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A review of the approach and parameters used by the ERC in the determination of the weighted average cost of capital

Prepared on behalf of TRANSCO

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1 Introduction

This report has been prepared as part of the regulatory reset review under the performance base regulation framework administered by the Energy Regulatory Commission ("ERC").

The report titled "Regulatory Reset for the National Transmission Corporation (TRANSCO) for 2006-2010: Issues paper" ("Issues Paper") details the ERC's proposed estimates for the parameters determining the weighted average cost of capital (WACC).

This report reviews and provides commentary on the approach used by the ERC in determining the WACC. The report recommends a sector neutral approach to calculation of WACC and different methods for estimation of the parameters of WACC.

The ERC estimate of WACC is based on mid 2004 data. For the purpose of comparability of parameter estimates, the prime estimate of WACC derived in this paper is also based on mid 2004. However, for application to the reset period, the estimate of WACC should be based on data closer to the reset period. In order to achieve this and have certainty going forward, Transco recommends that the estimate of WACC for the reset period be based on August 2005 data. Accordingly, I also derive an estimate of WACC based on August 2005 data.

2 Context

The Transmission Wheeling Rate Guidelines (TWRG), adopted in 2003, sets out the methodology to be used in setting the maximum transmission wheeling rates that may be charged for the provision of regulated transmission services by TRANSCO.

The TWRG requires the ERC to publish an issues paper prior to the commencement of any regulatory reset process. The second regulatory reset period is set to commence on 1 January 2006 and in accordance with the TWRG requirements, the ERC released the Issues Paper in September 2004. The Issues Paper provides details on the proposed approach and parameter estimates to be used by the ERC in the determination of WACC. The purpose of calculating WACC is to provide a cost of capital for regulatory purposes, which can be applied to a building block cash flow model that generates a regulated revenue stream over a defined regulatory period for TRANSCO.

The ERC has given TRANSCO and other interested parties the opportunity to make written submissions on the method and data sources it has and should rely on in its determination of the risk-free rate within the Philippines, the equity and asset betas and the cost of debt for the purposes of calculating WACC. The formula for calculating WACC and its components are set out in Section 4.9 of the TWRG and cannot be altered by the ERC for the second regulatory period without agreement from TRANSCO.

Subsequent to this and other submissions, the ERC will publish, no later than 31 October 2005, a draft determination for WACC and other variables.

3 Calculation of WACC

3.1 WACC Formula

Consider an entity that is subject to income tax. Using a simple building block model, the revenue the entity would have to earn in order to break even would be given by

$$R = C + P + (R - C - P - r_dD)t + r_eE + r_dD$$

where

R = required revenue

C = expenses

P = depreciation

r_d = the cost of debt

r_e = the cost of equity

t = tax rate

E = the amount of equity funding

D = the amount of debt funding

V = $E + D$.

Thus

$$R = C + P + (R - C - P - r_dD)t + w_tV$$

where

$$w_t = r_eE/V + r_dD/V \quad (1)$$

and it is the WACC of the entity.

Then

$$R(1-t) = (C + P)(1 - t) - r_dDt + w_tV$$

that is

$$R = (C + P) + [1/(1 - t)](w_tV - r_dDt)$$

If a non tax paying entity earned the same cost of capital for the same level of output, then the required revenue, R_n, is given by:

$$R_n = C + P + w_tV$$

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Therefore

$$R - R_n = [1/(1 - t)](w_t V - r_d D t) - w_t V$$

$$= [t/(1-t)](w_t V - r_d D)$$

$$= [t/(1-t)]\, r_e E \qquad (2)$$

which is the amount by which required revenue would have to increase if a non tax paying entity was to continue earning the same return on capital following privatisation.

Alternatively, if it is assumed that required revenue continues at the same level following privatisation, then:

$$R = C + P + w_n V$$

and thus

$$w_n V = [1/(1 - t)](w_t V - r_d D t)$$

therefore

$$w_n = [1/(1 - t)](w_t - r_d t D/V) \qquad (3)$$

Thus, in order for tax status to be neutral in respect of prices, the return on capital earned by a non tax paying public entity should exceed that of a tax paying entity by the margin:

$$w_n - w_t = [1/(1 - t)](w_t - r_d t D/V) - w_t$$

$$= [t/(1 - t)]\,(r_e E/V) \qquad (4)$$

In the TWRG building block model it is assumed that Transco is a tax paying entity and WACC is defined as in (1) above. Thus if WACC is to be maintained at the same rate following privatisation, prices would have to increase so as to achieve the increase in revenue given by (2) above.[1]

The ERC estimated only WACC defined as w_t. In this paper we report estimates of both w_t and w_n.

3.2 Cost of Equity Formula

Section 4.9.4 of the TWRG specifies the following form of the Capital Asset Pricing Model (CAPM) for calculation of the cost of equity:

$$r_e = r_f + Beta_e\,(r_m - r_f)$$

where:

r_f = the risk-free rate within the Philippines

[1] This estimate abstracts from the differences between the TWRG building block model and the simple building block model assumed in the analysis presented in this section of the paper.

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$Beta_e$ = the equity beta for the electricity transmission business undertaken by TRANSCO

$(r_m - r_f)$ = the market risk premium (MRP).

However, this form of the CAPM is actually only applicable where personal taxes on interest and dividend income are neutral. In fact, personal taxes on these forms of income in the Philippines are not neutral – the tax rate on interest income is 20% and the tax rate on dividend income is 10%. In that case the form of the CAPM that should be used to calculate the cost of equity is:

$r_e = r_f T + Beta_e(r_m - r_f T)$

where

$T = (1-t_i)/1-t_d)$

t_i = rate of tax on interest income

t_d = rate of tax on dividend income.

3.3 ERC WACC Estimate

Using the TWRG methodology for calculating WACC, the ERC obtained an estimate of WACC in the range of 13.0% to 14.6%. However, in doing so, not all parameters were 'freely' estimated. For the second regulatory period, the ERC has specified the values of two of the parameters used in the calculation of WACC, namely:

- Market Risk Premium set at 6.0% pa; and
- Leverage set at 50% funding by debt and 50% funding by equity, resulting in a debt/equity ratio of 1.0 or debt/(debt + equity) and equity/(debt + equity) ratios of 0.5.

The reasons given for adopting this approach relate to the difficulty in obtaining estimates of these parameters using data from the relatively immature and small Philippines market place. [2]

The ERC's estimates of the parameters of WACC and the resulting estimate of WACC itself are tabulated below.

[2] See Section 6.1.4, page 28 of the 2004 Issues Paper.

Parameters	Range	
	Low	High
Risk-free Rate	10.1%	10.6%
Debt Margin	1.0%	1.5%
Marginal Tax Rate	0.0%	0.0%
Debt/(Debt+ Equity)	50.0%	50.0%
Cost of Debt	11.1%	12.1%
Equity Beta	0.8	1.08
Equity/(Debt+ Equity)	50.0%	50.0%
Market Risk Premium	6.0%	6.0%
Cost of Equity	14.9%	17.1%
WACC	13.0%	14.6%

Table 1. The ERC's estimate of WACC and the estimates of the individual parameters.

4 Review of the WACC Parameters

4.1 Risk-free rate

In the Issues Paper, the ERC considered two approaches to determining the appropriate risk-free rate, namely a direct measure and an indirect measure.

The ERC's estimate using the direct measure suggests a risk-free rate of 12.4% pa in mid 2004. This is based on information on the yield of the 10-year Philippines (peso) Treasury Bond, resulting from the auction process during mid 2004. However, given the low liquidity for this bond and the apparent lack of a secondary market, the ERC stated that such a yield might not necessarily provide a good representation of the returns expected from a long-term liquid risk-free rate investment by debt providers in the Philippines.

The indirect measure estimated by the ERC is the risk-free rate for the US adjusted for the difference between expected Philippines and US inflation rates and the country risk premium[3] associated with investing in US dollar denominated retail investments in the Philippines rather than the US. Using this approach, the ERC estimated the risk-free rate

[3] This risk referred to by the ERC as the "country risk premium" actually covers both credit risk and the country risk (non credit risks) and should be referred to as the "sovereign risk premium".

at between 10.1% and 10.6%. The spread in this rate was due to the spread associated with the ERC's estimate of the US risk-free rate and the country risk premium.

While I agree with the ERC in not adopting the direct approach I do not agree that the indirect method is a suitable means of estimating the risk free rate. Even aside from concerns over liquidity the direct method is not suitable because it includes a premium to reflect the fact that Philippines Treasury Bonds are unlikely to be viewed as a true risk-free security relative to Treasury Bonds issued by the US government. The indirect method is not a suitable means of estimating the risk free rate as it includes an estimate for sovereign risk. I agree that sovereign risk should be included in the estimation of WACC (in both the costs of debt and equity) but not as part of the risk free rate.

The Philippines risk free rate should be calculated simply as the risk free rate adjusted for the difference between the expected US and Philippines inflation rates, that is:

$$r_f = [(1+ r_{USA})/(1 + CPI_{USA})](1 + CPI_{Phil}) - 1$$

Given the long life of Transco's assets, the estimate of the risk free rate should be based on long term bonds. Using the estimated 20-year US Treasury composite yield of 5.42% for mid 2004,[4] the Philippines risk free rate is

$$r_f = [(1+0.0542)/(1+0.024)](1+0.044) - 1$$

$$= 7.5\%$$

Similarly for August 2005[5], with r_{USA}, CPI_{USA}, and CPI_{Phil} estimated at 4.60%, 2.6% and 6.5% respectively, the estimate of the risk free is:

$$r_f = [(1+0.0460)/(1+0.026)](1+0.065) - 1$$

$$= 8.6\%$$

4.2 Leverage

The ERC has set the debt/(debt + equity) and equity/(debt + equity) parameters at 0.5 stating that these values represent estimates of average or good financial industry practice for financially viable companies.

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[4] The bond rate is an average taken over the four-week period to 15 July 2004. The spot rate at 15 July is likely to be the best predictor at that date of future rates but I have used the short-term average instead in order to avoid possible inappropriate impacts of unusual short term fluctuations in the market. The spot rates have been sourced from Bloomberg. I have estimated expected inflation in both the USA and the Philippines from average inflation over the preceding two and a half year period to July 2004. The ERC estimate of the USA rate was also based on the same two and a half year period but the estimate for the Philippines was based on just the 6 months to July 2004.

[5] The bond rate is based on the average over the four-week period to 15 August 2005. The estimates of expected inflation are based on average inflation over the two and a half year period to 15 August 2005.

Although the ERC has stated that this parameter is locked in, I nevertheless make comment on the value set by the ERC as I regard it as being inappropriately conservative. In choosing one capital structure over another, firms are likely to balance up factors such as the reduction in agency costs from increased debt against higher expected bankruptcy costs. However, theory does not indicate the level at which this balance might be struck by any particular firm. It is therefore common practice in estimation of WACC to assume that firms nevertheless balance up the competing factors and that the optimal level of leverage can thus be inferred from practice. Using that approach, data from comparable utility companies[6] and various regulatory decisions[7] suggests that a reasonable level of leverage for TRANSCO would be around 60%. However, I understand that the privatisation plan for TRANSCO, as endorsed by the Joint Congressional Power Commission (JCPC) on March 13, 2002 and approved by the President of the Philippines on October 4, 2002, allowed for 25% down payment and 75% deferred payment over the maximum of 25 years. For the present purposes I therefore use 65% as the level of leverage.

4.3 Cost of Debt

Estimation of the cost of debt requires the addition of three components, namely the risk free rate, the sovereign risk premium and a margin for credit risk specific to Transco. The risk free rate is the US risk free rate adjusted for the margin of Philippines expected inflation over US inflation. The sovereign risk premium is the margin of the yield on Philippines US dollar denominated treasury bonds over the US treasury bonds.[8] Therefore the risk free rate plus the sovereign risk premium just add to the yield on Philippines US dollar denominated treasury bonds adjusted for the margin of Philippines expected inflation over US inflation. The average yield on Philippines US dollar denominated 20 year treasury bonds over the four weeks to 15 July was 10.14%, and therefore

$$\text{Risk free rate + sovereign risk} = [(1+ 0.1014)/(1+0.024)](1+0.044) - 1$$

$$= 12.3\%$$

[6] See www.damodaran.com, levered and unlevered betas by industry, emerging markets. The data set includes average D/E ratios for industry sectors.

[7] For example, the Australian regulatory decisions quoted by the ERC (Issues paper, p 34). For Powernet (Victoria Transmission Network Revenue Caps 2003-2008), the final leverage ratio of 60% was chosen. Further, the ACCC states in its Final Decision (p 30) that, "Given that most regulators have adopted a leverage ratio of 60%…there is little compelling reason to vary from this assumption." Also, in the final decisions by the ACCC for the Snowy Mountains Hydro-Electric Authority Transmission Network Revenue Cap 1999/00 – 2003/04 and the NSW and ACT Transmission Network Revenue Caps for TransGrid 2004/5 – 2008/9 a leverage ratio of 60% was chosen.

It is noted that the Standard and Poor's survey, 'Rating methodology for global power companies' (1999) suggests that leverage ratios for transmission and distribution businesses are between 55% and 65%.

[8] The ERC estimated the premium from retail investments but the commonly accepted basis for estimation of the premium is treasury bonds.

Current indications are that Transco's credit risk margin is of the order of 0.5 to 1.0%. Taking the midpoint, the cost of debt in mid 2004 is therefore estimated at 13%.[9]

Over the four week period to 15 August 2005, the yield on Philippines US dollar denominated 20 year treasury bonds was 9.38% and therefore

Risk free rate + sovereign risk = $[(1 + 0.0938)/(1+0.026)](1+0.065) - 1$

$= 13.5\%$

When Transco is privatised the credit rating is expected to drop from the Philippines rating of BB+ to BB- down to B+ to B-. This will result in a margin of around 1.7% [10]. The estimated cost of debt in August 2005 is therefore

Cost of debt $= 13.5\% + 1.7\%$

$= 15.2\%$

The estimates above for the cost of debt relate to leverage of 50%. Data on US utilities suggests that leverage of 65% adds a margin of 0.8%. The cost of debt for mid 2004 is thus 13.8% and for August 2005, 16.0%.

4.4 Beta

Beta is a measure of the expected volatility of a company's returns relative to the market and indicates the level of systematic risk faced by the investor. In general, the asset beta can be estimated from a regression analysis of returns on the market and returns on the security in question. However, where such information is not available or, for example, suffers from either low trading volumes or insufficient data points for statistical veracity, the asset beta is estimated from the asset betas of comparable companies for which estimates of beta are available. This method of beta estimation is known as the pure play method.

When determining the set of appropriate comparable companies, the following key relevant factors need to be considered:

(i) The nature of the products (industry), and the extent to which demand for the products varies with the strength of the economy (the income elasticity of the demand for the company's products). The more demand varies with economic activity, the higher the beta.

(ii) The extent to which the company's costs vary with demand (operating leverage). The greater the proportion of costs that are fixed, the greater the variation in the company's profits with changes in demand, and thus the higher the beta.

[9] This estimate fails to take into account implicit government support.

[10] Source: BondsOnline.com; Reuters.

Other factors commonly mentioned in the finance literature include pricing structure, duration of contract prices with suppliers and customers, degree of market power, level of industry regulation, and real options. Selection of the appropriate companies thus requires simultaneous judgments of comparability on a number of different dimensions. Selection of the set of companies is therefore among the most difficult of the tasks involved in the estimation of WACC. Furthermore, beta also varies with the level of leverage. Therefore, use of the betas of similar companies requires correction for any differences in leverage.

The ERC has used the pure play method to estimate the asset beta for TRANSCO. I concur with that choice of method, but expect that a larger sample of relevant companies would provide a more reliable measure of the beta for Transco.

I have extended the ERC's sample of companies to include companies that are (i) in the same sector or (ii) face risks similar to that of a transmission company. In Table 1 of Appendix 1, I have listed such companies, described the industry that they are in and estimated their asset beta.[11]

I note that the ERC appears to have been inconsistent with the TWRG formulas in delevering the observed equity betas to obtain the asset betas of the three firms listed in Section 6.1 of the Issues Paper. It seems that the ERC has applied the formula prescribed in Section 4.9.7 of the TWRG rather than the formula prescribed in Section 4.9.8.[12] The adjusted values are shown in the final column of Table 2.

[11] The leverage ratios (market debt/equity), tax rate and equity beta were taken from the data available from the Damodaran website (www.damodaran.com). The data was originally sourced from Bloomberg and last updated in January 2005. For comparison purposes, I have also extracted the most recent data available on the unlevered betas from Bloomberg. There is some variation in values, but this only highlights the difficulty in estimating beta accurately. Note, the beta for Red Electrica is higher than given by the ERC.

[12] Page 34, paragraph 6.10.1 of the Issues Paper states, "This is after application of the formula is Section 4.9.8 of the TWRG."

Company Name	Beta	D/E	Tax rate	Asset Beta	Adjusted Asset Beta)
Red Electrica de Espana	0.47	105%	34%	0.23	0.28
Cia de Transmissao de Energi	0.8	5%	20%	0.76	0.77
Interconexion Electrica SA	0.96	125%	48%	0.43	0.58
			mean	0.47	0.54
			median	0.43	0.58

Table 2. Asset betas for the 3 electricity transmission companies given in Section 6.1 of the Issues Paper. The adjusted asset beta values were calculated using the formula $Beta_a = Beta_e / [1+ (1-T_e)D_m/E_m]$ in accordance with the formula stated in Section 4.9.8 of the TWRG.

As shown in Table 2, the mean asset beta for the benchmark firms is 0.54 if calculated consistent with the TWRG formulas.

The larger sample of firms provides a mean and median asset beta of 0.65 and 0.59 respectively. These results suggest that the ERC's range estimate of 0.40 to 0.54 is likely to underestimate the asset beta for a transmission company. I propose a range estimate of between 0.54 and 0.65.

As noted earlier, the TWRG specifies a form of the CAPM that is inappropriate to the Philippines tax structure. The same holds true of the formula stated in 4.9.7 for relevering asset betas. The correct formula is

$$Beta_e = Beta_a\{1+[(1-t)/T]D/E\}$$

Applying this formula, re-levering of the asset beta range estimate of 0.54 to 0.65 results in a revised equity beta range estimate of between 1.27 and 1.53.[13]

4.5 Market risk premium

The market risk premium is the margin of the expected rate of return on the market portfolio over the risk free rate. This cannot be observed and must be estimated. The estimation is subject to considerable uncertainty and in recent years has been a matter of some controversy in finance.

[13] Note that while the ERC's relevering of asset betas appears to have been inconsistent with the formula specified in the TWRG, the method used was actually correct in terms of the form of the CAPM specified in the TWRG.

As noted above, the ERC has locked in a value of 0.06 for the market risk premium. However, in my view, that value grossly understates the market risk premium likely to apply in the Philippines.

The following approaches have been used in the finance literature to estimate market risk premiums:

(i) extrapolation of the historical margin earned from investment in some suitable proxy for the market portfolio in excess of the return on a proxy for a risk-free investment.

(ii) use of economic models, which include the expected rate of return on the market portfolio as one of the variables.

(iii) extrapolation from surveys of opinion on the premium.

In my view, extrapolation of the historical margin is likely to provide the most reliable estimate of the MRP. Of the various sources of information available for this approach, Dimson (2003) is currently the superior source. It does not provide evidence on the MRP for Philippines. However, an estimate can be formed by adding to the estimate for developed economies a country risk premium to reflect the greater relative riskiness of equity in a developing economy such as the Philippines. The Dimson data suggests an estimate of 0.06 for the MRP for developed economies. The adjustment made for the additional risk is that suggested by Damodaran (2001):

Adjusted MRP = MRP + sovereign risk premium x relative volatility of equity i

where

relative volatility of equity = standard deviation of equity/
standard deviation of long term bonds

Damodaran suggests an estimate of 1.5 for the relative volatility of equity. In mid 2004 the sovereign risk premium for the Philippines was 4.72% (= 10.14 – 5.42) and hence the adjusted MRP is therefore:

= 0.06 + 0.07

= 0.13

In August 2005 the sovereign risk premium was 4.78% (= 9.38 – 4.60) and hence the adjusted MRP is:

= 0.06 + 0.07

= 0.13

5 Impact of setting WACC too low

Whenever faced with a possible WACC range, the regulator is faced with the difficulty of deciding which point estimate is most appropriate. Assuming the estimates are all equally likely, selection of single estimate over another estimate within the permissible range is no more or less accurate than the other.

In the current situation, the ERC faces the exact same dilemma. The WACC estimate has been proposed as a range rather than a single estimate due to uncertainty associated with some of the individual parameter estimates.

In the paragraphs below, I explain why when faced with such situation, it is necessary to select from the upper end of any range estimate.

5.1 Asymmetrical impact of under and over investment

In general, under-investment in infrastructure is likely to have significantly higher economic cost than over-investment. The main reason for this is that modest over-investment will typically lead to slightly higher prices than otherwise, but the consumer is able to access the desired service. Given the relatively low price elasticity of demand, such small price increases are not likely to have a significant impact on consumer choices. In addition, in a growth environment, the negative effects of over-investment are also continually diluted.

Under-investment on the other hand, will lead to the degrading of services and in some cases cause major disruption to the consumer's process and business, or prevent businesses from being set up.

In economic terms, under-investment leads to the loss of the entire consumer and producer surplus associated with the output shortfall. In contrast, slight over-investment is equivalent to providing higher quality service than consumers demand, and hence the only economic loss is that associated with the difference between the consumer valuation of the higher service level and its opportunity cost.

The need to ration firm resources suggests another reason for this view. If the regulator sets the allowed rate of return too low, projects are unprofitable and the firm chooses not to invest, with all the attendant social costs. But if the rate is set too high, thereby encouraging the firm to undertake wasteful investment, its attempts to do so are constrained by the quality of organisational, physical and managerial resources it has available. So long as it allocates its resources to the highest-yielding projects, the amount of wasteful investment is limited. As a result, setting the cost of capital too low creates greater economic costs than setting it too high.

5.2 Insufficient compensation for investors

Basic finance theory is quite clear on the effect of too low returns on investment – if investors perceive that they are not compensated in accordance with the risk faced by their investment, they will withhold or withdraw that investment.

Rational investors would indeed require returns in accordance with what they perceive the risk of an investment to be. This perception of a fair return would not be swayed by theoretical arguments about the calculation of the WACC, but would rather be based on market perceptions. Our view of market perceptions of the factors underlying the WACC calculation is presented above and would argue for a WACC above that proposed by the ERC.

By setting the WACC at the low end of industry expectations and not sufficiently allowing for project-specific risks, we believe that investment in electricity transmission will be seriously discouraged.

5.3 Impact of under-investment by transmission businesses

Electricity transmission networks are a vital part of the country's infrastructure. They play a critical role in facilitating growth and providing energy to businesses throughout the Philippines.

Any regulatory decision that could inhibit investment in infrastructure, has the potential to create significant long-term damage to the economy. Setting the WACC too low would lead to under-investment in infrastructure that the country can ill afford.

In my view, it is critical that regulation should not impede infrastructure businesses from investing to maintain and enhance services consistent with consumer demand and that the ERC's estimate of WACC for regulating TRANSCO's electricity transmission business should allow for this.

6 Additional margin over WACC

There is growing evidence that the traditional approach to estimation of WACC, as prescribed in the TWRG, does not fully capture the true costs facing a company when making investment decisions. That is, in the real world there are significant departures from the assumptions of the CAPM used in calculation of the cost of equity. Therefore it is necessary to include an additional margin over WACC to capture the additional costs. Consequently, I believe the WACC should be calculated as follows:

$$WACC = r_e E/V + r_d D/V + \text{additional risk premium}$$

Below, I outline three aspects of investment, namely market frictions, irreversibility and timing flexibility, and firm resource constraints, and describe how these increase the true capital cost of a project.

6.1 Market frictions

The CAPM (WACC) framework assumes that the capital markets are frictionless. Thus the failure of a project has no effect on the ability of the firm to raise funds for future projects. This notion of 'costless refinancing' does not exist in the real world. Project losses impact the firm's balance sheet and invariably make it costly, or even impossible for the firm to raise further funds from capital markets. Consequently, firms may have to forego valuable investment opportunities or even shutdown existing ones. The potential for these adverse outcomes lowers the value of these assets at the time the project commences, thereby increasing the true cost of capital.

Regulated firms face an additional market friction. Kolbe, Tye and Myers (1993) point out that regulated firms face an additional investment cost that is not encountered by unregulated firms and thus face a true cost of capital that exceeds the WACC. This is due to the fact that regulated firms are typically constrained to earn no more than the WACC on their investment base. In other words, once the project is under way, the regulated firm

is allowed to charge prices that allow it to earn WACC on allowed investment expenditure. However, at the time of the investment the regulated firm faces the additional risk that the regulator may subsequently disallow inclusion of some of the investment in the rate base. Subsequently, the firm earns exactly WACC if the entire investment is allowed, but it earns less than WACC if some of the investment is disallowed. For any positive probability of disallowance, the firm will therefore have an expected rate of return that is less than the WACC. Investment will not, therefore, proceed because providers of capital expect to receive a return less than what they require. Only if the firm is allowed to earn more than the WACC is the investment worthwhile.

Another way of thinking of this situation is to draw an analogy with real options. When a regulated firm invests, it effectively gives the regulator an 'option' (to appropriate some of the firm's profits). This 'gift' increases the cost of investment so, ex ante, investment in the project increases shareholder wealth if and only if NPV is not only positive, but also sufficiently positive to cover the cost of the 'gift'.

To reiterate, when a regulated firm invests, it gives away an option-like claim on the project's profits. Consequently, the value of this claim must be included in the cost of the investment. This drives a wedge between the company's 'true' cost of capital and WACC.

6.2 Irreversibility and timing flexibility

Myers (1977) states that the firm value can be considered as having two components, i.e. the value of its existing assets-in-place and the value of its real growth options. The latter represents projects that the firm has not yet undertaken, but may at a future date. Although these are not yet assets-in-place, and are therefore intangible, they nevertheless offer a positive probability of positive future cashflows and are thus incorporated in today's stock price (see Brealey et al 2000).

This categorisation has a significant implication for optimal investment policy. As first noted by McDonald and Siegel (1986) and subsequently popularised by Dixit and Pindyck (1995), if the firm has growth options exercisable today or in the future, then the investment today not only incurs the usual direct costs, but also the indirect cost of sacrificing or exercising its growth option. This is due to the fact that the company gives up the option to invest in exactly the same project at a later date. This loss of opportunity represents an additional cost to the firm. In effect, if an option is exercised, firm value increases by the amount of the project's NPV, but falls by the amount of the growth option, since it no longer exists.

The standard approach implicitly assumes that the growth option is non-existent or never expires. That is, investment projects are either 'now-or-never' or if not, then fully reversible. In other words, if the project commences today, then there is no opportunity to wait and therefore no opportunity cost to investing today. Alternatively, if the project can be delayed, but is fully reversible, then (i) it can be initiated again in the future if economic conditions are better (i.e., launching today doesn't preclude launching again in the future) and (ii) its cost can be fully recovered tomorrow if economic conditions turn out to be worse (i.e., launching today does not entail an irretrievable loss). Thus there is no possibility of the decision to invest today being 'wrong' and the opportunity cost reverts to zero.

These stylised assumptions of perfect reversibility and timing flexibility apply in a static world, but fail to capture the full costs of investments in a dynamic environment. In the real world, projects are only partially reversible[14] and most can be delayed. For irreversible investments, the ability to delay is valuable because it allows the firm to gather more information about the project's viability, thus maximising the potential for maximum profits and minimising the potential for losses. However, if the project commences, then the opportunity for further delay disappears. This loss of flexibility is an additional capital cost of the project, the size of which is increasing in the specific risk of the project.

6.3 Firm resource constraints

Another assumption of the CAPM/WACC framework is that firms have unlimited resources. In contrast, Jagannathan and Meier (2002) point out that good firms frequently face rationing of managerial talent and organisational capital, simply because the number of desirable projects exceed the resources available. Consequently commencing a project today may entail sacrificing the option on another project in the future and this foregone opportunity is an additional capital cost of the current project. Again, the more uncertainty there is about the future project's prospects, the more valuable is the firm's option on it, and hence the greater the additional cost.

6.4 Evidence from the field

There is ample evidence that competitive firms require a significant premium for exposure to risk other than market (systematic) risk and therefore require a minimum-acceptable expected rate of return on investments that exceeds their WACC.[15] Furthermore, regulators are beginning to recognise the need for an additional risk premium and incorporating this factor into their determination of WACC.[16]

In the paragraphs below, I explore the evidence of companies applying a discount rate over WACC and provide two examples of regulators who have recognised the need for a margin over WACC.

Summers (1987) found that the average discount rate used by Fortune 500 firms in the mid-1980s was approximately double the maximum WACC possible for the average firm. More recently, Poterba and Summers (1995) reported similar findings for Fortune 1000 firms: an average real discount rate of 12.2% versus a maximum-possible WACC of 7%.

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[14] In the electricity sector many investments can be considered irreversible. Poles, lines and cables have minimal salvage values, and trenches and backfilling and major construction cost components have no salvage value.

[15] The minimum-acceptable expected rate of return is sometimes known as the user cost of capital. It measures the expected return that is required on capital investment if that investment is to adequately cover all its capital costs, both direct and indirect.

[16] For example, the Electricity Market Authority in its regulation of electricity generators in Singapore and the Commerce Commission in its inquiry into imposing control in the gas sector in New Zealand. Both examples are explored further in the report.

Of course, it is possible that behaviour of this sort simply reflects an internal mechanism for controlling overly optimistic cashflow forecasts by managers, or the firm's acceptance of projects riskier than its average. However, this seems unlikely to be important for at least two reasons.

First, direct evidence suggests otherwise. For example, Mukherjee and Hingorani (1999) report that the most common reasons for top-line managers to employ high discount rates are high non-market risk, project irreversibility, and valuable future investment opportunities. The first and third points are consistent with the concern about market frictions and future financing costs; the second is consistent with the recognition of the value of timing flexibility. In addition, they find that internal control reasons seem to be considerably less important than the above three factors. Similarly, Graham and Harvey (2001) find that more than a third of firms adjust their discount rate upwards in response to project-specific risks, and also to non-market macro risks such as interest rates, GDP, and unexpected inflation. Keck, Levengood and Longfield (1998) report that such behaviour is even more prevalent in the firms of smaller countries that are less integrated into global markets. Finally, Froot (1999) examined eight possible reasons for the high implicit discount rates used in the catastrophe insurance industry and concluded that capital market frictions were the most likely reasons.

Second, internal control procedures cannot explain other common firm responses to project-specific risks, the most notable of which is hedging.

We have clear evidence that firms hedge, and considerably so. They hedge currency risk, interest rate risk, price risk, demand risk, and most other risks to which they have significant exposure. For example, weather hedges paid out more than USD 4 billion in 2002. But hedging cannot be rationalised in a pure CAPM world. If the risks being hedged are project-specific, then the firm is expending resources on activity that investors could undertake themselves. If the hedged risks contribute to a firm's market risk, then hedging simply moves the firm along the capital market line and its value remains unchanged. Thus, in a CAPM world, hedging is a zero net-present-value project at best. The ubiquity of hedging, therefore, is about as clear an indicator as we have that project-specific risk matters to competitive firms, and that it matters a lot. As Froot et al (1993) point out, hedging only makes sense as a response to the under-investment costs of capital market frictions.

The above evidence of firms applying a discount rate greater than WACC to recognise exposure to risks other than systematic risk has been focused on firms within the private sector. However, within the regulated environment, the same risks still prevail, necessitating a margin over WACC.[17] Consequently regulators need to recognise this in determining the appropriate discount rate, otherwise a risk exists that the permissible return on investment does not commensurate the exposure to risk by the regulated entities.

An example of a regulator recognising the need for a margin over WACC can be drawn from the New Zealand Commerce Commission's inquiry into whether its gas sector

[17] In fact the regulator faces the further need to recognise a margin over WACC due to the additional regulation-specific costs that regulated firms face and the asymmetric costs associated with underestimating the hurdle rate.

should be regulated. During its inquiry the Commission stated[18], " The Commission recognises that the risks associated with imposing control are asymmetric…" and went on to state: "The Commission notes that [it] is of the view that a margin on WACC should apply in determining whether to impose control on the gas businesses to address concern about asymmetric risk." Thus in determining whether control should be imposed, the Commission recognised the presence of indirect costs of control and the asymmetric costs of adopting a WACC below the true hurdle rate facing the firm.

Another example of a regulated entity recognising the need for a margin over WACC is evident from the Electricity Market Authority's (EMA) regulation of electricity generators in Singapore. In the EMA's vesting contract[19], implemented in January 2004, it incorporated an additional risk premium in the calculation of WACC. In the vesting contracts, the additional risk premium is described as, "[The] premium over the cost of capital to reflect risk associated with full exposure to a merchant power market and full construction risk." The vesting contract also advises that this premium was determined by the EMA in consultation with finance experts.[20]

To sum up, there is clear evidence that firms care about project-specific risks and require compensation for bearing them (or are prepared to pay to avoid them). Unless one believes that firms consistently forgo profits by under-investing or over-hedging, there seems to be no alternative to the view that project-specific risk matters, both in theory and in practice. Furthermore, regulatory bodies are beginning to recognise the presence of project-specific costs, as well as asymmetric costs in determining the appropriate discount rate for regulated entities.

6.5 Quantitative assessment of the margin over WACC

The challenge of allowing a margin over WACC is that the magnitude of the margin cannot be conclusively demonstrated. Research in this area is at the cutting edge of finance and surveys carried out in this regard are not yet extensive or conclusive.

Ultimately, however, the presence of indirect costs helps explain the action of companies in the real world and thus should not be ignored in the determination of WACC. While the debate about the size of the indirect costs is legitimate, simply excluding it would be ignoring both state-of-the-art academic research and business reality.

I recommend that although the original TWRG does not include an additional risk premium in the determination of WACC, its inclusion is necessary to cover the additional indirect and regulatory costs to the firm, not accounted for in the traditional WACC model.

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[18] See Section 6.139 of the Commerce Commission's final report on the Gas Control Inquiry, dated 29 November 2004.

[19] The vesting contracts are bilateral contracts made between the Singapore generation companies and SP Services Ltd (the Market Support Services Licensee) on behalf of consumers. Vesting contracts impose a contractual obligation to produce a specified quantity of electricity, at a specified price.

[20] See page 9, Schedule C of the Vesting Contract between the 'holder' and SP Services Ltd.

I propose using, as a minimum, an additional risk premium of 2%. This would be included in the current WACC formula as a separate parameter. While the size may be contentious, it is the inclusion of the additional risk premium, which is pertinent while the size will (for now) remain contestable.

7 Conclusions

In this report, I have reviewed the approach and methodology of the ERC in its calculation of WACC for mid 2004 and August 2005. Whilst the ERC has only required commentary on the determination of the risk-free rate within the Philippines, the equity and asset betas and cost of debt, I have felt it necessary to question in this review also the calculation of WACC, the cost of equity, the MRP and leverage ratio.

The tables below set out a summary of the results obtained. In Table 3 the "ERC" column shows the ERC high estimates of the parameters and the resulting estimate of WACC for Transco calculated using the formulas set out by the ERC. The "Adjusted ERC" column shows the estimates of the parameters derived above and the resulting estimate of WACC for Transco but calculated using the TWRG formulas. The "Recommended WACC " column shows again the parameter estimates derived above but with the resulting estimate of WACC for Transco based on the correct formulas for the cost of equity and beta as explained above. The estimate of WACC, w_t , was defined in section 3.1 and applies where it is assumed that required revenue can increase following privatisation so that Transco can earn the same return on capital pre and post privatisation. The estimate of WACC, w_n , derived in section 3.1, is an estimate of the return that Transco should earn pre privatisation if it can earn w_t post privatisation but required revenue has to remain the same.

Table 4 repeats the last two columns of Table 3 but for estimates of the parameters as at August 2005 and assuming that Transco has been privatised.

As at mid 2004:

Parameters	ERC WACC	Adjusted ERC WACC	Recommended WACC
US Risk Free Rate	4.7%	5.42%	5.42%
Philippines RFR	10.6%	7.5%	7.5%
Cost of debt	12.1%	13.8%	13.8%
Company Tax Rate (CTR)	35.0%	35.0%	35.0%
Application of CTR	No	No	Yes
Interest Tax Rate	20.0%	20.0%	20.0%
Application of ITR	No	No	Yes
Dividends Tax Rate	10.0%	10.0%	10.0%
Application of DTR	No	No	Yes
D/A ratio	0.5	0.65	0.65
D/E Ratio	1.0	1.86	1.86
Beta Unlevered	0.54	0.65	0.65
Beta Relevered	1.08	1.86	1.53
E/A ratio	0.5	0.35	0.35
Market Risk Premium	6.0%	13.0%	13.0%
Cost of Equity	17.1%	31.7%	26.6%
WACC : w_t	14.6%	20.0%	18.3%
Additional Risk Premium (ARP)	0.0%	2.0%	2.0%
WACC : w_t + ARP	14.6%	22.0%	20.3%
WACC : w_n	19.2%	26.0%	23.3%
WACC : w_n + ARP	19.2%	28.0%	25.3%

Table 3. As at mid 2004: A comparison between the ERC estimate of WACC and the estimates of WACC recommended in this paper.

As at August 2005:

Parameters	Adjusted ERC WACC	Recommended WACC
US Risk Free Rate	4.60%	4.60%
Philippines RFR	8.6%	8.6%
Cost of Debt	16.0%	16.0%
Company Tax Rate (CTR)	35.0%	35.0%
Application of CTR	No	Yes
Interest Tax Rate (ITR)	20.0%	20.0%
Application of ITR	No	Yes
Dividends Tax Rate (DTR)	10.0%	10.0%
Application of DTR	No	Yes
D/A ratio	0.65	0.65
D/E Ratio	1.86	1.86
Beta Unlevered	0.65	0.65
Beta Relevered	1.86	1.53
E/A ratio	0.35	0.35
Market Risk Premium	13.0%	13.0%
Cost of Equity	32.7%	27.5%
WACC: w_t	21.8%	20.0%
Additional Risk Premium (ARP)	2.0%	2.0%
WACC: w_t + ARP	23.8%	22.0%
WACC : w_n	28.0%	25.2%
WACC : w_n + ARP	30.0%	27.2%

Table 4. As at August 2005: A comparison between the adjusted ERC WACC and the estimate of WACC proposed in this paper.

Appendix 1

	Company Name		Equity Beta	Market Debt to Equity	tax rate	Asset Beta*	Asset Beta**
Gas in Asia							
	Petronas Gas BHD	Gas Distribution - Malaysia	0.77	11.42%	13.36%	**0.70**	**0.71**
	GAIL India Ltd	Gas Distribution-India	1.5	11.85%	33.58%	**1.39**	-
Electricity T&D Europe							
	National Grid Transco	Electricity Distribution - England	1.11	83.54%	22.98%	**0.68**	-
	Red Elecrica	Electricity Transmission - Spain	0.47	105.00%	34%	**0.28**	**0.34**
	Terna Spa	Electricity Transmission -Italy	NA	7.66%	39.37%		
	Viridian Group	Electricity Distribution - London	0.52	44.23%	19.76%	**0.38**	**0.13**
US							
	Duquesne Light Holdings	Electric Utility (East)	0.75	70%	18.06%	**0.48**	**0.51**
	UIL Holdings	Electric Utility (East)	0.8	73.96%	53.10%	**0.59**	**0.69**
Latin America							
	Cia de Transmissao de Energi	Electricity Transmission - Brazil	0.8	5%	20%	**0.77**	-
	Interconexion Electrica SA	Electricity Transmission - Columbia	0.96	125%	48%	**0.58**	-
					MEAN	**0.65**	
					MEDIAN	**0.59**	

Table 1: Comparable listed companies in the electricity/gas transmission and distribution sectors.

Note: Company names in italics are those that were also given in table 6.1 of the Issues Paper and the ERC values were used to determine the Asset Beta.

* Excluding the ERC named companies, the asset beta estimates were determined from the most recent data available on the Damodaran website. Asset beta was calculated as follows: Beta (asset) = Beta (equity) / [1+ (1-T_e) x D_m/E_m] in accordance with page 43 of the TWRG document.

** Where possible values were sourced from BLOOMBERG.

Appendix 2

Qualifications and Experience

Tony van Zijl

I am Professor of Accounting & Financial Management in the Faculty of Commerce & Administration at Victoria University of Wellington. At present my teaching is mainly in financial reporting and my research interests include capital markets, valuation, financial reporting, and performance measurement and reporting.

My academic qualifications are PhD (Finance), BSc (Mathematics), BCA(Hons) (Economics) and DipAcc (Accounting). My PhD thesis dealt with theoretical aspects of the Capital Asset Pricing Model (CAPM) and my academic publications include a number of papers on that topic.

I am a member of the member of the Institute of Finance Professionals of New Zealand (Certified Securities Analyst Professional) and of the Institute of Chartered Accountants of New Zealand (Fellow Chartered Accountant). I am a life member of the Accounting and Finance Association of Australia and New Zealand (AFAANZ) and I was recently awarded the AFAANZ Outstanding Contribution to Practice Award.

During 2002-03 I was Chairman of the ICANZ Financial Reporting Standards Board, having earlier been a member of the Board from 1989 to 1999. I was a member of the Accounting Standards Review Board from 1991 to 2001 and I was Director of Research for the Institute of Chartered Accountants of New Zealand from 1985 to 1988.

I have served on a number of government working parties, including on securities law reform, capital charging for tertiary education institutions, and value-based reporting for state-owned enterprises. I have been a member of the Valuation & Property Standards Board of the New Zealand Property Institute since 1998.

I am a Director of LECG and provide consulting advice and litigation support in the areas of financial reporting, financial management, capital markets, cost of capital and valuation. I have given expert evidence on these matters in High Court proceedings, arbitrations and Commerce Commission hearings.

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