FINAL REPORT

Prepared For:

Unison Networks Ltd

1101 Omahu Road

Hastings, New Zealand

Leverage and the Cost of Capital

Prepared By:

CRA International (Hong Kong Limited

trading as Charles River Associates

1902A Tower Two Lippo Centre

89 Queensway, Hong Kong

Date: 2 December 2009

CRA Project no:

Author(s): Andrew Shelley (Consultant)

DISCLAIMER

Charles River Associates and its authors make no representation or warranty as to the accuracy or completeness of the material contained in this document and shall have, and accept, no liability for any statements, opinions, information or matters (expressed or implied) arising out of, contained in or derived from this document or any omissions from this document, or any other written or oral communication transmitted or made available to any other party in relation to the subject matter of this document. The views expressed in this report are those of the authors and do not necessarily reflect the views of other CRA staff.

TABLE OF CONTENTS

1. INTRODUCTION

At the Commerce Commission’s workshop of 12-13 November 2009, Commissioner Duignan asked for submitters to comment on his example of the application of the simplified Brennan-Lally model, in which increasing leverage increased the cost of capital. Commissioner Duignan’s example utilised the Harris and Pringle levering formula for the simplified Brennan-Lally model and the Hamada formula for the classical CAPM.

This note comments on the issue raised by Commissioner Duignan, and addresses the question of whether a regulatory WACC that increases with leverage will necessarily provide an incentive for regulated firms to increase their leverage to an unreasonably high level.

This note is structured as follows:

- Section 2 briefly reviews a number of “traditional” levering formulae, highlighting (a) how different assumptions about debt management lead to different levering formulae; and (b) that the traditional formulae are generally not capable of identifying an optimal capital structure;
- Section 3 briefly touches on the incorporation of imputation credits into the levering formulae, and the question of whether the Harris and Pringle formula is the only levering formula applicable to the simplified Brennan-Lally CAPM;
- Section 4 then comments on the discrepancy between the observed cost of capital and the true cost of capital, and in particular how the firm’s true cost of capital is likely to rapidly rise above the observed cost of capital as the firm approaches constraints such as borrowing covenants; and
- Section 5 provides some concluding comments.

2. TRADITIONAL LEVERING FORMULAE DO NOT YIELD AN OPTIMAL CAPITAL STRUCTURE

There are a large number of levering formulae, differing in respect to assumptions made about, inter alia, the way that debt is managed (and hence the appropriate discount rate for the tax shield arising from interest deductions), the existence or otherwise of personal taxes, and the existence and treatment of dividend imputation. Fernandez (2006) notes that:[1]

> *Modigliani and Miller (1963) [and by implication Hamada (1972)], Myers (1974), Luehrman (1997), Brealey and Myers (2000) and Damodaran (2006) propose discounting the tax savings arising from the cost of debt (r_D), whereas Harris and Pringle (1985) and Ruback (1995, 2002) propose discounting these tax savings at the cost of capital for the unlevered firm (r_A). Miles and Ezzell (1985) propose discounting these tax savings at the cost of debt in the first year and at [the unlevered cost of equity] in subsequent years.*

The genesis of the difference in the treatment of tax savings is the assumption about the debt policy of the firm. Consistent with the assumptions of Modigliani and Miller (1963), Hamada (1972) assumes a constant dollar level of debt and that personal taxes on debt and equity returns are identical. A constant dollar level of debt implies that future returns to debt are known and free of systematic risk. The result is the well-known Hamada model:

$$\beta_e = \beta_a \left(1 + (1 - t_c) \frac{D}{E} \right)$$

where β_e is the (levered) equity beta, β_a is the (unlevered) asset beta, t_c is the corporate tax rate, D is the market value of debt, and E is the market value of equity.

Conine (1980) identified that the Hamada relationship failed to fulfil Modigliani and Miller's assumption that earnings before interest and tax (EBIT) should remain constant and independent of leverage. Conine solves this problem by introducing a debt beta (β_d):

$$\beta_e = \beta_a + (\beta_a - \beta_d)(1 - t_c) \frac{D}{E}$$

One flaw with Conine's approach is that the "constant EBIT" problem is only solved if the entire debt premium is assumed to relate to systematic risk. When the debt premium also includes compensation for non-systematic default risk and liquidity risk then the Conine formula fails to yield EBIT that is invariant to leverage.

1 Fernandez, P. (2006) "A General Formula for the WACC: A Correction", IESE Business School Working Paper No. 663, University of Navarra, December, p. 1.

On the assumption that the tax shield has the same systematic risk as the firm's underlying cash flows, Harris and Pringle (1985) propose that value of the tax shield should be calculated with the required return to assets as the discount rate. The resulting model is simply:

$$\beta_e = \beta_a \left(1 + \frac{D}{E}\right)$$

Miles and Ezzell (1985) adopt the assumption of a constant market-value leverage ratio, i.e. debt is constantly adjusted so that it is a constant proportion of the market value of equity (and hence also a constant proportion of the value of the firm). The implication of this assumption is that the stream of future tax savings from interest is uncertain and has the same systematic risk as the underlying value of the firm, and therefore the unlevered cost of equity is the appropriate discount rate for calculating the value of future tax savings. The resulting levering formula is:

$$\beta_e = \beta_a + \beta_a \left[1 - \left(\frac{kd}{1+kd}\right)t_c\right]\frac{D}{E}$$

where kd is the cost of debt.

Commissioner Duignan noted that it was appropriate to employ the levering equation that was specific to the assumptions of the model. We agree, but note that classical CAPM framework admits all of the models levering formulae mentioned above. We also note that Fernandez (2006) argues that "it is not possible to derive a debt policy for which the appropriate discount rate for tax shields is [the cost of capital for the unlevered firm] in all periods", thus directly throwing doubt upon the merits of the Harris and Pringle formula.[2]

We are thus left with the Modigliani and Miller / Hamada / Conine formulae for fixed debt and the Miles and Ezzell formula for constant market value leverage. Fernandez (2007) and de Bodt and Levasseur (2007) both argue that neither of these policies is likely to be satisfactory in practice, and instead propose a fixed book value leverage ratio. Given this assumption De Bodt and Levasseur (2007) derive the following levering formula:[3]

$$\beta_e = \beta_a \left(1 + \left[\frac{(1-t_c)r_f - g}{r_f - g}\right]\frac{D}{E}\right)$$

2 Op. cit.

3 De Bodt, E. and M Levasseur (2007) "A short note on the Hamada formula", 26 March, p. 9. Available at http://ssrn.com/abstract=976347.

where g is the assets' constant growth rate,[4] and rf is the risk-free rate of return. This is the same formula implied by Fernandez's (2007) derivation of the cost of equity under the Modigliani-Miller assumptions.[5] When the growth rate is zero then the formula reduces to the Hamada formula (which assumes constant value debt).

Turning to the issue of whether an optimal capital structure can be generated by the WACC, Cohen (2008) demonstrates that Conine (1980) does solve the "constant EBIT" problem if the debt premium is assumed to relate solely to systematic risk, but offers the following criticism of the Conine formula:[6]

> *The methodology is not capable of generating a weighted average cost of capital [WACC], or a firm's value, VL, curve, that passes though an optimal capital structure (i.e. minimum in WACC or maximum in VL). The reason for this is that if we were to force [the unlevered value of the firm] to remain constant along the WACC curve (as per [Modigliani and Miller]), then as one increases the debt level ... the levered value of the firm ... would increase indefinitely with leverage. This is inconsistent with the principle that the firm's value should eventually fall at some point, owing to higher interest expense overtaking the benefits of the interest-related tax shield.*

This is exactly the issue raised by Commissioner Duignan.

Based on earlier analysis that establishes optimal leverage from a constrained optimisation of the value of the firm, Cohen (2008) proposes to adopt a measure of "idealised debt" ($D*$)leading to an adjusted leverage:

$$D^* = \frac{kd}{r_f} D$$

Cohen hence derives the levering formula:

$$\beta_e = \beta_a \left(1 + (1 - t_c) \left(\frac{kd}{r_f} \right) \frac{D}{E} \right)$$

This is simply the Hamada formula but with idealised debt rather than the actual (market) value of debt. Like the Hamada equation this would seem to incorporate an assumption of constant debt.

4 Because of the assumption of constant book value leverage the constant growth rate of assets is also the growth rate of debt.

5 Fernandez, P. (2007) "A More Realistic Valuation: APV and WACC with Constant Book Leverage Ratio", IESE Business School Working Paper No. 715, University of Navarra, November, p. 16, equation 16.

6 Cohen, R.D. (2008) "Incorporating Default Risk into Hamada's Equation for Application to Capital Structure", Wilmott Magazine, March/April 2008.

Although Cohen potentially offers a solution to the problem of optimal capital structure, there is no one model that is “correct” – all relying on assumptions which may or may not be appropriate – and a wide range potentially applying to any given specification of the CAPM. The classical CAPM admits the Hamada, Myers, Conine, and Miles and Ezzell formulations, as well as many others. Neither a constant dollar debt policy nor the constant market value leverage policy is likely to be a particularly good approximation to the debt policy applied by regulated firms.

3. IMPUTATION CREDITS AND THE SIMPLIFIED BRENNAN LALLY MODEL

None of the above models are necessarily suitable formulae for the cost of capital in the presence of imputation credits.

Combining the Conine and Miles and Ezzell formulae produces:

$$\beta_e = \beta_a + (\beta_a - \beta_d)\left[1 - \left(\frac{kd}{1+kd}\right)t_c\right]\frac{D}{E}$$

As noted by Lally (2004), if imputation credits are included in returns then the corporate tax rate tc must be replaced by the imputation adjusted tax rate Te.[7] Adapting the Conine-Miles-Ezzell model for imputation credits gives rise to the Monkhouse formula which is employed in Australia (including by the AER):

$$\beta_e = \beta_a + (\beta_a - \beta_d)\left[1 - \left(\frac{k_d}{1+k_d}\right)(1-\gamma)Te\right]\frac{D}{E}$$

The parameter γ reflects the ability of investors to utilise imputation credits, and Te is the imputation adjusted effective tax rate. A similar levering formula can be employed for the Brennan-Lally model, although the treatment of imputation credits and the effective tax rate is more sophisticated.

The simplified Brennan-Lally model assumes that all investors are able to utilise franking credits (i.e., γ=1 in the above model). If we also assume that the debt beta is zero then the Monkhouse formula collapses to that of Harris and Pringle.

Similarly, Lally (2004:77-78) derives the following for use in the simplified Brennan-Lally Model:

7 Lally, M. (2004) “The Cost of Capital for Regulated Entities”, Report prepared for the Queensland Competition Authority, 26 February, p. 72.

$$\beta_e = \beta_a \left(1 + \frac{D}{E}\right)$$

which is identical to the Harris and Pringle formula.

It is not correct to suggest that the Harris and Pringle formula is the only levering equation of relevance to the simplified Brennan-Lally model. As Lally (2004:76) notes, this formula assumes that a constant market value leverage ratio is maintained, as per the assumptions of the underlying Miles-Ezzell model. Other debt policy assumptions may give rise to different leverage formulae.

Further, it is incorrect to compare the results of the classical CAPM calculated with the Hamada levering formula against the results of the simplified Brennan-Lally CAPM calculated with the Harris and Pringle levering formula. In one model the assumption is being made that a constant dollar debt is maintained; in the other model the assumption is being made that a constant market value leverage is maintained. These differing assumptions can have a material effect on the resulting cost of equity.

4. THE TRUE COST OF CAPITAL MAY BE HIGHER THAN THE OBSERVED COST OF CAPITAL

Finally, we note that all of these models are mere abstractions of reality and do not include a number of true economic costs. Firms will, for example, have a maximum leverage constraint specified in debt covenants with their financiers. A typical limit is 60% of debt plus equity for a New Zealand utility.

Exceeding debt covenants is a default event and has potentially severe consequences. Legally, financiers are entitled to demand repayment of the full amount of the debt. Practically, what is more likely to happen for a utility is that the financiers would work with the firm to develop a plan to reduce debt to acceptable limits. Such a plan would include cuts to dividends, and is likely to include cuts to capital and operating expenditure, and possibly the sale of non-strategic assets. The firm may also be required to refinance its debt, and if so is likely to face a higher debt premium as a result of having violated a debt covenant.

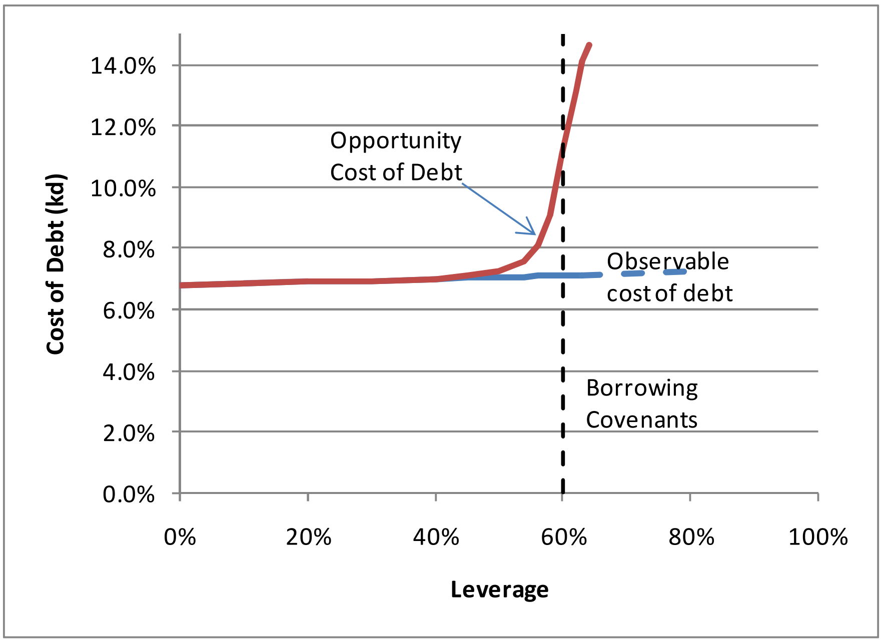
The maximum leverage constraint does not just bind at the specified limit, but also starts to bind at lower levels of leverage. For example, as illustrated in Figure 1, a limit of 60% could start to bind at around 55% as both the firm and financiers want to ensure that the borrower has sufficient debt capacity to meet any contingencies.

Given a strong incentive to avoid exceeding covenants, discretionary projects face higher rate-of-return hurdles, either implicit or explicit, as undertaking “one more” project may signficantly limit the ability to undertake other profitable projects in the future.

From an economic perspective the true cost of debt starts to climb rapidly as soon as any of these constraints start to bind. The opportunity cost of borrowing another dollar rapidly becomes much higher than the headline interest rate. Faced with a rapidly rising opportunity cost of debt the firm will choose a leverage point that is below the maximum specified in covenants.

When the firm anticipates that significant investment opportunities may arise then it may elect to maintain leverage at an even lower level, as this will provide a buffer of debt that can be rapidly and easily accessed in the event that an opportunity becomes available.

Figure 1: Difference Between the Observable Cost of Debt and the Opportunity Cost of Debt



While increasing leverage may increase the regulatory WACC and hence allowed revenue in a way that is relatively easy to quantify, the impact on opportunity cost is difficult to quantify with any degree of precision and yet is potentially so significant that it will dominate any effects on revenue. It is extremely unlikely, therefore, that a regulated firm will alter its leverage simply to take advantage of an increase in the regulatory WACC. In theory a highly sophisticated firm might conceivably have a constrained optimisation model of firm value and seek to set the leverage that would optimise value within that context, but even that would only serve to make explicit the opportunity costs associated with borrowing covenants and would not alter the general conclusion.

5. CONCLUSIONS

There are a large number of levering formulae, a selection of which have been reviewed here. One source of difference between the various formulae is the assumption about the debt policy employed by the firm. Formulae such as the Hamada (1972) formula assume constant dollar debt. Formulae such as Miles and Ezzell (1980) and Harris and Pringle (1985) assume constant market leverage. It is not appropriate to compare the results of the classical CAPM and the simplified Brennan-Lally CAPM when different leverage assumptions are employed in the two models.

More recent literature suggests that a constant book value leverage ratio might be more appropriate. Fernandez (2007) and de Bodt and Levasseur (2007) both present empirical evidence to support the proposition that firms are more likely to target a constant book value leverage ratio than a constant market value leverage ratio, and both also present levering formulae for a firm that employs constant book value leverage.

Setting aside the question of the appropriate leverage policy that should underpin the CAPM, the phenomena of the absence of an optimal capital structure is not unique to the simplified Brennan-Lally model.

The observation that the simplified Brennan-Lally model produces a WACC that increases with increased debt does not mean that a regulated firm will employ higher leverage just to obtain a (slightly) higher regulated WACC. The WACC is based on the observed cost of debt and the estimated cost of equity; it does not include the opportunity costs that arise as leverage approaches externally imposed borrowing covenants. Faced with an uncertain future, firms will maintain a “buffer” to accommodate potential adverse contingencies, and potentially a larger buffer if investment opportunities are expected. These factors will raise the opportunity cost of increasing leverage well above the observed cost of debt, and will mean that the firm will not increase borrowing to the maximum level permitted by debt covenants. It is likely that the magnitude of these opportunity costs will far exceed any increase in the regulatory WACC, and hence it is unlikely that the identified characteristics of the simplified Brennan-Lally WACC will have any impact on the behaviour of regulated firms.

REFERENCES

Cohen, R.D. (2008) “Incorporating Default Risk into Hamada’s Equation for Application to Capital Structure”, *Wilmott Magazine*, March/April 2008.

De Bodt, E. and M Levasseur (2007) “A short note on the Hamada formula”, 26 March, p. 9. Available at http://ssrn.com/abstract=976347.

Fernandez, P. (2006) “A General Formula for the WACC: A Correction”, IESE Business School Working Paper No. 663, University of Navarra, December.

Fernandez, P. (2007) “A More Realistic Valuation: APV and WACC with Constant Book Leverage Ratio”, IESE Business School Working Paper No. 715, University of Navarra, November.

Lally, M. (2004) “The Cost of Capital for Regulated Entities”, Report prepared for the Queensland Competition Authority, 26 February.