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# Asset Valuation and The Post-Tax Rate of Return Approach to Regulatory Pricing Models.*

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**Abstract**
This paper provides an overview of the interrelationship between asset valuation concepts and cost of capital concepts involved in regulatory models proposed for the determination of access prices. It outlines the implied objectives of the regulatory framework for relationships between different concepts of asset value, and comments on whether past experience is indicative of success in achieving those objectives. A simple framework is used to demonstrate choices available to regulators in specifying a regulatory model. It is argued that a model based on determining service provider revenues that provide the nominal post tax return required by equity holders (as proposed by the ACCC, May 1999) has practical advantages over (the conceptually equivalent) real pre tax weighted average cost of capital approach. The paper outlines the interrelationships between this approach to required returns and the evolution of asset values through time as implied by the "competition depreciation" approach based on DORC projections and adjustments to the regulatory asset base at regulatory reviews.

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## 1. Introduction

There are a number of ways of measuring the value of an asset. They include:

- Accounting measures such as Historical Cost (adjusted for depreciation)
- Replacement Cost
- Market Value

In practice, these concepts give rise to different estimates of value for an asset, although competitive market conditions do suggest some tendency towards equality between at least two of the concepts. Specifically, if competition (or contestability) prevents the generation of abnormal profits (a return in excess of that required by suppliers of capital) market value should not exceed replacement cost[1]. Conversely, if assets have alternative uses wherein normal profits can be earned (and can be easily transferred to those uses), market value should not fall below replacement cost.

It is also possible, in principle – if not always in practice, to adopt accounting conventions which cause accounting values to converge to either replacement value or market value. Use of "economic depreciation" (essentially the change between reporting dates in the present value of remaining cash flows expected from the asset), would cause the accounting value to mimic market value. Use of a depreciation schedule which involves estimating the expected change between reporting dates in the replacement value of the asset (due to aging, technological change, and price changes) would lead the accounting value to mimic replacement cost.

It is possible to think of the regulatory approach to access pricing by reference to these concepts. By attempting to provide a "fair" rate of return to suppliers of financial capital, an outcome (in terms of efficiency of output, pricing and investment) which mimics that which would be observed under a hypothetical case of competition is targeted. If successful, market value of the assets (reflected in the market value of service provider) should be close to the replacement value of assets. Of course, there are many potential sources of error, not least of which is the problem caused by the fact that many regulatory assets involve "sunk" costs, and are not able to be (easily) transferred into other uses if market value in the current activity falls below replacement cost.

It is also possible to think of some aspects of the approach to the design of regulatory models in these terms. Specifically, the adoption of certain asset valuation and depreciation practices for determining the regulatory asset base may lead to closer correspondence between that and replacement (and market) value. The "competition depreciation" approach recommended in the DRP[2] in essence attempts to implement a depreciation schedule for the return of capital component of allowable revenues which would lead to the regulatory asset base approximating the replacement value of assets.

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[1] Except in the short run until new entrants or expansion of capacity in response to the abnormal returns occurs.

[2] Australian Competition and Consumer Commission *Statement of Principles for the Regulation of Transmission Revenues*, 27 May, 1999

Ideally, under the proposed regulatory framework, the market value of access providers, the regulatory asset base, and depreciated optimised replacement cost (DORC) should move closely in line.

## 2. Lessons from Past Experience

The main case study which can be called on to examine the success of regulatory approaches used to date is that of the Victorian Gas Industry. In the privatization of the gas transmission company (Transmission Pipelines Australia), this company was sold in May 1999 by the Victorian Government for just over $A 1 billion, a figure over twice the replacement value of the underlying assets. Since the regulatory regime under which the company operates should lead to future cash flows with a present value equal to (or slightly above) the replacement value of underlying assets, the gap between market value and asset replacement value presents a conundrum warranting explanation.

One possible explanation is that the “winner’s curse” has prevailed, with the successful bidder simply paying too much for the company. Since similar gaps between the privatization sale price and asset value of gas distribution companies and electricity companies (under a similar regulatory structure) appear also to have occurred, and because expected cash flows and risks are readily apparent under the regulatory regime, this seems unlikely to provide the entire (or even a large part of the) explanation.

An alternative explanation, appealing to advocates of privatization, is that the premium paid reflects the efficiency gains (beyond those assumed in the regulatory model) which the successful bidder believes can be extracted under private ownership. However, given the nature of the industry, the magnitude of likely gains in operating efficiency possible cannot explain the sale price premium. Other “operations-side” explanations are that there may be synergies available to successful bidders who also operate other power utilities, or that the other incentive features built into the regulatory model warrant a market value in excess of asset replacement cost.

Neither of these explanations appears able to explain much of the sale price premium, prompting two, mutually compatible, “finance-side” hypotheses. One hypothesis is that asset values were significantly overstated leading to two effects. First, the allowed rate of return would be on an excessive asset base. Second, the allowed return of capital would exceed the true replacement value of the assets. Hence the market value of those assets would be above the regulatory asset base. A second hypothesis is that some investors are willing to accept a rate of return lower than that used in the regulatory model. This also has two effects. First, an excessive rate of return on the existing asset base is achievable for those investors. Second, future additions to the asset base would be positive NPV projects - since the allowable rate of return exceeds that required. Again, a sale price premium would be expected.

Both hypotheses may contribute jointly to the explanation of a sale price premium in the privatisation process and to a gap between stock market valuation of access service providers and asset replacement values. It is worth noting that the existence of a “back end loaded” depreciation schedule would magnify the distorting effect of both excessive asset valuations and excessive regulatory rates of return – since the excess returns would be maintained for longer. Appendix 1 illustrates how use of the real depreciation approach (required by the pre-tax real WACC approach used in the Gas Industry Decision) implies a significant back end loading of depreciation relative to a more common straight line approach. To the extent that the complexities of the pre tax real WACC approach obscured reality and enabled those interest groups arguing for a higher regulatory rate of return to mount a more vocal and persuasive case[3], resulting errors would tend to be automatically exaggerated.

## 3. The Basic Regulatory Model

Regulatory Access Pricing models, as implemented in Australia, involve the determination of a CPI-X revenue cap, or price cap, path over the regulatory horizon based on a "building block" approach. Critical components of that building block approach are the forecast operating and maintenance expenses (dependent upon demand forecasts); return of capital (depreciation); and return on capital[4].

Alternative approaches to implementing such a model arise, *inter alia*, from different possible treatments of depreciation, inflation, and taxation. In the Victorian Gas Industry access determination, the approach was based on use of "current cost" depreciation, a real pre tax WACC, and an estimate of an effective tax rate equal to the statutory tax rate. In this approach, the "real pre tax" WACC needs to be derived from the more commonly estimated "nominal post tax" WACC by some adjustment to allow for inflation and tax liabilities. The "target revenue" stream derived by use of the equation:

*Target Revenue = Operating Costs + Return of Capital + Return on Capital*

has several important features:

- Taxes to be paid by the entity are allowed for implicitly through the estimated (real pre tax) return on capital rather than as an explicit item
- The need for the return on capital to incorporate an allowance for inflation is achieved through the use of a "current cost accounting" depreciation schedule rather than through use of a "nominal" return on capital.

In implementing this approach, significant complications arose through:

- the need to model the impact of the dividend imputation tax system on the cost of capital
- the existence of tax depreciation allowances which were quite different to (both) regulatory and "economic" depreciation schedules
- the need to develop a "conversion formula" to convert a "nominal post tax" WACC to a "real pre tax" WACC.

[3] An assessment of the relative strengths of interest groups arguing for higher versus lower regulatory rates of return, and the implications for the nature of the privatisation process outcome are contained in Kevin Davis, "Public Policy and Efficiency: Some Lessons from Reform of the Australian Gas Industry" June 1999, available at http://www.ecom.unimelb.edu.au/finwww/staff/Davis/kevin.html .

[4] In the analysis which follows certain aspects of the regulatory approach are not considered. In particular, in several places in the argument, it is assumed that the periodic regulatory horizon is equivalent to the life of the assets involved. To the extent that the regulatory approach is applied consistently across future periods this should not cause any major complications. The possibility that the newly proposed regulatory approach for the electricity industry involves a change in approach from that currently in existence does raise some potential transitional issues which are not pursued here.

The approach recommended in the *Draft Statement of Principles for the Regulation of Transmission Networks* embodies a number of significant changes in approach – reflecting concerns with the previously used method. These changes include:

- Use of a nominal post tax return on capital concept
- Use of a "competition depreciation" approach
- Explicit modeling of the expected annual tax payments of the entity for explicit inclusion in the target revenue model.
- Use of an "equity" rather than "entity" framework

These changes are not uncontroversial – although it can be shown (see Appendix 2) that the different approaches are all mutually consistent and should give rise to the same outcomes, provided the correct input parameters are used in the modeling process. If incorrect parameters are used, the model can give rise to significant undesirable wealth redistribution effects affecting regulated entities, their customers, and taxpayers. In that sense, the reasons for preferring one approach over another arise from concerns over:

- Accuracy of estimation of key parameters in each approach
- Transparency of the process
- Ease of interpretation

Since the "true" values of the key parameters in the approaches are not observable, a concern for all participants in the process is whether particular approaches are more likely to generate better estimates of the true values or be more subject to "gaming" behavior and spread of misinformation. For the "nominal post tax returns to equity approach" favoured in the DRP, several advantages can be identified. These include: the explicit modelling of tax payments and franking credits in the cash flows (rather than incorporation in the cost of capital); the avoidance of the problematic need to convert from a post tax nominal to a pre tax real rate of return; use of a nominal post tax cost of equity which is more easily interpreted than a real pre tax WACC; and an approach (due to the competition depreciation assumption) which should align market and book values of assets (and of market value of equity and net tangible assets).

## 4. Asset Values, "Competition Depreciation" and Cost of Capital

The use by the ACCC of a nominal cost of capital approach, brings with it a requirement that the depreciation schedule chosen should provide for the return of a sum equal to the original cost of the asset over its life. (In contrast, the real cost of capital approach built inflation compensation into the depreciation schedule rather than the cost of capital, so that the return of capital over the life of the asset was of an amount equal to the real value of the original cost).

It is easily shown that any depreciation schedule which returns 100 per cent of the original cost of the asset can be used in the building block approach adopted by the ACCC. Consider an asset with an initial cost of $K_0$ and a life of N years. The following table sets out net cash flows (revenue minus operating costs) which are based on a return of capital D and a return on capital rK, and the NPV of each of those cash flows. It is assumed that the rate of return on capital allowed by regulators in the determination of cash flows is the same as that used by investors in discounting future cash flows.

| **Year** | **0** | **1** | **2** | **……..** | **N** |
|---|---|---|---|---|---|
| Cash Flow | $-K_0$ | $rK_0+D_1$ | $rK_1+D_2$ | ……. | $rK_{N-1}+D_N$ |
| NPV | $-K_0$ | $(rK_0+D_1)/(1+r)$ | $(rK_1+D_2)/(1+r)^2$ | ……. | $(rK_{N-1}+D_N)/(1+r)^N$ |
| | | | | | |

Substitute $D_t = K_{t-1} - K_t$

| **Year** | **0** | **1** | **2** | **……..** | **N** |
|---|---|---|---|---|---|
| NPV | $-K_0$ | $K_0-K_1/(1+r)$ | $K_1/(1+r) - K_2/(1+r)^2$ | ……. | $K_{N-1}/(1+r)^{N-1} - K_N/(1+r)^N$ |

Adding the NPV's of the individual cash flows to get the overall NPV we can see that provided that $K_N = 0$ (ie that depreciation sums to the original asset value), the overall NPV equals 0.

It is worth reiterating that any depreciation schedule which sums to the original asset value will generate a zero NPV outcome (provided that the regulators have chosen the correct rate of return). At the start of the regulatory process (or when the asset is first purchased) the market value will equal the replacement cost. However, it should be noted that over the life of the asset, the regulatory asset base (given by initial value minus accumulated depreciation) can diverge from the replacement value – unless the depreciation schedule chosen happens to mimic changes in replacement cost.

The choice of "competition depreciation" in effect aims to achieve an outcome of the regulatory asset base tracking the replacement cost of the asset over its life. At the start of the regulatory period, a projected DORC valuation for five years hence (the end of that regulatory period) is made, and depreciation based on that difference. To the extent that the projected DORC is accurate, the regulatory asset base will approximate replacement cost, and, if the correct rate of return has been chosen, market value and replacement cost will be in close proximity.

It may be thought that this approach runs into problems of dealing with inflation since a DORC projection will reflect an assumed inflation rate over the regulatory period – and compensation for inflation is already built into the nominal rate of return. However, there is no conflict. Consider, for example, the case where an asset costing \$100 has a life of ten years and it is believed that its DORC value would be \$50 after five years if there were no inflation. If there were 5% p.a. inflation projected, the DORC value will be $\$50(1.05)^5 = \$50(1.276) = \$63.80$. Allowed depreciation over that five year period would be \$27.20 (rather than \$50 in the case of zero inflation). Note however, that allowed depreciation over the next five year period would then be \$63.80 (since the DORC value at the end of10 years would be zero). The DORC projection approach simply changes the pattern of allowable depreciation over the life of the asset.

One of the merits of this approach is illustrated in Appendix 3. There, the case referred to in the previous paragraph is set out in a spreadsheet for the alternative scenarios of a zero expected inflation rate and a five percent inflation rate. While in the latter scenario, the allowable depreciation over the first five year period is less than in the zero inflation case, the higher nominal return on capital (of 10.25% as given by the Fisher relationship, $i = r + \pi + rp$) exactly offsets the real cash flow consequences. The competition depreciation approach thus has the advantages of

- preserving (approximate) equality between the regulatory asset base and the replacement cost of assets
- making real cash flows over the life of the asset independent of the projected rate of inflation.

It should be noted that the competition depreciation approach combined with CPI-X smoothing has some implications for the path of revenues over the regulatory period[5]. The smoothing process operates as follows. Once a set of target revenues ($c_1$, ….$c_5$) for years 1 to 5 of the current regulatory period have been derived, allowable cash flows of $C_1$, ….$C_5$ are obtained as $C_t = C_{t-1}\ (1+\pi)(1-x)$ where $\pi$ is the assumed inflation rate and x is a so-called "productivity / efficiency" adjustment factor. The allowable cash flows are calculated by determining the x factor such that the PV of the series $c_1$ ….. $c_5$ equals that of $C_1$ ….$C_5$, where $c_1 = C_1$. Even if different approaches give rise to a different time path for $c_1$…. $c_5$, the CPI-X smoothing largely offsets this. There may be differences between the initial year cash flow, but these will be offset by differences in the calculated x factor such that the present value of the allowable revenue streams are equal – provided the correct parameter values are used. However, if incorrect parameter values are used, the extent of wealth redistribution may very well be significantly affected by the approach used.

In the approach adopted by the ACCC, the CPI-X smoothing in determining the allowable revenue stream is to some extent redundant[6]. Because the allocation of depreciation over the regulatory period is based on constant real amounts per year, the resulting nominal cash flow stream already exhibits a steady growth rate. The implied x factor can be calculated, but does not lead to any adjustment to the cash flow stream. It is however, relevant in adjusting allowable cash flows within the regulatory period to reflect deviations of actual inflation from the inflation rate predicted at the start of the period.

It is worth asking what interpretation can be placed on the "x" adjustment factor. It can be shown that the x factor will be zero if the allocation of depreciation over the regulatory horizon is based on a "real annuity approach". In this case, the annual allocation of depreciation is back-end loaded to an amount which means that the real cash flows generated from the model are constant over the period. Since in that case, $c_t = c_{t-1}(1+\pi)$, the x factor used to derive allowable cash flows ($C_1$…. $C_5$) will clearly be zero. If the depreciation schedule is more "back loaded" than the real annuity schedule, the x factor derived will be negative. This reflects the fact that the initial period cash flow is less than for the real annuity case and that a steeper increase in future period cash flows is necessary to achieve the same NPV over the regulatory period. Conversely, if the depreciation schedule is more "front loaded" than the real annuity schedule (such as in the case of a straight line allocation), the x factor will be positive. Thus, the "x" adjustment factor has nothing to do with efficiency or

[5] Generally the process of determining a CPI-X price (or revenue) path over the regulatory horizon can significantly moderate the effects of the approach taken to determining the "target revenue".

[6] It is not completely redundant for two reasons. First, the analysis used here ignores the role of operating costs and focuses solely on net cash flows. Projected annual variations in demand and thus in operating costs could have an effect. Second, the ex post adjustment of allowable cash flows to actual inflation requires knowledge of the x factor.

productivity issues, but is an immediate consequence of the choice of depreciation schedule over the regulatory period. The approach adopted by the ACCC of constant real allocations of depreciation over the regulatory period means that a positive x factor can be expected. Simulations suggest that a figure in the region of 3 per cent p.a. can be expected, with higher values for higher real rates of return. (The x factor is unaffected by the assumed rate of inflation).

## 5. Conclusion

The “competition depreciation” approach advocated by the ACCC, together with the “building block” approach should, if regulatory determination of initial asset values and required rates of return are correct, lead to close correspondence between the regulatory asset base, the replacement cost of assets, and the market value of those assets.

This is a desirable feature of the approach, and is enhanced by the choice of a post tax nominal returns to equity approach to the determination of revenue streams. Such an approach is more transparent than the real pre tax WACC approach previously adopted, so that causes of discrepancies between those asset valuation concepts are hopefully, more likely to be readily identified and corrected.

## Appendix 1
## The Back-End Loading of the "Real Depreciation" Approach

| | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| **Nominal Depreciation Approach – straight line depreciation** | | | | | | |
| Capital – Kt | 100 | 80 | 60 | 40 | 20 | 0 |
| Depreciation - Dt | | 20 | 20 | 20 | 20 | 20 |
| Cash Flow – Ct | | 35.5 | 32.4 | 29.3 | 26.2 | 23.1 |
| **Corresponding Real Depreciation Approach** | | | | | | |
| $K_{t-1}*(1+\pi)$ | | 110.0 | 96.8 | 79.9 | 58.6 | 32.2 |
| Dt* | | 22.0 | 24.2 | 26.6 | 29.3 | 32.2 |
| Kt* | 100.0 | 88.0 | 72.6 | 53.2 | 29.3 | 0.0 |
| $Ct^* = rK_{t-1}^*(1+\pi) + D_t^*$ | | 27.5 | 29.0 | 30.6 | 32.2 | 33.8 |
| *Implied Nominal Depreciation Equivalent* | | | | | | |
| $iK_{t-1}$ | | 15.5 | 13.6 | 11.3 | 8.3 | 4.5 |
| D (implied) = $C_t^*$ $-iK_{t-1}$ | | 12.0 | 15.4 | 19.4 | 24.0 | 29.3 |
| $C_t^*$ | | 27.5 | 29.0 | 30.6 | 32.2 | 33.8 |
| K (implied) | | 88.0 | 72.6 | 53.2 | 29.3 | 0.0 |

**Assumptions**

| | |
|---|---|
| i | 15.5% |
| π | 10% |
| r | 5% |

## Appendix 2
## The Nominal, Post – Tax, Returns to Equity Approach

To examine alternative approaches, the following definitions are used:

$TR_t$ = target revenue in year t

$OC_t$ = operating costs in year t

$D_t$ = depreciation in year t

$K_{t-1}$ = capital at start of year t

$B_{t-1}$ = debt at start of year t

$E_{t-1}$ = equity at start of year t

$r_b$ = cost of debt

$r_e$ = cost of equity (partially grossed up measure)

$T_t$ = tax paid in year t

$FC_t$ = value of franking credits distributed in year t

(Note that $FC_t$ equals $\gamma$ times the dollar value of franking credits distributed and, if there is a 100 per cent distribution of franking credits generated each year, $FC_t = \gamma.T_t$).

It is assumed that capital structure is maintained such that $B_t = bK_t$, i.e. that debt is a constant proportion of the value of capital, and $E_t = (1-b)K_t$. Under these assumptions, and ignoring working capital and additions to capital, a target revenue specification for returns to the entity, which is after tax but which incorporates the value of franking credits would be:

$$\mathbf{TR_t = OC_t + D_t + r_e (1-b) K_t + r_b\, b\, K_{t-1} + T_t - FC_t} \qquad \textbf{Equation 1}$$

Denoting $r_o = r_e(1-b)+ r_b.b$ as a (non standard)WACC, this permits a return on funds employed ($r_oK_{t-1}$) plus return of capital $D_t$, plus coverage of operating costs $OC_t$, plus payment of company taxes ($T_t$) less the value of any franking credits distributed. Denoting operating cash flows (C) as

$$\mathbf{C = TR\text{-}OC}$$

and noting that

$$\mathbf{K_t = K_{t-1} - D_t}$$

it is possible to rewrite equation 1 as:

$$\mathbf{C_t = K_{t-1} - K_t + r_e (1-b) K_{t-1} + r_b\, b\, K_{t-1} + T_t - FC_t} \qquad \textbf{Equation 2}$$

so that:

$$\mathbf{C_t + K_t - T_t + FC_t = (1-b) K_{t-1} (1+ r_e) + b\, K_{t-1}(1+ r_b)} \qquad \textbf{Equation 3}$$

Noting that E=(1-b)K and B=bK (so that E+B=K) gives

$$\begin{aligned}\mathbf{C_t + K_t - T_t + FC_t} &\mathbf{= E_{t-1}(1+r_e) + B_{t-1}(1+r_b)} \\ &\mathbf{= E_{t-1}+B_{t-1} + E_{t-1}r_e + B_{t-1}r_b} \\ &\mathbf{= K_{t-1} [1+r_o]}\end{aligned} \qquad \textbf{Equation 4}$$

where $r_o = r_e(E/K)+r_b(B/K)$ is a version of the WACC.

Equation 4 is a one period present value relationship which relates operating cash flow plus end of period capital value minus taxes paid plus value of franking credits paid to the starting asset value. Note that

- The cost of debt is before tax
- The tax is calculated to include the interest tax shield (i.e. actual tax paid is used)

An alternative specification which could be used is to calculate tax cash flows *as if* the company were unlevered, so that $T_t$ on the LHS of equation 4 can be written as:

$$\mathbf{T_t = t\ EBDIT - OTS - ITS}$$

where OTS is other tax shields (depreciation) and ITS is the interest tax shield). Noting that ITS = $tr_bB_{t-1,}$ and writing

$$\mathbf{T(unlevered)_t = tEBDIT - OTS}$$

Gives

$$\mathbf{C_t + K_t - T(unlevered)_t + FC_t = (1\text{-}b)\ K_{t-1}\ (1+ r_e) + b\ K_{t-1}\ (1+ r_b)\text{-}tr_bbK_{t-1}}$$

$$\mathbf{C_t + K_t - T(unlevered)_t + FC_t = K_{t-1}\ [\ 1 + (E/K)r_e + (B/K)r_b(1\text{-}t)]}$$

Or

$$\mathbf{C_t + K_t - T(unlevered)_t + FC_t = K_{t-1}\ [\ 1+ wacc]}$$

Note that this approach

- Uses the after tax cost of debt in the calculation of the wacc
- Calculates taxes *as if* the company were unlevered
- Uses the "partially grossed up" cost of equity measure
- Assumes that the value of franking credits created and distributed is unaffected by the debt position and size of the interest tax shield.

Particularly because of the last requirement, this approach is not recommended.

### Returns to Equity Approach

The target revenue model could alternatively be specified using the "returns to equity" approach, by calculating a target revenue net of interest costs which generated the required return to equity. The complication which arises here is that the "return of capital" in the form of depreciation is partially a return of capital to providers of debt finance, and thus needs to be recognised. Commencing with equation (1) which depicted returns to all providers of credit

$$\mathbf{TR_t = OC_t + D_t + r_e\,(1\text{-}b)\ K_{t-1} + r_b\ b\ K_{t-1} + T_t - FC_t} \qquad \textbf{Equation 1}$$

note that of these returns some part will go to debt holders. Since debt outstanding is linked to capital by B = b K, cash flows to debt holders in period t ($C_t^b$) will comprise:

$$\mathbf{C_t^b = r_b\ b\ K_{t-1} + bK_t - bK_{t-1}}$$

Denoting cash flows to equity by $C_t^e$ and noting that:

$$\mathbf{C_t^e = C_t - C_t^b}$$

rearranging equation (1) gives:

$$C_t^e = K_{t-1} - K_t + r_e(1-b)K_{t-1} + T_t - FC_t + bK_t - bK_{t-1} \qquad \textbf{Equation 5}$$

or

$$TR_t = OC_t + D_t + r_e(1-b)K_{t-1} + T_t - FC_t + b(K_t - K_{t-1}) \qquad \textbf{Equation 6}$$

so that

$$\begin{aligned} C_t^e + K_t(1-b) - T_t + FC_t &= K_{t-1}[1-b+r_e(1-b)] \\ C_t^e + E_t - T_t + FC_t &= (1-b)K_{t-1}(1+r_e) \\ &= E_{t-1}(1+r_e) \qquad \textbf{Equation 7} \end{aligned}$$

It can be seen that equation 7 is a present value relationship which links cash flows to equity holders after all tax (with value of franking credits added back) plus end of period equity value (as a proportion of capital stock) to the start of period equity value. The discount rate required is the nominal cost of equity capital (partially grossed up). Equation 6 provides the "target revenue" model for the equity based approach. Target revenue to equity holders must cover operating costs plus depreciation plus the "partially grossed up" return on equity (from the CAPM) plus total tax paid net of the value of franking credits distributed. In addition, the target revenue needs to be adjusted for the net flow of debt capital required to maintain capital structure unchanged.

# Appendix 3
## Competition Depreciation and Inflation

| Year | 0 | 1 | 2 | 3 | 4 | **5** | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Zero Inflation Case* | | | | | | | | | | | |
| DORC projection | 100 | 90 | 80 | 70 | 60 | **50** | 40 | 30 | 20 | 10 | 0 |
| Depreciation - Dt | | 10 | 10 | 10 | 10 | **10** | 10 | 10 | 10 | 10 | 10 |
| Return on Capital | | 5 | 4.5 | 4 | 3.5 | **3** | 2.5 | 2 | 1.5 | 1 | 0.5 |
| Cash Flow | | 15 | 14.5 | 14 | 13.5 | **13** | 12.5 | 12 | 11.5 | 11 | 10.5 |
| *5% Inflation Case* | | | | | | | | | | | |
| DORC projection | 100 | 94.5 | 88.2 | 81.0 | 72.9 | **63.8** | 53.6 | 42.2 | 29.5 | 15.5 | 0.0 |
| Depreciation - Dt | | 5.5 | 6.3 | 7.2 | 8.1 | **9.1** | 10.2 | 11.4 | 12.7 | 14.0 | 15.5 |
| Return on Capital | | 10.3 | 9.7 | 9.0 | 8.3 | **7.5** | 6.5 | 5.5 | 4.3 | 3.0 | 1.6 |
| Cash Flow | | 15.8 | 16.0 | 16.2 | 16.4 | **16.6** | 16.8 | 16.9 | 17.0 | 17.1 | 17.1 |
| Cash Flow - real value | | 15.0 | 14.5 | 14.0 | 13.5 | **13.0** | 12.5 | 12.0 | 11.5 | 11.0 | 10.5 |
| Assumptions | | | | | | | | | | | |
| i | 10.25% | | | | | | | | | | |
| $\pi$ | 5% | | | | | | | | | | |
| r | 5% | | | | | | | | | | |