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Risk Sharing Arrangements in Australian Regulatory Access Pricing*

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Abstract: The determination by regulators of access prices in the case of natural monopolies involves judgements about the sharing of risks between suppliers and customers and the appropriate compensation for risk bearing. An important focal point of the debate in Australia has been the determination of an appropriate cost of capital for regulated industries, but other important considerations include the regulatory treatment of such things as "asymmetric risks", technological change and "asset stranding", and regulatory risk. This paper provides an overview of how risk sharing has been handled in the Australian regulatory framework.

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1. Introduction

Across a wide range of industries exhibiting features of natural monopoly, Australaian regulatory bodies[1] such as the ACCC, IPART, ORG, QCA, ACA are required to make determinations on "access prices" – the prices which monopoly suppliers are allowed to charge those wishing to access that service. Examples include gas and electricity transmission and distribution services, airport facilities, rail services, and telecommunications services[2]. In making such determinations, regulators are charged with developing a fair and efficient regime for setting prices, which encourages efficient usage of those services, appropriate investment in the regulated industry, and incentives for improvements in operational efficiency.

The determination of access prices is a complex, and usually controversial, process, not least because of the need to identify and appropriately compensate, through the price setting process, risk bearing activities of the service suppliers. Since the design of the regulatory system can itself affect the sharing of risk between suppliers and their customers (and taxpayers), regulators must also consider the appropriate allocation (as well as pricing) of risk.

Most of the debate surrounding risk issues and access pricing in Australia has focused on the appropriate compensation for risk in the determination of the cost of capital. This is hardly surprising. The industries involved are generally characterised by large capital outlays relative to operating costs, such that compensation for the opportunity cost of capital tied up in the industry (the return on capital) and return of capital invested dwarf operating expenses in the determination of required revenue streams. In many cases the investments involve "sunk costs", where the assets have limited or no other feasible uses, creating extra complications for the determination of appropriate risk sharing arrangements and compensation for risk bearing.

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[1] Access price regulation responsibilities are currently the responsibility of both Federal and State government authorities. The ACCC(Australian Competition and Consumer Commission) and the ACA(Australian Communications Authority) are federal bodies, while authorities such as IPART (Independent Pricing and Regulatory Tribunal), ORG (Office of the Regulator General), QCA (Queensland Competition Authority) are state bodies.

[2] Access pricing determinations of the ACCC can be found at their web site http://www.acc.gov.au , together with links to other regulatory web sites and determinations.

The objective of this paper is to provide an overview of the approach to risk assessment, risk sharing, and compensation for risk adopted by Australian regulators to date, and identify important, and in some cases unresolved, issues. The paper provides, in section 2, an overview of the basis of the regulatory model adopted by Australian regulators which provides a framework for identifying and clarifying risk related issues which have occasioned debate. These include the treatment of systematic versus non-systematic risk, the treatment of “asymmetric” risks, the risk of “asset stranding”, allocation of inflation risk, determination of systematic risk, regulatory risk. Since the structure of the regulatory system can itself influence the allocation of risk, section 3 addresses this issue and includes a brief digression outlining how to determine the cost of capital for Community Service Obligations (CSOs) as an illustration of this point. In Section 4, the issues of “asymmetric” risks and “asset stranding” and their treatment in the regulatory framework are considered, while section 5 provides an overview of some of the contentious issues in the determination of an appropriate rate of return.

2. The Regulatory Approach to Access Pricing

In Australia, regulators have adopted a “building block” approach to the determination of access prices, based upon a relatively simple framework which identifies a target revenue stream for the regulated firm[3]. The target revenue model (ignoring, for ease of exposition, the treatment of additions to the capital stock) is based on a version of Equation 1:

Total Revenue = Operating Costs + Return of Capital + Return on Capital **[1]**

Equation 1 states that in any year, total revenue should be sufficient to cover projected operating costs (based on demand projections), an appropriate return of capital (depreciation), and an appropriate return on capital. Once a revenue target is determined, a per unit price to achieve that target can be set based on projected

[3] ACCC (1999) provides an overview of the approach (together with discussion of reasons for changing the framing of the approach from one considering real pre tax returns to all providers of capital to one considering nominal post tax returns to providers of equity capital).

demand[4]. Incentives for improved efficiency are built into the system by (for example) allowing the regulated firm to profit (for some period) from reductions in operating costs below those projected.

If applied over the life of the asset in question, such that the cumulated return of capital just equals the original cost, equation 1 is equivalent to a zero NPV (or "fair pricing") condition[5]. To see this, consider an initial investment of K_0 in an asset with a life of N years for which the required rate of return is r% p.a.. Denote net cash flows (revenue minus operating costs) in period t by C_t. Suppose per period cash flows are set equal to $C_t = r.K_{t-1} + D_t$ where D_t is depreciation in period t, and K_{t-1} is the written down book value of the investment at the end of year t-1 (so that $K_t = K_{t-1} – D_t$). The cash flows thus comprise a return *of* capital (D_t) and a return *on* capital (rK_{t-1}). For any depreciation schedule (D_1,…… D_N) where D_1 + …. + D_N = K_0, the investment will have an NPV=0.

This can be seen by reference to the following table which sets out net cash flows which are based on a return of capital D and a return on capital rK, and the NPV of each of those 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 each cash flow to get the overall NPV we can see that provided that $K_N = 0$ (ie that D_1 + …..+ D_N = K_0), the overall NPV = 0.

[4] Typically projections of the composition of demand will be also needed for multi output activities and the pricing structure may not a simple per unit price.
[5] See, for example Schmalansee (1989) for further discussion of this point.

Note that this zero NPV demonstration also applies in an *ex ante* expected sense to investment decision making. If it is expected that annual revenues will cover annual operating costs plus return of the original investment over the life of the asset plus a return on capital each year equal to the required rate of return applied to the written down asset book value, then the investment will be worth undertaking.

Precise formulation, and implementation of this model for regulatory determination of access prices involves a number of conceptual and practical difficulties[6], many of which relate to risk sharing and compensation. For example, the *regulatory horizon* is of short duration (typically five years) relative to the asset life, such that a sequence of regulatory determinations is to be made over the life of the asset. For the current regulatory period, forecasts of output, operating costs, and inflation are among those required. How the regulatory model permits revenues and prices to be adjusted in response to forecast errors in such variables is clearly an important aspect of risk sharing between the regulated firms and their customers. These factors may impact upon the determination of an appropriate *rate of return* to compensate investors for risks associated with provision of funds.

Over the longer term, the regulated firms face the prospect of *regulatory risk*, reflecting several factors. One is that the rules applied by regulators and governments may change from one regulatory period to the next. A second is that regulatory reviews involve a resetting (updating) of key parameters in the regulatory model. The significance of this can be seen by noting that the preceding demonstration of the zero NPV result assumed that the rate of return *allowed* by regulators in determining cash flows is the same as that used by investors in discounting future cash flows. If regulators set a different rate of return to the (unknown) rate required by investors, windfall gains or losses can occur. Such a resetting of key parameters in response to market developments is also relevant to the nature of market risks borne by the

[6] Some fundamental ones include: whether to focus on cash flows to the *entity* or to *equity* holders; how to allow for taxation; whether to use a real or nominal rate of return framework; what depreciation schedule to adopt; how to determine initial asset values in the case of application of the regulatory regime to existing activities.

regulated entity over the life of the asset and thus to the determination of the required rate of return. This is considered in Section 5.

Also relevant over the longer term (but not confined to the distant future) are the risks associated with unanticipated changes in operating costs or in demand. For example, a particular investment in a sunk asset may prove to be a failure due to an absence of demand for that service, creating what is referred to as a *stranded asset*. With no demand, it is not possible to generate revenues. If there is some possibility of asset stranding, then use in the regulatory model of a typical depreciation schedule allowing 100 per cent of original purchase price will not lead to an *expected* return of capital equal to the original purchase price. This is taken up in Section 4. Likewise, an unexpected event (such as a fire) which interrupts ability to provide service and creates unexpected costs in particular periods creates another potential complication, particularly if such risks are one-sided or *asymmetric*. The appropriate treatment of such *asymmetric risks* is also taken up in Section 4.

3. Regulatory Design and Risk Allocation

The structure of the regulatory system affects the allocation of risk associated with the provision of access services[7]. To illustrate this point, this section provides first a brief digression on the cost of capital for the provision of *Universal Service Obligations (USOs)* in telecommunications. This gives a stark illustration of how regulatory design affects risk bearing. Following that, some general features of regulatory design in Australia and implications for risk bearing are considered.

The Cost of Capital for USOs[8]

USO’s occur when a service provider is required by government to provide services by investing in a project which is expected to be unprofitable, but deemed necessary for social reasons. Should the return not be “adequate” compensation is paid sufficient

[7] Crew and Kleindorfer (1996) provide an overview of different styles of incentive regulation approaches. See also Australian Treasury (1999).

[8] This discussion and that in the appendix relates to the USO scheme for telecommunications which applied in Australia for the period 1997-98 until 1999-2000.

to bring the sum of project return and compensation up to the “adequate” level. If the return exceeds the “adequate” amount, no compensation is paid, nor is there any claw back of the excess return. Some (such as the USO service providers) have argued that an “adequate” return should be based on a rate of return involving compensation for risk derived using the project’s underlying beta. However, because of the operation of the compensation scheme it can be shown (see Appendix 1) that a rate of return at (or even below) the risk free rate (ie a cost of capital associated with a zero beta) is appropriate.

The reason why the regulatory rate of return is below the risk free rate and below the required rate of return for a “normal” project is straightforward. Investors in risky assets require an expected rate of return above the risk free rate of return because of the possibility of bad (and good) outcomes different from the expected return. If the downside risk is taken away by the compensation scheme, the rationale for the higher required rate of return disappears. The required rate of return has nothing to do with the physical characteristics of the project – the fact that the physical assets might be used in some other location to generate a higher rate of return is irrelevant. The required rate of return is the return that suppliers of funds used to purchase those assets require given the risk characteristics of the payoffs arising from use of those funds. Only if there were some form of capital rationing in place (such that use of financial capital to undertake a USO project meant that another non USO project could not be undertaken) might there be some argument for use of the underlying asset required rate of return for calculating compensation. In a free capital market, such as Australia, that is not a relevant consideration.

Risk sharing arrangements for Inflation and Demand forecast errors

The regulatory approach used in Australia derives an initial set of target revenues for the 5 year regulatory horizon, and then applies a “CPI-X” smoothing adjustment (based on projected inflation) to ensure that expected nominal revenues (and/or prices) grow at a steady rate over that period.[9] The revenue path thus derived provides

[9] The methodology involves finding a CPI-X price path such that the present value of those revenues equals that arising from the initial outcome of the target revenue model. It should be noted that the “X”

for an "appropriate" rate of return provided that the inflation and product demand outcomes match those projected.

Inflation risk is largely passed onto customers, since prices during the regulatory period are adjusted in line with the CPI outcome (minus the X factor). Consequently the real rate of return achieved by the regulated firm will be largely unaffected by the actual inflation experience over the regulatory period.

The treatment of deviations of demand from that projected may vary between regulated industries. In some cases (such as electricity), the regulatory framework involves determination of a revenue cap. In others (such as gas, airports) it involves determination of an average revenue (or price) cap, and require annual adjustments to the average revenue cap to offset the revenue consequences of deviations of demand outcomes from those forecast.

These arrangements together with incentive mechanisms built into the regulatory approach are relevant for the determination of systematic risk faced by access providers and thus the required rate of return. Since such factors differ between national regulatory systems, it is not necessarily appropriate to assume that the *asset beta* for a similar activity elsewhere can be adopted for the Australian industry. Whether the Australian regulatory scheme leads to higher or lower systematic risk than regulatory schemes in operation elsewhere is a contentious question warranting further study[10].

4. Asymmetric Risks and Asset Stranding

The appropriate treatment of two types of idiosyncratic risk has occasioned much debate in the determination of access prices. Many protagonists have argued that required rates of return should be adjusted (upwards) to allow for these types of risk. For two reasons, that is not appropriate, and some other means of allowing for such

factor has nothing to do with efficiency/productivity improvements, but is a result of the shape of the depreciation schedule assumed in the regulatory model.

[10] Lewellen and Mauer (1993) examine analytically the relationship between risk and various types of incentive regulation. Alexander, Mayer and Weeds (1996) compare the systematic risk of similar industries operating in different countries under different types of regulation and suggest that systematic risk is higher in countries with incentive regulation than in those with rate of return regulation.

risks must be found. First, since the regulatory authorities have adopted a Capital Asset Pricing Model as the basis for determining rates of return, adjustment of CAPM based rates of return for idiosyncratic risk would seem inconsistent with the premise that only systematic (non-diversifiable) risks should be priced. Second, given the multi-period nature of the problem under consideration, ad hoc adjustment of rates of return builds in potentially inappropriate (and generally unclear) assumptions about the evolution of risk through time. For these reasons, it is appropriate to examine how such risks can be otherwise allowed for in the modelling of allowable cash flows.

Asymmetric Risks

The term asymmetric risk has been used to refer to such things as disasters (such as fire, flood, earthquake) which prevent the operation of the business for a period and prevent the generation of revenues or lead to higher operating costs due to required repairs to plant and equipment. Strike activity preventing the business from operating would be another example. The characteristic of such events is that they involve adverse consequences for the business relative to the projected financial statements, and are not matched by the possible occurrence of good news events.

In principle, such risks cause no problems for the regulatory approach. At the start of the regulatory horizon, it is necessary to make projections of *expected* (ie *mean*) operating costs and demand. The figures used should thus take into account the probability of such adverse events occurring. The complication which arises in practice is that most projections appear to be interpreted (and formulated) by practitioners in the context of the *most likely* (ie *modal*) outcome. If there is a small probability of an adverse event occurring (not offset by a positive probability of fortuitous events), the mean will lie below the mode. If modelling is undertaken using the modal figures, appropriate account will not be given to such adverse events.

In principle, the solution is simple. One possibility is to assign probabilities for the occurrence of such adverse events, and adjust the projections of operating costs and demand to reflect this. Another, is to estimate the actuarially fair insurance premium for protection against such events and include it as an additional imputed element of operating costs. In practice, of course, making such adjustments allows considerable scope for judgement (and gaming behaviour), and there may be concerns that profit outcomes will tend to appear excessive *ex post* in the high frequency event that no adverse event occurs. Nevertheless, making such adjustments to the cash flow components of the building block approach is much preferable to making an ad hoc adjustment to the required rate of return.

Asset Stranding

Asset stranding relates to the situation where an investment has been made in a sunk asset which has turned out to be a poor investment unable to generate adequate cash flows[11]. For example, construction of a gas pipeline to a planned residential development that does not eventuate would fall into this category. Likewise, investment in some network which unexpected technological change makes redundant through emergence of some much cheaper alternative, has similar characteristics.

The problem which this gives rise to is that lack of demand for the service means that revenues cannot be generated to provide either a return of capital or a return on capital for that investment. Ex post, the investment is a negative NPV project. In itself, that is not a problem for the regulatory model, as long as ex ante, the project is a zero NPV project. However, to achieve that latter outcome, a subtle adjustment needs to be made to the regulatory model if there is some positive probability of asset stranding over the life of the asset. For the NPV to be zero ex ante, the *expected* future cash flows required an *expected* amount of depreciation equal to the original investment amount. Implementing the regulatory model with a depreciation schedule which implies 100 per cent depreciation *in the event that* stranding does not occur means that the expected depreciation amount is less than 100 per cent.

There appears to be four possible ways to overcome this problem. The first is to assign some probability to stranding and allow for a depreciation schedule which could involve a return of capital in excess of 100 per cent (if stranding does not occur), but which has an expected value of 100 per cent. The problem here lies in the practicality of forecasting the probability of stranding. The second is to provide some

[11] Kolbe and Borucki (1998) suggest that increased possibility of asset stranding can affect the systematic risk and cost of capital of a regulated utility.

ex post compensation to regulated businesses which suffer asset stranding. The problem here lies in the political practicality of such compensation payments. A third is based on noting that the likelihood of stranding is often observable several years in advance of occurrence, such that it may be possible to adjust the revenue schedule to provide for a full return of capital prior to stranding. The problem here is the one of the ability of the (disappearing) market to bear the implied increase in service price. A fourth approach is to note that most service providers will have a portfolio of assets, only some of which may be stranded. Provided that the regulatory model operates on a firm wide basis, the total revenues of the business can provide for return on and return of the capital tied up in the stranded asset. In essence, other customers bear the cost of the asset stranding.

5. Determining Required Returns

One of the most contentious aspects of the regulatory process has been the determination of the regulatory rate of return. For the Victorian Gas Industry and in a number of subsequent cases, a value for a real pre tax WACC to apply over the initial five year regulatory horizon was required. The approach adopted by all contributors to the debate was to first estimate the nominal post tax WACC, and then adjust this value for taxation and inflation factors to calculate the real pre tax WACC. That process of adjustment (and results derived) is itself controversial[12]. In that case, the regulators decided upon a real pre tax WACC value of 7.75% p.a.. Subsequently, those businesses were privatised and sold at multiples of around twice the replacement value of assets – suggesting that the allowed rate of return was significantly higher than that required by investors in those businesses. It is instructive therefore to look at some of the inputs into the cost of capital determination in order to assess potential sources of over estimation.

The WACC formula used in early access determinations was

$$r_o^i = r_e \frac{E}{V} . \frac{(1-T)}{(1-T(1-g))} + r_d . \frac{D}{V} .(1-T) \qquad \textbf{[2]}$$

[12] Davis (1999) provides a demonstration of the errors involved in alternative approaches proposed for making this adjustment.

which is based on one of the formulas contained in a paper by Officer (1994). In this formulation, E, D and V are the market values of equity, debt and total firm value respectively and T is the actual company tax rate (36%). γ is a parameter representing the "valuation" of franking credits, and is a measure of the reduction in direct personal tax payments which follow from the distribution of $1 of franking credits. r_e and r_d represent the required (expected) returns of shareholders and debt holders respectively where r_e is defined as a "partially grossed up" rate of return on equity. In essence, it is the "traditional" rate of return (dividend cash flow plus capital gains) plus some proportion (γ) of the franking credits paid out with dividends.

Because r_e is a partially grossed up rate of return, it is not directly applicable to the valuation of cash flows as conventionally measured (i.e. as the cash flows after tax, calculated as if the company were unlevered). Consequently, r_e is adjusted in the formula by $(1\text{-}T)/[1\text{-}T(1\text{-}\gamma)]$ which is less than one if $\gamma>0$. The amended WACC as given in equation 2 is thus applicable to cash flows of the company (calculated on an assumption of zero leverage) after tax.

The treatment of the dividend imputation taxation system implicit in the WACC formula used is an *ad hoc* approach to the treatment of taxation derived by Officer by rearrangement of zero NPV valuation formula for perpetuity cash flows taking the form of only fully franked dividends, and assuming that an "average" valuation of franking credits is relevant to valuation.

More recently, the ACCC has moved towards specification of the target revenue model in a *nominal post tax returns to equity* format[13]. This means that company tax cash flows (net of franking credits) and cash flows to providers of debt finance are modelled explicitly (as a cost to equity holders). Moreover, required returns are expressed as nominal returns, so that inflation compensation for decline in the real value of capital invested occurs through the required rate of return (rather than through a current cost depreciation schedule).

To estimate the nominal post tax WACC, values for the components of equation 2 are required. These include: the cost of equity (r_e), the cost of debt (r_d), the optimal leverage (D/V), the average valuation of franking credits (γ), the effective tax rate (T).

Figure 1 provides a schematic overview of the parameters involved and their interrelationships. Values suggested for several of these have elicited considerable controversy. Moreover, given the diverse incentives of participants in the process, "cherry picking" behaviour is common – with different parameters suggested by the regulators occasioning different degrees of support from participants. In what follows, some of the issues which have caused controversy in determination of an appropriate return to reflect risk taking by providers of capital are briefly examined.

The cost of equity: While it has been generally accepted that the CAPM might be used to calculate the cost of equity, determining numerical values for its ingredients has been controversial. Given the CAPM equation of:

$$\mathbf{E(r_e) = r_f + b_e\,[\,E(r_m) - r_f\,]} \qquad \textbf{[3]}$$

debate over appropriate values for the risk free rate (r_f), the market risk premium [$E(r_m) - r_f$], and systematic risk (β_e) has been fierce.

The Risk free rate: Two issues have been controversial.

- The first has been the question of whether a "rate on the day" (of the determination) or "historical average" (over some recent months) should be used. When interest rates have been declining (increasing) use of an historical average would lead to a significantly higher (lower) risk free rate than using a rate on the day approach, and applicant preferences between the alternatives appear to vary with the recent historical experience! The main justification however has been on the grounds of "smoothing" the likely change in the WACC at the start of the next regulatory five year cycle. While some smoothing might occur, the level of serial correlation in interest rates suggests that this will be a relatively minor effect. More specifically, there appears to be no grounds in finance theory for such an approach.

- The second has been the choice of maturity. Here, theory provides little guide – since the CAPM is a one period model and the problem at hand is a multi-period one. A common practical response is to "match" the choice

[13] See ACCC(1999)

> of the risk free rate maturity to the duration of the assets. Many applicants have argued that since assets are long lived, a long term risk free rate is appropriate. The alternative view, adopted by the regulators is that while the assets are long lived, the duration of the cash flows is of less than five years – since future cash flows are to be reset at each horizon date in line with movements in market interest rates and required returns. To compensate investors for bearing long tem interest rate risk, when they are protected against this by the regulatory review process would be unwarranted[14].

The Market Risk Premium: the market risk premium in equation 14 involves a "partially grossed up" return on equity over the risk free rate. Conventional wisdom (based primarily on historical data collected by Officer, 1992) is that the appropriate value for Australia is in the range of 6-8 per cent p.a. Notably, there is a rapidly growing literature which make two important points. First, various authors (eg Mehra and Prescott, 1985) have demonstrated that such premia are higher than can be realistically explained by "normal" estimates of risk aversion. Second, several recent studies have presented cogent arguments (such as survivorship bias) as to why observed historical (ex post) premia derived from particular markets may not be good proxies for expected (ex ante) premia on which financial decisions are based. In Australia, the issue is clouded further by the introduction of dividend imputation and changed capital gains tax treatment in the mid 1980s which, by altering the relative tax treatment of equities versus debt securities, may have significantly affected the market risk premium[15].

Systematic Risk (b): In the absence of traded equity prices for gas transmission and distribution companies in Australia, estimates of systematic risk must be derived indirectly. Considerable evidence is available on equity betas of comparable international energy companies, which might be used to derive gas industry asset

[14] Davis (1999, Appendix 1) provides a fuller demonstration of the argument

[15] It is also worth noting that Officer's calculations involve comparison of the average over the period specified of yield to maturity on ten year bonds with the average of one year holding period returns on the All Ordinaries Index. An alternative calculation, which matches up the risk free holding period with that on the market generates a premium (ignoring franking credits) for the last three decades of around 4 per cent – for both long and short term holding periods. (Davis, 1998). If the value of franking credits were added in (although many commentators have argued that they have very little value) the "partially grossed up" market risk premium thus calculated might be as much as six per cent.

betas (equivalent to the equity beta of an unlevered company) by a "delevering" process. Australian equity beta estimates can then be obtained for an assumed level of gearing by reversal of the delevering process. Issues which have proved controversial here include:

- the leverage adjustment formulae used which need to reflect the different taxation systems in place in different countries
- the appropriate value to use for the beta of debt in the levering /delevering formula
- the appropriate level of leverage
- the effect of different regulatory environments on systematic risk

Notably, much of the discussion about the "risk" associated with the industry, and forming the basis for assertions about the appropriate value of beta, has related to non systematic risk factors.

The optimal degree of leverage: The degree of leverage is relevant for both the determination of the cost of equity and the weighting of the components of the WACC. Notably, industry participants have argued strongly that the degree of leverage could be expected to be much higher than that adopted by comparable overseas utilities. Given the lower tax shield associated with debt under an imputation system relative to a classical tax system, the rationale for this is perplexing. One explanation might be that in certain regulated industries, given the projected long term tax loss positions of the businesses, imputation is largely irrelevant. However, since this means that the present value of debt tax shields is significantly reduced the preference for comparatively high leverage remains hard to explain.

Franking Credit Valuation: The appropriate choice of value for γ, or indeed whether γ is relevant have been matters of disagreement. Conventional wisdom attributes an average value of around 0.5 to γ, relying primarily on inferences derived from dividend drop off studies. In this context, there are several controversial matters:

- Does the potential identity of investors in the business (and their ability for utilise franking credits) matter for the revenue determination process?
- Can dividend drop off studies be relied upon to provide reliable evidence on valuation of franking credits?
- Is the average value of franking credits relevant to share valuation?

The Effective Tax Rate

The WACC formula given by equation 2 includes a term (T) for the corporate tax rate, although whether it should be the statutory corporate tax rate or an “effective” tax rate is not immediately obvious. In the derivation of equation 2 by Officer (1994) it would appear impossible for T to be anything other than the statutory tax rate – since that equation is based on the assumption that equity returns take the form solely of fully franked dividends in perpetuity. In practice, and particularly in the situation under consideration here, companies may have tax shields which reduce the amount of tax payable and possibly lead to non-taxpaying situations. Modelling undertaken for the ORG and ACCC (see Macquarie Risk Advisory Services, 1998) indicated that the gas businesses were likely (because of significant depreciation concessions) to be in tax loss positions for some time – indeed unlikely to pay tax for some twenty years. To reflect this, the regulators decided to utilise an effective tax rate value of around 0.25 for use in equation 2.

That approach is ad hoc at best, but it is difficult to see what else might be done given the imposed starting point of equation 2. In that equation, the tax variable enters in several roles: reflecting the interest tax shield from debt, and through the creation and valuation of franking credits. If the company is in a tax paying position, the former role requires use of the statutory rate, but the latter role may warrant use of some effective rate. If the company is not in a tax paying situation for some time, the use of equation 2 seems potentially inappropriate. Reflecting that concern, the approach proposed by the regulators (ACCC, 1999) is to model anticipated tax payments explicitly as a cash outflow in the building block approach, and focus upon the nominal post tax return to equity. While that avoids ad hoc adjustments to the rate of return formula, it leaves unanswered the question of how required rates of return may be influenced by the tax status of the business (and thus the extent to which shareholder returns will take the form of capital gains versus unfranked dividends versus franked dividends).

6. Conclusion

The regulatory approach to access pricing has developed significantly in a relatively short space of time. The debate occasioned by regulatory determinations has thrown up many contentious issues associated with optimal risk sharing and the pricing of risk, on which there is a need for further research. Significantly, many participants have argued for the need to compensate particular (idiosyncratic) risks by ad hoc adjustments to the required rate of return. In this paper, it is argued that such an approach is inherently undesirable, and that the "building block" approach to regulatory access pricing provides a framework in which many of those issues can be explicitly considered in the modelling of cash flows rather than in a rate of return determination. Nevertheless there is considerable work remaining to be done to identify the optimal approach to handling such idiosyncratic risks, as indeed there is in obtaining a better understanding of the systematic risk characteristics and appropriate rate of return for regulated businesses in Australia.

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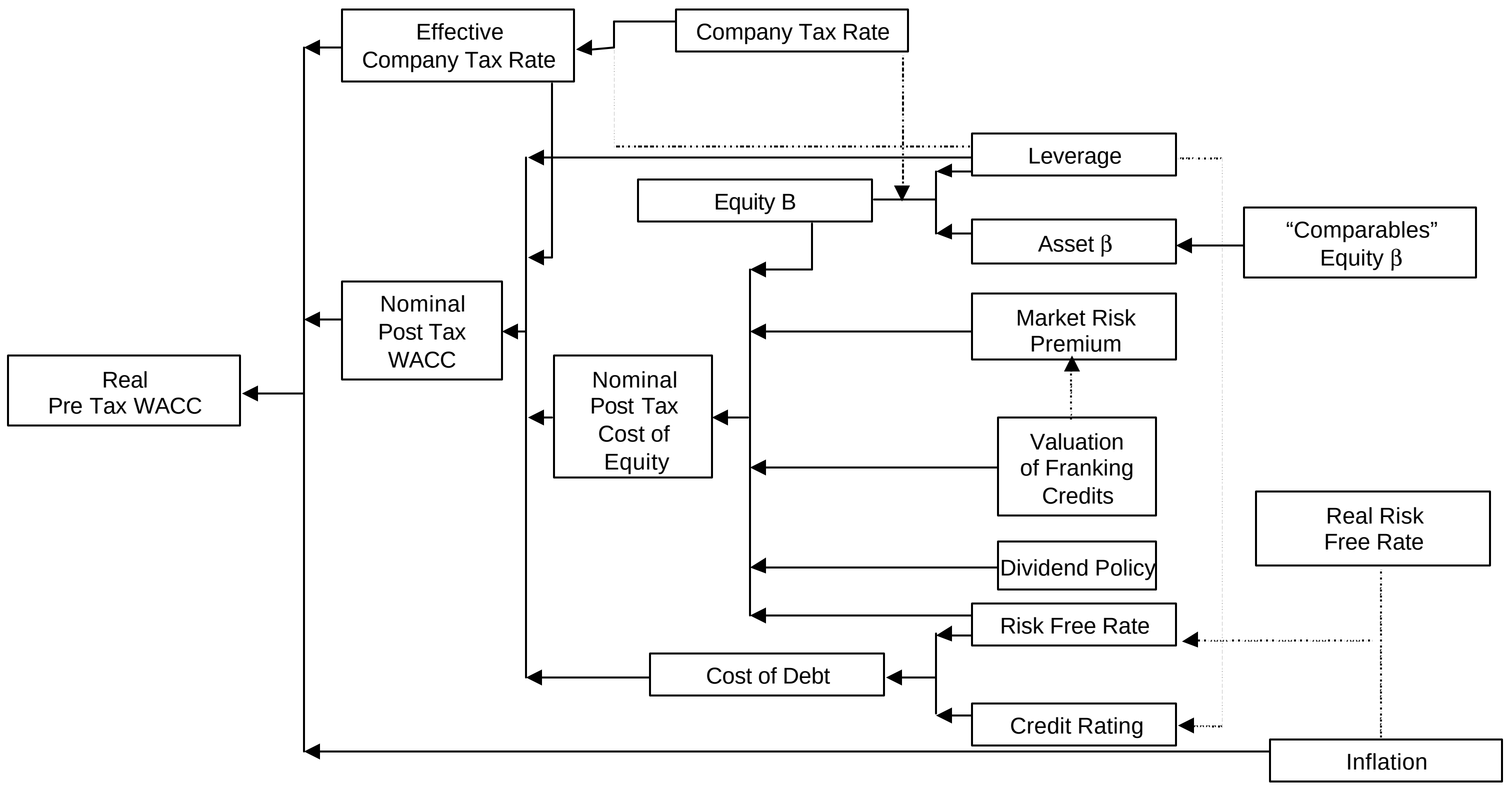
FIGURE 1


Effective
Company Tax Rate
Company Tax Rate
Leverage
Equity B
Asset β
"Comparables"
Equity β
Nominal
Post Tax
WACC
Market Risk
Premium
Real
Pre Tax WACC
Nominal
Post Tax
Cost of
Equity
Valuation
of Franking
Credits
Real Risk
Free Rate
Dividend Policy
Risk Free Rate
Cost of Debt
Credit Rating
Inflation

Appendix 1

The Required Return for Universal Service Obligations

To facilitate analysis, it is assumed here that projects have a one year life – such that the cash flow generated at the end of the year involves both return of capital and a return on capital[16].

Consider two projects which involve an outlay of $1 now and which each give a once only uncertain payoff in one year's time. One is a "normal" project which has an expected payoff of \$$(1+r_a)$, where r_a is the required rate of return for this project, and thus has a zero NPV. The probability distribution of payoffs is the dashed line designated by A in Figure 1. The other is a project with the same risk characteristics but with a payoff distribution which is shifted to the left, designated in Figure 1 by B and an expected value of $1+r_x < 1+r_a$. It has a negative Net Present Value, given by:

$$NPV_B = (1+r_x)/(1+r_a) - 1 < 0$$

and would thus not normally be undertaken.

However, project B is a USO project which must be undertaken by some company, and for which it is to receive compensation from some party to ensure that the project, inclusive of compensation, is a zero NPV project. What is required is the determination of a particular regulatory rate of return r_r with the following properties:

- If the payoff of project B, denoted by c_1, is less than $1+r_r$, the company will receive an amount of subsidy $s_1 = 1+r_r - c_1$, such that the total return is $s_1 + c_1 = 1 + r_r$
- If the payoff is above $1+r_r$, the subsidy will be zero.

The effect of such a regime is that the total return distribution to the company is now represented by the distribution truncated at the point $1+r_r$ (and with probability at that

[16] Using instead a multi year project would not markedly affect the argument, although it would introduce the need to consider the appropriate form for the depreciation schedule (return of capital).

point equal to the cumulative distribution of the original B distribution) in Figure 2. Note that (as formally demonstrated later) if the regulatory rate of return r_r is equal to or exceeds the risk free rate, the company undertaking this investment can make risk free arbitrage profits. Thus, to the extent that the compensation scheme is one sided (such that returns in excess of the regulatory minimum are retained by the company), the regulatory rate of return for measuring the cost of making the investment and thus the compensation amount must be less than the risk free rate.

To illustrate the issue, suppose that potential investors in the USO project knew that the compensation scheme would provide a sum s_1 such that $c_1 + s_1 = 1+r_f$ if c_1 were below $1+r_f$, and that if c_1 were above $1+r_f$ there would be no compensation. As Table 1 illustrates, an arbitrage profit would be possible by raising funds at the risk free rate (which could be done since the period 1 cash flows must be no less than $1+r_f$.

Table 1

	Date 0 cash flows	Date 1 cash flows	
		$c_1 < 1+r_f$	$c_1 > 1+r_f$
Project cash flows	-1	c_1	c_1
Compensation cash flows		$s_1 = 1+r_f - c_1$	0
Financing cash flows	+1	$-(1+r_f)$	$-(1+r_f)$
Net cash flows	0	0	$c_1-(1+r_f) > 0$

Set out in this fashion, it becomes apparent that the determination of the regulatory rate of return for determining the compensation amount involves an option pricing problem. If the regulatory rate is set at r_r the compensation cash flow at date 1 is $s_1 = \text{Max}[1+r_r - c_1, 0]$ which is the payoff to a put option on the variable c_1 with a strike price of $(1+r_r)$. Hence the compensation scheme is equivalent to giving the company a put option at date 0 which has a value $P[c^*,1+r_r,1,r_f,\sigma_c]$ in which c^* is the perceived date 0 value for c_1 at which the option is to be evaluated, and σ_c is the volatility of c.

A fair regulatory scheme will involve a choice of r_r such that the value of this put option exactly offsets the negative NPV of the project considered in isolation, ie that:

$$-1+ E(c_1)/(1+r_a) + P[c^*,1+r_r,1,r_f,\sigma_c] = 0$$

It is possible to solve for r_r by, for example, setting $c^* = E(c_1)$ and using the Black Scholes formula. The resulting value of r_r will depend upon $E(c_1)$, r_a, r_f and σ_c.

Figure A1

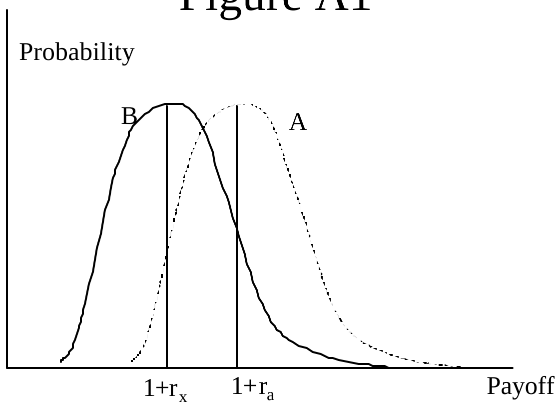


Figure A2