AER RIANTA'S COST OF CAPITAL

A Final Report for Aer Rianta

Prepared by NERA

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Project Team:
Ian Jones
Dr Richard Hern
James Grayburn
Helen Lay
Susanne Toft

n/e/r/a

National Economic Research Associates
Economic Consultants

15 Stratford Place
London W1C 1BE
Tel: (+44) 20 7659 8500
Fax: (+44) 20 7659 8501
Web: http://www.nera.com

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EXECUTIVE SUMMARY

NERA was commissioned by Aer Rianta to estimate the cost of capital for Aer Rianta's regulated activities, and to consider the appropriate allowed rate of return to be used in the forthcoming regulatory review for setting tariffs. This report sets out NERA's methodology and conclusions.

WACC Methodology

A company's cost of capital must be estimated with reference to the rate of return investors could expect to earn on investments of equivalent risk.

The Weighted Average Cost of Capital (WACC) methodology is now widely accepted as a suitable method for calculating the cost of capital. The WACC methodology states that the cost of capital is calculated as the weighted average of the cost of debt and the cost of equity, weighted by the market values of debt and equity of an efficiently financed business. In applying the WACC methodology it is necessary to estimate the cost of debt, the cost of equity, and the "efficient" market-based weights separately with respect to investments of equivalent risk.

The WACC should be calculated on a post tax basis first to reflect the returns that investors require after corporation tax. Allowance for corporate taxes can then be made by either adjusting the post tax WACC to a pre tax WACC or by allowing for taxes separately in the revenue formula.

Our calculation of the WACC is also consistent with the valuation of the capital base in real replacement cost terms, and is an integral component of the regulatory building block approach to setting Aer Rianta's permitted tariff levels.

Single and Dual till estimates

In this report NERA estimates a WACC for Aer Rianta's under a single till and dual till regulatory regime. The single till considers all of Aer Rianta's operations in setting an allowable rate of return, namely:

- The core domestic airport business, i.e the ownership and operation of Dublin, Shannon and Cork airports; and,
- Aer Rianta's non- aeronautical businesses, such as retail airport management and property businesses.

The single till approach takes account of the contribution of Aer Rianta's aeronautical and non-aeronautical activities to overall company profits in setting the appropriate tariff level, and in this instance the appropriate cost of capital relates to the riskiness of aeronautical and commercial cash-flows. To the extent that profits from the non-aeronautical services display

different systematic risk than the core airport business, the single till cost of capital will differ from the dual till cost of capital. This report considers evidence on the differences in the cost of capital for Aer Rianta under single and dual till regulation based on differences in the riskiness of Aer Rianta's aeronautical and non-aeronautical businesses.

Although this report presents a WACC estimate to be applied in both a dual till and single till regime, NERA broadly supports the arguments put forward in Aer Rianta's recent submissions to CAR in favour if a dual till approach to regulation.[1]

Aer Rianta's "State Owned Enterprise (SOE)" Status

Since Aer Rianta is currently a State Owned Enterprise, market based measures of the cost of equity and the cost of debt and hence the riskiness of its cashflows cannot be directly observed. The procedure that is used in this paper for estimating the WACC of Aer Rianta is to examine market-based data for a set of comparator airport companies that share similar risk characteristics, with an appropriate adjustment for the particular operating conditions of Aer Rianta. In this way the WACC that is estimated will be consistent with the "market required" rate of return for Aer Rianta in the event that Aer Rianta was privatised.

It is not appropriate to assume that the WACC for Aer Rianta should be based on either the government borrowing rate or the embedded debt costs to Aer Rianta which reflect an implicit sovereign guarantee. The lower interest rate paid by a government simply reflects the guarantee provided by taxpayers to lenders. If Aer Rianta's allowed rate of return does not adequately reflect the nature of Aer Rianta's risks, then it would be implicitly assumed that the government and hence the tax payer would have to bear the shortfall in the event that cash flows were unexpectedly low.

Application of the Capital Asset Pricing Model (CAPM)

In estimating the cost of equity for Aer Rianta, NERA has applied the Capital Asset Pricing Model (CAPM), widely established as an appropriate model to use to estimate the post tax cost of equity of a regulated company. NERA considers that alternative cost of equity models such as the Dividend Growth Model (DGM) are not appropriate for estimating the cost of equity for Aer Rianta given the lack of availability of robust data.

The CAPM is based on the theory that the required return on an asset is related to the asset's *systematic risk*, that is, the degree of co-movement between the company's returns and the market returns. This measure of systematic risk is known as the beta factor and can only be directly observed for quoted companies.

[1] Submission to the Commission for Aviation Regulation on The Economic Regulation of Airport Charges in Ireland CP2/ 2001, March 27th 2001.

Since Aer Rianta is not quoted, it is necessary to estimate the beta factor of Aer Rianta's regulated activities by reference to observed equity beta factors of quoted "comparator companies". The estimated equity beta coefficients are then adjusted for differences in the financial riskiness of these comparator companies by a process of "unlevering" to calculate an asset beta which reflects the fundamental business riskiness of the airport industries. An adjustment is then made to the estimated asset beta factors to reflect the relative riskiness of Aer Rianta.

In estimating a beta factor for Aer Rianta, NERA has relied heavily on long run market based beta estimates of Aer Rianta's most appropriate comparator company, BAA. BAA has a similar, but not identical, balance of aeronautical and non-aeronautical activities in its revenue base, and is subject to a price cap regime. However, we would still expect their respective betas to diverge because of key differentiating factors, such as:

- composition of revenue (aeronautical/ non-aeronautical);
- the traffic mix (domestic/international/business/ leisure);
- the cost structure (operating/capital cost mix).

We have also taken into account regulatory precedent on airport beta estimation in both the UK (for a single till regime) and Australia (to inform our dual till estimate).

Cost of Debt and Optimal Gearing Methodologies

NERA's estimates of the cost of debt and optimal gearing for Aer Rianta are calculated with reference to private sector companies that have similar risk characteristics. Specifically, NERA considers both the actual observed costs of debt of the comparators and the relationship between the cost of debt finance and a company's capital structure.

NERA's estimates of the cost of debt and optimal gearing for Aer Rianta are based on the assumption that Aer Rianta must maintain at least a single A credit rating status. Given Aer Rianta's large capital investment programme over the next quinquennium, NERA consider that a single A credit rating is necssary to ensure that Aer Rianta is able to raise finance even in weaker capital market conditions. It has been recently observed that during periods of market turbulence, access to debt markets can be restricted for companies with weak investment grade credit ratings.

Post Tax WACC Estimates

Table 1 below presents NERA's estimate of the post tax WACC of Aer Rianta under a single and dual till regulatory regime. Estimates of equity and debt costs are both based on the assumption that the relevant investor market is the Eurozone market. This reflects the fact that investor diversification opportunities extend more widely than the Irish domestic

capital markets, and that there is free movement of capital within the Eurozone currency area.

This table shows that NERA's best estimate of the post tax "Vanilla" WACC, calculated as the weighted average of the post tax return on equity and the cost of debt gross of the debt tax shield, for a single till approach is 8.0% and 7.8% for a dual till approach.

Table 1
Cost of Capital for Aer Rianta's Regulated Activities

Parameter	Regulatory Regime	
	Single till	Dual till
Cost of Equity		
Nominal return on risk-free	5.0%	5.0%
Expected inflation	1.7%	1.7%
Risk-free rate	3.2%	3.2%
ERP	6.0%	6.0%
Asset beta	0.75	0.7
Debt	30%	30%
Equity	70%	70%
Equity beta	1.04	0.97
Post-tax return on equity	9.4%	9.1%
Cost of Debt		
Debt premia (basis points over riskfree)	150	150
Cost of debt	4.7%	4.7%
WACC	150	150
Real post-tax "Vanilla" WACC	**8.0%**	**7.8%**

Comments on Parameter Values

The parameter values represent NERA's best estimate of the appropriate values for Aer Rianta, based on a wide-ranging examination of existing evidence, as well as by NERA's own research. The key supporting arguments for each parameter value are set out below.

- ***Risk Free Rate***: Current data on yields on German government bonds, our proxy for the eurozone riskfree asset, suggests an estimate of the nominal risk free rate of around 5.0%. We calculate a real risk free rate of 3.2% based on the estimates of the nominal risk free rate adjusted for 1.7% expected inflation, where inflation estimates are based on consensus analyst forecasts.

- ***Equity Risk Premium (ERP)***: NERA's best estimate of the ERP for the eurozone market is 6.0%. In reaching this estimate, NERA have taken into consideration long run historic data on equity returns (for the UK, US and Euro markets), forward looking evidence (P/E ratios) and recent academic studies.

  - NERA strongly reject the basis of recent UK estimates of the equity risk premium by Ofwat (1999), Ofgem (2000) and the Competition Commission

(2000). These estimates relied heavily on interpretations of small sample survey results and non-published interviews with fund managers. This report notes a number of problems with the surveys that were conducted and the interpretation of the results. NERA note that other forward looking evidence from rigorously structured surveys used in US rate cases suggest an equity risk premium in the range of 6-7%.

- ***Beta:*** NERA estímate a beta coefficient for Aer Rianta under a single till and a dual till regulation system:

  - NERA's estimate of the beta coefficient for Aer Rianta under single till regulation is 0.75. This estimate relies heavily on market based evidence on the beta for BAA, which shows a long run beta for BAA since privatization of 0.67. NERA considers a beta for Aer Rianta would be higher than for BAA for the following reasons: (i) Aer Rianta has a higher proportion of non-aeronautical operations than BAA; (ii) Aer Rianta has a higher proportion of international and leisure traffic relative to BAA; (iii) Aer Rianta faces higher regulatory risk relative to BAA owing to a newer and more uncertain regulatory regime.

  - In deriving a beta estimate for a dual till business, NERA has taken account of evidence showing that variations in revenues from Aer Rianta's directly operated retail activities are very closely correlated with variations in traffic levels and so experience similar risk levels to aeronautical volume related revenues. NERA has also taken into account the higher operational leverage of the aeronautical business which, other things equal, leads to great profit volatility. Overall, NERA believes that only a small adjustment is appropriate when moving from a single till to a dual till beta estimate for Aer Rianta. NERA's best estimate of the asset beta for Aer Rianta under dual till regulation is 0.7, compared to 0.75 if it was subject to a single till regulatory framework.

- ***Cost of Debt:*** Our estimate for Aer Rianta's current debt premia (spread over government gilt of equivalent maturity) is based on evidence from private sector comparators that enjoy a similar single A credit rating. Recent medium term debt issues by a range of European utilities suggests a debt premium of 150 bps is consistent with a single A credit rating, and this is taken as our best estimate.

- ***Gearing***: NERA's analysis of quoted airports shows that their gearing (D/ D+E) ranges from 22 to 33% debt. We base our estimate for Aer Rianta's optimal gearing on an average of our quoted set of comparator companies of 30% debt. This is also consistent with regulatory precedent in the UK where in 1997 the MMC concluded that a gearing level of 30% was appropriate for BAA.

Taxation

There is no simple scaling formula for converting a post tax rate of return to a pre tax rate of return that can adequately capture the complexities of the interaction between a (nominal) tax system and a RPI-linked regulatory system. NERA also notes that Aer Rianta derives income from different sources and there is a degree of uncertainty whether some of these income sources will attract the passive corporation tax level of 25% or the reducing standard rate. Given this uncertainty a 25% tax rate is assumed.

For these reasons it may be more appropriate to set revenues on the basis of a post tax rate of return with separate allowance for forecast tax costs determined through financial modelling.

An indicative estimate of the Real Pre tax WACC for Aer Rianta can be reached by applying the following formula, which takes into account the fact that taxes are paid on nominal profits.

Real Pre Tax WACC=(Nominal Post Tax "Net of Debt Tax Shield" WACC/(1-t)-I)/(1+I)

Where: I is the expected inflation rate, t is the tax rate.

In the table below NERA has estimated a real pre tax WACC for Aer Rianta based on current effective tax rates of 25% and 20% respectively for single till and dual till operations. This table shows that NERA's estimate of the pre tax WACC for a single till approach is 10.8% and 9.8% for a dual till approach.

Table 2
Pre Tax WACC

WACC	**Regulatory Regime**	
	Single till	**Dual till**
Real post-tax "Vanilla" WACC	**8.0%**	**7.8%**
Real post tax "Net of Debt Tax Shield" WACC[1]	7.7%	7.5%
Effective tax rate	25%	20%
Nominal "Net of Debt Tax Shield" WACC	9.5%	9.3%
Real Pre-Tax WACC using "Historical" Formula.	**10.8%**	**9.8%**

[1] Note: Post tax "Net of Debt Tax Shield" WACC = Post tax cost of equity*E/(E+D) + Cost of debt (1- tax rate)* D/(D+E)

We recommend, however, that this formulaic estimate of the tax wedge should be confirmed as accurate through the use of financial modelling of actual tax liabilities given the other regulatory assumptions.

Appropriate Rate of Return

The appropriate allowed rate of return must ensure that investors' average expected post tax returns are equal to the estimated post tax WACC. Differences can arise between the appropriate allowed rate of return and the estimated post tax WACC in the event of asymmetric risks, that may arise in particular from other regulatory price setting assumptions such as operating expenditure and capital forecast projections.[2] This report does not consider all the regulatory assumptions of tariff setting.

[2] In other words, if investors expect higher outturn costs that the regulator assumes then the expected rate of return will be lower than the allowed rate of return. Conversely if the allowance for tax is higher than investors' expected tax costs then the expected rate of return will be higher than the allowed rate of return.

1. INTRODUCTION

NERA was asked by Aer Rianta to estimate its cost of capital as part of its present price review process.

The structure of the report is as follows:

- Section 2 discusses a number of key issues central to the calculation of Aer Rianta's cost of capital, including the nature of the regulatory regime (e.g. single or dual till), and sets out our rationale for calculating its cost of capital in the context of a European market.
- Section 3 briefly discusses the economic and financial theory underpinning this study, in particular, it outlines the Capital Asset Pricing Model (CAPM), which is the basis for our calculation of Aer Rianta's equity costs.
- Section 4 sets out our estimates of the constituents of the CAPM, and calculates the cost of Aer Rianta's equity with reference to the eurozone area;
- Section 5 discusses the linked issues of Aer Rianta's cost of debt and gearing
- Section 6 examines the expected effective corporation tax rate.
- Finally, Section 7 draws upon these results to calculate the likely range of Aer Rianta's pre-and post-tax real and nominal cost of capital.

2. KEY ISSUES

This section discusses a number of key issues that affect our approach to estimating a cost of capital for Aer Rianta.

- The nature of Aer Rianta's regulated activities and the form of regulation.
- Aer Rianta's status.
- The relevant investor market.

2.1. The Nature of Aer Rianta's Regulated Activities and the Form of Regulation

Aer Rianta's main activities are:-

- The core domestic airport operations, i.e the ownership and operation of Dublin, Shannon and Cork airports, which together handle about 97 per cent of all air passenger traffic to and from Ireland
- International airport management, undertaken through a wholly owned subsidiary, Aer Rianta International.
- Non-aeronautical services, such as airport retail management, property services and its hotel business.

This report considers Aer Rianta's cost of capital under both single and dual till regimes. Although there is no clear cut distinction between activities that fall within each regulatory regime, we broadly interpret Aer Rianta's regulated activities under a dual till framework as consisting of the services provided to airlines at its core domestic airports, for which airlines pay through airport charges, primarily in the form of landing, parking and passenger service charges. By contrast, under a single till approach, the regulator must set airport charges to airlines taking account of the contribution to Aer Rianta's common costs from a wider set of commercial activities.

To the extent to which these two "businesses" display different levels of systematic risk, the two forms of economic regulation will be associated with different costs of capital. Typically, it is assumed that the commercial activities of an airport operator's business display higher levels of systematic risk, and therefore a single till regime is associated with a higher cost of capital to compensate investors. The core airport business is assumed to be less cyclical, and therefore a less risky proposition.

The key differentiating factor is our measure of beta for the single and dual till businesses. We present a beta estimate for the single till business first, and then derive a beta estimate for a dual till regime from this single till estimate. Our single till estimate is directly

observed from BAA's equity beta calculated over a long timeframe, with adjustments for differentiating factors, to derive Aer Rianta's single till beta. Our dual till beta then takes into account largely qualitative evidence regarding the relative systematic risk of commercial activities vis-à-vis the aeronautical business, as well as regulatory precedent from Australia, which operates a form of dual till regime for its primary airports.

2.2. Aer Rianta's Status

Since Aer Rianta is currently a State Owned Enterprise, market based measures of the cost of equity and the cost of debt and hence the riskiness of its cashflows cannot be directly observed. The procedure that is used in this paper for estimating the WACC of Aer Rianta is to examine market-based data for a set of comparator airport companies that share similar risk characteristics, with an appropriate adjustment for the particular operating conditions of Aer Rianta. In this way the WACC that is estimated will be consistent with the "market required" rate of return for Aer Rianta in the event that Aer Rianta was privatised.

It is not appropriate to assume that the WACC for Aer Rianta should be based on either the government borrowing rate or the embedded debt costs to Aer Rianta which reflect an implicit sovereign guarantee. The lower interest rate paid by a government simply reflects the guarantee provided by taxpayers to lenders. If Aer Rianta's allowed rate of return does not adequately reflect the nature of Aer Rianta's risks, then it would be implicitly assumed that the government and hence the tax payer would have to bear the shortfall in the event that cash flows were unexpectedly low.

2.3. The Relevant Investor Market

It is common regulatory practice to estimate several key parameters in the WACC calculation by reference to the domestic capital market. For example, the risk free rate is estimated using appropriate domestic government debt instruments, possibly in conjunction with the predicted domestic inflation rate.

However, Ireland is now a full member of the Eurozone currency area, with free movement of capital between its members, so that investors in other Eurozone countries may hold Irish Government stock without currency risk. Irish investors in turn, are able to invest in assets quoted on other Eurozone stock markets without currency risk. Under these circumstances, we believe that there is a strong case for assessing WACC parameters on a Eurozone-wide basis.

3. COST OF CAPITAL PRINCIPLES

3.1. Introduction

This section briefly discusses the general principles underlying the calculation of a company's cost of capital. We begin by discussing the weighted average cost of capital (WACC) formula, which determines the required rate of return on a company's total capital base, before discussing the two key components of the WACC, the required return on equity, as determined by the generally accepted financial model, CAPM, and the return on debt.

3.2. WACC

Companies can raise capital through either debt or equity. The relative return required for equity and debt is different because debtholders enjoy a prior claim on a company's earning stream, and therefore face different levels of risk. Thus, the cost of capital for a company is a weighted average of the two instruments, with the weightings determined by the relative levels of debt and equity in the company's asset base, or the company's "gearing".

Formally, the post-tax cost of capital is:

$$\text{Post-tax WACC} = g \times r_d + (1 - g) \times r_e$$

where,

g = gearing = (debt/ debt + equity)

r_d = the post tax cost of debt; and

r_e = the post tax cost of equity

The post-tax WACC is the return required to persuade investors to take on the risks of investing in this company. However, since companies' profits are taxed, this is not the same as the return that a company is required to make in order to provide that post-tax return. In short, interest repayments on debt are not subject to corporate taxation and thus the pre-and post-tax rates of return on debt equate. However, returns on equity are subject to taxation, and this drives a wedge between pre- and post-tax cost of capital.

3.3. Cost of Equity

The post-tax cost of equity is the return on equities (either through dividends or through an increase in the value of shares) that is required to persuade investors to bear the risk associated with the company's equity. There are essentially two ways of calculating the cost

of equity, the Capital Asset Pricing Model (CAPM) and the Dividend Growth Model (DGM). However, in practice DGM is infrequently used by regulators, because one of its key components, the expected growth in company's dividends, is unobserved. Thus, to calculate Aer Riantas cost of equity we follow regulatory precedent and use the more generally accepted financial model, CAPM, to determine equity costs, as described below.

3.3.1. Principles of the CAPM

This section provides a description of the conceptual background of the Capital Asset Pricing Model. The standard Capital Asset Pricing Model determines required returns for investment in the equity capital of a firm as:

$$E[r] = E(r_f) + \beta(E[r_m] - E(r_f))$$

Where $E(r_f)$ is the current risk-free rate of return; beta (equity beta) is the expected covariance between returns on the risky asset and the market portfolio, divided by the variance of the market portfolio; and $E[r_m]$ is the expected rate of return for the market.

A key tenet of the CAPM is that an investor *diversifies* his or her stock holdings by combining risky securities into a portfolio. The effect of this diversification is to eliminate risks known as *specific* risks (also known as non-systematic risks). Specific risks arise from all those events that are unique to a particular share and have nothing to do with general market or economic factors. Because specific risks are not related, an investor holding a diversified portfolio can eliminate this type of risk.

Complete diversification of risk is not possible since securities all move together to a certain extent, a result of the influence of economy wide factors such as interest rates, inflation, and macro economic demand. The risks that cannot be eliminated through diversification are described as "market" risks (or "systematic" risks).

A fundamental notion of the CAPM is that investors are risk-averse and therefore they demand higher returns for assuming additional risk and that higher risks securities are priced to yield higher returns than are lower risk securities. The CAPM quantifies the additional return required for bearing incremental risk, and provides a formal risk-return relationship based on the idea that only market risk matters, as measured by beta.

There are a number of issues to stress about the underlying assumptions of CAPM:

- the standard CAPM (shown above) is a "single period" model that attempts to explain investors required returns assuming that risk free returns and the equity risk premium ($E(r_m) - E(r_f)$) defined over the same period are constant. The CAPM is mute with respect to how long the period is. Over different periods, required returns may change if expectations change or if attitudes to risk aversion change;

- the CAPM is an equilibrium pricing model that describes the risk-return relationship in "efficient" capital markets. By "efficient" it is meant that the capital market utilises all available information in setting the prices of its assets (Ross (1989)). In this situation, there should be no opportunity for traders to earn arbitrage profits on the basis of other "available information";
- the standard CAPM assumes that there are no transaction costs, taxes, or impediments to trading. It assumes that all assets are perfectly marketable and that no one trader is significant enough to influence price;
- the standard CAPM assumes that investors are risk averse and base their portfolio decisions only on the first two moments of the distribution of possible returns, the expected return and the variance of return, implying that returns are normally distributed; and
- the standard CAPM assumes that investors can lend or borrow unlimited amounts at the risk free rate.

In the theoretical literature, a number of variants of CAPM have been proposed to accommodate more realistic assumptions with respect to one or more of these assumptions.

It is also important to stress that the CAPM is an *expectational* model whereas most of the available capital market data to support the theoretical input variables (expected risk free rate, beta, expected market return) are historical. This is an issue that we will continually refer to in the calculation of the components of CAPM in Section 4.

3.4. Principles for Estimating the Cost of Debt

The cost of debt can be expressed as the sum of the risk free rate and the company specific debt premium. The company specific debt premium is driven by the ratings which specialist credit rating agencies, such as Standard & Poor's (S&P's), assign to that company.[3]

In essence, credit ratings are based on a number of financial characteristics such as market capitalisation, earnings volatility, and business risks specific to the company and/or the sector. However, particular regard is paid to the following two financial ratios:

- Funds From Operations (FFO) interest coverage; and
- Interest Coverage defined on earnings basis (EBIT).

Interest cover, defined as the number of times by which a company can meet its interest payments out of operating profits, is essentially a measure of the surety of interest payments

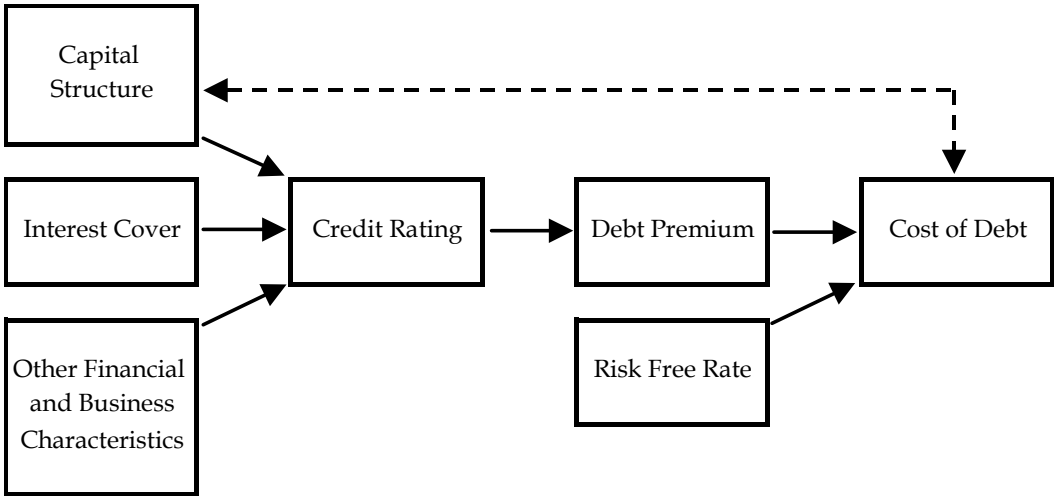
[3] Some companies, particularly large and well known, choose not to be rated but still access the capital markets for debt at appropriate levels.

being met. A company with low interest cover is less likely to maintain a premium credit rating, since the probability of default on interest payments will be relatively high. S&P's particularly emphasises funds flow interest coverage as a rating criterion.

A company with a high gearing ratio is also less likely to maintain a premium credit rating. This reflects the fact that the probability of default on interest payments will be higher if gearing is high. It is clear that credit rating agencies, in determining credit ratings, are concerned primarily not with capital structure per se, but rather with debt service coverage levels, measured on both a cash flow and earnings basis.

Figure 3.1 summarises the relationships between gearing and interest cover, credit ratings, other business and financial characteristics and the debt premium and cost of debt. In Section 5 we estimate the cost of debt for Aer Rianta with reference to comparable utilites. We consider both the actual observed costs of debt of the comparators and the relationship between the cost of debt finance and a company's capital structure, on the basis of these linkages.

Figure 3.1
Relationship Between Capital Structure, Interest Cover, Credit Rating and Cost of Debt



3.5. Principles for Estimating Gearing

Finance theory states that the appropriate discount rate for expected future cash flows is the Weighted Average Cost of Capital (WACC) which represents a weighted average of the expected costs of debt, equity and hybrid financing.

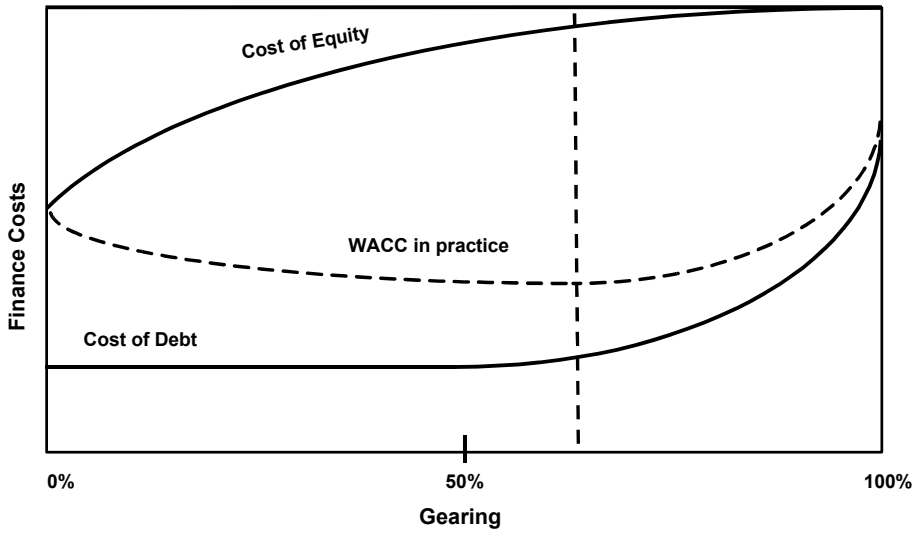
It is now generally accepted that changes in the proportion of debt and equity in the balance sheet can, in practice, have significant implications on a company's overall costs of finance. This is the result of a number of factors that occur when gearing is changed:

- Debt risk and interest rate changes;
- Equity risk changes;
- Probability of future default changes;
- Tax position (personal and corporate) changes;
- Investment strategy may change.

Academic theory cannot predict what proportion of overall finance should be raised through debt or equity. In general terms, debt is advantageous because of its low costs and tax deductibility but can be disadvantageous where personal taxes and bankruptcy costs are concerned. The optimal capital structure of a company will normally consist of a mixture of debt and equity finance.

Companies with stable cash flows and low risk profiles can absorb more debt into their balance sheets than most other types of companies. However, to assess the optimal capital structure of a utility, an empirical analysis is required that examines market evidence on how the perceptions of investors, credit rating agencies and financial markets in general are affected by capital structure changes.

Figure 3.2
Does Capital Structure Matter?



In assessing "optimal" capital structure it is important to focus not only on central case scenarios but also on downside scenarios. The possibility, for example, that capital expenditure may be substantially above central case projections may mean that an "optimal" capital structure will allow for unused borrowing capacity to increase debt in adverse

circumstances. Some trade-off is likely to exist between minimising the average cost of new finance and minimising the *possibility* of financial distress and bankruptcy.

4. ESTIMATING THE COST OF EQUITY

4.1. Introduction

The CAPM model discussed in section 3.3.1 determines the required returns to investment in equity capital as:

$$E(r) = E(r_f) + \beta [E(r_m) - E(r_f)]$$

where $E(r_f)$ is the expected risk-free rate of return; beta (equity beta) is the expected covariance between returns on the risky asset and the market portfolio, divided by the variance of the market portfolio; and $E[r_m]$ is the expected rate of return for the market. The term in square brackets, $[E(r_m) - E(r_f)]$, is known as the equity risk premium (ERP).

This chapter applies the CAPM approach to estimate the post-tax cost of Aer Rianta's equity finance.

- Section 4.2 gives estimates of the risk free rate.
- Section 4.3 discusses the equity risk premium.
- Section 4.4 discusses the equity beta.
- Section 4.5 presents conclusions.

4.2. Estimating the Risk-Free Rate

CAPM states that the risk-free asset has zero correlation with the market portfolio, that is, a return on a zero beta asset or portfolio. However, in practice it is difficult to identify an asset that is completely risk-free, since inflation, as well as other factors, has been shown to lead to covariance between notionally risk-free government debt and stock markets.

In the UK there is general agreement that index-linked-gilts (ILGs) provide the closest proxy to the risk-free asset. The reason for this is twofold. First, the yield on index linked gilts is immune from the effects of unanticipated inflation. Second, it has been argued that the returns on index linked gilts are less correlated with the market than the returns on Treasury bills and other government bonds, and are therefore closer to satisfying the theoretical requirement of having a zero beta.[4]

Unfortunately, neither the Irish government nor any other eurozone government issues ILGs. Thus, for our purposes we present government bonds with a return denominated in

[4] This point was made by Stephanie Holmans in Ofwat RP5 (1996) , Section 2.5.

nominal terms as our proxy for the risk-free rate, and then make an adjustment for expected inflation.

There are two key questions regarding the appropriate proxy for the risk-free rate:

- First, are current "spot" yields, or historic average yields a more appropriate measure of the expected return on the riskless asset?
- Second, what is the appropriate bond term or maturity: should it be commensurate with the regulatory period, investment horizon of an investor, or average asset life?

As the CAPM is an expectational model the appropriate yield measure would appear to be the present "spot" rate. The present spot rate embodies expectations of real interest rates over the term of the bond. However, if there is evidence to suggest there are temporary, short-term factors influencing the market, then yields over a longer timeframe might offer a better indicator of yields going-forward. For example, in UK there is evidence to suggest that "institutional factors" have suppressed present yields, which provides an argument for using an historic average.

With regard to the appropriate bond term or maturity, there are three conceptually attractive options.

- the "investment horizon" or security holding period for a representative equity investor, equivalent to the CAPM horizon;
- the "planning horizon", that is the average life of projects that are to be assessed using the estimate of the cost of capital.
- the time-horizon of the periodic review is the appropriate measure, as this offers an opportunity to readjust the ex-ante return on the asset base.

The preferred academic position - since the CAPM is a single period model - is to choose a maturity that is consistent with the investment horizon. However, as Paterson (1995) notes, there is little or no evidence to guide the length of the investment horizon of an equity holder, although cursory evidence in the US suggests one year or more.

A theoretical argument that is sometimes made in regulatory discussions is that "investment horizons" are heavily influenced by the nature of the regulatory regime. The WSA/WCA (1991) argued:

> "*The nature of the regulatory regime is such that each price review process represents an opportunity and indeed a requirement to redetermine the ex ante earnings potential of the assets….(T)o conclude the ten (or five) year time period between Periodic Reviews would seem to provide the most appropriate benchmark for determining the true time horizon to be used in estimating the risk free rate.*"

However, this argument overlooks the fact that in practice regulated companies issue bonds of considerably longer maturity than the periodicity of the price review, typically 5 years, and these bonds have to be serviced over their entire lifetime.

Although the arguments regarding the appropriate term have not been resolved, increasingly the consensus among regulators globally has been to adopt securities with maturities of around 10 years as the appropriate measure of the risk-free rate. The main reason underlying this choice is that the 10-year bond is typically the security that has the closest maturity to the 15 year-plus investment profile of utility assets, while also retaining a certain liquidity and market depth, and therefore price stability.

Thus, there is strong precedent for selecting current yields on long term bonds as the proxy for the risk-free return.

4.2.1. The risk-free rate in practice

Consistent with the view expressed in section 2.1 above, that the relevant investor market is (at least) Europe-wide, our discussion of the risk free rate focuses on conditions in the eurozone area, as proxied by yields on German government debt. We also demonstrate that, as we would expect, the existence of a common currency zone means that yields on comparable Irish government stocks are similar to the benchmark German stocks.

Table 4.1
German Bond Yields

Bond type	Maturity	Current yield to maturity[1]	Average yield to maturity[2]
4% Bundesschatzanweisungen	14/12/01	4.263%	4.784%
4.25% Bundesobligation	18/02/05	4.404%	4.799%
5.375% Bundesrepub. Deutschland	04/01/10	4.979%	5.019%
6% Bundesrepub. Deutschland	20/06/16	5.312%	5.192%

Source: NERA analysis of Bloomberg data. 1: Current yield to maturity is as of 05/06/01. 2: Annual average, from 05/06/00 to 05/06/01

Table 4.1 indicates that the German bond market is characterised by an upward-sloping yield curve, as we would expect. Comparing current yields to the average yield over the previous nine months indicates a very slight movement in the term structure of the bond market, with the yield on short term bonds increasing slightly and yields on medium to long term issues falling. A comparison with yields over the previous six months shows that current yields have fallen by about 0.5%.

Table 4.2 presents the return on Irish government debt for similar maturities to German government issues. The return on Irish bonds shows a similar pattern to German bonds, with an upward sloping yield curve and a recent fall in returns of approximately 0.5%. This is an important observation. The parallel movements in Irish and German bonds suggests

that there are no significant short-term "institutional factors" influencing bond returns in these two markets, and thus we conclude that fundamental economic changes underlie the movements. Indeed, other eurozone countries display similar trends (see Appendix A).

In such circumstances, there is strong theoretical preference for the current yield as a proxy for the expected risk-free rate. Thus, we assume that the appropriate return on the riskless asset in the eurozone market is the *current* yield on German 10-year Treasury bonds, equal to 5.0%.

Table 4.2
Irish Bond Yields

Bond title	Maturity	Current yield to maturity[1]	Average yield to maturity[2]	Yield at 30/6/2000
6.5% Treasury bond 2001[3]	18/10/01	4.512%	4.389%	5.029%
3.5% Treasury bond 2005	18/10/05	4.631%	4.983%	5.278%
4% Treasury bond 2010	18/04/10	4.949%	5.330%	5.487%
4.6% Treasury bond 2016	18/04/16	5.189%	5.554%	5.566%

Source: NTMA, NERA analysis of Bloomberg data. 1: As at 02/02/01. 2: Average over 11/05/99 to 02/02/01. 3: The buyback was limited to 30% of the outstandings by the NTMA for market management purposes.

4.2.2. Inflation expectations

German debt returns are denominated in nominal terms. Thus, we require a long term inflation forecast of similar maturity to calculate the real risk free rate.

Table 4.3 and Table 4.4 presents Consensus Forecasts (CF), a forecast based on a survey of a private sector and research institutions throughout Europe, and the UK's National Institute of Economic and Social Research (NIESR) long term forecasts for Germany, our eurozone proxy. The average inflation rate forecast by CF is approximately 1.7% over the period 2001-2010. The NIESR forecast for Germany is consistent with CF report, at a constant 1.7 per cent, albeit over a shorter timeframe.

Table 4.3
Consensus Forecasts Inflation Forecasts

Year	2001	2002	2003	2004	2005	2006 – 2010
Forecast	1.8	1.6	1.6	1.6	1.7	1.7

Source: Consensus Forecasts Global Outlook 2000 – 2010.

Table 4.4
NIESR Inflation Prospects

Year	2001	2002	2003-2007
Forecast	1.7	1.7	1.7

Source: National Institute Economic Review..

4.2.3. Conclusions on the value of the real risk free rate

On the basis of these forecasts, we assume that the relevant inflation rate is 1.7%. This suggests that, on the basis of the 10 year bond yields presented above, the real risk-free rate is approximately 3.2% in the context of a eurozone estimate of the cost of capital.

4.3. Equity Risk Premium (ERP)

Consistent with prevailing views amongst both academics and finance practitioners, NERA's approach to estimating the ERP relies primarily on the results obtained from the analysis of the average difference over the long term between realised returns on the market portfolio, and those on a risk free asset. NERA also follows mainstream opinion in favouring the use of the arithmetic rather than the geometric mean in deriving an average measure of returns to each type of asset. The arithmetic mean approach is consistent with the hypothesis that financial markets are efficient, with equity returns serially independent.

We begin, in section 4.3.1, by summarising the findings from analyses of historical returns. As we show in section 4.3.2, the historical findings are broadly corroborated by evidence from an alternative approach, based on ex-ante evidence on expected returns, derived either from surveys of informed market participants, or from market data on share prices and expected dividend growth. Section 4.3.3 examines recent regulatory precedent, and section 4.3.4 gives conclusions.

4.3.1. The evidence from historical returns

We have examined the available evidence on the arithmetic returns to equities and to a selection of government securities over the most recent 10 year (1991-2001) and 30 year (1971-2001) periods (Table 4.5), and over the very long term (100 years).

We focus on evidence on returns on the FTSE All Share and the S&P500 indices, both of which are mature and broadly based equity markets, with sufficient historical data to produce reasonable estimates of the risk premium. While there are other European equity markets that may be mature, such as the German DAX index, they tend to be dominated by a few large companies, and therefore are not representative of a well-diversified portfolio.

Table 4.5
10 and 30 year Equity Market Risk Premium Estimates

Sample period	Market used	Average total returns on market[1]	Average risk-free rate[2]	Equity market risk premium
10 years	FTSE all share	11.48%	7.33%	4.15%
10 years	S&P500 index	16.12%	6.23%	9.89%
Average				***7.02%***
30 years	FTSE all share	13.24%	7.33%	5.91%
30 years	S&P500	10.99%	6.23%	4.76%
Average				***5.3%***

Source: NERA analysis of Bloomberg data. 1: Equity returns defined as the average annual return on the indicated stock market. 2: The risk-free rates are calculated using an average 10 year bond yield.

Estimates of the ERP over a very much longer time period are available in the recent LBS / ABN AMRO publication[5] which reports the returns on equity markets around the world over the last 101 years, and compares them against the returns on treasury bills and bonds. The summary results, presented in Table 4.6, indicate a long term global ERP of approximately 7 per cent using arithmetic averaging.

Table 4.6
LBS / ABN AMRO estimates of the equity risk premium

	ERP relative to Bills		ERP relative to Bonds	
	Arithmetic	**Std. dev.**	**Arithmetic**	**Std. dev.**
UK	6.5%	19.4%	5.6%	16.7%
Ireland	6.7%	23.2%	6.0%	20.4%
Germany[1]	10.3%	35.3%	9.9%	28.4%
USA	7.5%	19.8%	6.9%	19.9%
World average[2]	7.5%		6.7%	

Source: LBS / ABN AMRO "Millennium Book II, 101 years of investment returns", 2001. 1: The estimates are based on 99 years of data, with 1922/3 excluded where hyperinflation had a major impact on the risk premia and bills returned –100%. 2: The countries included in this average are: Australia, Belgium, Canada, Denmark (from 1915), France, Germany, Ireland, Italy, Japan, Netherlands, Spain, Sweden, Switzerland (from 1911), UK and USA.

[5] E. Dimson, P. Marsh, M. Staunton, "Millennium Book II, 101 years of investment returns", 2001

These results would suggest that whilst the estimated ERP over the past 30 years has been somewhat lower than the ERP estimated over the most recent 10 year period, the 10 year estimate, of around 7%, is remarkably similar to the average for the UK and US over the very long term.

We would interpret the historical evidence as supporting an ERP in the range of 6-7%.

4.3.2. Ex ante approach

An alternative approach described as a "full ex ante" approach, is to consider evidence on current investors' expectations of equity returns instead of evidence on historical long run outturns of equity returns.

4.3.2.1. Survey Evidence

The table below summarises the results of surveys, in both the UK and US, which have been referred to in a regulatory context. We summarise comments made on the robustness of these results.

Table 4.7
Survey Evidence Regarding Equity Risk Premium

Survey	Equity risk premium: findings	Robustness / comment
UK SURVEY EVIDENCE		
UK Strategy Forecasts at Investment banks	range of 2% - 5% reported	Range of market premia from UK strategists from SSSB, Deutsche Bank and Morgan Stanley.
NERA 1998 UK Analysis	3% – 4% mean estimate	Sample size of six analysts only. Answers show wide variation
Credit Lyonnais Securities (CLSE) 1998	2.75% - 7.2%, based on estimates on required returns on water equity	The survey did not ask investors for direct estimates of equity risk premium OFWAT/OFGEM interpreted a range of 2.7-4.2%. The LBS suggested the range could be approx. 3% higher
PriceWaterhouseCoopers (1998)	7 funds reported 2 – 3% 3 funds reported -1 - 1% 2 funds reported 6 – 8%	Polled 12 big pension fund managers in the UK on their expected market premium in the next 15 years.
MMC / Bgas 1993	3.37% - 3.5%, based on reported average 7.0% for expected equity returns.	Sample size of eight fund managers responses considered.
US SURVEY EVIDENCE		
Welch 1998 (US Financial economists)[6]	6% mean estimate	70 financial economists; estimates varied between 4% and 8%
Harvard Business review (1995)	Most corporations used 5%; M&A groups used 7% based estimates on historic rather than forward-looking data.	Best practices study among investment banks, M&A groups and 27 leading North American corporations.
Carleton and Harlow (1993), US, using database of analysts' forecasts	6.5% for period 1982 – 1990; 7.5% for period 1989 – 1993	Methodology approved in US rate setting cases
Harris and Martson (1992), US, using IBES database of analysts' forecasts	6.5% based on expected return for equity market minus long term yields on government bonds	Methodology approved in US rate setting cases

[6] Welch (1998) "Views of financial economists on the equity premium and other issues", Working paper, Anderson Graduate School of Management, UCLA, April

It is clear from Table 4.7 that the estimates of the ERP derived from US surveys are significantly higher than those shown in UK surveys. Such differences are hard to justify given that casual evidence shows stock market returns between the UK and the US to be highly correlated.

NERA would argue that more weight should be put on the US than on UK survey evidence for the following reasons:-

- First, the US data are based on much larger sample sizes;
- Second, the US data have regularly been used as evidence on the appropriate allowed cost of equity in US rate cases, and as such, have been subject to far more demanding scrutiny and testing than UK material.

The US data are broadly supportive of the estimates of an ERP of 6-7% derived from historical data.

4.3.2.2. Evidence from Price-Earnings Ratios

The so-called dividend growth model offers an alternative approach to deriving an ex-ante estimate of the ERP. The model uses market data on actual share prices and earnings per share, in conjunction with forecasts of the growth in earnings, to derive an implied cost of equity, such that:.

> *Share Price = Expected earnings/share next period / (Required return on equity – expected growth rate)*

The model thus implies that the required return on market equity (R_e) is:

> R_e = *(Expected earnings / market price) + expected earnings growth rate*;

Using this model to calculate the required return on the market index, defining the required return on the market portfolio (R_m) as the sum of the market ERP (R_m-R_f) plus the risk free rate, it therefore follows that the market ERP can be expressed as:

> $ERP = (E/P)_{MARKET\ INDEX} + (expected\ earnings\ growth\ rate)_{MARKET\ INDEX} - R_f$

The approach is market-driven and uses current data.. Table 4.8 shows the implied equity premiums in the European market based on the current P/E ratios of the index, a real risk-free rate for Europe at 2.94%, and a real earnings growth rate of 4% across Europe, the latter slightly above the growth in EPS in the US since 1945. However, US GDP growth in this period was also less than growth of eurozone GDP, suggesting that the 4% per annum assumption is consistent with historical experience for the eurozone.

Table 4.8
Implied Equity Risk Premium Based on Current P/E Ratios

Index	Country	Current P/E	Implied ERP[1]
Bloomberg European 500	Europe	22.69x	5.47%
FTSE Eurotop 300	Europe	24.37x	5.50%
FTSE Eurotop 100	Europe	22.51x	5.16%

Source: NERA analysis of Bloomberg data May 2001. 1: Based on a long-term real risk-free rate of approximately 3% (based on earlier derivation of riskfree rate) and an annual earnings growth rate of 4%.

Using this methodology, the implied eurozone ERP is in the 5-6% range, slightly less than the estimate from historical returns.

4.3.3. Regulatory precedents on the equity risk premium

Recent UK regulatory estimates by Ofgem, the ORR and Ofwat of the UK equity risk premium are in the range of 3.5-5%. The Competition Commission (2000) used an equity risk premium of 4% in its review of the price limits for Mid Kent Water and Sutton and East Surrey Water. These estimates of the equity risk premium rely heavily on small sample survey evidence of the equity risk premia by CLSE (1999), NERA (1998) and other evidence from Investment Bank analysts.

The basis for the estimates of the ERP derived by UK regulators has come under considerable scrutiny by academics and industry commentators who have questioned the reliability of the survey evidence used by the UK regulators. NERA highlight a number of the main concerns:

- *Small sample biases* – Many of the surveys conducted appeared to use very small samples. The NERA (1998) survey, for example, was of six utility analysts and the answers showed a wide range of results.

- *Questionnaire biases* – it is well known that the results of surveys are sensitive to the design of the questionnaire. No evidence was provided to suggest that the structure of the surveys undertaken were sensitive to these possible biases.

- *Questionable interpretation of results* - the interpretation of the results of the surveys is also questionable. For example, Ofwat's (1998) interpretation of CLSE survey evidence led them to an estimate of the ERP of 2.4% to 4.7%. Cooper and Currie (1999) argue that other interpretations of the CLSE survey data could lead to a post tax cost of equity that is 1.7% to 2.5% higher. [7]

[7] *"(Surveys) tend to generate quite wide ranges of results and are increasingly subject to the problem that their replies have some bearing on the permitted returns in regulated industries"* MMC: Cellnet and Vodaphone p.65 (December 1998).

- *Short time horizons* - it is unclear what methodology is used by these utility analysts (and fund managers) to arrive at estimates of the ERP and, in particular, what time horizon is considered to derive these numbers. NERA would argue that an estimate of the equity risk premium based on a short time horizon is not appropriate for setting prices over a five year period.[8]

The Competition Commission and, most recently, the CAA (2001)[9] concurred that the results of survey evidence on the equity risk premium may be subject to biases that are difficult to quantify and assess. Given these concerns, the basis for the Competition Commission's and the CAA's estimate of the ERP of 4% is hard to understand since it is inconsistent with the historic data on equity returns which both the CAA and the Competition Commission state that they place greater reliance.

In the Netherlands, the electricity regulator DTe has recently published its guidelines for price cap regulation in the period from 2000 to 2003 whereby it "*considers it reasonable to fix the market risk premium between 4% and 7%*[10]". This is derived on the basis of the available data and responses from the sector. This is in line with the decision of OPTA Commission in assessing the telephone tariffs.

In the US, although the CAPM is not widely used to estimate the cost of equity, the most widely quoted source used in the rate of return cases of the equity risk premium is the Ibbotson data. The method recommended by Ibbotson is to compute, for each year, the excess of the stock market return over the long-term treasury bond yield prevailing at the beginning of that year, and then arithmetically average them over the years. The result is an estimate of 8.0%. The final adopted figures are generally in the range of 6-7%. Such estimates are based on detailed survey data from the IBES database, and historical evidence. The Table 4.9 shows an example of the ranges accepted.

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8 Short term estimates of the equity risk premium can be affected by market volatility. A number of academic studies show that the equity risk premium can vary substantially in the short term.

9 "Cost of Capital: Position Paper", CAA, June 2001.

10 "Guidelines for price cap regulation of the Dutch electricity sector in the period from 2000 to 2003", Netherlands Electricity Regulatory Service, February 2000

Table 4.9
Recent decisions regarding the equity risk premium in the US

Decision	ERP estimate	Comments
Connecticut Department of Public Utility Control Decision 98-01-02 (February 1999) for Connecticut Power & Light Company	6.52%, 5.89%	Different witnesses performed the CAPM calculation with different ERPs. These are the ERPs used in the CAPM calculations that the Commission approved of.
Maine Public Utilities Commission, Decision 97-580 (March 1999) for Central Maine Power Company	7.40% - 8.90%	The Commission uses CAPM analysis as a check on the DCF method, and employs this range of ERPS, based on witnesses' recommendations.
Public Service Commission of Utah, Decision 97-035-01 (March 1999) for Pacificorp, dba Utah Power and Light	7.8%	Use CAPM as check to DCF model.
Connecticut Department of Public Utility Control Decision 99-04-18 (January 2000) for Southern Connecticut Gas Company	6.13%	The Commission used a Risk Premium Method to check DCF. The ERP is the arithmetic average from 1974-1998.
Public Utility Commission of Oregon Order 99-697 (November 1999) for Northwest Natural Gas	8.5%	Commission chose the ERP for use in CAPM.

In recent decisions, Australian regulators have concluded that the market risk premium is most likely to lie in the range of 5.0% to 7.0%. The most recent regulatory decision by the ACCC in the price review of Sydney Airports used an equity risk premium of 6%. In the electricity sector, on the other hand, independents experts have used 6.5% in their submissions for electricity distribution pricing. In May 1999, one market practitioner noted that "[it] believes 6 per cent [equity risk premium] to be a reasonable, if not conservative, estimate[11]".

4.3.4. NERA conclusions on the equity risk premium

NERA believes that – compared to the rather weak UK survey evidence - more weight should be attached to estimates of the ERP based on historic data and market based evidence such as that derived by analysis of P/E ratios, and worldwide evidence such as that used in US rate cases.

On this basis our best estimate of the equity risk premium applicable to Aer Rianta is 6 per cent. This is consistent with world estimates of the equity risk premium, and the

[11] Grant Samuel & Associates Pty Ltd, Valuation of Cultus Petroleum NL in relation to the takeover offer by OMV Australia Pty Ltd.

methodology used to derive these estimates is consistent with best international regulatory practice, such as that observed in the US and Australia.

4.4. Estimating Beta

CAPM theory states an investor holds a diversified portfolio of assets, and thus the *specific risk* associated with each company is "diversified away". An asset's return is therefore related only to the asset's *covariant* risk with the market portfolio, that is, the degree of co-movement between the company's returns and the market returns. The degree of co-movement is measured by an asset's beta.

AR's beta is dependent on the nature of the regulatory regime. For a single till regime, the appropriate beta relates to the covariance of all of Aer Rianta's activities, both aeronautical and non-aeronautical with market returns. A dual till beta relates to the covariance of cash-flows from aeronautical activities only with market returns. Our approach to estimating Aer Rianta's beta is to first estimate a beta for a single-till regulatory regime, and then base our beta estimate for a dual-till regime on the estimate for a single-till, by considering the relative riskiness of Aer Rianta and comparator companies' non-aeronautical activities. This is the logical way to present the evidence for Aer Rianta's beta, because the primary evidence is BAA's observed equity beta that reflects the riskiness of BAA as a single till business.

4.4.1. Estimating a Single Till beta

The first step in measuring a company's covariant, or beta risk, is to regress the return to a company's shares against the return to an appropriate market index. The resulting estimate of the equity beta is then adjusted to take account of gearing, to derive an estimate of the ungeared or asset beta.

There are three significant practical difficulties in estimating an equity beta for Aer Rianta.

- First, since Aer Rianta is an unquoted company and therefore its equity beta is not observed, which comparator companies should be used as proxies for its equity beta?
- Second, over what timeframe should the equity betas for comparator quoted companies be estimated?
- Third, what adjustments should be made to betas for comparator companies to reflect possible differences in covariant risk between Aer Rianta and the comparators arising from the nature of their activities, and differences in demand and cost conditions?

4.4.2. The choice of comparators

In total, there are only six quoted airport operators, five of which are in Europe (BAA, Copenhagen, Rome, Vienna and Zurich), as well as Auckland in New Zealand. Some of these companies are better comparators than others. Although, we would expect companies in the same economic sector to have broadly similar covariance of returns with the market, there are other factors that influence a company's beta. Among the most important are, the balance of aeronautical to non-aeronautical activities, and the type of regulatory regime. A price cap regulatory regime implies greater systematic risk than a negotiated or cost plus regime that offers greater opportunities to pass costs through to consumers and protect the regulated company's earnings.

To estimate a beta for Aer Rianta, therefore, we restrict our analysis to BAA. This approach acknowledges that BAA has a similar balance of aeronautical to non-aeronautical revenues, and is subject to a price-cap regulatory regime, until now of the single till variety. However, we also recognise that there are still differentiating factors between BAA and Aer Rianta that imply different levels of systematic risk. The main differentiating factors are, the higher proportion of non-aeronautical revenues at Aer Rianta, and the different composition of the passenger base. We discuss the implication of these differences for Aer Rianta's relative equity beta in Section 4.4.4.

4.4.3. The appropriate estimation timeframe

There are two key issues that are relevant to the estimation period.

- the "economic relevance" of the estimation period to the expected operating environment over the next control period; and
- the need for a sufficiently long time period to ensure the regression results are robust.

4.4.3.1. Economic relevance

Figure 4.1 shows beta value for BAA for a rolling period of five years, from 1989 to 2001. This clearly indicates the relatively stable behaviour of BAA's equity beta over time, prior to a sharp fall in its value towards the end of the 1990's. The decline in BAA's beta reflects a general downward trend of utility betas, typified by the experience of companies in the power sector (Figure 4.2).

Figure 4.1
Time Series of BAAs Asset Betas

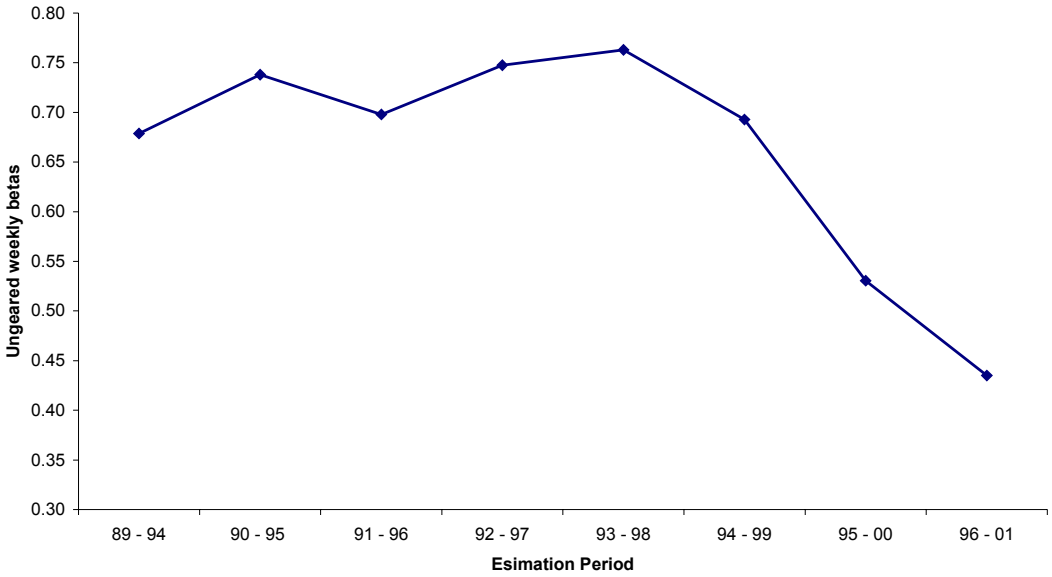
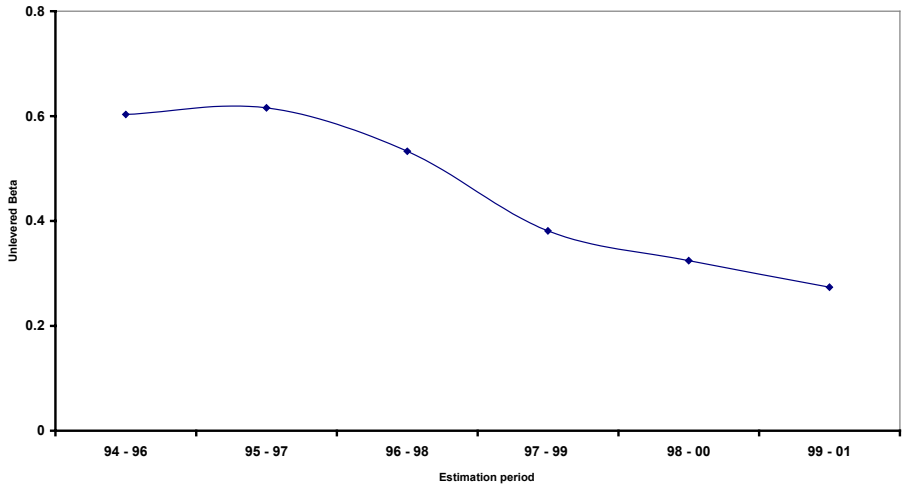


Figure 4.2
Composite Beta Trend for Power Utilities[12]



There are a number of factors that have been put forward to explain the decline in utility betas, including:

[12] The companies represented in the composite beta calculation are: Veridian Group Plc; Sondel - Societa Nordelettrica SpA; Iberdrola SA; Endesa SA; National Grid Plc; Powergen; and, Union Electrica Fenosa SA.

- *A decline in the level of regulatory risk* :- this view was put forward by Ofwat in its 2000 price determination. However, there is no reason to suppose that a change in the regulatory environment should affect non-diversifiable risk and hence the equity beta value.

- *Excess volatility in the market*:- Cooper and Currie (1999), among others, have observed that recent estimates of beta are biased downwards as a result of the high volatility of capital markets in the recent past. As a consequence of this volatility, there is a "flight to quality", including utility stocks, that results in a lower correlation of these stocks with the market portfolio.

- *Changes in the composition of the market portfolio*:- OXERA recently argued that changes in the market portfolio with increased levels of high risk technology stocks has caused the overall level of market risk to increase and the *relative* level of utility risk to decline. However, if this explanation is correct, we would expect the overall market risk premium to increase (to reflect the higher risk associated with the market portfolio). This would potentially offset the fall in beta values.

- *Effect of changes in gearing*: As we discuss below, asset betas are not observed, but are derived from equity betas by applying an adjustment factor, to reflect the effect of gearing, such that equity betas should increase with the level of gearing if the underlying business risk is unchanged. In fact, utility equity betas have been reasonably constant since 1997 despite an increase in the gearing of utility firms. This has led some observers, such as SBC Warburg, to argue that the gearing adjustment suggested by orthodox finance theory might not apply if the starting level of debt was low, as has typically been the case.

It is important to distinguish between those causes that would result in a permanent change in the cost of equity finance, and those that leave the cost of equity unchanged. It appears from the proposed range of possible reasons for the decline that only a reduction in the level of regulatory risk would result in a permanent fall. The other causes either involve what we would expect to be temporary phenomena, or involve compensatory changes in the equity risk premia, and therefore leave the cost of equity finance unchanged.

However, given that Aer Riantas regulatory environment is only now being established, Aer Riantas cost of equity finance would not benefit from the market's perception that regulatory risk has declined, the only explanation that suggests the decline in beta values is permanent. Therefore, we suggest the most "economically relevant" period for beta estimation is the period from privatisation to the end of 1998, prior to the general fall in utility beta values.

4.4.3.2. Ensuring robust estimates

To ensure that our estimates are statistically significant we consider evidence on company and market returns over a long run period using monthly time intervals. We regress each

company's return against a broad-based European index, consistent with our overall approach of calculating Aer Rianta's beta in the context of a European market.[13]

4.4.3.3. Adjusting equity betas

There are two "technical" adjustments that need to be made to the regression (or raw) betas to ensure they are comparable. The first adjustment takes into account the biases in the raw beta. A further adjustment is then required to convert equity betas to asset betas. This adjustment involves calculating the "unlevered" beta of the company, defined as the value of beta for the company on the assumption that the company holds no debt. To estimate Aer Rianta's cost of equity we then have to "re-gear" the unlevered beta to accord with Aer Rianta's expected capital structure.[14]

Finance theory offers two alternative approaches to deriving an asset beta from the observed equity beta, each approach reflecting a different view on the relative value of a company's debt shield. These are:

Modigliani-Miller (MM) equilibrium: $\beta_{equity} = \beta_{asset} (1+(1-T_c)/(1-T_s)*(D/E))$

Miller equilibrium: $\beta_{equity} = \beta_{asset} (1+(D/E))$

where Tc is the corporate tax rate, Ts is the imputation tax credit rate, D represents a company's debt, and E represents a company's equity.

In short, the MM beta-gearing relationship is based on the assumption that debt offers a tax shield, whereas equity is subject to corporation tax. Miller subsequently proposed that personal taxes on debt offset the effect of the corporate tax shield and therefore there is no advantage to debt. In practice, the Miller adjustment implies a higher asset beta than the MM adjustment for any given observed equity beta, although the differences are minimal in a low corporation tax environment such as Ireland's. To derive asset betas from equity betas we use an average of the two formulae.

4.4.3.4. Empirical results

Table 4.10 presents our preferred beta values, estimated from 1991, the start date of our preferred European index, to the end of 1998, prior to the general fall in utility betas.

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[13] The Dow Jones STOXX (Price) Index is a broad capitalisation-weighted index of European stocks that duplicates the Dow Jones Global Indexes European Index, consisting of 600 individual stocks.

[14] As a company issues more debt, the prior claim on a company's earnings, i.e. the fixed interest costs on debt increases, increasing the volatility of the residual profit and increasing a company's beta. This is referred to as "financial risk". Because observed betas reflect both "business risk" and "financial risk", betas of companies with different financial structures are not directly comparable.

Table 4.10
BAA Long Term Asset Beta Value[1]

	Estimation period[1]	Asset beta value
BAA	31/12/91 – 31/12/98	0.67

Source: NERA analysis of Bloomberg monthly data. 1: The Dow Jones European index was created on 31/12/91, and for this reason the BAA estimates can only start from end of 1991.

4.4.4. Differentiating Factors

We would expect Aer Rianta's beta to differ from the observed beta for BAA because of the higher proportion of non-aeronautical activities in Aer Rianta's total revenues, as well as significant differences in the composition of their respective passenger profiles. By comparing Aer Rianta's operating characteristics with BAA, we can assess whether its beta is likely to be higher or lower than the observed quoted betas. We consider the following factors:-

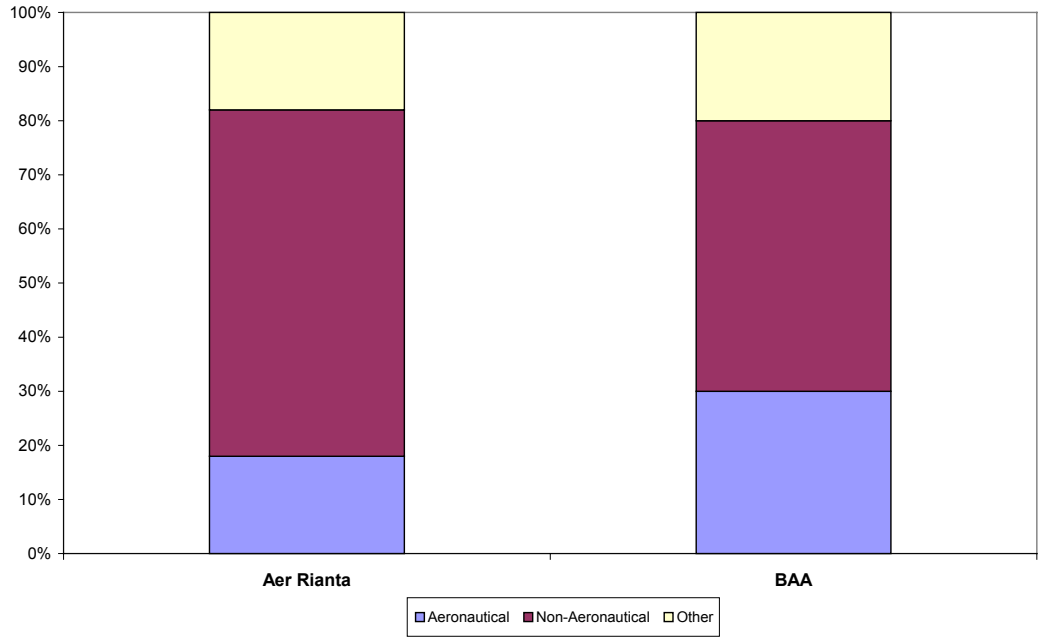
- The composition of revenue.
- Traffic mix
- Cost structure.

4.4.4.1. The composition of revenue

Airport operators' derive revenues from aeronautical and non-aeronautical operations. Aeronautical activities, which cover the provision of airside services, such as aircraft take-off and landing, aircraft parking, passenger processing, and, in some cases, ground handling services, tend to have lower covariant risk than non-aeronautical, or commercial, aspects of an airport's operations. These commercial activities consist largely of terminal retail developments and airport car parking, and exhibit similar risk characteristics to retail companies. Thus, the higher the proportion of non-aeronautical assets in a company's total asset base, the higher the beta, all other things equal.

We have therefore compared the proportion of revenue Aer Rianta derives from its aeronautical business compared to its non-aeronautical side, with the relative balance at BAA. The results of this analysis, shown in Figure 4.3 below show that Aer Rianta derives a higher proportion of its revenues from non-aeronautical revenues than BAA (which, like Aer Rianta has a highly developed airport retailing line of business). This evidence alone would suggest that Aer Rianta's asset beta should be higher than BAA's.

Figure 4.3
Relative Contribution of Activities to Revenue Base[15]



4.4.4.2. Demand risks

The level of covariant demand risk to which an airport operator is exposed vary according to the airport's passenger mix, since some types of traffic are more sensitive than others to changes in GDP. In Australia, the ACCC has made extensive use of the differences in passenger profiles between Australian airports in setting airport betas. The Commission's approach has been to use estimates of the income elasticity of demand for different categories of journey (business, leisure, international, domestic), in conjunction with data on the shares of each category at particular airports, to produce measures of the relative demand risk faced by different airport operators. The higher the weighted income elasticity, the greater the relative demand risk, and hence the higher the asset beta, all other things equal.

The ACCC concludes that:

- International travel is more sensitive than domestic travel;
- Leisure travel is more sensitive than business; and

[15] Source: Warburg Dillon Read, Report to the Minister for Public Enterprise and the Minister for Finance, December 1999.

- Outbound travel (travel by nationals) is more sensitive than inbound (travel by foreigners).

We have data disaggregating Aer Rianta and BAA's passenger base by international and domestic travel, and leisure and business travel. As Table 4.11 shows, Aer Rianta has a higher proportion of both international and leisure passengers, the more "income sensitive" passenger groups. This suggests Aer Rianta's beta is higher than BAAs.

Table 4.11
Passenger Profiles for Aer Rianta and BAA[16]

Airport Operator	Domestic (%)	International (%)	Business (%)	Leisure (%)
Aer Rianta	5	95	25	75
BAA	11	89	35	65

There are other factors than passenger profile that determine a company's demand risk. In particular, airports where there is excess demand, and that are capacity constrained, are less vulnerable to the economic cycle than less busy airports. This factor further suggests that Aer Rianta has higher systematic risk than BAA, whose London airports are severely capacity constrained.

4.4.4.3. Cost risks

Operating leverage is a key determinant of a company's beta. Formally, this is the percentage change in total costs associated with a percentage change in output. Intuitively, it measures the degree to which costs are fixed, and therefore non-variable with revenue. The higher the proportion of fixed costs, the more volatile are earnings, and the higher the asset beta.

Unfortunately, even proxy measures for operating leverage, such as capital costs divided by operating costs, are difficult to compare across countries, because of differences in accounting practices, which we have been unable to resolve in the time available. Analysis of airport cost drivers would suggest that capital inputs per passenger would be higher for international than domestic traffic, and for business passengers than for leisure passengers. As we have seen, compared to the comparators, Aer Rianta has a relatively high proportion of international traffic, but it also has a relatively small proportion of business traffic.

4.4.4.4. Conclusions

Our analysis of the business factors likely to be the source of inter-airport differences in asset betas suggests that Aer Rianta's asset beta should be significantly higher than BAA, on the

[16] World Airports Comparative Data, 1999.

basis that it has a more income sensitive passenger base, and a larger proportion of earnings from more risky non-aeronautical activities.

4.4.5. Regulatory Precedent (Single till)

In the UK, both BAA's south east airports and Manchester Airport are subject to single-till price regulation that can inform our estimate for Aer Rianta's single-till beta.

The most recent reviews of BAA and Manchester Airport were conducted by the Monopolies and Mergers Commission (MMC) in 1996 and 1997. With respect to BAA, the regulator determined that the appropriate level for BAA's *equity* beta was in the range 0.7 to 0.9. The lower bound was set by the beta of US utilities subject to rate of return regulation, and therefore considered less risky, with the upper bound set by the view that utilities were less risky than the market portfolio. It also invoked evidence from BAA's market beta, which varied in value according to the exact timeframe and data set, but was consistent with this range. The MMCs central estimate of the implied asset beta is approximately 0.67[17].

Manchester Airport (MA) is unlisted and therefore the MMC could not use direct beta evidence. Thus, the MMC set the cost of capital using BAA as a benchmark, and then adjusted this value for the perceived greater riskiness of Manchester's operations. The factors contributing to Manchester's greater riskiness were, according to MMC, MA's greater dependence on charter traffic, the weaker demand of scheduled airlines, particularly compared to BAA, and the lower profitability of scheduled operators. However, MMC adjusted the overall cost of capital to account for these risk factors, rather than explicitly revising the beta value upwards.

There are two key conclusions to draw from UK price review:

- MMC set Manchester's systematic risk in the context of a comparable quoted company (BAA);
- MMC then made adjustments to BAA's quoted betas to reflect the different operational characteristics of Manchester airport.

Table 4.12
Recent regulatory decisions on asset beta

Regulator	Company	Asset beta	Comments
MMC (1997)	BAA	0.67	Set partly on basis of BAA market data
MMC (1997)	Manchester Airport	> 0.67	Cost of capital set relative to BAA

Source: MMC Reports

[17] See Cost of Capital, Position Paper, June 2001, CAA.

4.4.6. Conclusions Regarding a "Single- till" beta

As we have set out above, we think that it is most appropriate to estimate Aer Rianta's beta based mainly on evidence of BAA's observed beta estimated over a long timeframe up until the end of 1998, prior to the most recent period where there is widespread evidence that beta estimates have destabilised, mainly, NERA believe because of the internet and technological changes in the stock market compositions.

NERA consider that an adjustment to BAA's beta is appropriate to take account of the different operating characteristics of Aer Rianta. Our analysis suggests:

- Aer Rianta has a higher proportion of non-aeronautical operations than BAA. Activities such as retail tend to have a higher asset beta than aeronautical operations, often close to unity.
- Aer Rianta has a higher proportion of international and leisure traffic relative to BAA. These passenger groups tend to be sensitive to changes in income, which translates into a relatively higher beta. In addition, Aer Rianta is not capacity constrained to the extent of BAA's south east airports. This also increases its relative demand risk.

Thus, Aer Rianta's operating characteristics suggest its beta value is greater than BAA's long term average of 0.67. We also note regulatory precedent. At the last price review MMC set an asset beta of 0.67 for BAA, and implicitly assumed a higher beta for Manchester. On this basis, our best estimate of Aer Rianta's single-till beta is 0.75.

4.4.7. Estimating Aer Rianta's "Dual till" Beta

There are a no quoted "pure" aeronautical companies, and therefore we cannot estimate Aer Rianta's dual-till beta by observing an equity beta for a comparable company. We therefore take two alternative approaches to estimating Aer Rianta's dual till beta. These are:

- "extracting" Aer Rianta's dual till beta from our single-till estimate by examining the systematic risk of its non-aeronautical activities; and,
- by looking at regulatory precedent for dual-till regimes.

We consider each of these below.

4.4.7.1. Extracting a dual-till estimate from Aer Rianta's single-till beta

In theory, Aer Rianta's dual till beta should be equal to its single till estimate, minus the beta risk associated with its non-aeronautical activities, weighted by the expected contribution of each of these activities to overall profits.

AR's predominant non-aeronautical activities are airport retail, property and to a lesser extent, car parking. If we can estimate betas for these activities, then it is simple to calculate Aer Rianta's dual till beta estimate from our single till estimate. However, there are a number of problems with undertaking this approach formally:

- We only have inexact comparators for Aer Rianta's non-aeronautical activities. For example, there are no quoted "airport retail" businesses or quoted property businesses with a similar portfolio. Instead, we can only observe betas for general high-street retailers or general property companies. These companies, because they have a different customer base, can display significantly different levels of systematic risk.
- The actual contribution of each activity to group profits is difficult to calculate because of common costs. Moreover, weightings of each beta should be based on the *expected* contribution of the activity to overall profit rather than the actual contribution.

For these reasons, we believe that to calculate Aer Rianta's dual till formally on the basis of its single till value, would lend spurious accuracy to the figure. Instead, we base our estimate of Aer Rianta's dual till beta value on the following observations:

- We would expect Aer Rianta's non-aeronautical activities to display higher systematic risk than the aeronautical side of its business. In particular, (general) retail activities are often assumed to have a beta close to unity (because retail returns are driven by consumer expenditure which is highly correlated with the market portfolio).
- However, the underlying determinant of demand for the non-aeronautical side of the business is the same as for the aeronautical side, i.e. passenger volumes. Therefore, we would expect the riskiness of Aer Rianta's commercial operations to be relatively close to the riskiness of volume related revenues for the aeronautical business.
- The systematic risk of a business is not only determined by demand conditions, but costs conditions. On the cost side, we would expect the cost fixity of retail services to be lower, leading to lower systematic risk than aeronautical services, all other things being equal.

On the basis of these qualitative arguments, we believe that the non-aeronautical services will display only slightly higher systematic risk than the aeronautical services, and therefore the asset beta for a dual till operation will be very close to the asset beta for a single till business.

4.4.7.2. Regulatory precedent (dual till regimes)

The Australian Consumer and Competition Commission (ACCC) has recently conducted price reviews for Adelaide, Brisbane, Perth, Melbourne, Canberra and Sydney in the context of a dual till operation. All of these companies are unquoted and thus the ACCCs approach is of particular relevance for the process in Ireland.

Adelaide was the first airport to be subject to the ACCCs price review process. The rate of return on its capital base was set according to four quoted benchmarks, Copenhagen, BAA, Vienna and Auckland. Subsequent airport betas were then set according to the relative risk of their operations compared to Adelaide (as discussed in Section 4.4.4.2). Although the ACCC's approach lacks transparency, it appears "relative risk" has been measured exclusively in terms of the passenger profile at each airport. We believe that this approach is seriously incomplete, and would suggest that relative covariant riskiness should be assessed by reference to a wider set of factors, as discussed in section 4.4.3 above.

We also note that the ACCC's final determination does not appear to explicitly adjust its beta estimates for the nature of the regulatory regime in the case for Adelaide, Brisbane, Perth and Melbourne, although the ACCC's final determination for Sydney airport refers to the importance of the regulatory regime[18]

As Table 4.13 sets out, the ACCC has determined that the asset beta under a dual till regime lies in the range of 0.6 to 0.7. As stated above, the differential is largely accounted for by the differences in passenger composition. Unfortunately, we do not have a sufficient break-down of the Australian airports' passenger base to compare their relative risk with respect to Aer Rianta.

Table 4.13
Australian Regulatory Precedent (Dual till Regime)

Regulator	Company	Asset beta	Comments
ACCC (1999)	Adelaide Airport	0.61	Based on Copenhagen, BAA, Vienna and Auckland betas
ACCC (2000)	Brisbane Airport	0.7	Set relative to Adelaide
ACCC (2000)	Perth Airport	0.7	Set relative to Adelaide
ACCC (2000)	Canberra Airport	0.65	Set relative to Adelaide
ACCC (2000)	Melbourne Airport	0.7	Set relative to Adelaide
ACCC (2001)	Sydney Airport	0.6	Set relative to Adelaide

[18] ACCC, Sydney Airport Final Determination, p156, 2000.

4.4.7.3. Conclusions regarding Aer Rianta's dual-till beta

It is possible to determine Aer Rianta's dual till beta on the basis:

- adjusting its single till beta using qualitative evidence regarding the systematic risk of its non-aeronautical activities; and,
- by invoking regulatory precedent.

We do not think that it is possible formally to derive Aer Rianta's dual till beta from its single till estimate, because of the absence of close proxy companies for its non-aeronautical services. We believe that a qualitative assessment of the relative beta risk of these activities, supported by Australian regulatory precedent, suggests that non-aeronautical activities display only marginally more systematic risk than the aeronautical side of the business. NERA's best estimate of Aer Rianta's beta for a dual till regulatory system is 0.70.

4.5. Conclusions on the Cost of Equity for Aer Rianta

Bringing together the discussion in sections 4.2, 4.3 and 4.4, Table 4.14 summarises NERA's recommended values for the three key parameters of the cost of equity for Aer Rianta.

Table 4.14
Cost of Equity Parameters

	Single till	Dual till
Real risk free rate	3.2%	3.2%
Equity risk premium	6%	6%
Asset beta	0.75	0.70

5. THE COST OF DEBT AND GEARING

5.1. Introduction

The cost of debt can be expressed as the sum of the risk free rate and the company specific debt premium. As explained in section 3.4, the debt premium will reflect both the level of business riskiness and financial riskiness of a company. As a company's gearing increases, the debt premium will normally increase to reflect an increase in the financial riskiness of the company.

Although the Irish Treasury does not formally extend a sovereign guarantee to Aer Rianta's debt stock, it seems likely that the company's credit rating, and hence its cost of debt, are likely to reflect its SOE status.

NERA's approach to estimating a cost of debt and optimal gearing for Aer Rianta is to consider market based evidence on the costs of debt for Aer Rianta comparator companies. Specifically, NERA consider both the actual observed costs of debt of the comparators and the relationship between the cost of debt finance and a company's capital structure.

NERA's estimate of the cost of debt and optimal gearing for Aer Rianta are based on the assumption that Aer Rianta must maintain at least a single A credit rating status in order to be able to raise finance for its capital investment programme in all economic conditions.

In developing estimates of Aer Rianta's cost of debt and gearing to assess a WACC, we have taken account of the following factors:-

- Capital structure and market based costs of debt of Aer Rianta comparator companies.
- Evidence on the cost of debt for other European utilities with a credit rating of Single A.
- Recent regulatory precedent.

5.2. Market Based Evidence on the Cost of Debt and Gearing for Aer Rianta Comparator Companies

5.2.1. Comparator's Capital Structure

Table 5.1 presents actual market gearing ratios for our comparator set of airport operators. This shows that the gearing decisions of the quoted companies are quite close, ranging from 22% (Auckland) to 33% (BAA). We exclude Rome and Vienna airports that do not have any debt on their balance sheet. Taking an average of these four comparators, suggests an optimal capital structure for Aer Rianta of approximately 30 per cent.

However, we would expect this to be an upper limit. Companies take on debt because interest payments can be offset against their corporate tax liability- the "tax shield" effect. Obviously, a company that operates in a lower tax environment has less incentive to increase debt, because the relative value of the tax shield is lower. Table 5.1 also presents corporation tax rates for our comparator companies. Although, Aer Rianta's corporation tax situation is uncertain, its upper limit is 25 per cent, this is clearly less than the tax liabilities of our comparator set. We therefore suggest that a gearing level of 30 per cent debt represents an upper limit.

Table 5.1
Comparator Gearing Ratios

Company	Gearing (Debt/ Debt + market cap)	Corporate tax rate (%)
BAA	0.33	30
Aeroporti di Roma SPA	0	41.25
Kobenhavns Lufthavne	0.30	25
Flughafen Wien AG	0	34
Unique Zurich Airport	0.31	25.1
Auckland International Airport Ltd	0.22	33

5.2.2. Evidence on the Cost of Debt

We present evidence for Aer Rianta's cost of debt by looking at similarly rated companies, in the range to AA to BBB+. These data are shown in Table 5.2. This shows an average spread of approximately 130 bps for BAA that enjoys a slightly better (AA-) rating than Aer Rianta.

Bond ratings for single A credit ratings are in the range of 105 to 150 bps, although the lower end of this range appears to be dominated by relatively short term debt. We are interested in medium to long term debt issues, consistent with the term of our CAPM assumptions. Scottish Power is a useful comparator. It has a number of debt issues with differing maturities, with an average term of approximately 16 years. Taking an average of these debt issues, which ensures that no single debt issues unduly influences the result, suggests a single A company can raise debt at approximately 150 bps above the risk-free rate.

Table 5.2
Bond issues by utility companies in the European market

Company	Issue date	Matuirty date	Coupon	Gearing (debt / market cap)	Credit rating	Spread over government security	Weighted average
European market							
Vodafone Group Plc	27/10/1999	27/10/2006	5.75	0.03	A	105.3	105.3
Kelda Group Plc	26/07/1999	26/07/2006	5.25	1.37	A /*-	112.1	112.1
AWG Plc	02/07/1999	02/07/2009	5.375	1.31	A-	143.7	143.7
British Telecommunications Plc	15/02/2001	16/02/2004	5.625	0.14	A /*-	127.0	149.8
	15/02/2001	15/02/2006	6.125		A /*-	172.6	
UK market							
BAA Plc	10/02/1997	10/02/2007	7.875	0.49	AA-	84.0	133.2
	28/02/1991	31/03/2016	11.75		AA-	141.9	
	31/01/1996	29/03/2021	8.5		AA-	148.7	
	04/08/1998	04/08/2028	6.375		AA-	157.8	
Scottish Power Plc	12/08/1998	26/11/2004	6.63	0.54	A /*-	83.3	149.8
	13/02/1998	13/02/2008	6.715		A /*-	113.5	
	04/08/1999	14/01/2010	6.625		A /*-	147.1	
	20/02/1997	20/02/2017	8.375		A /*-	174.3	
	29/05/1998	29/05/2023	6.75		A /*-	184.0	
	09/12/1999	09/12/2039	5.75		A /*-	195.4	
British Energy Plc	11/06/1999	25/03/2003	5.949	0.81	BBB+	99.5	152.8
	11/06/1999	25/03/2006	6.077		BBB+	156.5	
	11/06/1999	25/03/2016	6.202		BBB+	202.0	

Source: NERA analysis of Bloomberg data.

We also need to consider how a change in Aer Rianta's credit rating might affect its cost of debt. The data in Table 5.2 suggest that there is no clear relationship between credit ratings and debt spreads across the range of issues that are considered. This is mainly because bond spreads also depend on a number of factors such as coupon, maturity, yield and the presence and type of embedded covenants. For a more accurate comparison of debt spreads, we have compared spreads for specific bonds with similar maturities. As Table 5.3 shows, a decrease in credit rating of one notch from A- to BBB+ might increase debt spreads by approximately 40 basis points.

Table 5.3
Comparison of Holding Company Debt Yields

Rating	Company	Coupon	Maturity	Yield	Spread
A-	Vodafone Group plc	7.625%	2005	6.149%	142
BBB+	United Utilities	6.25%	2005	6.604%	187

Source: NERA analysis of Bloomberg data

A survey by NERA of financial analysts, undertaken in December 1998, asked what average debt spreads were expected over the period 2000 to 2005 for UK utilities, at different S&P's credit ratings. Our survey showed that the average *expected* difference between a single A rated company and a BBB rated company in expected debt spread would be roughly 50 basis points. This expected premia reflected no specific debt maturity. Respondents to the survey also made the point that many investors cannot buy BBB rated corporate bonds since this is outside their investment criteria. This increases the cost of BBB rated debt in adverse market conditions.

5.2.3. Regulatory Precedents

The best estimate of the future cost of raising debt finance changes over time to reflect changing market conditions and economic cycles. For this reason, previous regulatory decisions in Ireland, the UK and Worldwide on the cost of debt for utilities have little relevance to the best estimate of the "market" cost of debt for Aer Rianta.

There are also few direct regulatory precedents relevant to Aer Rianta's optimal gearing. Perhaps the most relevant is the MMCs decision for BAA, as BAA is subject to a single till regulatory framework. In its 1997 price review MMC concluded that a gearing level (D/ D+E) of 30 per cent was appropriate, based on actual observed levels of gearing over the previous control period.

More widely, UK utility regulators have recently considered the issue of optimal gearing level for other types of utility companies:

- In the 1999 Price Review Ofwat estimated an optimal gearing of 50% for UK water companies;

- In the 2000 price review Ofgem estimated an optimal gearing of 50% for REC Distribution companies;
- In the 200 price review for NGC, Ofgem concluded that NGC's "optimal" gearing ratio lay in the range of 60 to 70 per cent.

It can be assumed that the optimal gearing for Aer Rianta is below the optimal gearing for water and electricity companies on the basis that such companies have more stable cash flows and hence are able to raise debt finance, and retain strong credit ratings, more easily at higher levels of indebtedness.

5.2.4. Summary

Overall, NERA consider that an assumed market gearing of 30% seems appropriate for Aer Rianta. This is consistent with available evidence market gearing ratios for comparator companies, as presented in Table 5.1, which shows a range from 22% to 33%, with an average of approximately 30%. An assumed gearing of 30% is also consistent with regulatory precedents, most notably the 1997 MMC on BAA where a gearing ratio of 30% was used.

Our conclusions regarding Aer Rianta's debt costs are based on the assumption that a gearing ratio of 30% will allow Aer Rianta to maintain a single A credit rating. Table 5.2 presents a range of recent debt issues by European utilities. On the basis of this evidence NERA consider that a best estimate of the cost of debt for a single A rated company is approximately 150 bps above the riskfree rate.

6. TAXATION

6.1. Introduction

There has been considerable academic and regulatory debate worldwide surrounding the use of pre- or post-tax formulations of the rate of return, the appropriate conversion formula and the application of statutory or effective tax rates. In principle this stems from:

- A fundamental tension between regulation on the basis of RPI-linked real revenues and a taxation system which operates in nominal terms; and
- Differences in timing between the depreciation allowed for taxation and that allowed for regulatory purposes.

The effects of these two factors means that the use of a simple formula to take account of taxation in converting from a post tax WACC to a pre-tax WACC is only an approximation of the actual effects of inflation. Even if the second effect is ignored the impact of inflation in a RPI-lined revenue regime is sufficiently complex since rising price levels cause real taxable income and regulatory return on equity to diverge in two, potentially offsetting, ways. Essentially, inflation drives a wedge between:

- depreciation allowed for regulatory purposes and depreciation allowed for taxation purposes; and
- nominal interest rates (which are fully deductible for tax purposes) and real interest rates (which is the true cost of debt used in determining regulatory profits).

The level of inflation will determine to what extent these two effects are material.[19]

Three formulas have been used by regulators to convert a nominal post tax WACC into a real pre tax WACC. The nominal post tax WACC is defined as

Nominal post tax WACC = Re(nominal)*E/V + (1-t)*)Rd(nominal)*D/V ***(1)***

This is the post tax cost of capital recognising that nominal debt costs are tax deductible and should therefore be reduced in proportion to corporate tax rate (t). Where Re is the post tax cost of equity; E is equity; V is total value defined as debt plus equity; D is debt; Rd is the pre tax cost of debt. We define the approaches that have been used by regulators to convert a nominal post tax WACC into a real pre tax WACC as follows:

[19] Neither of these effects applies in a regulatory framework based on nominal returns on a historic cost asset base

6.2. Approach 1: The "Macquarie" Approach

Approach 1, known in Australia as the Macquerie approach[20], converts a nominal post tax WACC to a real pre tax WACC as follows:

- **Step 1**: Convert nominal post tax "net of debt tax shield" WACC to real post tax WACC by adjusting for inflation using Fisher equation.
- **Step 2**: Convert real post tax WACC to real pre tax WACC by adjusting for the statutory tax rate.

Note that in this case, the post tax WACC is defined as a weighted average of the cost of debt net of debt shield and the post tax cost of equity.[21] The "Macquarie Approach" defines the real pre tax WACC in terms of the nominal post tax WACC as follows:

Real Pre Tax WACC $_{Macquarie}$ *=(Nominal Post Tax "Vanilla" WACC-I)/((1+I)*(1-t))* ***(1)***

Where I is the inflation rate; t is the corporate tax rate.

6.3. Approach 2: The "MMC" Approach

Approach 2 is known in the UK as the "MMC" Approach.

- **Step 1**: Converts the nominal post tax return on equity and the nominal pre tax return on debt to their real counterparts
- **Step 2**: Convert the real post tax return on equity to real pre tax return on equity by adjusting for the statutory tax rate

The "MMC Approach" defines the real pre tax WACC in terms of the nominal post tax WACC as follows:

Real Pre Tax WACC $_{MMC}$ *=(Nominal Post Return on Equity -I)/((1+I)*(1-t))* E + (Nominal Pre tax Return on Debt -I)/(1+I)* D* ***(2)***

Where I is the inflation rate; t is the corporate tax rate; E is the proportion of equity; D is the proportion of debt.

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[20] Macquerie Risk Advisory Services (1998) "The Appropriate Level of Taxation to Apply for Gas Distribution Businesses in Conjunction with the CAPM models in the Determination of Regulated Use of System Charges" Submission to the ORG.

[21] This is the post tax cost of capital recognising that nominal debt costs are tax deductible and should therefore be reduced in proportion to corporate tax rate (t).

6.4. Approach 3: The "Historical" (or "CSFB") Approach

Approach 3, known (mainly) in Australia as the CSFB[22] or Historical approach**,** converts a nominal post tax WACC to a real pre tax WACC as follows:

- **Step 1** Convert nominal post tax "net of debt tax shield" WACC to nominal pre tax WACC by adjusting for the statutory tax rate.
- **Step 2**: Convert nominal pre tax WACC to real pre tax WACC by adjusting for inflation using Fisher equation.

The "The Historical Approach" defines the real pre tax WACC in terms of the nominal post tax WACC as follows:

$$\textit{Real Pre Tax WACC}_{\textit{Historical}} = (\textit{Nominal Post Tax WACC}/(1-t)-I)/(1+I) \qquad \textbf{(3)}$$

Where I is the inflation rate; t is the corporate tax rate.

6.5. NERA Approach

In general (where expected inflation and the expected tax rate are both positive) the MMC approach will give a lowest estimate of the Real Pre Tax WACC and the Historical approach will give the highest estimate of the Real Pre Tax WACC. Intuitively, this is because the MMC approach scales up for tax a (lower) real WACC whereas the Historical approach scales up for tax a (larger) nominal figure. The differences between the three approaches will increase as inflation increases.[23]

Recent academic debate suggests that all simple scaling formula are likely to be a mis-estimation of the true tax liabilities (and hence the correct real pre tax WACC) faced by RPI-linked regulated companies. NERA is not aware of any empirical work that evaluates which of the three formula is likely to be more accurate and in which circumstances.

NERA's conclusion therefore is that it is not possible to say which formula should be preferred in converting a post tax nominal WACC to a pre tax real WACC for the case of Aer Rianta. We note that all formulae also ignore the effect of capital allowances on the true tax liabilities faced by Aer Rianta.

The only way of determining which, if any, of the above formulae is a better approximation to the true tax paying position of companies is to have a prior opinion on what the correct answer is through the use of tax cash flow modelling. We suggest that the regulator may

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[22] Based on the formula proposed by CSFB in relation to the Victoria Gas Access Arrangements

[23] For inflation of around 2% and a tax rate of around 30%, the difference between the three approaches is around 1%.

consider supporting his arguments about the appropriate pre tax WACC using financial modelling of projected tax liabilities.

For the purpose of deriving a pre tax WACC for Aer Rianta we have applied the Historical approach. We have applied a taxation adjustment to the nominal post tax cost of equity to convert to a nominal pre tax cost of equity, assuming an effective corporation tax liability of 25 per cent for a single till operation and an effective tax rate of 20 per cent for a dual till operation. The difference in effective taxation for the two regulatory regimes arises because of the differential tax rates on passive and trading income. This approach has the advantage over the widely criticised MMC approach in that it takes into account the fact that taxation payments are paid on nominal profits.

In the table below NERA have estimated a real pre tax WACC for Aer Rianta based on current effective tax rates of 25% and 20% respectively for single till and dual till operations.

Table 6.1
Pre Tax WACC

WACC	**Regulatory Regime**	
	Single till	**Dual till**
Real post-tax "Vanilla" WACC	**8.0%**	**7.8%**
Real post tax "Net of Debt Tax Shield" WACC[1]	7.7%	7.5%
Effective tax rate	25%	20%
Nominal "Net of Debt Tax Shield" WACC	9.5%	9.3%
Real Pre-Tax WACC using "Historical" Formula.	**10.8%**	**9.8%**

[1] Note: Post tax "Net of Debt Tax Shield" WACC = Post tax cost of equity*E/(E+D) + Cost of debt (1- tax rate)* D/(D+E)

We recommend, however, that this formulaic estimate of the tax wedge should be confirmed as accurate through the use of financial modelling of actual tax liabilities given the other regulatory assumptions.

7. WACC

Table 7.1 presents our overall estimate of Aer Rianta's cost of capital on the basis of a pre-tax WACC and for both a single and dual till regulatory regime. This is equal to 10.8 per cent and 9.8 per cent for a single and dual till respectively, and represents our best estimates of the rate of return required to compensate existing equity and debt holders for bearing risk, as well as ensure that Aer Rianta can raise finance to fund future investments.

Table 7.1
Aer Rianta WACC Estimates

Parameter	Regulatory Regime	
	Single till	**Dual till**
Cost of Equity		
Nominal return on risk-free	5.0%	5.0%
Expected inflation	1.7%	1.7%
Risk-free rate	3.2%	3.2%
ERP	6.0%	6.0%
Asset beta	0.75	0.7
Debt	30%	30%
Equity	70%	70%
Equity beta	1.04	0.97
Post-tax return on equity	9.4%	9.1%
Cost of Debt		
Debt premia (over riskfree)	150	150
Cost of debt	4.7%	4.7%
WACC	150	150
Real post-tax "Vanilla" WACC	**8.0%**	**7.8%**
Real post tax "Net of Debt Tax Shield" WACC[1]	7.7%	7.5%
Effective tax rate	25%	20%
Nominal "Net of Debt Tax Shield" WACC	9.5%	9.3%
Real Pre-Tax WACC using "Historical" Formula.	**10.8%**	**9.8%**

[1] Note: Post tax "Net of Debt Tax Shield" WACC = Post tax cost of equity*E/(E+D) + Cost of debt (1- tax rate)* D/(D+E)

Finally, we emphasise that the returns demanded by investors will be affected by the projected financial profile of the company. There needs to be consistency between the allowable rate of return and the WACC as established in the market.

APPENDIX A. EUROZONE DEBT YIELDS

Table A.1
European bond yields

Country	Bond type	Current yield to maturity	Average yield over last year	Yield at 30/6/00
Germany	Bundesschatzanweisungen 4% 14/12/2001	4.519%	4.812%	4.959%
Germany	Bundesobligation 5.25% 18/02/2005	4.494%	4.964%	5.051%
Germany	Bundesrepub. Deutscheland 5.375% 04/01/2010	4.725%	5.165%	5.228%
Germany	Bundesrepub. Deutscheland 6% 20/06/2016	4.982%	5.282%	5.297%
Italy	Buoni Polienniali del Tes 4.5% 15/01/2003	4.562%	5.085%	5.276%
Italy	Buoni Polienniali del Tes 9.5% 01/02/2006	4.842%	5.360%	5.502%
Italy	Buoni Polienniali del Tes 5.5% 01/11/2010	5.174%	5.500%	5.574%
Spain	Bonos y Oblig. del estado 8.4% 30/04/2001	4.6%	4.786%	4.877%
Spain	Bonos y Oblig. del estado 3.25% 31/01/2005	4.671%	5.174%	5.277%
Spain	Bonos y Oblig. del estado 4% 31/01/2010	5.049%	5.439%	5.504%
Spain	Bonos y Oblig. del estado 4.75% 30/07/2014	5.326%	5.608%	5.661%
Portugal	Oblig. do tes medio prazo 5.75% 23/03/2002	4.574%	4.939%	5.134%
Portugal	Oblig. do tes medio prazo 5.25% 14/10/2005	4.75%	5.270%	5.389%
Portugal	Oblig. do tes medio prazo 5.85% 20/05/2010	5.129%	5.525%	5.611%
Portugal	Oblig. do tes medio prazo 5.45% 23/09/2013	5.265%	5.616%	5.691%
Average of short term bonds (< 5 years)		**4.627%**		**5.183%**
Average of long term bonds (> 10 years)		**5.093%**		**5.509%**

Source: NERA analysis of Bloomberg data

APPENDIX B. RISK FREE RATE DATA USED TO CALCULATE THE ERP

Table B.1
Analysis of risk-free rates

Bond type	Issue date	Current yield	Average yield to maturity	
			Arithmetic mean	Geometric mean
Ireland				
Capital 9% 2006	N/a	4.98%	6.62%	6.45%
Capital 8.5% 2010	N/a	5.23%	6.85%	6.72%
Capital 8.75% 2012	N/a	5.32%	6.52%	6.33%
Average		5.18%	6.62%	6.45%
England & Wales				
Treasury 5.5% 2008/12	5/10/1960	5.07%	7.21%	7.05%
Treasury 7.75% 2012/15	26/12/1972	5.32%	7.45%	7.31%
Average		5.20%	7.33%	7.18%
Treasury 6% 2028	21/1/1998	4.34%	4.75%	4.72%
Treasury 4.125% 2032	25/5/2000	4.32%	4.37%	4.37%
Average		4.33%	4.56%	4.55%
Germany				
Bundesrep. Deutschland 8.375% 21/05/2001	19/05/1991	4.60%	5.65%	5.42%
Bundesrep. Deutschland 8.25% 11/10/2001	20/09/2001	4.50%	5.59%%	5.39%
Average		4.55%	5.62%	5.41%
Bundesrep. Deutschland 6% 20/06/2016	20/10/1986	5.02%	6.79%	6.69%
Bundesrep. Deutschland 5.625% 20/09/2016	20/09/1986	5.06%	6.82%	6.74%
Average		5.04%	6.81%	6.72%
US				
Treasury 7.5% 2001	15/11/1991	4.80%	6.19%	6.14%
Treasury 7.75% 2001	15/02/1991	5.10%	6.27%	6.21%
Treasury 7.875% 2001	15/08/1991	4.83%	6.21%	6.16%
Treasury 8% 2001	15/05/1991	4.96%	6.24%	6.19%
Average		4.93%	6.23%	6.17%
Treasury 9.125% 2009	15/05/1979	7.13%	7.78%	7.74%
Treasury 10.375% 2009	15/11/1979	7.52%	8.00%	7.96%
Treasury 10% 2010	15/05/1980	7.18%	7.89%	7.84%
Treasury 11.75% 2010	15/02/1980	7.94%	8.20%	8.16%
Treasury 12.75% 2010	17/11/1980	7.95%	8.26%	8.22%
Treasury 13.875% 2011	15/05/1981	8.05%	8.32%	8.29%
Treasury 14% 2011	16/11/1981	7.87%	8.27%	8.23%
Average		7.66%	8.10%	8.06%

Source: NERA analysis of Bloomberg data.

Table B.2
Equity market risk premium estimates for European indices

Sample method and period	Market used	Average total returns on market[1]	Average risk-free rate[2]	Equity market risk premium
Arithmetic mean				
10 years	Irish overall index	16.03%	5.18%	10.85%
10 years	FTSE all share	11.48%	7.33%	4.15%
10 years	DAX index	17.41%	5.62%	11.79%
10 years	S&P500 index	16.12%	6.23%	9.89%
30 years	FTSE all share	13.24%	4.56%	8.68%
30 years	DAX index	11.16%	6.81%	4.35%
30 years	S&P500	10.99%	8.10%	2.89%
Geometric mean				
10 years	Irish overall index	14.19%	5.18%	9.01%
10 years	FTSE all share	11.01%	7.18%	3.83%
10 years	DAX index	15.66%	5.41%	10.25%
10 years	S&P500 index	15.56%	6.17%	9.39%
30 years	FTSE all share	10.99%	4.55%	6.44%
30 years	DAX index	9.23%	6.72%	2.51%
30 years	S&P500	9.87%	8.06%	1.81%

Source: NERA analysis of Bloomberg data. 1: Equity returns defined as the average annual return on the indicated stock market. 2: The risk-free rates over the same period are averaged using the same methodology as the average of the market returns.

APPENDIX C. EQUITY RISK PREMIUM REGULATORY PRECEDENT

Decision	ERP estimate	Comments
ACCC Final Decision Victorian Gas Distribution (October 1998)	6%	Adopted 6% as this was the mid value of a range from 4.5 to 7.5 per cent estimated by its economic advisor. The Energy Projects Division's advisor CS First Boston proposed 6.5 per cent for the market risk premium given that the conventionally accepted value has been six to seven per cent under the classical tax system.
ACCC Final Decision Adelaide Airport (October 1999)	6%	Adopted 6% with reference to Victorian Gas decision
ACCC Final Decision Perth Airport (April 2000)	6%	Adopted 6% as recent studies suggested that the Australian MRP was unlikely to be in excess of 6% and this was consistent with ACCC's decision on Adelaide and Victorian Gas.
ACCC Final Decision Brisbane Airports (April 2000)	6%	Estimate adopted with reference to consistency with Adelaide decision and electricity transmission decisions.
ACCC Draft Decision Canberra Airport (June 2000)	6%	No reference made
ACCC Final Decision Melbourne Airport MUDT (August 2000)	6%	No reference made
ACCC Draft Decision Sydney Airport (February 2001)	6%	Adopted 6% in spite of recent studies suggesting that MRP is unlikely to be in excess of 6% as the ACCC remains to be convinced that the Australian MRP is decidedly lower than 6%. This figure was supported by the commission's economic advisor.
ORG Victorian Ports Price Review Draft Determination (May 2000)	6%	Adopted 6% with reference to being upper end of recent regulatory decisions and consistent with a range of historical estimates.
ORG Electricity Distribution Price Review (September 2000)	6%	6% adopted as within range provided by historical averages, is at upper end of range in recent regulatory decisions and is above value implied by ex ante model (which gave an average of 4.8% over 8 years).
IPART NSW Electricity Distribution Final Determination (December 1999)	5%-6%	5%-6% decision adopted with regard to suggestion that MRPs are trending down and with reference to discussion of recent studies including estimates based on

Decision	ERP estimate	Comments
		historical measures, ex ante approach, long term averages and US and UK evidence.
OPTA decision on the cost orientation of KPN Telecom's proposed voice telephony tariffs (September 1998)	4%-7%	Decided that a MRP "of between 4%-7%" would be used in assessing telephone tariffs with reference NERA report to recommending that range.
DTE guideline for price cap of Dutch Electricity sector (February 2000)	4%-7%	4%-7% adopted on basis of "available info" and sector responses – the latter included reference to Ibbotson Associates (1997) with arithmetic mean of EMRP of 7.47%; Fase and Van de Poll (1997) with ERP of 6% for 1889-1978; Fase (1997) and Pronk and Hallerbach (1999) with ERP of min. 8% and Opta's adoption of 4%-7% for KPN fixed charges
IPART Report on rates of return for network service providers (June 1999)	5%-6%	5%-6% decision adopted with regard to suggestion that MRPs are trending down and with reference to discussion of recent studies including estimates based on historical measures, ex ante approach, long term averages and US and UK evidence.
2001 Electricity Distribution Review submission by AGL Electricity Ltd	6.5%	Provided results of studies by recognised Australian authorities in estimating the long-term arithmetic means of historically observed market risk premiums. These studies indicate a risk premium of above 6%. Used 6.5% as final estimate based on long-term market evidence, rather than a methodology that seeks to rationalise recent movements in share prices.
Pacific Gas & Electricity Company, Cost of Equity Capital for Gas Distribution. Testimony by James Weide	4.9% - 6.4%	Ibbotson Associates – 7% risk premium on A-rated utility bonds, but 8% over long-term government bonds. (use S&P500 for equity returns) Carried out comparable returns received by bonds and stock investors over 1937 to 1999. S&P500 grew by 12.53%, whilst Moody's A-rated utility bond gave 6.13% yield => 6.40% ERP. S&P utilities grew 11.01% per annum, so ERP is 4.88%.
Pacific Gas & Electricity Company, Cost of Equity Capital for Electricity Distribution. Testimony by Lawrence Kolbe of The Brattle Group – Used for its unbundled electricity distribution business	5% for short-term ERP and 6.5% for long-term ERP	Estimated market risk premium over short and long-term.

Decision	ERP estimate	Comments
Envestra's Angaston to Berri Transmission pipeline, assessed at 31/10/99	6% - 7%, but used 6%	Adopted 6% because it is adopted by ACCC and ORG in Victoria and IPART I respect of the Wagga Wagga gas distribution network. Original estimate based on RR Officer "Rates of return to shares, bonds yields and inflation rates: A historical perspective". Return on equity compared to return on 10-year bonds.

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