COMMERCE COMMISSION

Effects of Leverage on WACC Under Two Difference CAPMs

Introduction and assumptions

This note compares the effect of leverage on the Weighted Average Cost of Capital (WACC) and the Cost of Equity under the simplified Brennan Lally Capital Asset Pricing Model (Brennan Lally CAPM) model and the Classical CAPM model.

For this comparison, we have calibrated the Brennan Lally CAPM with parameter estimates for the risk-free rate of return, debt premium, leverage, asset beta, tax-adjusted market risk premium (TAMRP) and tax rates as per the Commission's straw person example, which was based on the Revised Draft Guidelines.

For the purposes of this comparison, we have assumed that the asset beta estimate was known and that the debt beta was equal to zero.

Holding all other parameter estimates constant, we have calculated the changes in post-tax WACC of increasing leverage from 20% to 70%. In the analysis we assume that equity betas[1] change as per the standard formulae for the effects of leverage on beta under the tax imputation system assumed in the Brennan-Lally model[2] and the tax system assumed in the Classical model.[3] As noted, the underlying asset beta used is the same for both the Classical and Brennan-Lally models. We have assumed a TAMRP of 7% for the Brennan-Lally model and a MRP of 5.4% for the Classical model.[4]

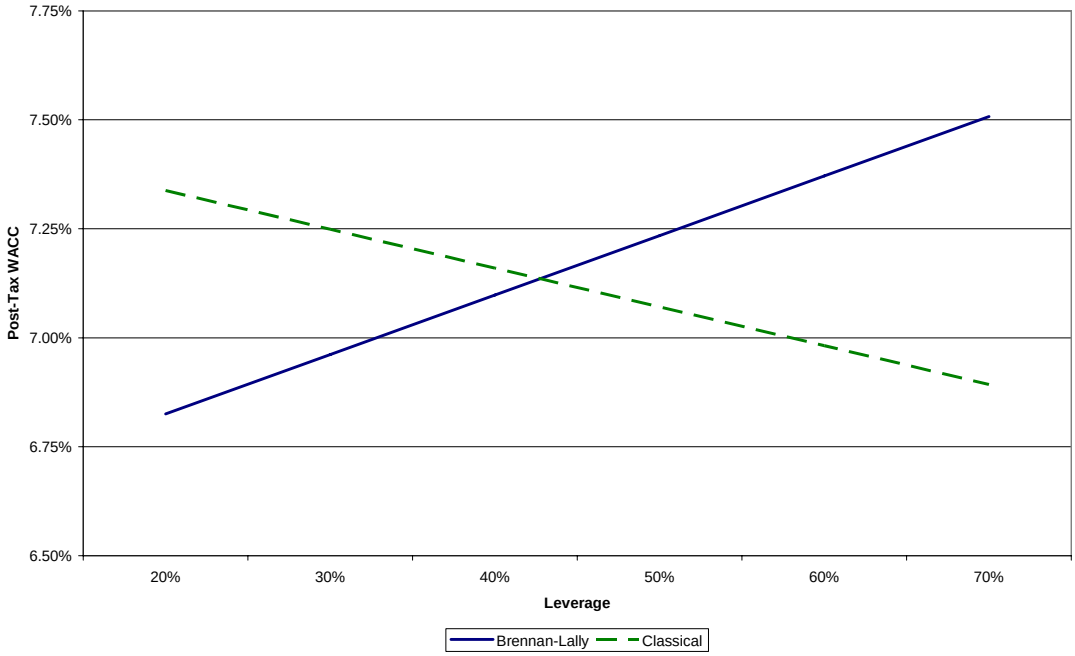
Analysis and conclusion

Figure 1 below illustrates that using the Brennan-Lally CAPM, post tax WACC increases with leverage. The same figure also illustrates that using the classical CAPM, post-tax WACC decreases as leverage increases.

[1] The Harris & Pringle formula for leveraging the asset beta, to obtain the equity beta, has been used in the simplified Brennan-Lally CAPM.
[2] We note that, as leverage increases, the debt premium should also increase. However, such increase is difficult to model as the function would be non-linear.
[3] The traditional formula (Hamada) for leveraging the asset beta, to obtain the equity beta, has been used in the classical CAPM.
[4] Assuming 7% for the TAMRP is consistent with the Commission's straw person example. We derived the MRP for the classical model applying the following calculation: MRP = TAMRP – Rf(Ti), i.e. 5.4=7-5.36*0.3.

Figure 1: Effects of Changes in Leverage on Post-tax WACC

Brennan-Lally versus Classical CAPM



In the Brennan-Lally model, as leverage increases, WACC increases. In his note (WACC and Leverage dated 17 November 2009, as published on the Commission's website[5]), Dr Martin Lally identifies that the increase can be attributed to the effect of the debt premium.

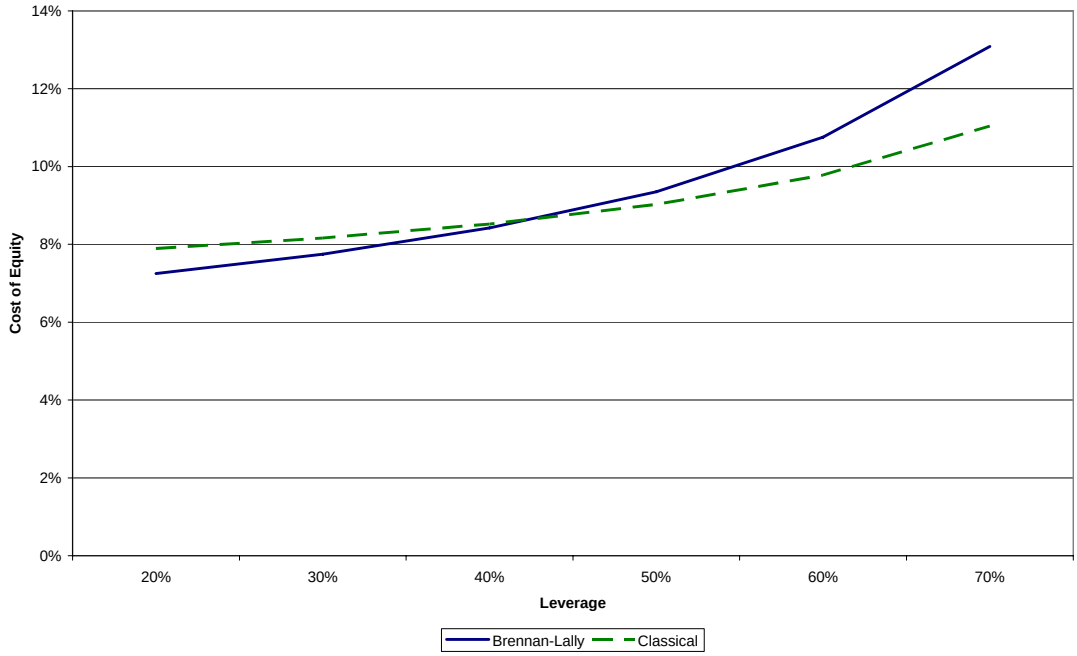
In case of the Classical model, as leverage increases, WACC decreases. This is the standard result, which is usually described as reflecting the advantages to debt provided by the tax system (i.e. interest is deductible to the firm in contrast to returns to equity) in the absence of dividend imputation.

Figure 2 below illustrates that in the Brennan-Lally model the cost of equity increases at a greater rate than in the Classical model.

[5] http://www.comcom.govt.nz/IndustryRegulation/Part4/DecisionsList.aspx

Figure 2: Effects of Changes in Leverage on Cost of Equity

Brennan-Lally versus Classical CAPM



For details of the formulae applied in the current analysis, please refer to Appendix 1. For details of all parameter estimates, please refer to Appendix 2.

APPENDIX 1

Formulae used

Weighted Average Cost of Capital (*WACC*)

$$WACC = r_d \times (1\text{-}T_c) \times L + r_e \times (1 - L),$$

Where

r_d is the cost of debt capital
r_e: is the cost of equity capital
T_c is the corporate tax rate
L: is leverage

Simplified Brennan Lally

$$r_d = r_f + p$$
$$r_e = r_f(1\text{-}\ T_i) + \beta_e \times TAMRP$$
$$\beta_e = \beta_a + \beta_a \times L/(1\text{-}L)$$

Where

r_f is the risk free rate of return
p is the debt premium
T_i is the investor tax rate
TAMRP is the tax-adjusted market risk premium
β_e is the equity beta
β_a is the asset beta

Classical

$$r_d = r_f + p$$
$$r_e = r_f + \beta_e \times MRP$$
$$\beta_e = \beta_a + \beta_a\ (1\text{-}\ T_c) \times L/(1\text{-}L)$$

Where

MRP is the market risk premium

APPENDIX 2

Details of Parameter Estimates

Table A1: Simplified Brennan-Lally CAPM

Rf	5.36%	5.36%	5.36%	5.36%	5.36%	5.36%
Debt premium	1.95%	1.95%	1.95%	1.95%	1.95%	1.95%
Leverage	20%	30%	40%	50%	60%	70%
Ba	0.40	0.40	0.40	0.40	0.40	0.40
Bd	0.00	0.00	0.00	0.00	0.00	0.00
TAMRP	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%
Tc	30%	30%	30%	30%	30%	30%
Ti	30%	30%	30%	30%	30%	30%
Be	0.50	0.57	0.67	0.80	1.00	1.33
Ke	7.25%	7.75%	8.42%	9.35%	10.75%	13.09%
Post-taxWACC	6.83%	6.96%	7.10%	7.23%	7.37%	7.51%
Vanilla WACC	7.26%	7.62%	7.98%	8.33%	8.69%	9.04%

Classical A2: Classical CAPM

Rf	5.36%	5.36%	5.36%	5.36%	5.36%	5.36%
Debt premium	1.95%	1.95%	1.95%	1.95%	1.95%	1.95%
Leverage	20%	30%	40%	50%	60%	70%
Ba	0.40	0.40	0.40	0.40	0.40	0.40
Bd	0.00	0.00	0.00	0.00	0.00	0.00
MRP	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%
Tc	30%	30%	30%	30%	30%	30%
Ti	30%	30%	30%	30%	30%	30%
Be	0.47	0.52	0.59	0.68	0.82	1.05
Ke	7.89%	8.16%	8.52%	9.03%	9.78%	11.04%
Post-tax WACC	7.34%	7.25%	7.16%	7.07%	6.98%	6.89%
Vanilla WACC	7.78%	7.91%	8.04%	8.17%	8.30%	8.43%