

# **Estimating the Cost of Capital: CAPM variants and alternatives**

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# Introduction

1. CAPM under dividend imputation.
2. Derivation of the simplified tax-adjusted version of the CAPM commonly adopted in NZ – also called Brennan-Lally model.
3. Comparison with the Officer model.
4. Application of the simplified tax-adjusted version of the CAPM by the NZ Commerce Commission.
5. Concluding comments.

# Impact of imputation on cost of capital.

Two approaches:

1. Imputation lowers personal tax rates on cash dividends; or
2. Imputation lowers the effective corporate tax rate – i.e., part of corporate tax is a pre-payment on account of personal tax.

## The CAPM model with taxes – Lally (1992) extension of Brennan (1970)

$$k_j = d_j T_j + r_f(1 - T_I) + (TAMRP)\beta_j$$

where:

$k_j$  = expected return on risky asset j before personal tax.

$d_j$  = dividend yield on risky asset j.

$T_j$  = weighted average over investors of  $(T_{di} - T_{gi}) / (1 - T_{gi})$ .

$r_f$  = return on risk free asset.

$T_I$  = weighted average over investors of  $(T_{Ii} - T_{gi}) / (1 - T_{gi})$ .

$TAMRP$  = tax-adjusted market risk premium  
 $= r_m - d_m T_m - r_f(1 - T_I)$ .

$\beta_j$  = systematic risk (beta) of risky asset j.

## Relationship between $T_j$ and $T_I$ : (see Lally, 2000)

$$Div(1 - T_j) = (Div + U \times IC)(1 - T_I)$$

$$T_j = T_I - U(1 - T_I) \frac{IC}{Div}$$

where:

$U$  = utilisation rate of an imputation credit.

$IC$  = imputation credits distributed by the company during the period.

$Div$  = cash dividends paid by the company during the period.

# Derivation of the simplified tax-adjusted CAPM in NZ

Assumptions: A domestic CAPM

$$\begin{aligned}
 T_i &= T_c \text{ or corporate tax rate (i.e., effective rate of capital gains tax = zero).} \\
 IC/Div &= T_c / (1-T_c). \\
 U &= 1 \text{ (i.e. imputation credits fully valued or utilised).}
 \end{aligned}$$

Under these assumptions:

$$T_j = T_i - U(1-T_i) \frac{IC}{Div} = T_c - 1(1-T_c) \frac{T_c}{1-T_c} = 0; \text{ and the Brennan – Lally CAPM collapses to:}$$

$$k_j = r_f(1-T_i) + (r_m - r_f(1-T_i)) \beta_j$$

## Simplified tax-adjusted CAPM

$$k_j = r_f(1 - T_i) + (r_m - r_f(1 - T_i))\beta_j$$

This “form” of the CAPM or a model that is similar to this “form” is currently used by:

- NZ Commerce Commission – e.g. Draft Guidelines: The Commerce Commission’s Approach to Estimating the Cost of Capital.
- Many (but not all) practitioners in the New Zealand market.

This CAPM model is also “similar” to Dempsey and Partington (2007) – equation 8.

$$k_j = r_f q^B + (r_m - r_f q^B)\beta_j; \text{ where } q^B = 1 - T_I \text{ and “suggested” to be 0.70 in the Australian context? } \Rightarrow k_j = r_f(1 - .30) + (r_m - r_f(1 - 0.30))\beta_j$$

## Officer Model

$$T_j = T_1 - U(1 - T_1) \frac{IC}{Div}$$

Recall that:

$$T_1 = \text{weighted average over investors of } (T_{li} - T_{gi}) / (1 - T_{gi})$$

If tax on interest income equals tax on capital gains then  $T_1 = 0$

$$\text{And } T_j = -U \frac{IC}{Div}$$

We can then substitute back into the Brennan-Lally model or the Lally and van-Zijl (2003) model and derive the Officer (1994) versions of the CAPM and cost of capital equations where:

$$k_j = r_f + (r_m + \tau - r_f) \beta_j \text{ and } \gamma = U \frac{IC}{Tax}$$

# Impact of imputation on cost of capital

“Approaches” whereby imputation either:

- (i) lowers personal tax rate on dividends; or
- (ii) Reduces the corporate tax rate

are, in my view, “equivalent” in substance when the same set of assumptions are adopted.

# Company Valuation and cost of equity capital

$$V_0 = \frac{EBIT(1 - T_c) + V_1}{1 + k_j \frac{E}{V} + k_b(1 - T_c) \frac{D}{V}}$$

Where:

**Lally (1992)**

$$k_j = d_j T_j + r_f(1 - T_i) + (r_m - r_f(1 - T_i))\beta_j$$

Under the **simplified tax-adjusted CAPM**

$$k_j = r_f(1 - T_i) + (r_m - r_f(1 - T_i))\beta_j$$

And under the **Officer (1994)** version – equation 7.

$$k_j = [r_f + (r_m + \tau - r_f)\beta_j] \times \frac{(1 - T_c)}{(1 - T_c(1 - \gamma))}$$

## Model parameter inputs. My “take” on the NZ Commerce Commission’s Draft Cost of Capital Guidelines.

Parameter	Comment
$r_f$	Term of the risk free rate should match the regulatory review period.
Asset to equity beta.	$\beta_e = \beta_a(1 + D/E)$
$r_m - r_f(1 - T_c)$	Term of the risk free rate in the market risk premium does not have to exactly match the term of the risk free rate in the first term of the CAPM - a reasonable and practical option.
Asymmetric risks (e.g., asset stranding, adverse events but not gold plating or imprudent investment etc).	Preferred approach is to model risks in the cashflows as opposed to an increment to WACC (but will also be determined by practical considerations).

## Summary

- In general Australia and NZ have adopted a different set of assumptions in adjusting the CAPM for dividend imputation.
- These differences in adjusting the CAPM for imputation and other model input assumptions have potential implications for rate of return and company value.
- As far as I am aware in NZ we are still awaiting public release of the outcome of an external Panel review of the NZ Commerce Commission - Draft Cost of Capital Guidelines.
- A number of issues are still not resolved

Thank you.