast, recognizes the actual after finance

Summary

Gearing levels are always taken as market gearing inside WACC valuations. This is easily done with an all-equity valuation but more difficult with a vanilla WACC valuation. The way around this problem is to force the debt level and associated interest payments and tax shields to be consistent before and after the valuation calculation. This is trivially done via a spreadsheet using a built-in goal seeking utility.

It should be noted that there are other problems with gearing not addressed in this Note. Not the least is the case of projects valued with project finance. In these cases, the debt repayments are

typically concentrated in the early stages of the project and the equity extraction is allocated to the back or later stages of the project. The gearing of such a project undergoes large swings through time. Such projects are best valued using the sum of the value of the debt and the value of the equity. This will allow for the timing variations alluded to above. A WACC valuation is a combined debt and equity valuation done in one hit along with a raft of assumptions such as a given gearing. If these assumptions are substantially violated then we could not expect the WACC valuation model to deliver reasonable results.

Some academics have proposed valuation models that allow for changing gearing levels but we rarely see practitioners using them so a modified approach of commonly used methods is our preference.

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