WACC AND LEVERAGE

17 November 2009

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1. Introduction

When using the simplified Brennan-Lally CAPM in conjunction with the simplified beta gearing model, WACC as usually defined rises with leverage and therefore implies that leverage is undesirable. However, the use of debt by companies is typical. This implies that companies are acting irrationally or that there is some deficiency in the model used to estimate WACC. This paper assumes that companies are acting rationally and therefore investigates whether there are deficiencies in the model used to estimate WACC.

2. Analysis

When defined in the usual way, the weighted average cost of capital WACC is as follows

$$WACC = k_e(1-L) + k_d(1-T_c)L \tag{1}$$

where k_e is the cost of equity capital, k_d is the current promised interest rate on debt capital, T_c is the corporate tax rate, and L is the leverage ratio. In addition, k_d can be expressed as the sum of the current riskfree rate R_f and a debt premium p, i.e.,

$$k_d = R_f + p \tag{2}$$

In addition, the simplified version of the Brennan-Lally version of the Capital Asset Pricing Model yields a cost of equity as follows

$$k_e = R_f(1-T_I) + \phi\beta_e \tag{3}$$

where T_I is the average (across equity investors) of their marginal tax rates on ordinary income, ϕ is the market risk premium, and β_e is the beta of equity capital. This model is a simplified version of that in Lally (1992) and Cliffe and Marsden (1992), in which it is assumed that capital gains taxes are zero, that firms attach maximum imputation credits to their dividends (at the rate .43), and that all shareholders can fully utilise the imputation credits. Finally, under the tax regime

assumed here, the simplified beta gearing model (which treats the debt beta as zero) is as follows

$$\beta_e = \beta_a \left[1 + \frac{L}{1-L} \right] \tag{4}$$

where β_a is the asset beta (the equity beta in the absence of debt). These four equations correspond to those currently used by the Commerce Commission. Under the usual assumption that the tax parameter T_I matches the corporate tax rate, substitution of equation (4) into (3), and both (3) and (2) into (1) yields the following result (as noted in Lally, 2008, section 7):

$$WACC = k_u + p(1-T_c)L \tag{5}$$

where k_u is the unlevered cost of capital (WACC when leverage is zero). So, as L rises, WACC rises and such a result appears to be perverse in the sense of being inconsistent with the general preference of firms to use some debt.

The immediate "cause" of this apparently perverse result is the existence of the debt premium p, i.e., a zero value for the debt premium would yield WACC that was invariant to leverage. In turn the debt premium exists for three reasons. Firstly, corporate debt experiences some systematic risk, thereby raising the cost of debt above the government bond rate. Secondly, corporate debt is less liquid than government bonds and this induces a liquidity premium within the cost of debt that has no counterpart within the cost of equity shown in equation (3).[1] Thirdly, the cost of debt is generally defined and therefore measured as the promised rate rather than the expected rate, and the promised rate is enlarged by the expected default costs on corporate debt; this in turn arise from the existence of limited liability by shareholders (i.e., shareholders possess a default option) and the expected default costs suffered by debt holders are aggravated by the existence of bankruptcy costs.[2]

[1] Almeida and Philippon (2007, pp. 2567-2569) estimate this illiquidity premium at up to 0.50% for US corporate bonds.

[2] Andrade and Kaplan (1998) estimate bankruptcy costs at 10-23% of the value of a firm in the event of bankruptcy.

The implications of these points for WACC are as follows. Firstly, in respect of systematic risk, the positive relationship between WACC and leverage disappears if the debt premium is due entirely to systematic risk on debt and this systematic risk is properly recognised in WACC. Such recognition requires two modifications to the previous analysis. Equation (4) must be modified to recognise the debt beta as follows:

$$\beta_e = \beta_a \left[1 + \frac{L}{1-L} \right] - \frac{L}{1-L} \beta_d \tag{6}$$

In addition, equation (2) must be modified to recognise that the debt premium is due entirely to systematic risk. Accordingly, the cost of debt is an expected rate of return and is determined purely in accordance with the CAPM. Following equation (3), but with recognition that the cash yield on corporate debt is taxable at the personal level rather than tax-free, the expected return on debt $E(R_d)$ is then as follows:

$$E(R_d) = R_f (1 - T_I) + E(R_d) T_I + \phi \beta_d$$

and therefore

$$E(R_d) = R_f + \frac{\phi \beta_d}{1 - T_I} \tag{7}$$

Substitution of equation (6) into (3), and both (3) and (7) into (1), along with the usual assumption that $T_I = T_c$, then yields the result that $WACC = k_u$. However, k_u is now determined using β_a extracted from an estimate of β_e in accordance with equation (6) rather than equation (4). The effect of this caveat is important because the use of equation (4) rather than (6) does not necessarily lead to error; error is only present if the leverage specified in equation (5) diverges from that present in the firm used to estimate β_a and the error could be in either direction.

Secondly, in respect of the liquidity premium, a properly specified cost of equity ought to include allowance for this in so far as a firm's equity is less liquid than government bonds.[3] However, proper recognition of this would not overcome the

[3] There is a vast literature on this matter, including Amihud and Mendelson (1986), Chordia et al (2001), and Acharya and Pedersen (2005).

positive relationship between WACC and leverage because liquidity premiums are likely to be much smaller on equity than corporate debt. Thus, a properly defined WACC will still rise with leverage because debt is likely to experience a greater liquidity premium than does equity.

Thirdly, in respect of the default option possessed by equity holders and exercisable against debt holders, this is merely a contract that allocates risk *between* the two parties and therefore should have no impact upon the overall cost of capital. So, WACC should be invariant to the existence of the default option. The fact that equation (5) is not invariant to it is simply due to defining the cost of debt as the promised rate; it ought to be defined as the expected rate of return to debt holders plus the allowance for bankruptcy costs. However, even in this case, a properly defined WACC will still rise with leverage because debt incurs bankruptcy costs and equity does not.

In summary, of the factors that underlie the debt premium and therefore cause WACC as specified in equation (5) to rise with leverage, the impact arising from the systematic risk of debt is spurious in the sense that allowance for the debt beta would eliminate the upward effect of leverage (and the expected error would still be zero even if no such allowance is made). In addition, the effect arising from the liquidity premium on debt is at least partly real because corporate debt is less liquid than equity. In addition, the effect arising from the default option possessed by equity holders (but exclusive of the effect of bankruptcy costs) is spurious in the sense that properly defining the cost of debt as the expected yield would eliminate it. Finally, the effect arising from the existence of bankruptcy costs is real because corporate debt (but not equity) gives rise to the possibility of these costs being incurred. So, the upward effect shown in equation (5) is an overstatement of the true situation but a properly defined WACC would still rise with leverage due to the relative illiquidity of corporate bonds and the presence of bankruptcy costs.

Three possible solutions present themselves. The first option is the status quo, which would lead to WACC being overstated because the cost of debt is improperly defined as the promised yield rather than the expected yield plus the allowance for bankruptcy costs. The second option is to set WACC at the unlevered cost of equity (k_u), which

would lead to WACC being understated because it would ignore the relative illiquidity of corporate bonds and the presence of bankruptcy costs. The third option would be to attempt to more properly estimate WACC, which would involve estimation of debt betas and defining the cost of debt as the expected yield plus an allowance for bankruptcy costs. However, measurement difficulties would seem to rule out the last option, leaving a choice between the first option (thereby overstating WACC) and the second option (thereby understating WACC).

3. Further Considerations

The previous section has identified a number of deficiencies in the WACC model used by the Commission, which are not readily amenable to correction. However, it still remains true that WACC (even if measured in a way that properly deals with these issues) would rise with leverage. So, the question still remains as to why firms generally prefer some debt.

One possible explanation is that all firms do not offer full imputation credits on their dividends and/or all local investors cannot fully benefit from these credits. Consequently, the simplified Brennan-Lally model (which recognises only local investors) overstates the personal tax advantages of equity and adoption of the generalised version of the model (with parameter estimates that better reflect the true tax situation) *may* generate a WACC that falls with leverage, i.e., the downward effect on WACC as leverage rises due to taxes may offset the upward effect described in the previous section. However the tax effect here is likely to be small.

A second possible explanation is that many investors in New Zealand equities are foreigners, who gain only partial benefits from imputation credits, and recognition of these investors would reduce the personal tax advantages of equity. So, again, WACC *may* decline with leverage because the downward effect due to taxes may offset the upward effect described in the previous section. However, if the impact of foreign investors on the usability of imputation credits is to be considered, it would be necessary to comprehensively recognise the impact of foreign investors. In turn this would require some judgement about the extent to which national equity markets were

integrated, and an appropriate model to account for this. However these questions are highly contentious.

A third possible explanation is that debt possesses a number of qualitative advantages over equity that cannot be incorporated into WACC. These include the signalling value of debt in the presence of asymmetric information (Ross, 1977), the reduction of underinvestment problems springing from the use of equity finance (Myers and Majluf, 1984), the reduction of agency costs springing from the use of equity finance (Jensen and Meckling, 1976), the disciplinary effects of debt (Jensen, 1986), and the financial flexibility arising from debt. Prima facie, these effects seem sufficient to explain the general preference for some debt capital in spite of the conclusions presented in the previous section.

4. Conclusions

When using the simplified Brennan-Lally CAPM in conjunction with the simplified beta gearing model, WACC as usually defined rises with leverage and therefore implies that leverage is undesirable. However, the use of debt by companies is typical. This implies that companies are acting irrationally or that there is some deficiency in the models used to estimate WACC. This paper shows that there are some deficiencies in the WACC model currently employed by the Commerce Commission, but these are not readily correctable, leaving the choice between the status quo (which overstates WACC) and a simple alternative in the form of setting WACC equal to the unlevered cost of capital (which would understate WACC). Choosing between these two options is a judgement matter for the Commission.

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