Europe Economics

Cost of Capital for Mobile, Fixed Line and Broadcasting Price Controls

Report for ComReg

April 2014

Europe Economics
Chancery House
53-64 Chancery Lane
London WC2A 1QU

Tel: (+44) (0) 20 7831 4717
Fax: (+44) (0) 20 7831 4515

www.europe-economics.com

Contents

1 Executive Summary

Europe Economics has estimated the cost of capital in three telecommunications markets on behalf of the Commission for Communications Regulation (ComReg). The WACCs that we estimate are for a hypothetical efficient operators in their respective markets. These markets are:

- The market for wholesale mobile call termination and the rate charged for that service (the mobile termination rate, or "MTR"). This is the WACC for a hypothetical efficient mobile operator.
- Fixed-line telephony. This WACC is estimated with reference to an Irish fixed-line operator with an efficient capital structure, notwithstanding Eircom's recent Examinership and the company's distorted capital structure. This is the WACC for a hypothetical efficient fixed line operator.
- Access to digital terrestrial television (DTT) transmission assets ("Broadcasting Market A", in which 2rn, a wholly-owned subsidiary of RTÉ, operates) and the DTT multiplex ("Broadcasting Market B" in which RTÉ operates). Although these are separate markets, we do not find strong arguments for assigning different WACC values between these two markets. We therefore estimate the WACC for a hypothetical efficient broadcaster, which is the appropriate cost of capital for each of these markets.

We estimate forward-looking WACCs for these three markets covering a three to five year period from 2014/15.

1.1 Theoretical Approach

Our approach uses the weighted average cost of capital-capital assets pricing model (WACC-CAPM) approach. This is in view of an assessment of the relative merits of using the WACC-CAPM approach over using the dividend growth model, residual income model, Fama-French three factor model, or the third moment CAPM approach. We estimate the WACC on a pre-tax nominal basis, consistent with ComReg's regulatory approach.

1.2 Generic Parameters in the WACC-CAPM Approach

We view total market returns to be more stable than their component parts, which are the risk-free rate and the equity risk premium (ERP). Real total market returns have been relatively stable in Irish regulatory determinations compared with the risk-free rate and the ERP, and have decreased from around 8.5 per cent in the early 2000s to a post-crisis level of around 7 per cent.

We argue that the Eurozone is a single capital market. Capital market conditions in Ireland continue to improve, and government borrowing costs in particular have come down markedly since their highs during the Irish sovereign debt crisis. Nevertheless, investors continue to demand a premium for Irish government debt relative to other Eurozone sovereigns. Given a single Eurozone capital market and the recent premium attached to Irish government debt, we argue that the German government bond is the appropriate asset to use in an assessment of an Irish and Eurozone risk-free rate.

However, with low to negative real yields on government bonds, interpreting government bond yields as the risk-free rate in current conditions is problematic. In addition to regulatory precedent and current market data, we appeal to a relationship between economic growth and the risk-free rate to inform our estimate of the risk-free rate.

The real risk-free rate is converted into a nominal risk-free rate, as ComReg sets the WACC according to a nominal post-tax WACC. This is done using a forward-looking inflation estimate. Inflation forecasts, Ireland's current and historic experience with inflation, and the European Central Bank's view to keep inflation below, but close to, two per cent inform our analysis of the appropriate inflation rate.

On the ERP, we appeal to the authoritative estimates of Dimson, Marsh, and Staunton (DMS). They estimate that the arithmetic mean ERP for Ireland is 4.6 per cent, based on 112 years of data. Recent regulatory precedent and the possibility for elevated equity risk premia in the event of a re-emergence of Eurozone financial turbulence suggests 4.6 per cent may be too low on a forward-looking basis, however. We consider the DMS evidence in light of these two factors.

On taxation, we use the statutory 12.5 per cent Irish corporation tax rate, consistent with previous ComReg regulatory WACC determinations. The table below lays our our ranges and point estimates for each generic parameter.

Table 1.1: Generic WACC parameters

	Low (%)	High (%)	Point (%)
Real risk-free rate	1.8	2.5	2.3
Inflation	1.5	2.0	1.75
Nominal risk-free rate	3.3	4.5	4.1
ERP	4.6	5.25	5.0
Tax Rate	12.5%	12.5%	12.5%

Source: Europe Economics

1.3 Specific Parameters in the WACC-CAPM Approach

The specific parameters in the CAPM are gearing, beta and the debt premium. On gearing, we use a notional gearing informed by market evidence on operators' actual gearing in each sector to determine a notional level that is consistent with achieving an investment-grade credit rating. This is consistent with ComReg's previous approach in regulatory WACC determinations.

As we view the Eurozone capital market as a single capital market, we estimate Eurozone companies' equity betas on a European equity index. Equity betas are converted into unlevered betas or asset betas using the gearing of actual companies. We arrive at our estimates of the appropriate equity betas by relevering our estimates of the appropriate unlevered betas at our notional gearing estimate.

On the cost of debt, we argue against embedded debt adjustments, as they are inconsistent with the thought experiment of an efficient new entrant. We estimate the cost of debt via a bottom-up approach. This involves estimating the cost of debt by adding a debt premium to the risk-free rate estimate. We argue that there is a premium that would elevate the cost of debt for an efficient company operating in Ireland relative to an identical efficient company operating in certain "core" European countries.

We argue that the adverse consequences of setting the cost of capital too low or worse than those of setting the cost of capital too high. For that reason, we "aim up" on our WACC estimates, adjusting parameters one standard deviation above our point estimate in each case.

1.4 Mobile WACC

In assessing the Mobile WACC, we estimate each specific parameter with reference to regulatory precedent and market data on listed operators. Furthermore, we analyse data provided to us in a ComReg data request to operators to be covered under this price control. Finally, our estimates are informed by the results of a ComReg survey to the national regulatory authorities of EU Member States that make up

the Body of European Regulators of Electronic Communications. The table below contains our range and point estimates for the cost of capital parameters derived from this analysis. Aiming up on our central pre-tax WACC estimate of 8.2 per cent gives a WACC of 8.7 per cent.

Table 1.2: Mobile WACC

	Low	High	Point Estimate
Tax rate (%)	12.5	12.5	12.5
Real risk-free rate (%)	1.75	2.50	2.30
Inflation (%)	1.50	2.0	1.75
Nominal risk-free rate (%)	3.28	4.55	4.09
Equity risk premium (%)	4.60	5.25	5.00
Gearing (%)	30	30	30
Asset beta	0.40	0.60	0.55
Equity Beta at notional gearing	0.57	0.86	0.79
Nominal post-tax cost of equity (%)	5.9	9.0	8.0
Nominal pre-tax cost of equity (%)	6.7	10.3	9.2
Debt Premium (%)	1.50	2.25	1.75
Nominal pre-tax cost of debt (%)	4.8	6.8	5.8
Nominal Vanilla WACC (%)	5.6	8.4	7.4
Nominal pre-tax WACC (%)	6.2	9.3	8.2

Europe Economics calculations

1.5 Fixed Line WACC

In our assessment of the fixed line cost of capital, we rely primarily on regulatory precedent and market evidence to inform our parameter estimates. We also consider Eircom's actual financial position. Eircom is currently very highly geared and, as a result, has a high cost of debt. Also, as the company is not listed and has a very distorted capital structure, it is difficult to estimate Eircom's cost of equity with any certainty.

The table below contains our estimates of the fixed line cost of capital. Aiming up on our point estimate of a pre-tax nominal WACC of 8.0 per cent gives an aimed-up WACC of 8.5 per cent.

Table 1.3: Fixed Line WACC

	Low	High	Point Estimate
Tax rate (%)	12.5	12.5	12.5
Real risk-free rate (%)	1.75	2.50	2.30
Inflation (%)	1.50	2.0	1.75
Nominal risk-free rate (%)	3.28	4.55	4.09
Equity risk premium (%)	4.60	5.25	5.00
Gearing (%)	40	40	40
Asset beta	0.40	0.60	0.50
Equity Beta at notional gearing	0.67	1.00	0.83
Nominal post-tax cost of equity (%)	6.3	9.8	8.3
Nominal pre-tax cost of equity (%)	7.2	11.2	9.4
Debt Premium (%)	1.50	2.25	1.75
Nominal pre-tax cost of debt (%)	4.8	6.8	5.8
Nominal Vanilla WACC (%)	5.7	8.6	7.3
Nominal pre-tax WACC (%)	6.3	9.4	8.0

Source: Europe Economics

1.6 Broadcasting WACC

We estimate the WACC for Broadcasting Market A and Broadcasting Market B. We argue that the recent discussion about the lack of a commericially-viable DTT service in Ireland would not affect the cost of capital as such, since DTT will continue to be used as a public service distribution platform. Were DTT to cease to be the distribution platform for public service broadcasting, an appropriate way to address this would be to alter the depreciation of the regulated assets.

The lack of any pure-play operators in the DTT broadcasting or DTT multiplexing market complicates the use of market evidence in the assessment of the broadcasting WACC. Furthermore, the fact that 2rn and RTÉ are public service statuory corporations makes assessing a regulatory WACC using their financial data difficult, since they do not operate with an aim to return capital to investors. This is in part the reason we assess the WACC for an Irish broadcaster with an efficient capital structure.

Previous regulatory precedent suggests that towers and masts companies and integrated telecommunications companies are appropriate comparators for DTT broadcasters. Our parameter estimates are informed by regulatory precedent and market data on operators in these two sectors.

The table below contains our range and point estimates for cost of capital parameters. Aiming up on our nominal pre-tax WACC estimate of 8.1 per cent gives an aimed-up WACC of 8.7 per cent.

Table 1.4: WACC applicable to Broadcasting Market A and Broadcasting Market B

	Low	High	Point Estimate
Tax rate (%)	12.5	12.5	12.5
Real risk-free rate (%)	1.75	2.50	2.30
Inflation (%)	1.50	2.0	1.75
Nominal risk-free rate (%)	3.28	4.55	4.09
Equity risk premium (%)	4.60	5.25	5.00
Gearing (%)	25	25	25
Asset beta	0.4	0.6	0.55
Equity Beta at notional gearing	0.53	0.80	0.73
Nominal post-tax cost of equity (%)	5.7	8.7	7.8
Nominal pre-tax cost of equity (%)	6.5	10.0	8.9
Debt Premium (%)	1.50	2.25	1.75
Nominal pre-tax cost of debt (%)	4.8	6.8	5.8
Nominal Vanilla WACC (%)	5.5	8.3	7.3
Nominal pre-tax WACC (%)	6.1	9.2	8.1

Source: Europe Economics

2 Introduction

Comreg has commissioned Europe Economics to produce recommendations on the appropriate costs of capital for the following price controls:

- Mobile termination rates (MTR), applied to the following mobile providers deemed to have significant market power: Hutchison 3G Ireland, Lycamobile Ireland, Eircom Group Mobile, Telefonica Ireland, Tesco Mobile Ireland and Vodafone Ireland. The appropriate WACC to be used in this price control is assessed for a hypothetical efficient mobile operator. This will be referred to as the "Mobile cost of capital".
- Eircom's fixed-line telecommunications business. The WACC is estimated for an Irish fixed-line operator with an efficient capital structure. This will be referred to as the "Fixed Line of cost capital".
- Broadcasting, applying to 2rn in Broadcasting Market A (transmission and distribution via towers and masts infrastructure) and to RTÉ in Broadcasting Market B (DTT multiplexing). 2rn is a fully owned subsidiary of RTÉ. The WACC is estimated for an Irish broadcaster with an efficient capital structure. Although these are separate markets, we do not find strong arguments for assigning different WACC values between these two markets. Thus, we estimate a WACC for an Irish broadcaster with an efficient capital structure, which is the appropriate cost of capital for each of these markets.

This report gives our recommendations on costs of capital for each of the three controls. We proceed as follows:

- In section 3 we discuss our theoretical approach to determining the WACC. This covers the Weighted Average Cost of Capital-Capital Asset Pricing Model (WACC-CAPM) approach, which is overwhelmingly the preferred approach in European price controls. We discuss whether this approach remains appropriate and the applicability of possible alternative.
- In section 4 we give our recommendations on the generic parameters of the cost of capital. These are the risk-free rate, the equity risk premium and, in this case, the tax rate.
- In section 5 we discuss methodological issues in determining the specific parameters of the cost of capital, namely gearing, equity beta and the debt premium.
- In section 6 we present our recommendations on the appropriate cost of capital for the MTR determination.
- In section 7 we present our recommendations on the appropriate cost of capital for Eircom.
- In section 8 we present our recommendations on the appropriate cost of capital for broadcasting, consisting of a joint recommendation for Market A and Market B.

3 Theoretical Approach

3.1 The Regulatory Cost of Capital

Companies finance their operations through two sources of capital: debt and equity. Each comes at a cost: the cost of debt is the price paid for fixed-payment liabilities, such as bonds and loans, while the cost of equity represents the opportunity costs of employing contributed capital, such as public shares or private equity investment. Given that the level of return to investors is uncertain, companies must compensate investors for the risk that investing in them induces in the investor's portfolio.

Firms operating in competitive markets earn exactly the rate of return required by the market to finance their assets. However, this is not generally the case for firms with significant market power. One of the purposes of a price control is therefore to set the rate of return at the cost of capital that would occur in a competitive market.

3.2 The WACC-CAPM Approach

The WACC-CAPM (Weighted Average Cost of Capital—Capital Asset Pricing Model) approach has been the standard conceptual framework within which the cost of capital has been examined in Irish regulatory determinations and has generally been favoured in other European jurisdictions (for example, the UK).

The CAPM framework was developed in the 1960s, building on the portfolio analysis work of Harry Markowitz, as a way to estimate the value of assets. The key feature of CAPM is that, given its important assumptions concerning the efficiency of financial markets and that investors care only about the mean and variance of returns, investment returns can be expressed as:

$$r = r_f + MRP * \beta_A$$

where r is the (expected) return on the asset, r_f is the return that would be required for a perfectly risk-free asset, MRP is the "market risk premium", that is to say the excess return over the risk-free rate that would be delivered by a notional perfectly diversified portfolio equivalent consisting of all assets ("the whole market"), and β_A is a measure of the correlation between movements in the value of the asset of interest and in the value of assets as a whole. It is also called "beta" (or sometimes the "asset beta").

Under the capital asset pricing model (CAPM) approach, the cost of capital is computed from (a) the average cost of debt for the various forms of debt held by the company, and (b) the cost of equity. This is the return that investors (shareholders and lenders of various types) require in order to invest in the company. The weighted average cost of capital (WACC) is calculated using the following formula:

$$WACC = \left(\frac{E}{(D+E)}\right) * r_E + \left(\frac{D}{(D+E)}\right) * r_D$$

where r_E is the cost of equity, r_D is the cost of debt and E and D are the total values of equity and debt respectively used to determine the level of gearing in the company, and so giving the relative weights between the costs of equity and debt finance.

Within the context of the WACC-CAPM approach, CAPM is generally most useful in estimating the cost of equity.[1] However, the CAPM remains a theory of the prices of assets in general, not simply equity, and the cost of debt may still be usefully thought about in CAPM terms, as we discuss below.

3.2.1 Cost of Equity

Within the context of the WACC-CAPM approach, CAPM is used to determine the cost of equity, r_E, applying the following equation:

$$r_E = r_f + \beta_E * MRP$$

- r_f is the return on a risk free asset, usually proxied by a measure of the rate on medium to long-term government bonds.
- β_E is the correlation between the risk in company returns and those of the market as a whole, which can be estimated from primary market data.
- *MRP* is the market risk premium over the risk free rate, an economy-wide parameter. In practice what is estimated is the equity risk premium (ERP) which will be a reasonable proxy for the MRP provided the equity market is sufficiently diverse.

Thus in the standard CAPM there are three determinants of the expected return on any asset: the return on a riskless asset; the market premium over that riskless rate that is earned by investors as a whole, reflecting systematic risk; and the particular company's exposure to systematic risk. Company specific risks do not enter the cost of capital, as they can, by definition, be diversified away by investors.

3.2.2 Cost of debt

The cost of debt measures the combination of interest rates charged by banks to the company and the return paid by the company on corporate bonds or other debt instruments. Note that although it may also be expressed in CAPM terms, the cost of debt is usually conceived as being made up of a risk free component and a company-specific risk premium.

$$r_D = r_f + debt\ premium$$

Assuming reasonable efficiency in capital markets, the premium on debt from one source should be the same as that on debt from any other source involving the same risk. This principle should apply however complex the particular structure of finance adopted. Since payments on debt are generally fixed (in contrast to the variable returns on equity), "risk" in this context principally means the risk of non-payment.

A key issue to note is that, since payments on debt are fixed but there is some risk of default, the observed return on debt is not necessarily identical to the expected return from holding the debt. For example, supposing that the whole value of a bond is lost on default, the expected return is:

$$1 + E(r_D) = (1 + r_D) * (1 - p_d)$$

where, p_d is the probability of default. However, the expected return in CAPM terms considers only systematic risk, i.e.:

$$E(r_D) = r_f + \beta_D * MRP$$

[1] Due to equity's role within companies' capital structures, there is generally more divergence between observed and required equity returns than is the case for debt.

Hence, the relationship between the observed return on debt, debt beta and the probability of default can be expressed as follows:

$$r_D = \left(\frac{1 + r_f + MRP * \beta_D}{1 - p_d}\right) - 1$$

Provided that the probability of default is sufficiently low, the observed return will therefore be a reasonably close estimate of the required return. This provides the justification for thinking of the cost of debt in terms of the risk-free rate and a debt premium. However, these considerations should be borne in mind when interpreting observed returns for bonds with a higher probability of default.

3.2.3 Inflation and Taxation

Depending on the precise form of regulation, the WACC may need to adjust for inflation and/or taxation. Taxation represents a cost to a regulated company, and it is a principle of economic regulation that such costs, when efficiently incurred, ought to be recovered by the company in question.

Some regulators, such as Ofwat, give companies explicit tax allowances in their charges, effectively treating taxation as an operating expense. Other regulators give companies allowed returns on a pre-tax basis, effectively including an allowance for taxation in the return on capital. We note that this is similar to the case for inflation, with some regulators using a real WACC with an index-linked asset base, and others using a nominal WACC without asset base indexation. ComReg's practice has been to use a nominal pre-tax WACC:

$$WACC_{pre-tax} = g * r_D + \left(\frac{1-g}{1-t}\right) * r_e$$

where g is the level of gearing, t is the tax rate, r_D is the pre-tax cost of debt and r_E is the post-tax cost of equity.

For the controls in question, it is proposed that both taxation and inflation will be allowed for within the cost of capital, so we will estimate a nominal pre-tax WACC.

3.2.4 Summary on CAPM

The WACC-CAPM approach involves two generic (i.e. market-wide) parameters: the risk-free rate and the equity risk premium, which sum together to form the "total market return"; and a number of idiosyncratic (firm- or project- or industry-specific) parameters including: the equity beta; the debt beta; the gearing; and the debt premium.

3.3 Use of CAPM and Alternatives

CAPM has been the dominant tool for the analysis of the cost of capital in regulation in Ireland (and, indeed, the UK). Given this dominance, and in view of the significant regulatory learning costs that would be associated with a change in methodology, we would need very good reasons to recommend using an alternative model to CAPM. We note that CAPM's use reflects significant advantages over other finance models. It has clear theoretical foundations, which allow for intuitive engagement by non-technical stakeholders. It is also well integrated with the rest of finance theory, for example the Modigliani-Miller theorem can be proved from the CAPM. Moreover, among possible models, none performs better empirically in explaining asset prices in the long run.

Like any model, CAPM is not without criticisms. Some empirical studies from the 1970s to 1990s identified a "small firm effect", with small firms found to have higher returns than predicted by CAPM, and/or a "value

effect", with some firms with low book to market value ratios having higher expected returns than predicted by CAPM. The standard way of empirically estimating CAPM assumes that the equities market as a whole is perfectly diversified, whereas in theory under CAPM diversification takes place across all assets, including non-equity assets such as gold and real estate. Further, CAPM does not explicitly account for investor's preferences about the skewness of returns. In view of these considerations, we therefore examine alternative models of the cost of equity to determine whether there is a justification for shifting away from CAPM.

3.3.1 The Fama-French three factor model

Fama and French (1992, 1996)[2,3] suggested a model for excess returns incorporating firm size and the ratio of book value to market value as explanatory factors in addition to beta. In this model, the empirical equation for the excess return on portfolio j, $Z_j \equiv r_j - r_f$, is given by:

$$Z_j = \beta_j * Z_m + s_j * SMB + h_j * HML + u_j$$

Where s_j is the size of the firm effect, h_j is the size of the ratio of book to market value effect, SMB is the difference between returns on portfolios of small and large stocks, and HML is the difference between returns on portfolios of high and low book-to-market ratios, Z_m is the market portfolio and u_j is the error term for portfolio *j*.

For most regulated companies the effect of using Fama-French instead of CAPM is expected to be small. For an average firm, β_j will be close to 1 (as is the case in the CAPM) while s_j and h_j will be close to zero (since firms are identified in relative terms, the average must be zero). The main impact of the additional factors would therefore be for firms at extremes, or in cases where the effect is to change materially the estimate of β.

The Fama-French model has been popular in the past, but has also been subject to criticism on the grounds of a lack of clear theory as to why the additional factors included should deliver positive premia. Moreover, it has been argued that the fact of having identified that small firms and firms with high book to market ratios have had higher returns than implied by their systematic risk should itself cause asset prices to adjust to eliminate this anomaly. Smithers & Co (2006) found only very limited evidence for the existence of the value effect for utilities in the UK.[4]

In recent UK regulatory determinations the Fama-French model has been used to advocate a small company premium to the cost of capital. The theory, evidence and substantial effect (in terms of there being any "small company premium" to the cost of capital) were rejected comprehensively by the UK Competition Commission in the Bristol Water case.[5] The Competition Commission stated that they "do not consider that there is robust UK empirical evidence of small firms being more risky and hence having a higher cost of capital",[6] and that they "consider that the arguments for a higher cost of equity due to small size in itself are weak".[7]

The Fama-French model therefore lacks the clear theoretical foundations of the CAPM, while its empirical basis is less clear. We do not, therefore, believe it would be appropriate to use it in place of the CAPM.

---

2 Fama, Eugene F. and French, Kenneth R. (1992) "The cross-section of expected stock returns" *The Journal of Finance,* 47(2), p. 427-465.

3 Fama, Eugene F. and French, Kenneth R. (1996) "Multifactor explanations of asset pricing anomalies" *The Journal of Finance,* 51(1), p. 55-84.

4 "*Report on the cost of Capital*", Smithers & Co (2006), provided to Ofgem.

5 See Appendix N of http://webarchive.nationalarchives.gov.uk/+/http://www.competition-commission.org.uk/rep_pub/reports/2010/fulltext/558_appendices.pdf

6 Ibid. Appendix N paragraph 131.

7 Ibid. Appendix N paragraph 137.

3.3.2 Dividend Growth Model

According to the dividend growth model, the rate of return required to sustain the value of a share is its current yield plus the expected rate of growth in yield. A simple DGM states that the current value of a stock can be expressed as:

$$P_0 = \frac{D_1}{r - g}$$

where P_0 is the current price of the stock, D_1 is the expected next period dividend, r is the required rate of return, and g is the expected constant long-term growth rate of earnings. Solving for r gives the following approximation of the cost of equity:

$$r = \left(\frac{D_1}{P_0}\right) + g$$

This means that the cost of equity is the prospective dividend yield of a stock plus the constant long-term growth rate of dividends. Clearly, this version of the DGM makes the strong assumption that the dividend growth rate will be constant. A multi-stage DGM allows the dividend growth rate to vary between dividend periods (for example, short and long term).

The DGM has strong theoretical foundations (since it is based on valuation of a share as the stream of future dividends expected by investors, discounted at the cost of equity) and was for many years the main working tool in US regulatory determinations. The challenge in applying it relates particularly to estimation of the future path of dividends expected by investors. Within a multi-stage DGM, analysts' forecasts can be used for the next few years. Thereafter, there are various proxies that could be used for dividend growth, ranging from historic trends in dividends to the long-run sustainable growth rate of GDP or trend growth in regulated assets. However, these typically give different answers and therefore often result in wide ranges in estimates from the DGM. As the UK Competition Commission put it in the Bristol Water case: "We… regard the DGM evidence as consistent with a wide range of figures for the cost of… equity".[8]

The DGM therefore shares a strong theoretical basis with the CAPM, though in practice its estimates are less precise than those given by the CAPM. While it would be perfectly possible to pick one's point estimate of the cost of equity within the DGM range, this should be done on the basis of sound theoretical considerations which would include CAPM in any case. We do not therefore believe it would be appropriate to use the DGM in the place of the CAPM as the main basis for estimating the cost of capital.

3.3.3 Residual Income Model

From an accounting perspective, the assets of a company are equal to the sum of the company's liabilities and equity attributable to shareholders. In any one year, the difference between a company's revenues and its expenses (including interest and taxes) is that company's net income. Any net income – or "residual income" – remaining after settling all in-year expenses accrues to equity holders.

The book value of a company's equity is total assets less total liabilities. Book values of assets and liabilities can be measured in various ways, including historical cost, amortised cost, current cost, settlement value, present value, or fair value. Accounting valuations such as these stand in contrast to the market's valuation of a company's equity. The market's valuation of a company's equity is equal to price of a single share in the company multiplied by the number of shares outstanding. The market value of a company's equity would exceed its book value if investors expected strong future returns on equity relative to similar investment opportunities. Alternatively, the company could simply be overvalued.

[8] Ibid., paragraph 143.

The total cost of employing equity in financing business operations is equal to the book value of a company's equity multiplied by that company's cost of capital. If equity shares are viewed as a claim on the future cash flows of a company, then the market value of a company's equity can be determined as the discounted cash flows accruing to equity investors over the company's lifetime. This is summarised as follows:

$$Market\ Value\ of\ Equity = BE_0 + \sum_{t=1}^{\infty} \frac{NI_t - K^e * BE_{t-1}}{(1+K^e)^t}$$

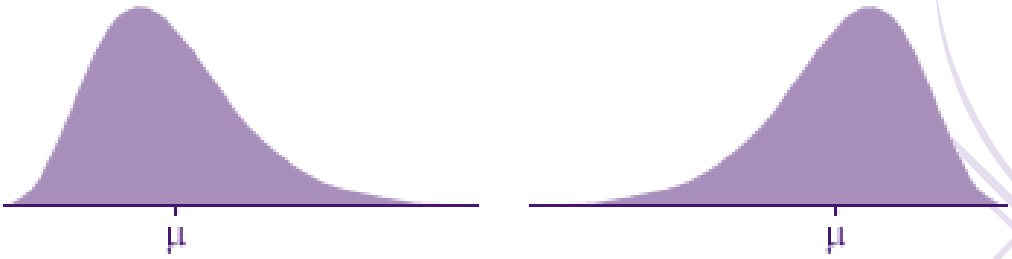
where *BE* is the book value of equity, *NI* is net income, and K^e is the cost of equity, all at time t. In other words, the market value of a company is equal to the current book value of equity and the present value of future residual income accruing to equity holders. The latter term is defined as the net income earned in the present period less the cost of employing last period's equity base in business operations, discounted using the cost of equity. This method of valuing a company's equity is known as the residual income model (RIM).

Although it is conceptually similar to the DGM, in practical application it has the advantage of being less reliant upon analyst forecasts. In other words, whereas the DGM back-loads equity value (including terminal values that may be extremely difficult to predict), the RIM model is frontloaded, using information from that part of the equity value that is captured by its current book value. This reduces the extent to which RIM estimates rely on uncertain future parameters. However, it remains the case that the RIM relies on estimates of future parameters, namely future net income and future equity book values. While these can be proxied by using analysts' forecasts and/or applying plausible future growth rates to current values, there remains uncertainty as to the appropriate choices of these inputs. Thus, although the RIM has significant advantages over the DGM, and retains its strong theoretical foundations, we do not believe in practice that it should replace the CAPM as the primary methodology of estimating the cost of capital.

3.3.4 Third moment CAPM

The traditional CAPM assumes that investor's investment decisions are based only on the mean and standard deviation of a portfolio of assets. In the third moment CAPM, investors may have preferences over the distribution of returns that go beyond their mean and variance. The third moment of a distribution of returns is its skewness, which describes asymmetry about the mean in a random variable's probability distribution. The probability density functions in Figure 3.1 have the same mean (μ) and same variance, but the left distribution is positively skewed while the right one is negatively skewed.

Figure 3.1: Distributions with the same mean and variance but differing skewness



The standard Arrow-Pratt measure of risk aversion implies that higher moments of the distribution of returns would be of interest to investors, and in particular that they would dislike skewness. The assumption in CAPM that investors are indifferent to skewness is thus a simplification at variance with standard decision theory.

It is possible that some (risk-averse) investors might, for example, prefer distributions of returns with positive skewness (where downside risk is, in some sense, relatively more restricted) over those with negative skewness. As a result, distributions with systematic negative skew would have a higher cost of capital than predicted by standard CAPM, while distributions with systematic positive skew would have a lower cost of capital.

Skewness is of clearest significance in a regulatory context under two circumstances: (a) when the entity is subject to material capacity constraints, in which case upside opportunity is curtailed by the price-cap and the capacity constraint (so creating negative skewness); (b) where technological or related innovative opportunities provide significant upside "blockbuster" opportunity especially with regard to upside risk to volume estimates (so creating positive skewness). Capacity constraints have generally been discussed in a regulatory context in cases where regulated businesses have been prevented from expanding, for example in the case of an airport at capacity. Moreover, given the relative maturity of the telecommunications markets analysed here, it is not clear that there is a good case for the existence of "blockbuster" opportunities that would generate the sort of upside risk that would generate positive skewness. In view of these considerations it appears the cost of capital would be adequately estimated using the standard model, so there appears no obvious reason to favour the use of a third moment CAPM.

3.3.5 Conclusion on Theoretical Approach

We therefore retain the CAPM as the main tool for determining the cost of capital. CAPM has a number of advantages, including clear theoretical foundations, a history of regulatory precedent and superior performance to other models in explaining asset prices over the long-run. Although like any model it has received some criticisms, other available models such as the Fama-French model or the Dividend Growth Model, have their own drawbacks. Given that a move away from CAPM would represent a significant departure from regulatory precedent, we would require strongjustification to endorse such a move. In the absence of such justification to do so, and in view of CAPM's advantages, we therefore continue to use the CAPM as our theoretical framework for estimating an appropriate WACC for the markets under consideration.

3.4 Other Issues regarding the WACC

3.4.1 Relevant time period

A key issue in determining what return is appropriate is the start date and the time period over which the price control applies. In the case of the present controls, our understanding is that they will last 3-5 years from 2014/15, implying a mid-point between 2015 and 2017.

3.4.2 Hypothetical efficient operator

The reason for imposing price regulation is that the absence of competition gives firms the power to raise prices about those that would prevail in a competitive market. The relevant point of comparison is therefore with the competitive price, and the relevant WACC in this case is not necessarily that of the incumbent firm. Rather, the relevant WACC is that of a hypothetical efficient company. Our WACC estimates are therefore for hypothetical efficient mobile, fixed line and broadcasting operators. There may be pragmatic reasons, such as financeability considerations, for departing from a regulatory WACC estimated on such a basis, but such departures would require sufficient justification.

3.4.3 CAPEX incentive mechanisms

If set at an appropriate level, the WACC should enable regulated firms to offer returns sufficient to finance their investment projects. However, there may be times when the regulator wishes to incentivise investment in certain projects in particular. CAPEX incentive mechanisms can be used by the regulator to encourage firms to pursue these projects. In general, the need for CAPEX incentives can arise in two ways.

First, the regulator and the firm can agree *ex-ante* to a particular project whose risk profile is higher than the average risk profile of the firm's other projects. The firm undertakes the project and the regulator allows a higher WACC to compensate the firm and its investors for bearing the additional risk. ComReg might wish to consider such a mechanism only in circumstances in which it was clear that a particular project was both desirable and sufficiently riskier than the average project undertaken by the regulated company to require a higher return.

Alternatively, the regulator can incentivise a firm to undertake a project it believes is in the public interest, regardless of the riskiness of the project. The difference between this situation and the first is that the risk of the project can be the same or lower than the average project risk for the company. To consider such an incentive, ComReg would need to be satisfied both that there was a sufficient public interest justification for the project to be desirable and that the regulated company would not otherwise engage in the project, even though its risk level was not necessarily higher than the average project for the company.

3.4.4 Trigger mechanisms

The purpose of a trigger mechanism is to adjust the cost of capital when market conditions change to such an extent that the actual cost of capital differs significantly from the realised cost of capital when firms raise funds in the market. The concept of a trigger mechanism is, to some degree, already factored into the concept of periodic price control reviews. Indeed, the reason price controls are updated at all is to incorporate changes in the expected future outlook into allowed returns on investment.

One effect of this periodic review, however, is to introduce regulatory uncertainty into the market. Regulatory uncertainty arises when investors are unsure of the expected rate of return on their investments due to uncertainty in regulatory outcomes. The more frequently the regulatory cost of capital is reviewed, the greater the scope for regulatory uncertainty. Introducing a trigger mechanism, then, can increase regulatory uncertainty.

On the other hand, not updating the cost of capital when market conditions change drastically also comes with risks. If, for instance, the cost of capital rises sharply during the course of the price control due to a deep recession or a drying up of liquidity in capital markets, firms may not be willing to invest unless the cost of capital is adjusted upward to reflect new market conditions.

The present controls are envisaged to hold for a period of three to five years. We do not envisage that trigger mechanisms would be required for these controls, since we believe that their duration is of such a length, and there is already sufficient flexibility within the process, to respond to significant changes in market conditions without increasing regulatory uncertainty.

4 Generic Parameters in the WACC-CAPM Model

This section deals with the WACC parameters that will be common across all three price controls. The key generic parameters are the risk-free rate, , and the equity risk premium. Together the risk-free rate and the equity risk premium represent the total market return. To assess these parameters we consider a range of evidence, including previous regulatory precedent, estimates from market data, and authoritative third-party sources.

The other key generic parameter is taxation. In theory the tax rate could be specific, since companies may differ in the effective tax rate that they pay. However, our recommendation is to use the statutory tax rate, so for our purposes taxation is a generic parameter. We explain our reasons for this below.

4.1 Total Market Returns and the Economic Cycle

Total market returns expressed in CAPM terms represent the sum of the risk-free rate and the market risk premium. Total market returns are generally considered to be more stable than their individual components. During economic downturns, the risk-free rate tends to be depressed, while equity risk premia are elevated. Conversely, when the economic outlook is more positive, risk premia are generally lower and the risk-free rate higher. Of course, total returns will generally be lower during downturns, reflecting lower expected returns on risk-bearing investments in a weak economy and a lower risk-free rate. But the key issue is that variations in overall returns will be significantly lower than variations in the risk-free rate and equity risk premium. It is therefore useful to consider the risk-free rate and the equity risk premium within the context of the total return and the economic outlook.

4.1.1 Precedent

The period leading to and following the financial crisis was especially turbulent for Ireland. Fluctuations in financial markets, large swings in Irish macroeconomic variables, and the bifurcation of Europe into a "core" and "periphery" have all complicated the estimation of the cost of capital. Current macroeconomic data and forecasts indicate that Ireland is likely to emerge from economic hardship and return to more "normal" economic performance over the next three to five years.

Regulatory precedent on the risk-free rate and the ERP are especially useful in this situation. Precedent over the course of booms and busts offer a picture of how regulatory cost of capital parameters change as

macroeconomic conditions change. As economic conditions in Ireland are expected to normalise[9], pre-crisis precedents give some idea of what total market returns might be in the future.[10]

Table 4.1 contains past regulatory precedent for the risk-free rate and ERP in Ireland since 2000. The real risk-free rate has varied between 2.0 and 3.0, while the ERP has ranged from 5.0 to 6.0. Total market returns have, in general, been falling since the early part of the 2000s. The highest total market returns figure is 8.6 per cent, used in 2001-2002 and 2005, each time in the context of aviation regulation.

Table 4.1: Total market returns in Irish regulatory determinations, 2000-2014

Regulator	Subject	Year	Real risk-free rate	Implied nominal risk-free rate	ERP	Real total market return
CER	ESB PG	2000	3.0	5.6	5.4	8.4
CAR	Aer Rianta	2001	2.6	5.2	6.0	8.6
CAR	Irish Aviation Authority	2002	2.6	5.2	6.0	8.6
CER	Bord Gáis Éireann	2003	2.5	5.1	6.0	8.5
ComReg	Eircom	2003	n/a	4.45	6.0	-
CAR	Dublin Airport Authority	2005	2.6	5.2	6.0	8.6
CER	ESB PG	2005	2.4	4.9	5.25	7.7
ComReg	Eircom	2008	n/a	4.75	6.0	-
CAR	Dublin Airport Authority	2009	2.5	n/a	5.0	7.5
CER	EirGrid and ESB	2010	2.0	n/a	5.2	7.2
CAR	Irish Aviation Authority	2011	1.5	n/a	5.0	6.5
CER	EirGrid and ESB	2014	2.0	n/a	5.0	7.0

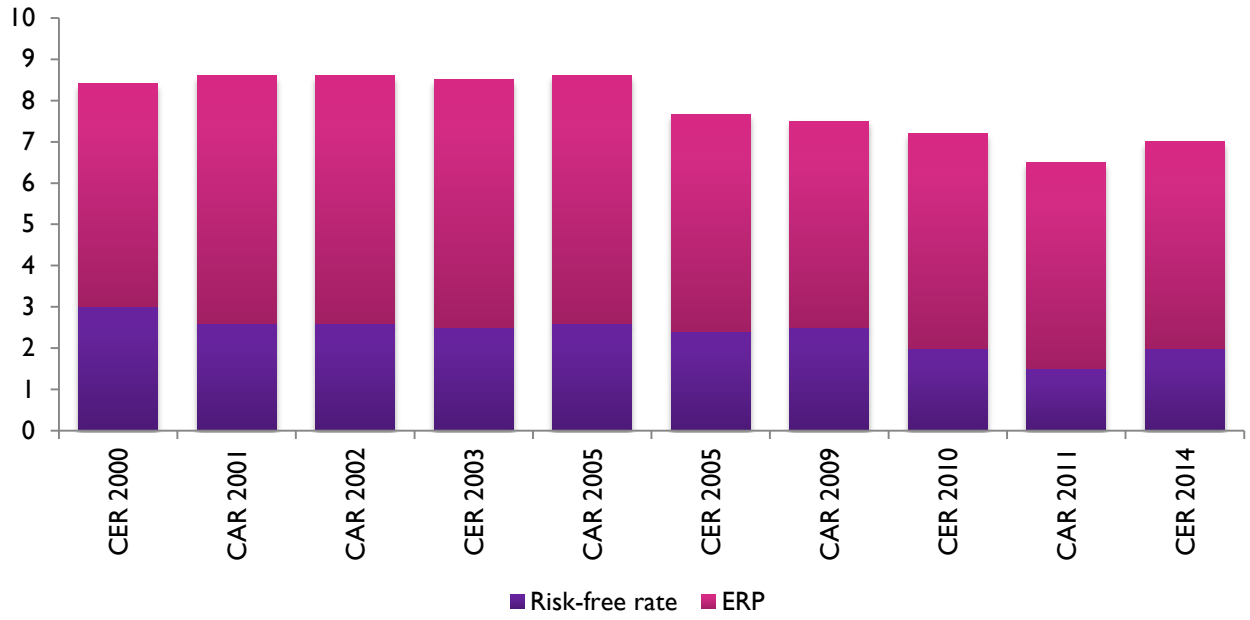
Source: Various regulatory determinations.

Figure 4.1 reinforces this point. Total market returns as the sum of the risk-free rate and the equity risk premium have remained relatively constant though slightly lower during the recession, when total market returns would be expected to be lower given a weak economic environment.

[9] For example, the Central Bank of Ireland forecasts that GDP growth in 2014 will be 2 per cent, which would represent a steady increase in the GDP growth rate. See: http://www.centralbank.ie/polstats/econpolicy/Documents/Forecast%20Summary%20Table%20Quarterly%20Bulletin%20Q4%202013.pdf. At the time of writing, Bloomberg consensus forecasts for GDP growth stand at 2.2 per cent. Similarly and from the same two sources, HICP inflation is forecasted to rise from 0.6 per cent in 2013 to 0.7 per cent in 2014 and 1.3 per cent in 2015. We interpret the forecasted increase in the GDP growth rate and inflation to be indicators of normalisation of economic conditions, moving out of recession and deflation to growth and moderate inflation.

[10] We are not asserting — and do not believe — that pre-crisis, and in particular 2005-2007, represent "normal" economic conditions. We analyse pre-crisis regulatory precedent only as a guide to how parameters may behave outside of the crisis, rather than relying exclusively on more recent, in-crisis data.

Figure 4.1: Total market returns in Irish regulatory determinations, 2000-2014



Source: Various regulatory determinations.

4.2 Risk-Free Rate

This section outlines our assessment of the appropriate risk-free rate in Ireland. We begin with a discussion of conceptual features of a risk-free rate in general and the Irish risk-free rate in particular. We then use this discussion as our point of departure for determining the Irish risk-free rate empirically.

4.2.1 Nominal versus Real Risk-Free Rates

Since our estimate is for a pre-tax nominal WACC, we estimate the appropriate nominal risk-free rate. What matters for investors is the real return on their investments, but to achieve this within a regulatory WACC there will need to be some allowance for inflation either within the WACC itself or within the value of the asset base. In this case, since the asset base is not adjusted for inflation, compensation for inflation occurs through the WACC, which must be expressed in nominal terms.

Our approach to estimating the appropriate nominal risk-free is to estimate separately the real risk-free rate and inflation. In principle nominal risk-free rates could be estimated directly from yields on nominal gilts. However, it is useful to decompose the nominal risk-free rate into the real rate and inflation, which are related as follows:

$$(1 + i) = (1 + r) * (1 + \pi)$$

where i is the nominal interest rate, r is the real interest rate, and π is the rate of inflation.

Since the nominal risk-free rate could change either due to changes in the real risk-free rate or due to changes in inflation, it is useful to consider these components separately. As we will see, there are also difficulties in interpreting the relationship between sovereign bond yields and risk-free rates, which also make it useful to consider the real risk-free rate separately from inflation.

4.2.2 Estimating the Risk-Free Rate

Estimation of the risk-free rate has generally been done with reference to yields on sovereign debt, on the grounds that these approximate a notional risk-free asset (in capital markets theory, the risk-free rate is the rate of return on an asset that bears no risk). The yield on a risky asset is some combination of the risk-free rate and a premium for bearing a variety of risks. Such risks could include:

- Credit or default risk.
- Currency risk.
- Inflation risk.
- Reinvestment risk.

An investor is exposed to credit risk when a credit rating downgrade could have a negative impact on the price. Bondholders, for instance, typically find that a credit rating downgrade prompts an increase in borrowing costs for the downgraded issuer. This increase in borrowing costs or the yield on the issuer's debt decreases the price of the issuer's bond and, therefore, is a source of capital depreciation for bondholders.[11] Thus, a credit downgrade can lower potential returns.

Issuers with the highest credit rating (i.e. AAA), who are likely to be able to continue to comfortably make payments on their debt obligations, are strong candidates for risk-free assets. This does not mean, however, that AAA issuers will never default.[12] An investor is exposed to default risk when there is a possibility of an issuer failing to make payments in line with the terms of its debt obligations. Among the universe of AAA issuers, AAA sovereigns have a unique ability to minimise (relative to other issuers) the likelihood of default given their ability to print money. The ability to issue money means that sovereigns can, in principle, meet any nominal bond payments in domestic currency.

It is important to note that a sovereign can always make *nominal* bond payments in *domestic* currency, but might struggle to make *real* or *foreign currency* denominated bond payments. In other words, AAA sovereigns can carry inflation risk and currency risk.[13]

Inflation risk entails being exposed to significant falls in the purchasing power of the bond issue's currency due to rising prices. Investors, receiving coupon and principal payments in domestic currency, receive a lower real return on investment in inflationary environments. All else held equal, printing additional money is likely to stoke inflation. Therefore, while a sovereign issuer can always meet nominal bond payments by printing additional money, doing so exposes investors to inflation risk.

Furthermore, printing additional money can also devalue a sovereign's currency. Currency depreciation exposes investors to currency risk in two ways. First, for foreigners investing in a sovereign's domestic bonds, a depreciation of the sovereign's currency reduces the purchasing power of investment returns to the foreign investors. For instance, if a German resident invests in UK sovereign bonds and the pound depreciates markedly against the euro, then the pound-denominated coupon and principal payments will be worth less in euros to the German investor.

Second, sovereign debt denominated in foreign currency also exposes investors to foreign exchange risk via default. As mentioned earlier, sovereigns have the ability to print domestic currency and therefore meet nominal domestic bond payments. Sovereigns who borrow in international markets cannot rely on monetary policy to service debts. Instead, sovereigns meet foreign currency debt obligations by a combination of maintaining the value of the domestic currency versus the foreign currency and through foreign exchange earnings via trade and investment flows. If the value of the domestic currency falls or

[11] The price of a bond moves inversely to its yield.
[12] Indeed, many AAA assets were downgraded to junk status and / or defaulted during the credit crunch.
[13] We note that, in addition to default risk, non-sovereign issuers are also exposed to these inflation and currency risks.

inflows of foreign currency slow, sovereigns can find themselves without the foreign currency to pay foreign currency-denominated debts. In this way, currency risk can lead to default risk.

Returns on a risk-free asset should be known with a high degree of certainty over a given time horizon. Periodic payments from an investment, such as coupon payments on a bond, need to be invested at the spot rate in order to actually yield the required coupon rate over the life of the asset. The future reinvestment rate is uncertain, and therefore the expected total return on an asset today may differ from the actual total return received at the end of the investment horizon. The potential for difference between the expected and actual returns on an asset is indicative of reinvestment risk.

4.2.3 The Appropriate Risk-Free Asset for Ireland

Within the Eurozone, non-euro-denominated sovereign bonds carry currency risk.[14] Eurozone investors based in one country investing in any other Eurozone country's sovereign debt will be remunerated in their domestic currency. Thus, variation in nominal exchange rates will not affect a Eurozone risk-free asset. Due to the lack of currency risk, we restrict the analysis of the Irish risk-free rate to the Eurozone.

Investors continue to demand a premium for holding peripheral sovereign bonds. Since the credit crunch and subsequent sovereign debt crisis, yields on bonds of beleaguered sovereigns have been elevated relative to their more favoured peers in Europe. Since around Q3 2012, however, yields on peripheral sovereign debt have come down materially, following the European Central Bank's President Mario Draghi's pledge "to do whatever it takes to preserve the euro."[15] Ireland returned to the public debt markets on March 13, 2013 with an auction of 10 year government bonds,[16] raising €5 billion at a yield of 4.15 per cent through the issuance.[17] The 4.15 per cent yield on the newly-issued bond was almost half of the 8.2 per cent yield on Irish government bonds prior to suspensions. On January 7th, 2014, Ireland issued €3.75b of 10-year government bonds at a yield of 3.54 per cent, bringing the Irish benchmark 10-year to 3.25 per cent, further evidencing a fall in the perceived risk of Irish government debt.[18]

The figure below shows nominal yields on a sample of European sovereign10 year bonds. In the case of Ireland, we also include data on 9 year bonds, as for some of the sample period there were no bonds with 10 years to maturity. As can be seen, there remains a premium for bonds from peripheral as opposed to core countries. In the case of Ireland, this premium has fallen significantly relative to its peak in 2011, though it remains in excess of the yield for core Eurozone countries.

[14] We abstract away from concerns about a current Eurozone member leaving the common currency area.

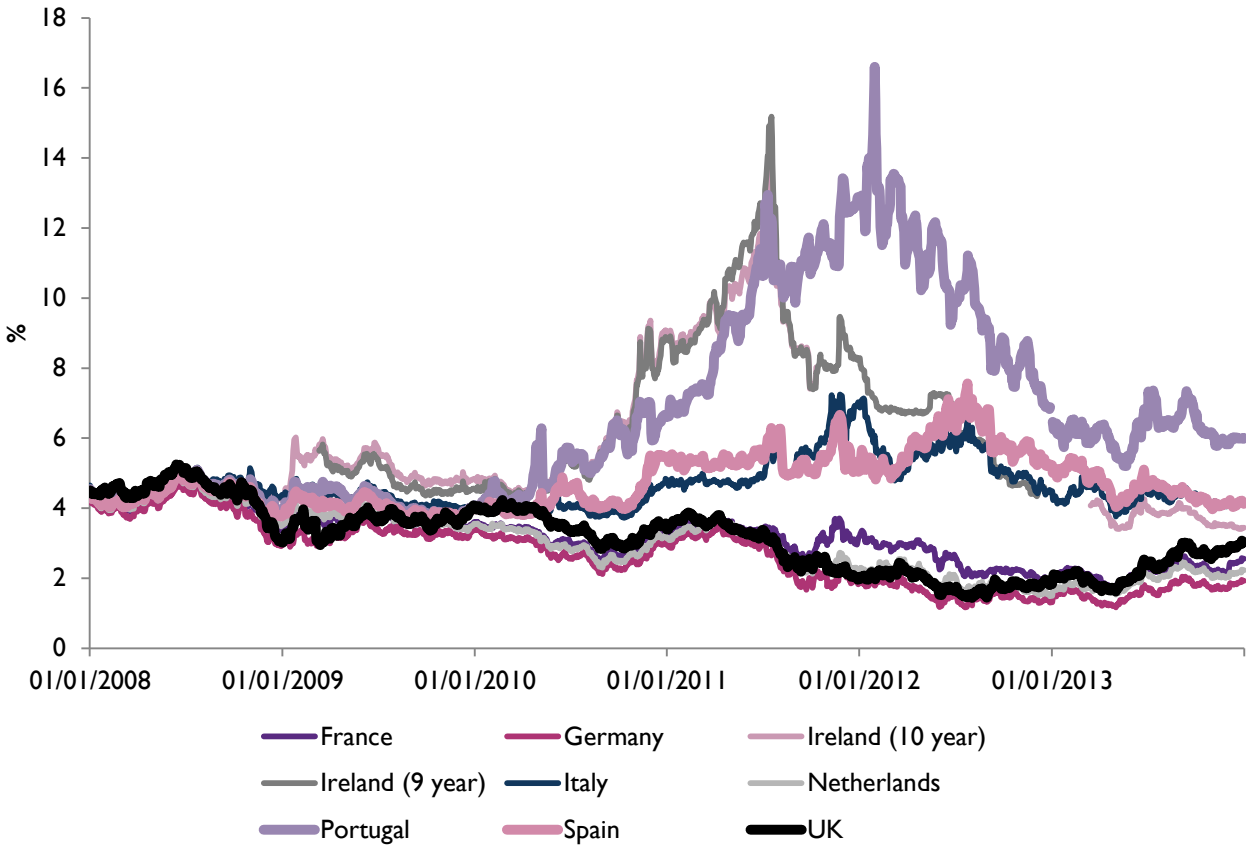
[15] http://www.ecb.europa.eu/press/key/date/2012/html/sp120726.en.html

[16] This is the first time the Irish sovereign returned to the debt markets. Dublin successfully issued a 5 year bond almost a year earlier. See: Smyth, Maie and Atkins, Ralph "Ireland returns to global bond market" *Financial Times*, July 26, 2012.

[17] Quinn, Eamon, Hannon, Paul and Ruffoni, Serena "Success for Ireland in bond market" *Wall Street Journal*, March 13, 2013.

[18] Edwards, Ben and Stubbington, Tommy "Investors snap up Irish bonds" *Wall Street Journal*, January 7, 2014.

Figure 4.2: Nominal yields on European sovereign 10 year bonds



Source: Bloomberg

The premium for holding these bonds is composed of a number of different risks, but one key risk is the motivation behind the sovereign debt crisis in the first instance: default risk. For the Eurozone, then, a risk-free asset would not be a peripheral bond, which the market believes continues to carry default risk.

Given the relatively higher Irish bond yields versus core Eurozone countries, and analysis from the Central Bank of Ireland that Irish yields have been volatile in 2013[19], we believe that the Irish government bond is not the appropriate risk-free rate for Ireland, in spite of the significant reduction in yields since 2011.

This assessment is in line with what practitioners and academics have argued. Finance professional tend to use the 10-year German bond as the benchmark risk-free asset for the Eurozone as a whole. This practice is, to varying degrees, endorsed also by a number of academic studies.

Favero et al. (2000, 2010)[20,21] assume the benchmark euro-denominated sovereign bond to be the one with the lowest yield at each maturity, which has recently been the German bond. Blanco (2002) identifies liquidity as another key characteristic of benchmark status.[22] In accordance with this argument, Favero et al. (2010) note that spreads can be observed even within the group of AAA-rated Euro-zone countries. For instance, in 2002, the 10-year AAA-rated Finnish debt yielded on average 20 basis points more than the

[19] Central Bank of Ireland (2013) "Central bank quarterly bulletin Q3", p. 40-41.

[20] Favero, C., A. Missale, and G. Piga, (2000), "EMU and public debt management: one money one debt", CEPR Policy Paper No. 3.

[21] Favero, C., M. Pagano, and E-L. von Thadden, (2010), ""How does liquidity affect government bond yields?", Journal of Financial and Quantitative Analysis, Vol. 45, No. 1.

[22] Blanco, R., (2002), "The euro-area government securities markets: recent developments and implications for market functioning", mimeo, Launching Workshop of the ECBCFS Research Network on Capital Markets and Financial Integration in Europe, European Central Bank.

10-year German Bund which suggests that the liquidity differential may potentially be responsible for the spread due to the Finnish bond being more thinly-traded. Beber et al. (2009) show that, whilst the bulk of Euro-zone sovereign yield spreads is explained by differences in credit quality, liquidity plays a nontrivial role, especially for low credit risk countries and during times of heightened market uncertainty.[23,24]

Finally, it is worth mentioning that a peculiar characteristic of the European government bond market is represented by the negative correlation between credit risk and liquidity across countries. For example Favero et al. (2010)[25] find that, between 2002 and 2003, Italian bonds were the most liquid government bonds (French and German bonds being respectively the second and third most liquid bonds). However, Italian bonds have rarely (if ever) been used as a benchmark and we therefore stress that, though important, liquidity alone does not represent a sufficient condition for determining a benchmark risk-free asset. Instead, liquidity may be used as a refinement criterion for selecting among assets with negligible credit risk and comparable yields.

For investment purposes, the core Eurozone typically includes Germany, Finland, France, and the Netherlands. The table below contains the average and standard deviations of European sovereign bonds from October 2011 through September 2013. German bonds had both the lowest average yield and the least yield volatility, suggesting German bonds were perceived to be safer and more liquid by investors.

Table 4.2: Average and standard deviations of yields on 10 year core Eurozone sovereign bonds

Country	Credit rating	Average yield	Standard deviation
Germany	AAA	1.62	0.26
Finland	AAA	1.93	0.36
Netherlands	AA	1.99	0.31
France	AA	2.47	0.46

Note: Calculations on data from October 2011 to September 2013.
Source: Bloomberg, Europe Economics' calculations.

On the basis of this evidence, we therefore believe that it is appropriate to use German sovereign bonds as the proxy for the risk-free asset for the Eurozone in general and Ireland in particular.[26,27]

4.2.4 German Bond Yields and the Risk-Free Rate

In our analysis of Germany yields, we favour using 10 year bonds. Such bonds will be less affected by movements in short-term interest rates than short-term borrowings such as 1 year bonds, and in any case, such short-term borrowing is not typically used to finance long-term investment projects. Long-term

[23] Beber, A., Brandt, M.W. and Kavajecz, K.A. (2009) "Flight-to-quality or flight-to-liquidity? Evidence from the Euro-area bond market", Review of Financial Studies, Vo. 2, Issue 3.

[24] We stress that the concept of benchmark asset is not necessarily identical to the concept of risk-free asset.

[25] Favero, C., M. Pagano, and E-L. von Thadden, (2010), "How does liquidity affect government bond yields?" *Journal of Financial and Quantitative Analysis*, Vol. 45, No. 1.

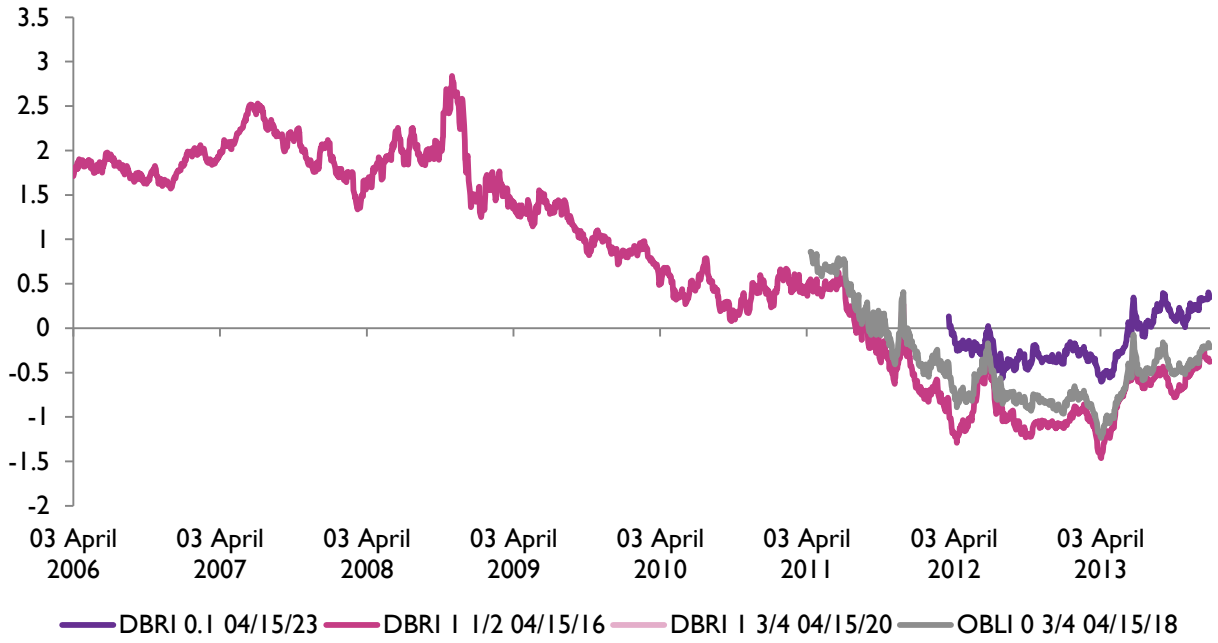
[26] This is in line with Oxera's approach to determining the risk-free rate in the last ComReg WACC determination for Eircom's fixed-line business. They analysed Irish and German government bonds in an assessment of the risk-free rate. Given the divergence of German and Irish yields, we feel that incorporating Irish yields into the risk-free rate would be inappropriate.

[27] As economic and financial conditions in Ireland continue to improve with respect to its core European peers, using Irish government bonds to estimate the risk-free rate becomes less and less problematic. This is because investors perceive Irish government bonds to be without the risks that caused the widening of the Irish-German spread. It is also because, in a unified capital market, the yields on the bonds of any one country should not differ dramatically, and therefore the risks of holding Irish bonds would not differ materially from the risks of holding German bonds. This is precisely what happened in the post-euro, pre-crisis period, where borrowing costs for European sovereigns converged.

borrowing can be influenced by factors such as pension fund investment, long-run macroeconomic growth, and other concerns that are less relevant for a 3-5 year price control. The 10 year rate strikes a balance between these considerations.

The nominal yield on a risk-free asset is a combination of the real yield and expected inflation. In order to remove the effects of expected inflation from the assessment of the risk-free rate, it is preferable to analyse inflation-linked bonds. Unfortunately, Germany has only a few inflation-linked bonds outstanding. These few observations are not sufficient for a robust analysis of real risk-free returns. Further, as Figure 4.3 shows, some German inflation-linked bonds are pricing at a *negative* yield.

Figure 4.3: Yields on German inflation-linked bonds



Note: "DBRI" and "OBLI" are the names of the bonds as listed on Bloomberg.
Source: Bloomberg.

The negative real yield is a function of several factors. First, the European sovereign debt crisis has boosted demand for German debt at the expense of peripheral country debt, lifting the price and lowering the yields of German bonds. This "flight to quality" effect has pushed German real yields below zero. Second, quantitative easing in a number of countries has increased the global amount of liquidity in the financial system.[28] This has boosted the prices of a variety of asset classes, including German government bonds.

Flight to quality and excess liquidity effects are visible across the German yield curve. Figure 4.4 plots nominal yields on 5, 10, 20, and 30 year German government bonds. Since the end of 2008, when investors began bidding up the price of German bonds and central banks around the world started lowering policy rates, German yields were on a downward trajectory. However, they reached a trough in late 2012 and have risen over the course of 2013.

[28] We note that the European Central Bank has not engaged in quantitative easing, but has engaged in "extraordinary" monetary policy through its Long Term Refinancing Operations and communicating its willingness to purchase government bonds through its Outright Monetary Transactions.

Figure 4.4: Nominal yields on German government bonds

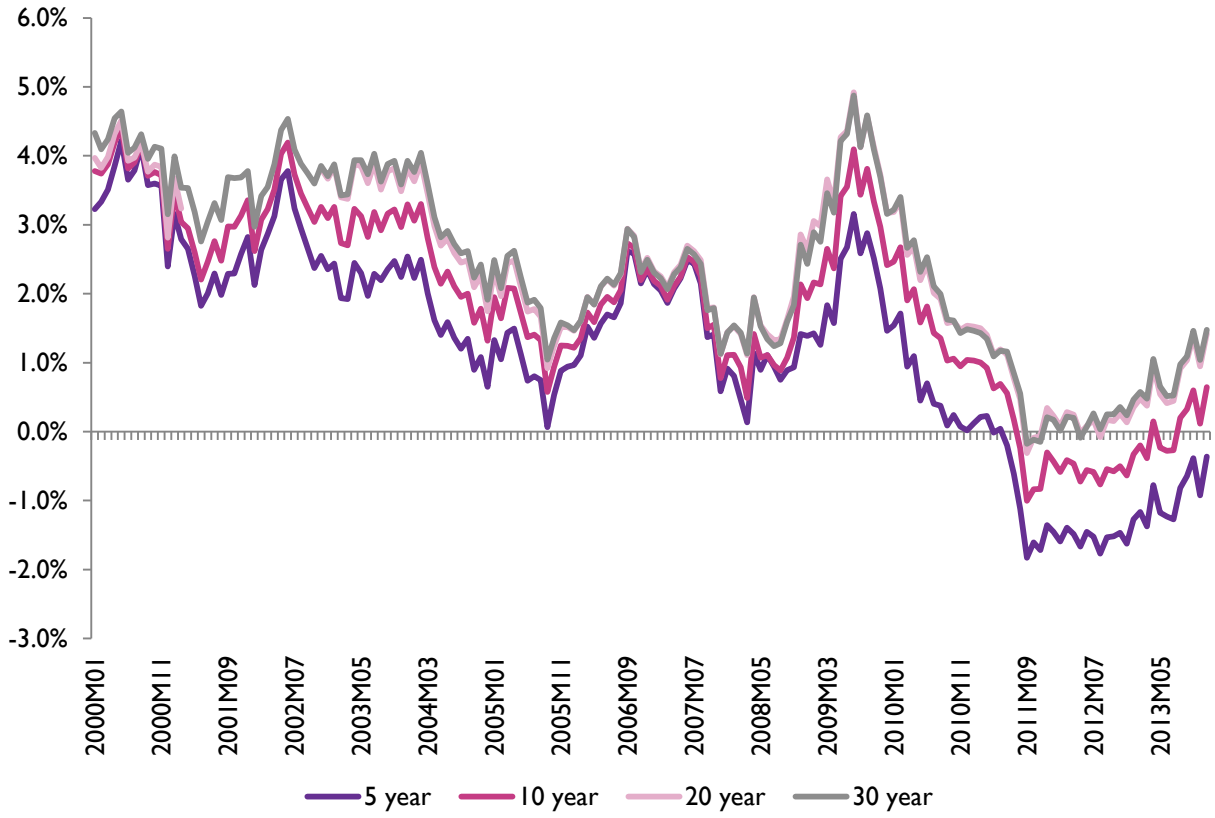
Source: Bloomberg.

Policy and market distortions in the German government bond market make the yield on German government bonds difficult to interpret in isolation. Our approach in interpreting this evidence on the appropriate risk-free rate is therefore to examine yields pre-crisis. We believe this is appropriate on two grounds. First, given the expected recovery in the Irish economy during the price control period, the appropriate risk-free rate is likely to be more in line with the pre-crisis rate than in more recent depressed conditions. Second, this is before flight to quality and excess liquidity effects drove down German yields, so such distortions do not affect or interpretation of the yields.

4.2.5 Historical German bond yields

The chart below shows historical German bond yields deflated by the German HICP inflation rate, which confirms that real German government bond yields are at extremely low levels, but beginning to increase.

Figure 4.5: Yields on German bonds yields (adjusted for inflation)



Source: Bloomberg, Eurostat, Europe Economics calculations.

Table 4.3 presents nominal and implied real yields on German 10 year bonds from 2000 to 2013.[29] We construct real yields from nominal yields and inflation to overcome.

[29] Real yields are derived from deflating the nominal yields using the Fisher Equation.

Table 4.3: Nominal and real yields on German 10 year bonds, 2000-2013

Period	Average nominal yield	Average inflation	Average real yield
2000	5.26	1.40	3.81
2001	4.82	1.90	2.87
2002	4.79	1.38	3.37
2003	4.10	1.02	3.05
2004	4.07	1.80	2.23
2005	3.38	1.89	1.47
2006	3.78	1.78	1.96
2007	4.23	2.29	1.90
2008	4.00	2.76	1.21
2009	3.27	0.23	3.03
2010	2.78	1.15	1.61
2011	2.65	2.50	0.15
2012	1.56	2.14	-0.57
2013	1.63	1.60	0.03
Average 2000-2013	3.59	1.70	1.87
Average 2000-2007	4.30	1.68	2.58

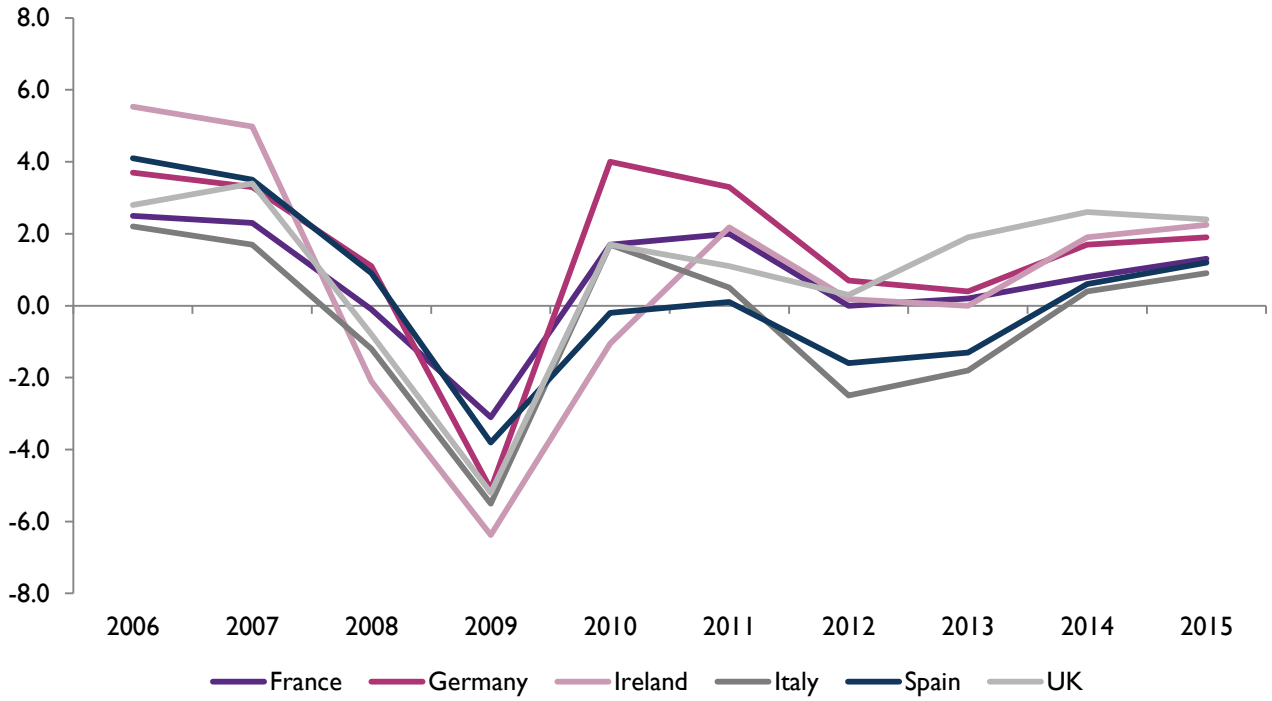
Note: Averages based on monthly data.
Source: Bloomberg, Eurostat, Europe Economics calculations.

The average implied real yield from 2000 to 2013 is 1.87 per cent, but we note that this includes the post-crisis period in which yields were abnormally low. From 2000 to 2007, the average implied real yield on German 10 year bonds is 2.58 per cent. We note that the real yield in 2000 was also particularly high and likely pulls up the average, so we believe a figure below this number is likely to be appropriate.

Our advice to the Commission for Energy Regulation on the real risk-free rate was for a range of 1.40-2.0 per cent for 2011-2013 and 1.75-2.00 per cent for 2014-2015.[30] This reflected the fact that 1.40 per cent was the lowest risk-free rate in regulatory precedent, and that 2011-2013 was a period of continued depressed economic circumstances. The rationale for increase in lower bound over this period comes from improved outlook for 2014-15 relative to 2011-2013, which implies higher risk-free returns. This can be seen in the figure below, which shows Irish actual growth for 2011 and 2012 alongside Bloomberg consensus economic forecasts to 2015.

[30] Europe Economics (2013) "Mid-term WACC for EirGrid and ESB Network". See: http://www.cer.ie/docs/000801/cer13222a-mid-term-review-of-electricity-networks-wacc---cer-europe-economics-report.pdf.

Figure 4.6: GDP growth (year-on-year per cent) and forecasts for European countries, 2006-2015



Note: 2014-2015 figures are forecasts for all countries; 2013 figures are forecasts for all countries except Germany and UK.
Source: Bloomberg.

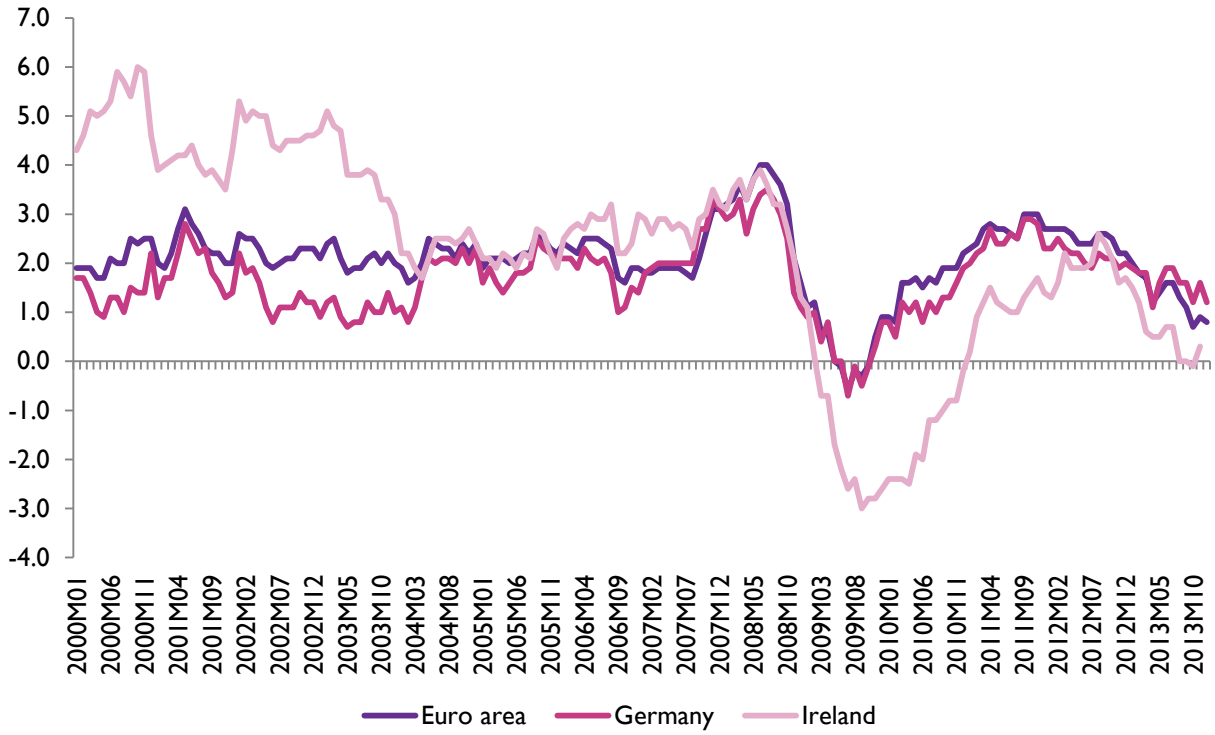
The price control will last 3-5 years from 2014/15, implying a mid-point between 2015 and 2017. The fact that there is further scope for recovery beyond 2015 implies increasing the upper bound of the 1.75-2.0 per cent range that Europe Economics suggested to Commission for Energy Regulation. We note that regulatory decisions have ranged from 2 per cent to 3 per cent and averaged 2.5 per cent since 2000. We believe that 2.5 per cent is appropriate as an upper bound on the risk-free rate.

This gives a real risk-free rate range of 1.75 to 2.5 per cent. We give more weight to the upper end of this range, with balance of probabilities on economic upside, and so believe that 2.3 per cent would be an appropriate point estimate of the relevant real risk-free rate.

4.2.6 Inflation

The analysis of the risk-free rate has up to now focused on the real risk-free rate. When calculating the WACC, however, we will use nominal variables, consistent with previous ComReg practice. Converting the risk-free rate from real to nominal requires an estimate of the rate of inflation over the price control period. plots the year-over-year inflation in Eurostat's harmonised index of consumer prices for Ireland, Germany, and the Eurozone.

Figure 4.7: Year-on-year HICP inflation in Ireland, Germany, and the Eurozone



Source: Eurostat.

Among the three inflation rates, the Irish rate has been the most volatile. The average Irish inflation rate over the past 10 years has been around 1.6 per cent, compared with an average rate of 1.7 per cent in Germany and 2.1 per cent in the Eurozone.

Figure 4.8: Annual year-over-year inflation rates and consensus forecasts

Note: 2014 and 2015 figures are forecasts.
Source: Bloomberg.

The ECB's mandate is to maintain price stability, which it has interpreted as keeping inflation "below, but close to, 2 per cent" on a year-over-year basis. Recently, inflation has been low across the Eurozone, including Ireland.

Our view is that the Irish economy and the Eurozone more broadly is on the recovery path and will return to more normal economic conditions during this price control. A near-zero rate of inflation is inconsistent with that view, as extremely low inflation is typically associated with economic contraction. Thus, we would not consider recent patterns or low-to-negative inflation rates to be relevant for a forward-looking price control. Furthermore, the Bloomberg consensus forecast for Irish inflation for 2015 is 1.5 per cent (and 1.9 per cent for Germany).

We take the Bloomberg consensus forecast for inflation in 2015 as our lower bound for inflation during the price control. As our upper bound, we take a combination of the ECB's implicit inflation target and the average rate of inflation in the Eurozone as a reasonable approximation for a target Irish rate of inflation. On this basis, we set our upper bound on inflation at 2 per cent. We select the mid-point of this range as our point estimate, which is 1.75 per cent. This is slightly above the 10 year average rate of inflation in Ireland. However, if Irish inflation were to maintain this average, then inflation going forward would have to be slightly higher than this, to compensate for recent low levels of price increases.

4.3 The Equity Risk Premium

The equity risk premium ("ERP") is the additional return investors in equities demand above the risk-free rate. Investors require an additional return over the risk-free rate because, by definition, equities are riskier than a risk-free asset. The ERP represents the mean level of additional return over the risk-free rate that investors need to bear equity risk.

4.3.1 Regulatory precedent

Irish regulatory precedent on the equity risk premium, shown in the table below, has been in the range of five to six per cent since 2000.

Table 4.4: Total market returns in Irish regulatory determinations, 2000-2014

Regulator	Subject	Year	ERP
CER	ESB PG	2000	5.4
CAR	Aer Rianta	2001	6
CAR	Irish Aviation Authority	2002	6
CER	Bord Gáis Éireann	2003	6
ComReg	Eircom	2003	6
CAR	Dublin Airport Authority	2005	6
CER	ESB PG	2005	5.25
ComReg	Eircom	2008	6
CAR	Dublin Airport Authority	2009	5
CER	EirGrid and ESB	2010	5.2
CAR	Irish Aviation Authority	2011	5
CER	EirGrid and ESB	2014	5

Source: Various regulatory determinations.

Note that determinations in the period up to 2005 generally had higher ERPs, with a strong preference for 6.0 per cent, whereas in the period after determined risk premia have been lower. This may appear counterintuitive, but may reflect very high total market returns in Ireland during the early 2000s in a period of particularly strong growth. Precedent therefore suggests an equity risk premium in the range of 5.0-6.0 per cent.

4.3.2 Long-run evidence

For the purposes of the CAPM, we wish to know what is the expected excess return to equity. In line with the other CAPM parameters that are expressed in expectation terms, our primary evidence on what is expected comes from evidence on what actually happened. For example, we use recent evidence on actual returns on companies' debt to estimate what premium over the risk-free rate is required to allow companies to offer investors a sufficiently high expected return on their debt. This estimation involves a trade-off between analysing a long enough period of data to be able to distinguish right value from statistical noise, and focussing on a sufficiently recent period so that changes in investors' required returns are not drowned out by excessive amounts of historical data.

In the case of the ERP this exercise is complicated by the fact that returns to holding equity vary substantially over short periods of time. Because of this variation, there is a very real danger that analysing too short a period of time would fail to capture the expected equity return, since we would in fact be sampling only a part of the distribution of equity returns. Further, because of the magnitude of changes in returns, the addition of a particular period in time can often have a substantial effect on the mean return calculated. To address these issues, the equity risk premium is generally estimated using very long-run historical data (often over 100 years).

Dimson, Marsh, and Staunton (DMS) (2002) sought to address the fact that many of the long-run empirical studies on the equity risk premium had been based on the experience of the US only. [31] DMS argued that,

[31] Dimson, Elroy, Marsh, Paul and Staunton, Mike (2002) "Global evidence on the equity risk premium" London: London Business School.

given how successful the US economy had been, the US risk premium was unlikely to be representative, so extended the evidence on the equity risk premium by examining data on bond and bill returns in 16 countries over a 102 year period (1900-2002). Their results showed that the equity risk premium has typically been lower than previous research had suggested.

Long-run risk premia are now estimated annually using the DMS methodology. Table 4.5 below shows worldwide equity risk premia over bonds from the latest round of estimates on data from 1900 to 2012.[32]

Table 4.5: Worldwide equity risk premia over bonds, 1900-2012

Country	Geometric Mean (%)	Arithmetic Mean (%)	Standard Error (%)	Standard Dev. (%)	Min. Return (%)	Min. Year	Max. Return (%)	Max. Year
Australia	5.6	7.5	1.9	19.9	-52.9	2008	66.3	1980
Austria	2.8	22.1	14.7	154.8	-81.1	1924	1571.8	1945
Belgium	2.3	4.3	2.0	21.0	-52.7	2008	80.1	1940
Canada	3.4	5.0	1.7	18.3	-40.7	2008	48.6	1950
Denmark	1.8	3.3	1.6	17.5	-54.3	2008	74.9	1972
Finland	5.3	8.9	2.8	30.1	-56.3	2008	173.1	1999
France	3.0	5.3	2.1	22.8	-50.3	2008	84.3	1946
Germany	5.2	8.6	2.7	28.4	-50.8	2008	116.6	1949
Ireland	2.6	4.6	1.9	19.8	-66.6	2008	83.2	1972
Italy	3.4	6.8	2.8	29.5	-49.0	2008	152.2	1946
Japan	4.8	8.9	3.1	32.7	-45.2	2008	193.0	1948
Netherlands	3.3	5.6	2.1	22.2	-55.6	2008	107.6	1940
New Zealand	3.7	5.3	1.7	18.1	-59.7	1987	72.7	1983
Norway	2.2	5.2	2.6	27.8	-57.8	2008	192.1	1979
South Africa	5.4	7.1	1.8	19.5	-34.3	2008	70.9	1979
Spain	2.1	4.1	1.9	20.7	-42.7	2008	69.1	1986
Sweden	2.9	5.1	2.0	20.8	-48.1	2008	77.3	1999
Switzerland	2.0	3.5	1.7	17.6	-40.6	2008	52.2	1985
United Kingdom	3.7	5.0	1.6	17.1	-38.4	2008	80.8	1975
United States	4.2	6.2	1.9	20.5	-50.1	2008	57.2	1933
Europe	3.4	4.8	1.5	16.3	-48.0	2008	57.3	1923
World ex-USA	3.0	4.1	1.4	14.7	-47.8	2008	36.1	1919
World	3.2	4.4	1.4	15.3	-47.9	2008	37.7	1958

Source: Dimson, Marsh, and Staunton (2013).

The arithmetic mean is generally preferred to the geometric mean when estimating a forward-looking risk premium. The arithmetic mean captures the rate of return on the marginal unit of capital, which is what is relevant for regulatory price controls. There would be a case for the use of geometric means if there were mean reversion in the ERP, as the geometric mean captures this underlying process. However, academic evidence suggests that markets in developed economies tend to be weakly efficient over any significant

[32] Dimson, Elroy, Marsh, Paul, and Staunton, Mike (2013) *Credit Suisse Global Investment Returns Sourcebook 2013*.

timescale, so that returns do not exhibit mean reversion.[33] We therefore use the arithmetic mean ERP estimate.

As we use 10 year governments bonds as our risk-free rate, the appropriate ERP is over bonds, rather than over short-maturity bills. For Ireland, DMS estimate the arithmetic ERP over bonds to be 4.6 per cent. Recent financial market turbulence has led regulators to consider whether an uplift to the ERP is necessary to reflect the influence of the financial crisis. In the past, the ERP in Irish regulatory cost of capital determinations has been uplifted by 20 per cent to incorporate this influence. We do not believe that an uplift of 20 per cent would be appropriate as a forward-looking estimate of the ERP, but we do recognise that there are some downside risks to the nascent economic recovery in Europe that may justify an ERP above the DMS long-run estimates.

Further, we note that an ERP of 4.6 per cent would be lower than any Irish regulatory precedent, which ranges from 5.0-6.0 per cent. We therefore adopt 4.6 per cent as a lower bound for the ERP. The Commission for Energy Regulation's 2014 final determination for electricity distribution and transmission networks uses 5.0 per cent as the upper end of its ERP range for 2014 to 2015. Given expected stabilisation in economic conditions, we do not believe that the upper bound of the ERP for relevant period would be significantly above this. We therefore suggest an upper bound to the ERP of 5.25 per cent. For a point estimate, we suggest an ERP of 5.0 per cent. This takes into account an expected improvement in economic conditions, long-run evidence on the ERP and is in line with, but on the lower side of, regulatory precedent.

4.4 Taxation

Taxation represents a cost to a regulated company, and it is a principle of economic regulation that such costs, when efficiently incurred, ought to be recovered by the company in question. Some regulators, such as Ofwat, give companies explicit tax allowances in their charges, effectively treating taxation as an operating expense. Other regulators give companies allowed returns on a pre-tax basis, effectively including an allowance for taxation in the return on capital. We note that this is similar to the case for inflation, with some regulators using a real WACC with an index-linked asset base, and others using a nominal WACC without asset base indexation. ComReg's practice has been to use a nominal pre-tax WACC.

Given the tax shield resulting from the ability to deduct interest expenses from taxes, calculating a pre-tax WACC involves inflating the cost of equity by a value of one less the tax rate:

$$WACC_{PRE\text{-}TAX} = g \cdot r_D + [(1 - g) / (1 - t)] \cdot r_E$$

where g is the level of gearing, t is the tax rate, r_D is the pre-tax cost of debt and r_E is the post-tax cost of equity.

This uplift to reflect tax may be done on the basis of either the statutory corporation tax rate, which is 12.5 per cent for Ireland, or on the basis of companies' effective tax rates, taking into account how various allowances affect the actual tax paid.

There may be a case for using the effective tax rate where there are significant differences between companies' actual tax paid and the statutory rate, for example due to capex allowances. However, this is a moot point, since the purpose of such allowances is likely to be the promotion of capital spending. This is often considered a matter for policymakers, and so it may not be appropriate for regulators to claw back the benefits of such allowances through the use of the effective rate when policymakers have deliberately

[33] See Fama, Eugene F. (1991) "Efficient capital markets: II" *The Journal of Finance*, 46(5), p. 1575-1617. For market efficiency in Europe (including Ireland), see: Worthington, Andrew and Higgs, Helen (2004) "Random walks and market efficiency in European equity markets" *Global Journal of Finance and Economics*, 1(1), p. 59-78.

allowed differences between the effective and statutory tax rates in order to provide particular forms of incentive.

Regulatory precedent in Ireland overwhelmingly favours the use of the statutory tax rate in the calculation of the pre-tax WACC. Moreover, in the case of the mobile control, since we are examining the WACC for a hypothetical efficient operator, there is no obvious basis on which to assess what such an operator's effective tax rate would be for this. On the basis of these considerations we therefore use the Irish statutory corporation tax rate of 12.5 per cent when calculating a pre-tax WACC.

4.5 Conclusion on Generic Parameters

The table below shows our suggested ranges for the components of total market returns.

Figure 4.9: Ranges for the risk-free rate and ERP

	Low (%)	High (%)	Point (%)
Real risk-free rate	1.8	2.5	2.3
Inflation	1.5	2.0	1.75
Nominal risk-free rate	3.3	4.5	4.1
ERP	4.6	5.25	5.0
Tax Rate	12.5	12.5	12.5

5 Specific Parameters in the WACC-CAPM Model

This section discusses methodological issues in the estimation of specific parameters in the WACC-CAPM model. These are the WACC parameters that *may* vary between the mobile, Eircom and broadcasting controls:

- Gearing.
- Equity Beta.
- Debt Premium.

This section also discusses aiming-up of the WACC, a process used to reflect the asymmetric consequences of setting an incorrect WACC. Since aiming-up reflects uncertainty in both generic and specific parameters, the appropriate extent of aiming up may differ between these controls, so we treat this as a specific parameter.

5.1 Gearing

5.1.1 Introduction to Gearing

The gearing of a company is the ratio of its fixed financing to its total financing, or the ratio of the value of its debt to the sum of its debt and equity.[34] Gearing is important for an assessment of the WACC for several reasons:

- We determine the WACC by assessing the costs of debt and equity, and gearing determines the appropriate weighting between the two.
- The costs of debt and equity are not invariant to the company's level of gearing.
- When setting the WACC for an entire industry, it is important to consider whether a company's observed, actual gearing should be used or a notional industry-wide gearing.
- Related to the above, interest paid on debt can be tax deductible, and therefore there may be tax shields associated with debt. Understanding the proportion of a company's financing costs consisting of debt is critical to understanding the presence and consequences of tax shields. This is especially important if the specified notional gearing differs significantly from actual gearing.

We consider some issues regarding gearing in general below.

5.1.2 Gearing and the Modigliani-Miller Theorem

Modigliani-Miller Proposition I (MM I) states that that the risk of a company depends on the risk of its real cash-flows, and hence on volatility in costs and demand for its products. This implies that, in the absence of taxes, incentive and information problems, the way a project or firm is financed does not affect its value or its cost of capital, (i.e. the market value of any firm is independent of its capital structure). This is because

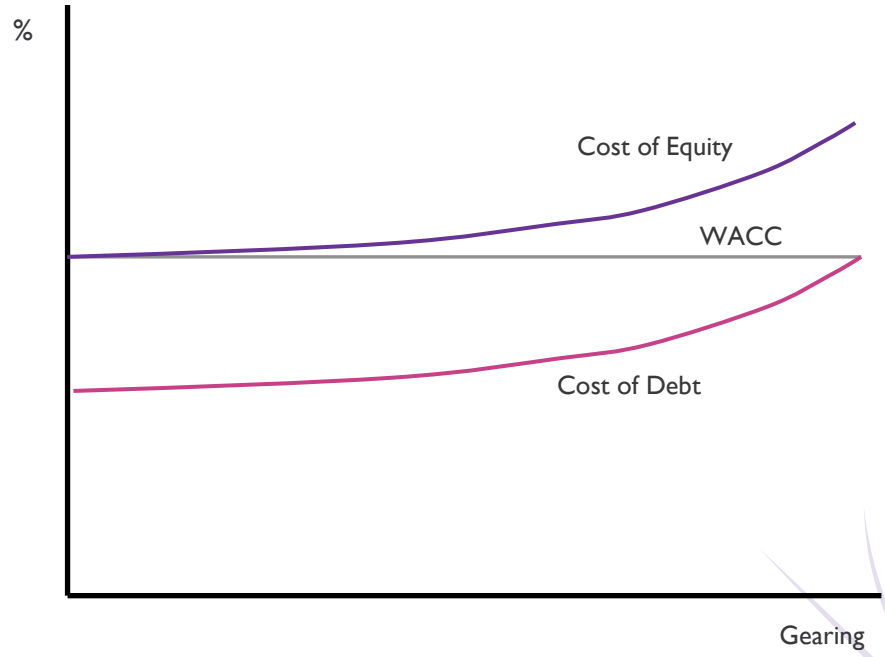
[34] This is the definition we have used, consistent with previous Irish and international regulatory precedent. Another interpretation of this definition of gearing is fixed financing over total capital.

the overall risk in a company's asset base, its asset beta, does not change with the capital structure of the firm.

A company may be thought of as a bundle of investment projects. A project can be represented as a stream of uncertain future cash flows or net revenues. Each stream of future revenues is equivalent to a certain amount of cash today, the exact amount being obtained by discounting future revenues by the cost of capital to obtain the present value of the project, net of costs to undertake that project. Financiers will invest in the project only if the net present value of future cash flows is positive. If the project is financed up front by a combination of debt and equity, then a fixed amount of future cash flows will accrue to debt lenders and the remainder, or the value of the cash flows less the amount paid out to debt lenders, will accrue to equity investors. The split between debt and equity financing does not matter from the perspective of the financiers; it simply determines how much of the return on capital investment accrues to each party.

Because the risk of an asset is determined by its real features, rather than its method of financing, causality runs from the asset cost of capital, through the capital structure, to the costs of debt and equity. In other words, it is the costs of debt and equity that depend on the level of gearing, and not the asset cost of capital. This is illustrated in the figure below. At zero level of gearing the weighted average cost of capital is equal to the cost of equity. As gearing increases, the weight on the (lower) cost of debt increases. However, cost of equity and debt both adjust such that the combined WACC remains unaltered, until at 100 per cent gearing WACC simply equals the cost of debt.

Figure 5.1: Modigliani-Miller proposition I



To see this within the context of CAPM, note that for financiers to be willing to put up the cost of a project, they must first determine what level of risk they are taking on and, therefore, what level of return they require for their investment. Within the CAPM framework this involves determining the asset beta, i.e. the extent to which net returns on the asset as a whole are correlated with changes in returns in the economy as a whole. The asset beta affects the WACC of the whole company, in contrast to the equity beta, which only affects the cost of equity:

$$WACC = (1 - g) * r_E + g * r_D$$

$$\beta_A = g * \beta_D + (1 - g) * \beta_E$$

If the firm uses no leverage, then the shareholders get all the project revenues and $\beta_A = \beta_E$. If the firm uses debt as well as equity, β_E overstates the risk of the company, and the equity beta must be "un-levered" to get the asset beta. From MM I the value of the company is determined by its future revenues and how those revenues are split between different types of financiers does not matter. This means that the asset beta is constant, so that as the company gears up, the weight on the equity beta decreases relative to the weight of debt beta. Assuming that the risk on the debt providers does not change, the risk on equity holders must increase, so that the risk on the firm's equity is affected by its capital structure as well as the risk inherent in the business as a whole.

Since, according to MMI, the capital structure is irrelevant, we might expect to see that choice of capital structure is random. That we do not see entirely random matters points to a number of matters from which MMI abstracts:

- Differential tax treatment of equity and debt finance may imply that increasing gearing will save tax and increase company value. Specifically, the tax deductibility of interest payments may increase the value of the firm in question. The existence of such a shield lowers the cost of debt and lowers cost of equity as more debt is used.
- In the absence of other distortions, the expected costs of financial distress rise with the level of gearing.
- Financial structures may affect the incentives that managers face to maximise the net present value of the company.
- The information that different market participants have access to at different times may vary.
- There may be transaction costs, for example in varying the level of gearing.

Taking these considerations together suggests that there may be an optimal (value maximising) level of gearing. For example, considering the effect of taxation suggests that the market value of a company may rise with gearing, but as the risks and expected costs of financial distress and the extent of incentive problems rise with gearing, there may be a point at which increased gearing causes value to fall.

5.1.3 Notional Versus Actual Gearing

There is no standard approach to gearing in cost of capital regulation, partly reflecting the Modigliani-Miller capital structure irrelevance result. In the previous fixed-line determinations by ComReg and various determinations of the Commission for Energy Regulation, a notional approach was adopted, which involved the regulator choosing a crediting rating for the company that it believes compatible with the company's obligations under their licence and the regulator's duties to ensure financeability. Some regulators, such as the UK's Ofcom in its regulation of BT, analyse the actual gearing of regulated companies. Based on the credit rating, notional gearing is set so that the credit rating can be secured at the determined WACC. With a target credit rating determined, the notional gearing is typically set at close to a level of gearing compatible with the target credit rating, bearing in mind regulatory precedent and companies' actual levels of gearing. This implies that some iteration in WACC calculation may be necessary to the extent that financeability analysis finds that the WACC at the notional gearing level is not compatible with the target credit rating.

An advantage of the use of actual gearing is that it directly reflects the choices of the regulated company, so examination of that company's debt yields and equity returns are simplified (if such data are available). In its regulation of BT, Ofcom has switched from the use of notional to actual gearing citing such benefits.[35] In its WBA charge control proposals, BT also stated that use of notional gearing was appropriate when actual

[35] Ofcom, *Proposals for WBA Charge Control* 2011, p91(http://stakeholders.ofcom.org.uk/binaries/consultations/823069/summary/condoc.pdf).

gearing was below optimal gearing, but that this is less appropriate when gearing is above the optimal level. However, we note that this requires a judgement as to the regulated firm's optimal gearing. Ofcom stated that it was "clear" that BT's gearing had been below the optimal level, but this requires the regulator to make an explicit judgement as to the appropriate capital structure for the firm in question. We note that regulators have used a notional gearing approach when firms' gearing is above the set notional level. For example, in the UK Heathrow's gearing is in excess of 80 per cent, while its notional gearing is set at 60 per cent by the CAA.

However, there are also advantages to the use of notional gearing. In particular, it leaves judgement of the optimal capital structure to regulated firms. Further, by tracking firms' actual choices, the use of actual gearing could leave the cost of capital open to regulatory gaming in situations in which the Modigliani-Miller assumptions did not hold and firms could influence their cost of capital through their gearing choices.

In view of these considerations, for each relevant price control, we will consider whether notional or actual gearing is appropriate and, if notional gearing is appropriate, at what level this should be set.

5.2 Equity Beta

5.2.1 Systematic risk

In particular, betas measure the extent to which the returns on any particular asset are correlated with the returns on the market[36] as a whole. A beta of 1 indicates that returns on the asset and return on the market move in a proportionally identical fashion, so that falls or increases in returns in the market are matched by identical falls or increases in the asset's returns. Similarly a beta of less than 1 indicates that falls in the market return are matched by less severe falls in the assets' return, while a beta of more than 1 indicates that falls in market returns are matched with more severe falls in the asset's returns.

In other words, betas measure systematic risk. This is risk that affects the entire market and cannot be avoided by investors through portfolio diversification. (Specific risk, by contrast, refers to those risks that affect a particular company or group of companies. Investors can avoid specific risk by diversifying their investments.) Since systematic risks are determined to varying extents by economy-wide factors, they cannot be diversified away by investors. Therefore the company has to compensate its investors for bearing the risk through the cost of capital. Examples of systematic risks might include:

- Macroeconomic fluctuations, such as in the rate of growth of GDP — such fluctuations contribute to the willingness to pay for telecommunications services being uncertain;
- Changes in interest rates;
- Changes in oil prices and the prices of related factor inputs;
- Catastrophic events, such as terrorist attack, war, or a global pandemic, undermining demand in so far as they affect the market as a whole.

5.2.2 Equity and asset beta

A company's "asset" or "unlevered" beta also measures a company's exposure to systematic risk and abstracts from the capital structure. If the Modigliani-Miller theorem holds, β_A is invariant to changes in gearing. The asset beta is:

$$\beta_A = g * \beta_D + (1 - g) * \beta_E$$

[36] Here we use "market" to mean the relevant equity market.

Where β_A is the company's asset beta, β_D is a company's debt beta, β_A is a company's equity beta, and g is the company's gearing. The debt beta is frequently, but not always, assumed to be zero. If the debt beta is equal to zero, then the asset beta is simply the equity beta multiplied by equity's share of the capital structure (or one minus debt's share of the capital structure). The more the company is geared, the higher the equity beta for a given asset beta. This is because more highly geared companies have more fixed financing costs relative to total financing costs, since interest payments are obligatory but dividends are discretionary. Higher fixed financing costs constrain a company's ability to cut financing costs during an adverse system-wide shock. Therefore an equity investor's exposure to systematic risk is higher if a company is more highly geared, as lower cash flows to cover high fixed financing costs would result in lower shareholder's equity.

As we use a notional gearing in our WACC estimates, we present unlevered betas which are then relevered using our notional gearing assumption to obtain the equity beta at that gearing level. We use the resulting relevered betas to estimate the cost of equity.

5.2.3 Estimating betas

Our preferred method of equity beta estimation typically usse of daily data over a one to two year time horizon are preferred , due to favourable statistical properties (i.e. low standard errors and relatively stable estimates). To examine the important issue of possible time variation in company betas, Smithers and Co. (2003) run rolling regressions at all frequencies, and have carried out parameter stability tests on monthly, weekly and daily data.[37]

Estimates based on many years of historical data may be of little relevance because the nature of the business risks undertaken by companies may have changed significantly over a long period such as 10 years. Smithers and Co. find that standard errors are generally low and betas reasonably stable over a two-year estimation period. For this reason, we place the most weight on rolling two-year betas estimated on daily data when assessing the appropriate beta for a hypothetical efficient Irish mobile operator. However, we also consider evidence from one- and five-year rolling betas as well.

Because companies will be geared at different levels, we compare companies' asset betas, using the ratio of net debt to the sum of net debt and market capitalization to estimate companies gearing. There is a further issue in the use of asset betas that calculating these requires a debt beta. Debt betas are difficult to estimate robustly, and are often assumed to be zero. This is often an appropriate simplifying assumption, for example when bond spreads are low (indicative of low beta risk) and notional gearing is close to observed gearing. In such cases, the inclusion of a small positive debt beta would not have a material effect on equity beta, after re-levering. Irish regulators have generally assumed a zero debt beta when calculating asset betas. However, Ofcom in the UK has favoured the inclusion nonzero debt betas (at 0.1) in the context of telecoms in general and mobile call termination in particular.

We therefore present our analysis with both zero and 0.1 debt betas and then determine the appropriate equity beta. In the present case, the assumption of a zero, or low (0.1) debt beta does not make a material difference to our conclusions, and for simplicity our final conclusion are presented with a zero debt beta for simplicity..

[37] However, Smithers (2003) have previously noted that beta estimates based on daily data may be downwardly biased if the stocks are not as liquid as the market portfolio: "For less frequently traded stocks where it may take more than a few hours for new information to be reflected in measured process a daily beta estimate is likely to be downward biased.". See Smithers and Co. (2003) "A study into certain aspects of the cost of capital for regulated utilities in the U.K.".

5.2.4 Choice of the relevant equity market

In order to estimate betas, one must select the relevant equity market for the analysis. We argue, however, that the Eurozone is a unified capital market. If this is the case, then investors in Germany are free to invest in the ISEQ, the IBEX, or any other equity market in the Eurozone as if it were, say, the DAX. A Europe-wide equity index may be more appropriate in these circumstances. Our methodological preference, then, is to estimate betas for Eurozone companies using a Europe-wide equity index. We estimate these betas on the MSCI Europe Index for Eurozone-base companies, which is a free-float weighted index of 16 developed European countries representing approximately 85 per cent of adjusted market capitalisation in Europe.[38]

For non-Eurozone companies, we use the domestic equity index of the company in question (e.g. FTSE for Vodafone, IBEX for Telefonica, etc.). However, taking into account the possibility of divergent capital market prospects within Europe, we also examine domestic betas for Eurozone companies.

5.3 Debt Premium

This section discusses some general considerations when estimating the cost of debt. First, we consider two issues when estimating the cost of debt, which are adjustments for existing financing costs and the appropriate methodology to estimate the cost of debt. We then estimate the debt premium by considering the cost of debt to be composed of the risk-free rate discussed earlier in the report and a "debt premium" or additional amount operators must pay investors for bearing additional investment risk.

5.3.1 Embedded debt adjustments

An embedded debt approach involves combining estimates of companies' existing costs of debt with an estimate of their forward-looking cost of debt, and weighting these according to the companies' expected future debt requirements. A forward-looking cost of debt approach does not take into account embedded debt costs, and instead relies on estimating what would be the costs of debt for new issuances.

An embedded debt approach may be appropriate for pragmatic reasons. For example, there may be feasibility problems for existing companies in adjusting costs quickly to an efficient level or it may have been cheaper to acquire or build relevant assets in the past than is currently the case. This approach may also be used by regulators seeking to meet duty-to-finance obligations. None of these cases would necessarily require a regulator to make an embedded debt adjustment, but such an approach may represent an appropriate pragmatic response to particular circumstances.

However, in the absence of such considerations, it is preferable not to apply embedded debt adjustments. This is because the key thought experiment in a price control is that of the competitive or contestable market, the existence of the control being due to a lack of competitive constraint. An efficient new entrant would not have access to past debts obtained at rates cheaper than those at the time of entry, nor would it have legacy debt that was more expensive than the debt it could obtain at entry. An efficient new entrant would therefore neither gain nor suffer due to embedded debt.[39] Thus, although pragmatic considerations may justify the use of embedded debt under some circumstances, best practice in economic regulation should be to seek to phase out embedded debt adjustments as and when doing so becomes feasible.

[38] Countries included as of September 2013 are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the UK. All of the companies sampled in our analysis are listed in one of these countries.

[39] These considerations do not make any presuppositions on the market share of either an entrant or existent market participants.

Our approach for determining the appropriate efficient mobile operator cost of debt is therefore to estimate a forward-looking cost of debt and make no embedded debt adjustment.

5.3.2 Bottom-up versus top-down cost of debt estimation

The key source of evidence for determining the forward-looking cost of debt is naturally bond yields for companies with a similar risk profile to the activities of the company or companies subject to the price controls. However, the forward-looking cost of debt can, in principle, be estimated either by observing directly the yield on telecommunications companies' bonds or by analysing the bonds' spreads over gilts of a similar maturity, and adding the debt premium to the estimated risk-free rate. The latter is our preferred approach for the following reasons.

First, in the CAPM movements in the debt premium and movements in the risk-free rate are conceptually different. Changes in the debt premium may occur due to re-evaluations of risk or changes in risk appetite for the company in question, which are distinct from the changes that are captured by variation in the risk-free rate. Separating the components of the cost of debt therefore allows for a more focused analysis of the cost of debt.

Second, with a debt premium approach, forward-looking estimates of a rise in the risk-free rate convert straightforwardly into a forward-looking cost of debt estimate. In the approach that uses the overall cost of debt this relationship is unclear. For example, loose monetary policy and quantitative easing are intended to reduce market interest rates below the cost of debt in order to enhance incentives to invest. The effect of this policy on market rates has been discussed in our analysis of the risk-free rate. An overall cost of debt approach risks under-appreciating the effects of deliberate policies

Third, it is consistent with the approach for estimating the cost of equity, which is built up from the estimated risk-free rate, and the multiple of equity beta and the market risk premium.

We note further that our estimated risk-free rate is itself generated in part from a disaggregation of total market returns in their respective components. Given the advantages of a bottom-up approach to the forward-looking cost of debt, we therefore prefer this approach to direct estimation from bond yields.

5.3.3 Higher debt premium for an Irish operator

In the analyses below we find that operators in some countries attract higher debt premiums than similar operators in other countries. We believe it plausible that an efficient operator in Ireland could attract a higher debt premium than an efficient operator in a core European country. We therefore estimate how much higher would be the debt premium of an efficient company operating in Ireland than the debt premium of a company in a core country.

One difficulty in estimating this premium is the lack of a pure play Irish mobile company with listed debt, the difficulty of reading any "Irish operating" premium off of Eircom's debt given its distorted capital structure and recent examinership process, and the lack of any quoted debt for 2rn or RTÉ.

The aim of this exercise is therefore to measure the additional debt premium an ostensibly similar company could attract when operating in Ireland instead of, say, Germany. To do this we compare debt premiums over German government bonds for utilities from a number of European companies. The logic is to select bonds from a low-risk set of sectors and examine how these vary across countries.The list of companies used to estimate a "country-operating" debt premium is presented below.

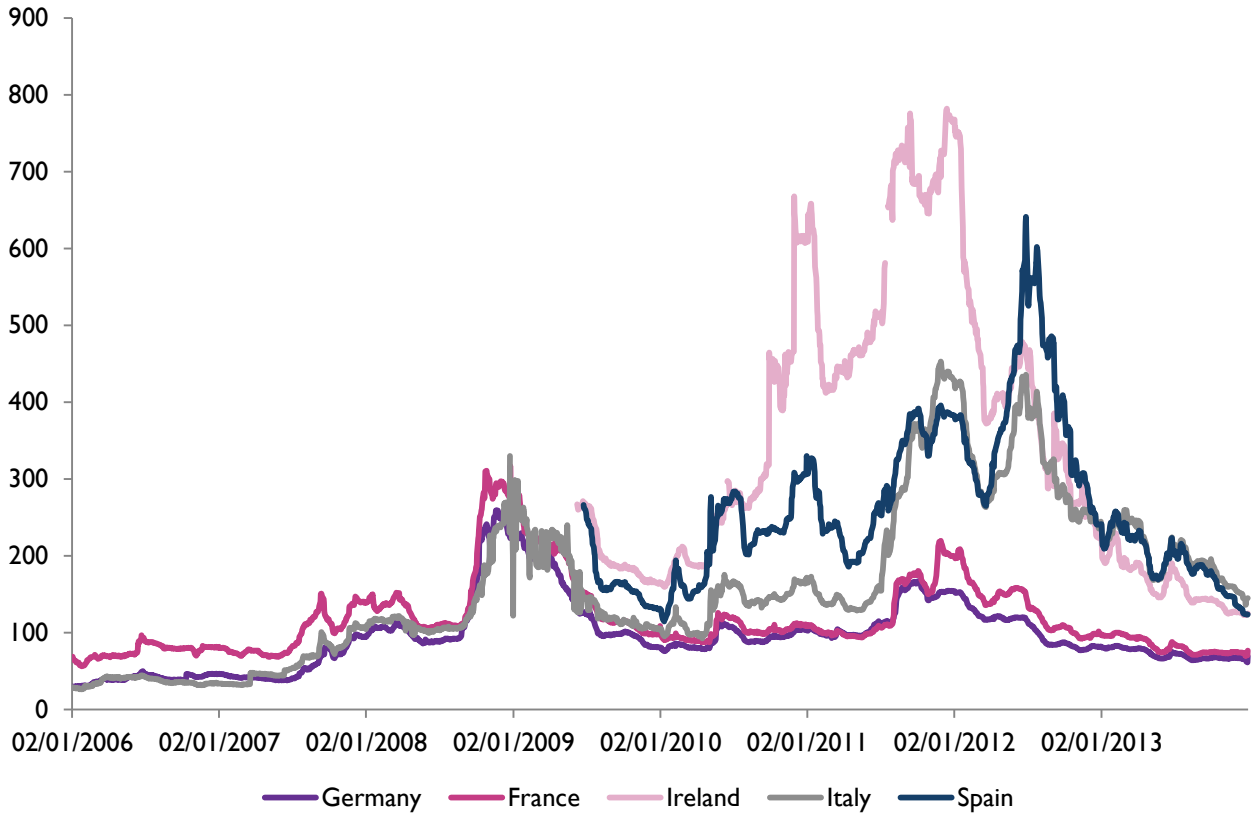
Table 5.1: European utilities companies sampled for debt premium analysis

Country	Company	Sector
Ireland	ESB	Electricity
	Bord Gáis Éireann	Gas and Electricity
Italy	Enel SpA	Energy
	A2A SpA	Electricity
	Hera SpA	Gas and Electricity
	Terna Rete Elettrica Nazionale SpA	Electricity
Spain	Gas Natural SDG SA	Gas and Electricity
	Red Electrica Corp SA	Electricity
France	GDF Suez	Gas and Electricity
	Veolia Environnement SA	Water / Other Utilities
	Électricité de France	Energy
Germany	RWE AG	Energy
	EnBW Energie Baden-Wuerttemberg AG	Gas and Electricity
	E.ON SE	Gas and Electricity

Source: Bloomberg.

Trends in the spreads of utility bonds closely parallel those of telecommunications companies' bonds presented in the mobile section of this report. Spreads were broadly similar prior to late-2009, including the spike during the credit crunch, and divergent thereafter. Indeed, even the magnitude of the spreads of telecommunications and utilities bonds over the risk-free rate are similar: Telefonica's spread peaked in late June of 2012 at 621 bps, while the average spread on bonds issued by two Spanish energy utilities topped out at 641 bps in the same period.

Figure 5.2: Spreads of average European utility bonds over German Bunds



Source: Bloomberg; Europe Economics' calculations.

The debt premium as of late December 2013 for two Irish energy utilities — Bord Gáis and ESB — was around 125 bps. As the above figure shows, this spread had come down considerable since the high points of the Irish sovereign debt crisis. The additional spread Irish energy utilities paid over their German peers currently stood at around 75 bps in September 2013 and 55 bps in December 2013. We believe that the upper bound for such a pemium on a forward-looking basis would be 75 bps. However, given continued stabilisation in the Irish economy, we expect that this wedge would decline and ultimately disappear. We therefore believe that efficient Irish costs of debt would be between 0 and 55 bps higher than a generic efficient operator, and our best estimate for this wedge over the course of the price control is 25 bps.

5.4 Aiming Up

5.4.1 The principle of aiming up

The principle that there is an asymmetry of consequences between those of setting the cost of capital too low and those of setting it too high is now well-established by regulators (and the Competition Commission in the UK).[40] Too high a cost of capital, and consumers today pay a little more than would occur in a competitive market. Too low a cost of capital, and consumers tomorrow miss out on the benefits of investment and innovation that does not occur. The latter costs are generally recognised as

[40] For aiming up in Ireland, see the most recent Commission for Energy Regulation decision on electricity transmission and distribution networks: Commission for Energy Regulation (2014) "Mid-Term review of WACC applying to the Electricity TSO and TAO and ESB Networks Ltd for 2014to 2015", CER/14/026.

significantly exceeding the former. Consequently, Europe Economics recommends that the regulatory cost of capital should be set above the central estimate of the market cost of capital.

The issue of precisely how much to aim up is debated, as is the issue of whether aiming up should take place on the basis of the overall WACC or its individual components. In its advice on the Q5 London airports price control, the Competition Commission aims up a number of estimated parameters in the WACC calculation (such as the equity beta) essentially by considering the 95 per cent confidence interval on the ground that if the true mean return is constant, then approximately a 95 per cent chance that the true mean lies between two standard deviations plus/minus the mean.[41]

In our advice to Ofwat in the PR09 water sector review in the UK, Europe Economics argued that the purpose of aiming up is not eliminate all possibility that the WACC has been set too low but, rather, merely to reflect the presence of some asymmetry in the consequences of too low versus too high a value. On this basis we disagreed with what was at that point the position adopted by the UK's Competition Commission, where it aimed up to the 95th percentile — i.e. close to two standard deviations from the mean in a normal distribution, the usual statistical measure of certainty. Instead, we proposed aiming up at the 66th percentile or one standard deviation above the mean. More recent regulatory judgements on aiming up have adopted figures in the 75th-80th percentile range.[42]

Whether the degree of aiming up in the current price control should reflect the precedent of the Competition Commission's previous recommendation or a more modest degree of aiming up might depend on the assumptions used to estimate the central value. If significant weight is attached to data from volatile market periods, then the appropriate degree of aiming up is likely to be greater — perhaps closer to the 95 per cent level recommended by the Competition Commission. Conversely, if the assumptions made are more forward-looking, anticipating that by the middle of the price control period market conditions should have stabilised, with generally higher returns, then something closer to a one standard deviation aiming up might be sufficient.

5.4.2 Aiming up in the present control

Our position is that it is appropriate to aim up by around one standard deviation above the central estimate of the WACC. We maintain that the purpose of aiming up should be to make it more likely than not that the determined WACC is above the central estimate, not to eliminate all possibility of the determined WACC being lower.[43] Further, since our central scenario envisages a return to stable market conditions with higher returns, so the extent of upside risk is naturally lower. Moreover, our expectation is of a price control lasting for three to five years. We note that this is relatively short compared to other controls (such as Ofwat's five year controls or Ofgem's eight year controls, notwithstanding the fact that the latter's methodology includes cost of debt indexation).

However, since we do not have direct information on the probability distribution of the WACC, there is no mechanistic method of determining where precisely one standard deviation above the WACC would lie. The most obvious way to infer this is to analyse uncertainty over the estimates of individual WACC parameters on which we base our judgement for the choice of range and point estimate. However there is a further issue in that a WACC calculated on the basis of aiming up each uncertain parameter by one standard deviation will exceed a point one standard deviation above the WACC. A particularly relevant point in this respect is that the risk-free rate and ERP tend to move in opposite directions, so aiming up on both would be a particular source of overstatement.

[41] See for example Competition Commision (2007), "BAA Ltd — A report on the economic regulation of the London airports companies (Heathrow Airport Ltd and Gatwick Airport Ltd)", Appendix paragraph 154.

[42] For example, see the UK Civil Aviation Authority's 2013 Q6 price control proposals.

[43] That is to say, we do not think it appropriate to target the 95th percentile.

In view of these considerations, our approach to estimate the appropriate degree of aiming up is a follows. We consider uncertainty around the risk-free rate, debt premium and beta in order to infer reasonable points for a standard deviation above our point estimates for the risk-free rate beta and debt premium. Naturally some components of the WACC, such as the tax rate and notional gearing are constants so these are not varied in the calculations. We also keep the equity risk premium at its point estimate. We then calculate how much higher the WACC would be on the basis of these estimates and then compare how much higher this is than our point estimate to infer the percentage by which to aim up the point estimate.

Were we to calculate the amount by which to aim up by using one standard deviation above the point estimate for all parameters, this would produce an estimate that would be more than one standard deviation above the point estimate, for the reasons set out above. By keeping the equity risk premium at its point estimate in our calculations, we have sought to mitigate this issue. However, it is likely that aiming up by the amount implied by this methodology would still produce a WACC that was in excess of one standard deviation above the point estimate.

It would in principle be possible to give a more precise estimate of the percentile at which the aimed up WACC exceeded the point estimate, but this would itself require a number of additional assumptions about the statistical distributions underpinning the WACC.

5.4.3 Generic parameter uncertainty

To infer uncertainty around the risk-free rate we examine variation in German bond yields. We have already detailed why we believe that rates since 2008 have ceased to reflect the true risk-free rate, so again we use variation in pre-crisis yields considered over the same time period as our analysis of yields. The table below shows standard errors for nominal yields, inflation, and our calculated real yields. For the sake of consistency we have used monthly data, since inflation and therefore real yields are only available on a monthly basis.

Table 5.2: Standard errors of German ten year yields and inflation (per cent)

	2000-2007	2000-2013
Real yield	0.090	0.105
Inflation	0.056	0.058
Nominal yield	0.063	0.086

Source: Bloomberg, Eurostat, Europe Economics calculations.

For the purposes of simplicity we believe that it is more appropriate to aim up on the nominal yield rather than separately on the real yield and inflation. This suggests using a point 0.1 per cent (to the nearest 0.1 per cent) above our central estimate of the nominal risk-free rate.

6 Mobile WACC

Given the generic WACC parameters we have estimated, and in view of the methodological discussion of the specific parameters detailed above, this section analyses evidence on the appropriate specific parameters for a hypothetical efficient mobile operator. Our analysis focuses on regulatory precedent, evidence supplied by mobile operators, and evidence from market data. For the latter, we sampled data from the companies listed in Table 6.1 and our analysis is informed by that larger sample. However, for presentational simplicity, we present analysis of data on Vodafone, Telefonica, Deutsche Telekom, and Orange.

Table 6.1: Mobile companies sampled for WACC analysis

Company	Country of exchange
Telefonica SA	Spain
Vodafone Group PLC	Britain
Orange SA	France
Deutsche Telekom AG	Germany
VimpelCom Ltd	Netherlands
Tele2 AB	Sweden
Freenet AG	Germany
Mobistar SA	Belgium
Sonaecom - SGPS SA	Portugal
Drillisch AG	Germany
Telecom Italia SpA	Italy
Koninklijke KPN NV	Netherlands

Source: Bloomberg

6.1 Gearing

In the present case we are analysing a hypothetical efficient Irish mobile operator for a WACC that will apply to six different companies which have different gearing levels. We proceed with estimating a notional gearing. To determine the appropriate level of notional gearing, we assess evidence from regulatory precedent and look at mobile companies' actual gearing.

6.1.1 Regulatory Precedent

The table below shows recent notional gearing choices of Irish regulators and non-Irish telecommunications regulators. Asset-heavy regulated industries, such as electricity and gas, airports, and fixed-line telephony, tend to be more highly geared than mobile operators. Regulatory precedent on gearing for asset-heavy industries has tended to be around 40 per cent to 60 per cent. This is considerably above gearing ranges for wholesale mobile termination rate (MTR) precedents, which has ranged from 10 per cent to 35 per cent.

Table 6.2: Recent regulatoy gearing decisions

Regulator	Year	Subject	Gearing (%)
Ofcom	2013	Openreach (draft determination)	40
Ofcom	**2011**	**Wholesale MTR**	**30**
Ofcom	2011	BT (wholesale broadband access)	50
Utility Regulator	2011	SONI	55
CAR	2009	Dublin Airport Authority	37-50
Ofcom	2009	Openreach	35
PTS Sweden*	**2008**	**Wholesale MTR**	**25-35**
Ficora (Finland)	**2008**	**Wholesale MTR**	**30**
NIAUR	2008	SONI	57.5
ComReg	2008	Eircom (fixed-line)	30-50
Ofcom	2005	Openreach	30-35
CER	2005	Transmission and distribution	50-60
CAR	2005	Airports	46
Ofcom	**2004**	**Wholesale MTR**	**10-30**
CER	2001	Transmission and distribution	50
CAR	2001	Airports	50

*Estimate by Copenhagen Economics.
Note: Ofcom expected to release draft mobile determination in May 2014
Source: Individual regulator reports.

Among MTR determinations, the lower end of the range (10 per cent) was considered by Ofcom in its 2004 MTR price control. Evidence suggests that this is too low in light of the evidence put forth in later in this report, and the rise in gearing levels used in more recent regulator precedents. In 2008, both the Swedish and Finish telecommunications regulators decided on the appropriate WACC for mobile operators' mobile termination charges. Ficora (Finland) used 30 per cent, while Copenhagen Economics on behalf of the Swedish Post and Telecom Authority argued that 25 per cent to 35 per cent gearing was appropriate. More recently, Ofcom used a 30 per cent gearing level in its 2011 MTR price control. This was based on Vodafone's actual gearing, which Ofcom took as a good indicator of the gearing of a hypothetical efficient UK mobile operator.

As part of the data collection to support this price control, ComReg administered a survey of national regulatory authority (NRA) members of the Body of European Regulators for Electronic Communications (BEREC). The survey requested information on parameters used to determine the WACC used in recent MTR controls. Table 6.3 presents a sample of BEREC member responses on gearing.

Table 6.3: Gearing in recent European MTR WACC determinations

Country	Year	Gearing
Netherlands	2013	33%
Poland	2013	39%
Norway	2012	20%
Greece	2012	53%
Finland	2012	30%
Czech Republic	2012	24%
Sweden	2011	25%
Belgium	2010	25%

Source: ComReg survey of BEREC members.

Among the NRAs surveyed, Greece appears to be an outlier with a gearing of 53 per cent. The second highest gearing assumption was in Poland, with 39 per cent. Excluding these two countries, gearing assumptions varied between 20 per cent and 35 per cent.

6.1.2 Mobile Companies' Gearing

We have used data from two sources to analyse mobile companies gearing:

- Market data from listed companies operating mobile businesses.
- Data submitted by the mobile operators designated to have significant market power, concerning only their Irish operations.

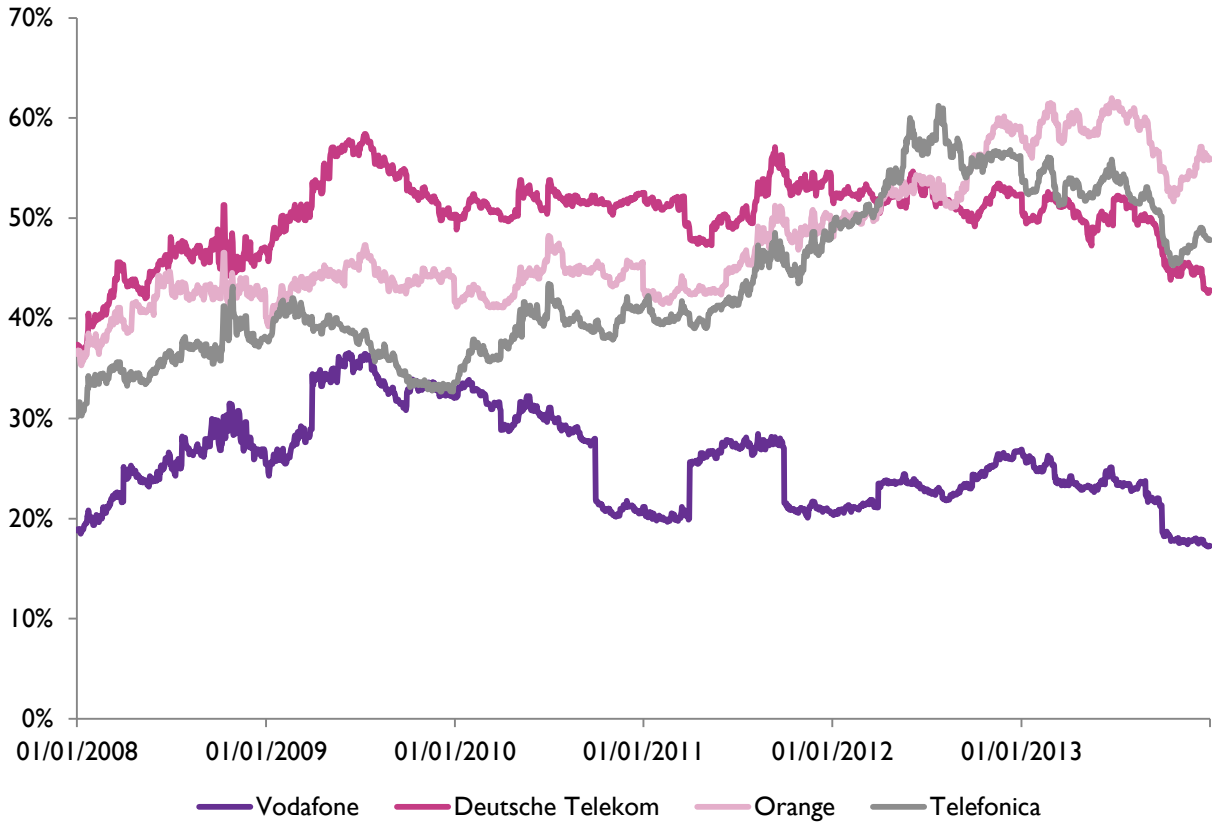
In line with Ofcom's approach in using market data, we have calculated gearing on the basis of the ratio of net debt to the sum of net debt and market capitalisation.

Our sample of European telecommunications companies with mobile operations has, on average, had gearing between 30 per cent and 40 per cent since 2006. As shown, gearing for the purer-play mobile company Vodafone (and Drillisch, Mobistar, and Freenet) has varied between roughly 20 and 30 per cent, with very occasional deviations above or below this level.

Multi-service telecommunication companies that operate across mobile, fixed-line, and other telecommunications markets have a considerably higher gearing. Gearing levels for Deutsche Telekom (Germany), KPN (the Netherlands), Orange (France), and Telefonica (Spain) have ranged between 35 per cent and 65 per cent since 2008.[44] Furthermore, multi-service providers' gearing levels have generally increased since the financial crisis, with all of the operators listed above having higher post-2008 gearing than pre-2008 levels. This is in contrast to purer-play mobile service providers, whose gearing levels are similar to or lower than pre-2008 levels.

[44] This list excludes Telecom Italia, who is geared at around 74 per cent and whose credit rating was cut to junk status by Moody's and S&P.

Figure 6.1: Gearing among telecommunications companies with mobile operations, 2006-2013



Source: Bloomberg; Europe Economics' calculations.

Table 6.4 presents credit ratings, ratings outlooks, and average gearing levels from January to September 2013 for companies rated by at least one of the three main credit rating agencies.[45] Among the companies rated, the company with the second lowest credit rating is also the company with the highest gearing: Telecom Italia. Vimpelcom, at 53 per cent gearing, also has a non-investment grade credit rating. Among the larger multi-service telecommunications companies in Western Europe, KPN (64 per cent), Telefonica (53 per cent), Deutsche Telekom (50 per cent), and Orange (59 per cent) are all investment grade, with KPN and Telefonica being just within the Baa3/BBB- threshold to be considered investment grade. Among the purer-play mobile service providers with a credit rating, the gearing levels are far lower. Vodafone, with a strong credit rating of A3/A-, has an average gearing of 22 per cent.

[45] The three main credit rating agencies are Moody's, S&P, and Fitch.

Table 6.4: Credit ratings and outlooks for telecommunications companies

	Gearing end 2013	Moody's		Fitch		S&P	
		Rating	*Outlook*	*Rating*	*Outlook*	*Rating*	*Outlook*
Deutsche Telekom	42.8	Baa1	Stable	BBB+	Stable	BBB+	Stable
KPN	49.1	Baa2	Negative	BBB-	Stable	BBB-	Stable
Orange	55.9	Baa1	Stable	BBB+	Negative	BBB+	Negative
Telefonica	47.8	Baa2	Negative	BBB+	Negative	BBB	Negative
Telecom Italia	70.0	Ba1	Negative	BBB-	Negative	BB+	Negative
Vimpelcom	49.3	Ba3	Stable	-	-	BB	Stable
Vodafone	17.3	A3	Stable	A-	Negative	A-	Stable

Source: Bloomberg; Europe Economics' calculations.

Submissions from the mobile operators subject to this price control for their Irish operations are consistent with the range suggested by the analysis of market data. Table 6.5 contains gearing figures derived from information provided by mobile operators in a data request made to operators. Operators provided non-intra-company net debt and the book value of the company's equity for group and Ireland-only operations.

Table 6.5: Gearing derived from data request to operators

	2010	2011	2012
3 HGI	0	0	0
Lycamobile	"Not applicable"	"Not applicable"	0
Eircom Group Mobile	100%	100%	100%
Telefonica (book value)	64%	67%	65%
Telefonica (adjusted book value)	36%	43%	45%
Tesco Mobile	"Not applicable"	"Not applicable"	"Not applicable"
Vodafone (book value)	30%	30%	31%
Vodafone (adjusted book value)	33%	30%	29%

Notes: "Not applicable" given by Lycamobile; "-" given by Tesco Mobile for value of non-intra-company debt; Eircom Group Mobile gearing in excess of 100% but presented as 100%, as gearing is typically bounded from 0% to 100%; 3 HGI reported non-inta-company net debt as 0.
Source: Data request to operators; Bloomberg; Europe Economics' calculations.

Among the operators, 3 and, in 2012, Lycamobile reported no non-intracompany net debt, and therefore have a gearing value of zero. Others, such as Lycamobile in 2010 and 2011 and Tesco Mobile, did not report figures for non-intra-company net debt for some or all periods. Gearing for Eircom Group Mobile exceeded 100% over the period, given its positive net debt position and negative book value of equity. This is due to the company being a wholly owned subsidiary of Eircom group, which is very highly geared and does not report debt and equity positions at the sub-group level.

Gearing ratios for Telefonica and Vodafone are higher than the gearing ratios calculated using market data. This is unsurprising for companies with strong cash flow prospects and who are expected to add value to their asset bases in the future. If the net present value of discounted future cash flows exceed the current book value of the assets used to generate those cash flows, then, in an efficient capital market, the market value of the company's equity will exceed the book value of the company's equity.[46] Where this is the case, gearing calculated using the book value of equity will exceed gearing calculated when using the market value of equity.

We calculate book value gearing as:

[46] The book value of the company's equity is defined here as the difference between the book value of total assets and the book value of total liabilities.

$$g_{book} = \frac{non - intra - company\ net\ debt}{(non - intra - company\ net\ debt + book\ value\ of\ equity)}$$

where g_{book} is the book value gearing. We also calculate an "adjusted book value" gearing, defined as:

$$g_{adjusted\ book} = \frac{non - intra - company\ net\ debt}{(non - intra - company\ net\ debt + book\ value\ of\ equity * \frac{P}{B})}$$

Where $g_{adjusted\ book}$ is the adjusted book value gearing and $\frac{P}{B}$ is the price-to-book ratio for a company. The price-to-book ratio is the market price per share of a company's common stock divided by the book value per share of a company's equity. The price-to-book ratios used to calculated adjusted book value gearing are cited in Table 6.6.

Table 6.6: Price-to-book ratios for Vodafone and Telefonica

	2010	2011	2012
Vodafone	0.89	1.04	1.11
Telefonica	3.13	2.77	2.24

Source: Bloomberg.

Book value gearing for Telefonica ranged between 64 and 67 per cent at a time when its market value gearing ranged between approximately. 35 and 50 per cent. The differences between Vodafone's gearing ranges are less pronounced, due to it trading at a lower premium to its book value of equity. The ranges implied by adjusted book value gearing correspond to the gearing figures calculated from market data alone.

6.1.3 Assessment

Notional gearing is generally assessed against a financeability benchmark, such that the level of notional gearing is consistent with the relevant regulator's notion of financeability. Some regulators, such as Ofwat in the UK, have a statutory obligation to ensure than regulated companies are able to finance their operations in public capital markets. When setting the allowed WACC, the regulator should ensure that return on investment is sufficient to ensure the financing of future operations. This is frequently done by explicitly stating a credit rating for a hypothetical efficient operator in the sector. The credit rating may be identified explicitly (Ofwat benchmarks against A3/A-) although some regulators aim for credit ratings "comfortably within investment grade" without stating a specific rating.

ComReg does not have a statutory obligation to ensure that regulated companies are able to finance themselves, and therefore does not set credit rating targets. We assess the notional gearing for a hypothetical efficient Irish mobile operator by assuming that the operator must maintain an investment grade credit rating, corresponding broadly to a level around Baa3 by Moody's rating and BBB- by S&P's rating.

Evidence from purer-play mobile service providers suggests that gearing of around 20 per cent is more than sufficient to ensure an investment grade credit rating. Indeed, Vodafone is geared around 20 per cent and achieves a credit rating that is significantly in excess of the target rating. Gearing levels observed for multi-service telecommunications companies of 50 per cent to 60 per cent are likely to be too high, however. Multi-service providers may have asset-heavy natural monopoly operations, such as network businesses, in their domestic markets, which are similar to utilities and can support higher levels of gearing. More asset-light businesses, such as mobile, would be unlikely to require or support such a level of gearing given the asset-light nature of the business compared to companies with a fixed-line network.

We place most weight on the actual gearing levels of purer-play mobile operators, which are around 20 per cent, and the gearing level in recent MTR WACC determinations. However, we note that these companies have very high credit ratings (particularly Vodafone[47]), so that a hypothetical efficient mobile operator could sustain higher gearing and remain investment grade. We believe that a notional gearing level above 20 per cent, but below the 50 to 60 per cent levels of multi-service operators would be appropriate. We therefore believe that a notional gearing level of 30 per cent would be consistent with the observed gearing level of mobile operators, our suggested target credit rating and regulatory precedent

6.2 Equity Beta

There are no publicly listed Ireland-only mobile operators in order to estimate the WACC for a hypothetical efficient mobile operator in Ireland. In the absence of data on a pure-play domestic Irish mobile operator, we use evidence from previous regulatory determinations and betas estimated directly from market data on telecommunications companies with mobile operations.

6.2.1 Precedent on Mobile Beta

Precedent from other European countries' mobile operator price controls give some indication of the level of systematic risk that a hypothetical efficient Irish mobile operator might carry.

Table 6.7: Regulatory precedent on mobile asset betas

Country	Year	Asset beta
UK	2011	0.56
France	2011	1.00
France	2010	1.00
Spain	2009	0.60
Sweden	2008	1.20
Finland	2008	1.20
UK	2007	1.18
France	2007	1.00
Spain	2007	0.60
Austria	2007	1.35
Netherlands	2006	1.08
Finland	2006	1.20

Source: Various regulator reports.

Prior to the financial crisis, unlevered betas used in mobile regulatory price controls ranges from 0.6 (Spain) to 1.35 (Austria). Since 2009, betas have been somewhat lower, ranging from 1 (France) to 0.56 (UK).

Of particular interest is the asset beta used in the UK MTR price controls, given the change in the asset beta between two price controls. In 2007, Ofcom used an asset beta of 1.18 to calculate the WACC for mobile operators. Four years later, and following the financial crisis, Ofcom judged that 0.56 was an appropriate asset beta. An April 2010 consultation proposed an asset beta of 0.62, but updated data suggested that the asset beta had fallen even lower.

In its response to Ofcom's consultation on the price control, Vodafone argued that Ofcom should exclude data from the credit crunch and financial crisis and instead focus on the pre-crisis data.[48] Ofcom disagreed,

[47] In their response to the operator data request, Vodafone stated that the group "targets a low single A credit rating and manages its capital structure according."

[48] Vodafone (2010) "Wholesale mobile voice call termination".

arguing they believed "that investors' [sic] perceive that the systematic risks of telecoms operators in general, and mobile operators in particular, has fallen in recent years" and that work by Ofcom and their consultants supported this view.[49]

Table 6.8 contains unlevered betas from ComReg's survey of BEREC members. The highest observation is Norway with 0.90, but it is important to remember that the gearing level in the Norway decision was 20 per cent. For a given equity beta, one would expect a relatively high unlevered beta with a lower gearing assumption. Finland's beta is the next highest at 0.67, followed by Sweden at 0.64. The remaining unlevered betas are around 0.5 or 0.55, with the exception of Greece at 0.39. Again, however, the low Greek unlevered beta would be expected, given the high assumed level of gearing.

Table 6.8: Unlevered betas in recent European MTR WACC determinations

Country	Year	Unlevered beta
Netherlands	2013	0.49
France	2012	0.48
Norway	2012	0.90
Greece	2012	0.39
Finland	2012	0.67
Czech Republic	2012	0.49
Sweden	2011	0.64
Belgium	2010	0.55

Note: Asset beta for France and Greece is that implied by reported equity beta and gearing.
Source: ComReg survey of BEREC members.

We place more weight on recent, post-crisis precedent than on pre-crisis precedent and the survey of BEREC members. Our own analysis of telecommunications companies' betas suggests that a reasonable beta range lies within 0.4 and 0.6 — below most pre-crisis precedent. We also observe a decrease in betas for some purer-play mobile companies, which would indicate a fall in the perceived level of systemic risk of these equities.

6.2.2 European Telecommunications Betas

Our examination of mobile betas focuses on the telecommunications companies listed below. These are telecommunications companies with significant mobile business, and are significant enough that their stocks will be liquid enough to ensure that accurate betas may be estimated.

Table 6.9: European telecommunications companies sampled for beta analysis

Company	Country of exchange
Telefonica SA	Spain
Vodafone Group PLC	Britain
Orange SA	France
Deutsche Telekom AG	Germany

Source: Bloomberg.

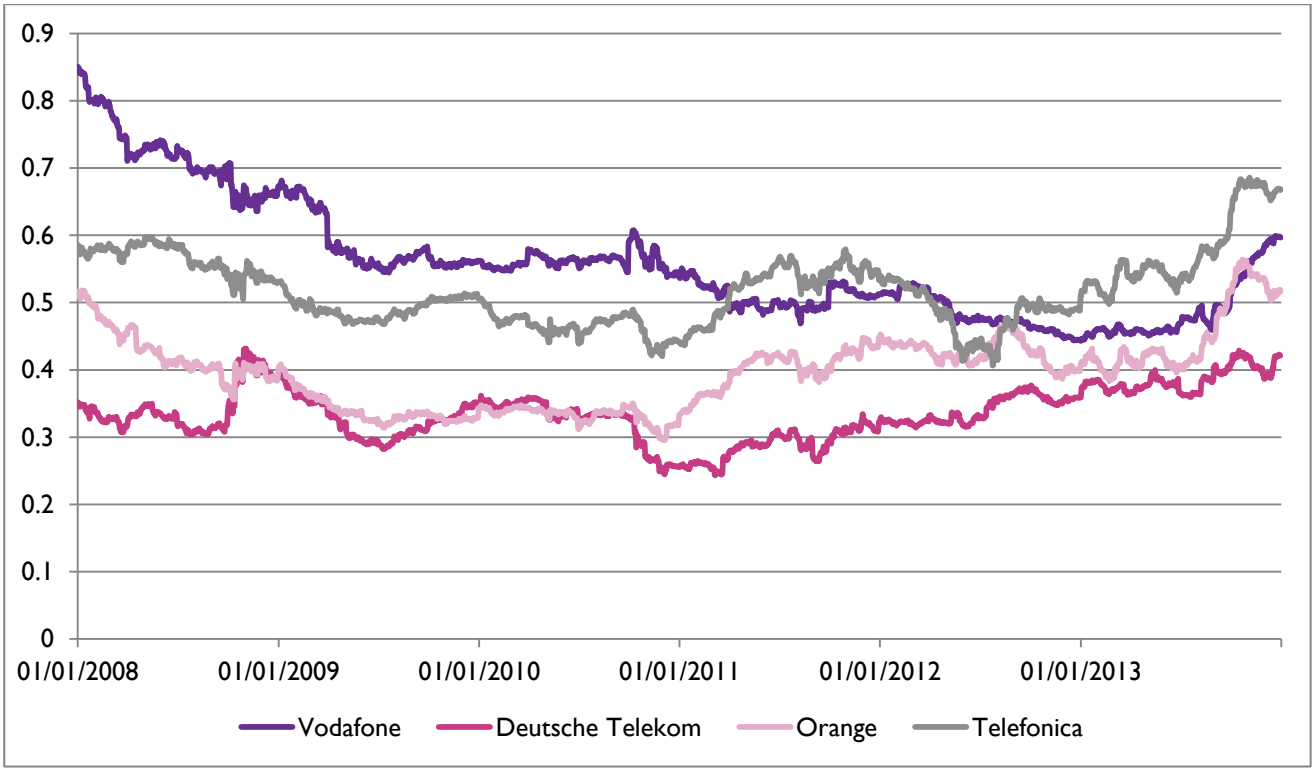
Of these companies, Vodafone is the closest to a pure play mobile operator, and so we place most weight on its beta estimates. The other three companies have substantial fixed-line businesses. In the appendix we demonstrate that our proposed beta range is also compatible with evidence from a wider set of European and international telecommunications companies. We estimate Telefonica, Orange and Deutsche Telekom Betas on a European market index and Vodafone's beta on the UK market index.

[49] Ofcom (2011) "Wholesale mobile voice call termination — modelling annexes".

Two and five year asset betas for the companies are shown in the diagrams below. These are calculated assuming zero debt betas (see section two for an explanation of the interaction between equity, debt and asset betas).

In general, betas have converged since 2008. The overall range of recent betas is around 0.4 to 0.6.

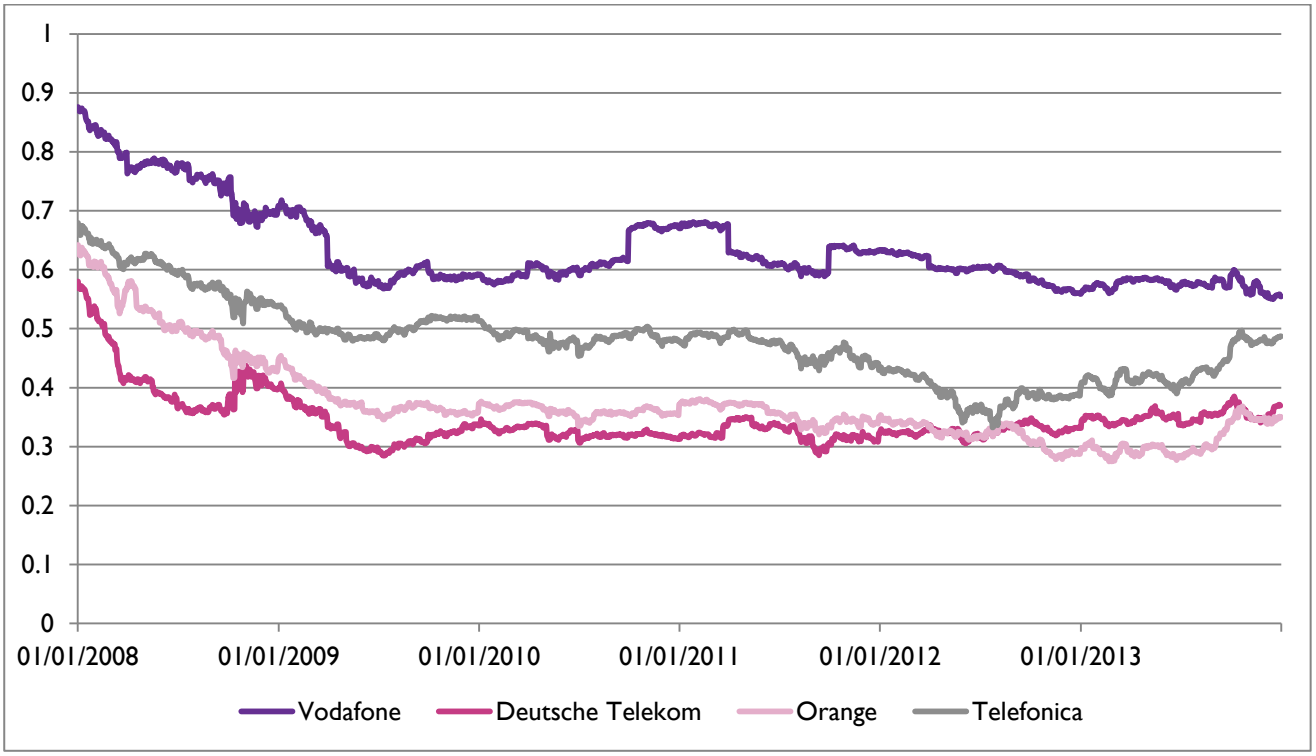
Figure 6.2: Two year asset betas for telecommunications companies



Source: Bloomberg and Europe Economics calculations.

Two year betas have also converged relative to early 2008, and on recent data also have a range of approximately 0.4 to 0.65.

Figure 6.3: Five year asset betas for telecommunications companies



Source: Bloomberg and Europe Economics calculations.

As expected, five year betas are the most stable. Their recent range has been in the region of 0.35 to 0.6. Overall, this evidence is consistent with an asset beta range of approximately 0.4 to 0.6.

The above evidence has focussed particularly on betas estimated on the basis of a European index and a zero debt beta. To consider wider evidence the table below shows betas at the end of 2013 on the basis of domestic and European markets, with zero and 0.1 debt betas.

Figure 6.4: Unlevered beta estimates, for comparator telecommunications companies

	Asset beta		Equity beta at 30 per cent gearing	
Two year	*Zero debt beta*	*0.1 debt beta*	*Zero debt beta*	*0.1 debt beta*
Vodafone	0.597	0.614	0.852	0.834
Deutsche Telekom	0.421	0.464	0.602	0.620
Orange	0.516	0.572	0.737	0.774
Telefonica	0.667	0.715	0.953	0.978
Five year	*Zero debt beta*	*0.1 debt beta*	*Zero debt beta*	*0.1 debt beta*
Vodafone	0.555	0.572	0.793	0.775
Deutsche Telekom	0.369	0.412	0.527	0.546
Orange	0.349	0.405	0.498	0.535
Telefonica	0.486	0.534	0.695	0.720

Source: Bloomberg; Europe Economics' calculations.

We note further that the inclusion of a debt beta does not make a significant difference to estimated betas. In particular, the variation between the companies is more significant than variation between estimates of the same company's equity beta with different debt beta assumptions.

The overall set of unlevered beta estimates suggests an asset beta approximately in the range of 0.4 to 0.6, the bulk of estimates being in this range. At 30 per cent gearing this corresponds to an equity beta of 0.57-

0.86). Given this wide spread, it is necessary to make a judgement as to which comparators' betas, over which time period, to place most emphasis on in our assessment.

We place most weight on Vodafone's beta, being the closest to a pure-play mobile operator. With respect to a point estimate, we place most weight on Vodafone's two year domestic beta. The most recent estimate of this is around 0.6, though we note that it has recently increased markedly, having been below 0.6 since late 2010. We place some weight on this evidence, and the fact that the five year beta is below 0.6. This leads us to shade down slightly from 0.6 in our point estimate, and suggest an asset beta of 0.55 . At 30 per cent gearing this corresponds to an equity beta of 0.79.

6.2.3 Conclusion

Our analysis suggests an equity beta range of 0.57-0.86, with a point estimate of 0.79. This is based on an asset beta of approximately 0.55 and a notional gearing of 30 per cent.

6.3 Debt Premium

6.3.1 Debt premia in precedent

Table 6.10 contains information on the debt premia used in MTR price control determinations in various EU Member States, as supplied by a ComReg survey of BEREC members.

Table 6.10: Debt premia from BEREC members

Country	Year	Debt Premium (bps)
France	2013	100
Netherlands	2013	400
Poland	2013	297
Finland	2012	275
Greece	2012	300
Norway	2012	150
Sweden	2011	150
Belgium	2010	150

Source: ComReg survey to BEREC members

Premia tend to cluster around the 100 to 150 bp mark, with some premia above this recently. Debt premia have been higher in some countries, but are either crisis countries (Greece) or paired with a relatively low cost of equity (Netherlands). Furthermore, Ofcom's recent MTR price control used 150 bps as a debt premium in its calculations.[50]

6.3.2 Data sampling logic for market data

As mentioned above, our preferred methodology for estimating the debt premium consists of observing the spread of corporate debt costs over the risk-free rate and not incorporating any embedded debt costs, as a hypothetical efficient firm would manage its treasury operations to achieve the lowest cost of debt possible.

Empirically, we estimate the debt premium by observing the spreads of corporate bonds over the relevant risk-free rate. We analyse traded bonds rather than loans, leases, or other forms of debt for two reasons.

[50] Ofcom (2011) "Wholesale mobile voice call termination: modelling annexes".

First, the appropriate estimate of the debt premium is not the interest rate on the face of the debt instrument (e.g. coupon rate), but the implied market borrowing cost (i.e. the yield-to-maturity). Since loans, leases, and other sources of fixed-cost financing are not widely or not at all traded, there is no straightforward way to estimate the instrument's yield-to-maturity.

The second reason follows from the first: we use traded bonds rather than other instruments because the price (and yield) are priced in the market and can change from day-to-day, while other sources of fixed-cost financing are not as frequently priced. The risk-free rate also changes in real time. In the absence of real-time pricing on the corporate debt instrument, measuring the debt premium as the spread over a benchmark risk-free asset that prices continuously would tend to over- or under-estimate the debt premium.

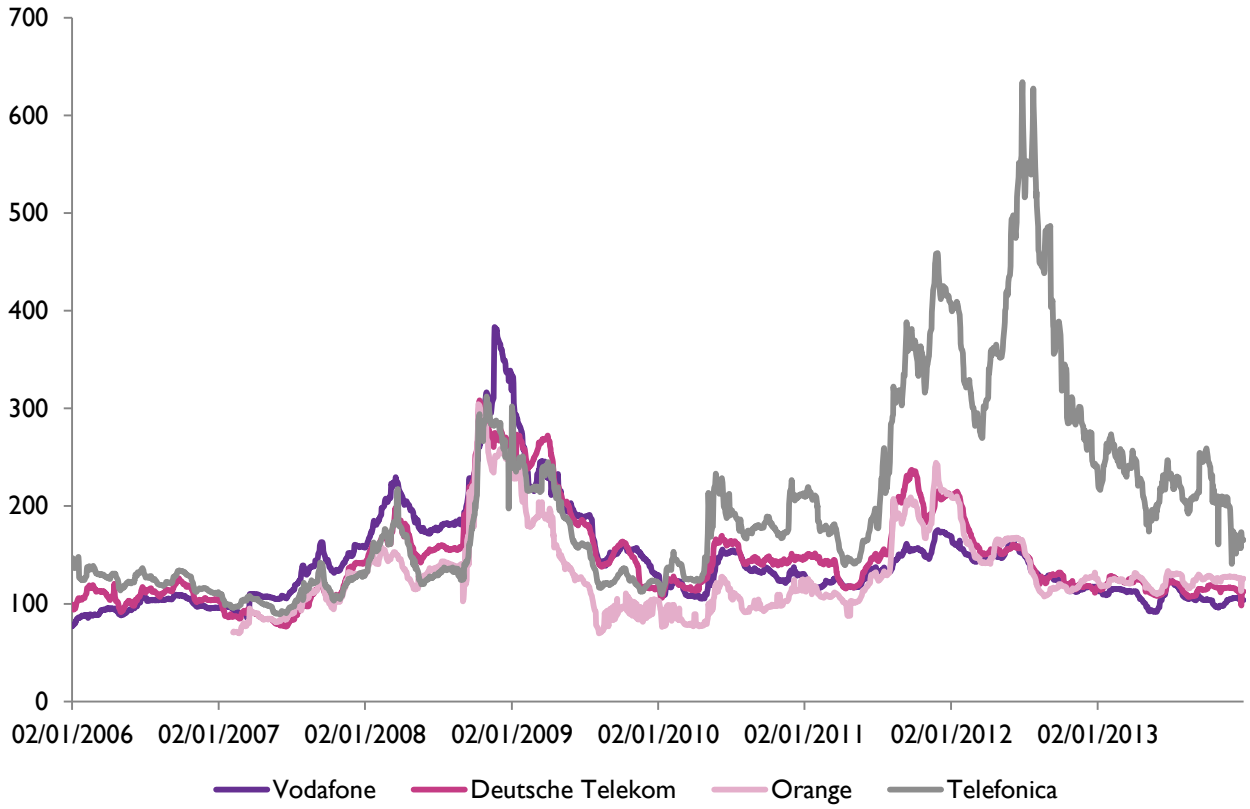
We collected the outstanding bonds for several European mobile operators, and present here the analysis of bonds of Vodafone, Telefonica, Deutsche Telekom, and Orange. In order to remove the effects of default risk, currency risk, term structure risk, and other risks associated with bond investing, we filter this sample of bonds. Since our notional gearing assumption is based on maintaining an investment grade credit rating, we sample bonds that are only listed as "Baa3" by Moody's or "BBB-" by S&P. We then filter the bonds by currency, keeping those denominated in EUR and GBP only. For bonds denominated in EUR, we keep only those whose benchmark bond is a German government bond, consistent with our approach to estimating a Eurozone risk-free rate.

6.3.3 Telecommunication company debt premia

We estimate the spread of various European telecommunication companies' yields over benchmark bonds from 2008 to 2013. At the beginning of 2008, the spread stood at around 150 basis points (bps) for four major telecommunications companies with mobile operations.[51] The premium spiked up to around 350 bps during the credit crunch of late 2008 and early 2009 and subsequently came down. Since the middle of 2009, debt spreads for Deutsche Telekom, Orange, and Vodafone over the relevant risk-free asset have been bounded between 100 and 200 bps.

[51] One basis point is .01 per cent.

Figure 6.5: Average debt premia over the risk-free rate for European telecommunications companies (bps)



Source: Bloomberg; Europe Economics' calculations.

The outlier among these set is the Spanish company Telefonica. Telefonica's borrowing spread was in line with its peers until around the middle of 2010, when Telefonica's spread began to widen. This corresponds with the emergence of the sovereign debt crisis in Spain in the summer of 2010, when spreads on Spanish sovereign bonds over German sovereign bonds began to widen (see Figure 4.2). This suggests there may be a relationship between the borrowing costs of a country and the borrowing costs of companies headquartered, listed, or otherwise significantly involved that country. If this were the case, then a hypothetical efficient Irish mobile operator, like Telefonica, could have to pay a premium above the observed generic telecommunications debt premium.

We therefore focus our attention for the moment on the premia for Deutsche Telekom, Orange and Vodafone, which appear to represent the debt premium for a generic telecommunications business. In general, spreads have moved between 1.0 and 2.0 per cent since the start of 2010, though they have fallen more recently. We note that Vodafone has a very low debt premium at less than 1.0 per cent, though this will reflect its low gearing and very high credit rating, such that the debt premium for an efficient operator at our target credit rating would be higher. This evidence suggests that, in line with precedent, a debt premium of 1.5 per cent would be appropriate.

Table 6.11: Credit ratings and credit spreads of mobile companies

	Credit Rating	Average spread end 2013
Vodafone	A-	102.97
Deutsche Telekom	BBB+	98.89
Orange	BBB+	123.16
Telefonica	BBB/BB	163.10

Source: Bloomberg, Europe Economics calculations

6.3.4 Conclusion on debt premium

Evidence suggests that a generic mobile operator's debt premium would be around 1.5 per cent at the target credit rating. However, we note evidence that an Irish operator's debt premium could be up to 0.75 percentage points higher than this, though such a premium could become negligible and our central estimate of this is 0.25 per cent. This evidence suggests a debt premium in the range of 1.5 to 2.25 per cent. Given expected continued improvement in the economic situation, we believe that a debt premium of 1.75 per cent would be an appropriate point estimate, reflecting both expected improvement but the possibility of a residual elevation in an Irish company's debt premium.

6.4 BEREC Member Survey on MTR WACC

As part of the evidence gathering process, ComReg sent a survey to the national regulatory authorities that form BEREC in order to gather more information regarding the WACC in MTR determinations across Europe. Table 6.12 provides a summary of their responses.

Table 6.12: WACC parameters for MTR determinations in Europe

	EE on Ireland	France	Nether-lands	Denmark	Poland	Greece	Finland	Czech Republic	Portugal[6]	Norway	Sweden	Belgium
	2014	2013	2013	2013	2013	2012	2012	2012	2012	2012	2011	2010
Actual gearing (nominal)	(30%)	(40%)	(33%)	N/A[7]	39%	53%	30%	(24%)	N/A	20%	(25%)	(25%)
Statutory tax rate (effective)	12.5%	35%	25%	24%	19%	(20%)	20%	19%	29%	28%	26.00%	34%
Nominal risk-free rate	4.1%	3.70%	2.60%	3%	5.8%[2]	1.60%	1.70%	4.40%	4.80%	4.50%	3.70%	4%
Equity risk premium	5%	5%	5%	3.80%	6.50%	11.90%	5.75%	5.20%	6%	4.50%	5%	5.25%
Equity Beta	0.79	0.8	0.61	0.5	0.93	0.82	0.9	0.58	0.81	0.9	0.86	0.73
Debt Premium	1.75%	1%	4%	N/A	2.97%	3%	2.75%[4]	0.13%	N/A	1.50%	1.50%	1.50%
Nominal (real) pre-tax WACC	**8.2%**	**9.50%**	**(4.6%)[1]**	**(2.62%)[1]**	**12.64%**	**12.5%[3]**	**7.33%**	**8.26%**	**11.10%**	**11.80%**	**9.40%**	**10.29%[5]**

Notes: 1: Pre-tax WACC for the Netherlands and Denmark is expressed in real terms; 2: Risk-free rate for Poland is expressed in real terms ; 3: Pre-tax WACC for Greece was rounded up from 12.49 and is expressed in real terms; 4: Debt premium for Finland was calculated by Europe Economics using the provided data; 5: The WACC figure for Belgium does not take into account the discount that is normally applied by the regulator; 6: No information on gearing or the debt premium was provided; 7: The regulator in Denmark assumed 100 per cent equity.
Source: Responses to BEREC member survey and Europe Economics calculations.

The sample of responses is recent, with only one response, from Belgium, going back to 2010. Gearing was in half of the cases determined using actual data and in the other half by using a nominal level. Denmark assumed 100 per cent equity in their determination while Portugal provided no information regarding gearing level assumptions. The gearing level assumptions ranged from 20 per cent in the case of Norway to 53 per cent in the case of Greece while the average level of gearing by the comparator group was 33 per cent. The recommended level of 30 per cent for Ireland is near the average value across comparators.

In terms of the tax rate used, all regulators, with the exception of the Greek regulator, based their calculations on the statutory rate, in line with our recommendation to ComReg.

Europe Economics' recommendation of a 4.09 per cent nominal risk-free rate is similar to the recommendations provided by Norway, the Czech Republic, Belgium and Poland. The recommended rate is relatively higher than the one used in most other countries (except Portugal) and the average across comparators which is 3.37 per cent.[52]

The equity risk premium used by European telecommunications regulators ranged from 3.8 per cent in Denmark to 11.9 per cent in Greece. The second largest figure used however was only 6.5 per cent (Poland), indicating that Greece can be considered as an outlier. Our recommended value of 5 per cent is within that range and close to the average value of 5.23 per cent.

Our equity beta estimate of 0.8 is similar to the average value across all respondents (0.76). Similarly, with the average of debt premium estimates provided being 2.17 per cent, which is slightly higher than our estimate of 1.75 per cent.

[52] Poland is excluded in this calculation as it has only provided a real risk-free rate.

6.5 Overall WACC for a Hypothetical Efficient Mobile Operator

Table 6.13 presents the cost of capital for a hypothetical efficient Irish mobile operator calculated from parameters estimated in this report.

Table 6.13: Unadjusted cost of capital for a hypothetical efficient Irish mobile operator

	Low	High	Point Estimate
Tax rate (%)	12.5	12.5	12.5
Real risk-free rate (%)	1.75	2.50	2.30
Inflation (%)	1.50	2.0	1.75
Nominal risk-free rate (%)	3.28	4.55	4.09
Equity risk premium (%)	4.60	5.25	5.00
Gearing (%)	30	30	30
Asset beta	0.40	0.60	0.55
Equity Beta at notional gearing	0.57	0.86	0.79
Nominal post-tax cost of equity (%)	5.9	9.0	8.0
Nominal pre-tax cost of equity (%)	6.7	10.3	9.2
Debt Premium (%)	1.50	2.25	1.75
Nominal pre-tax cost of debt (%)	4.8	6.8	5.8
Nominal Vanilla WACC (%)	5.6	8.4	7.4
Nominal pre-tax WACC (%)	6.2	9.3	8.2

Source: Europe Economics' calculations from sources previous cited.

The nominal pre-tax WACC range is therefore 6.2 to 9.3 per cent. Calculating the cost of capital using our point estimate for each parameter, the cost of capital comes out at 8.2 per cent. This is above the simple average of the end points of the ranges and reflects our view that the Irish economy will continue to normalise over the price control period, and therefore a WACC at the higher end of the range is justified.

As discussed above, we believe it is appropriate to aim up on our central estimate of the WACC. To infer the appropriate degree of aiming up, we examine uncertainty around individual WACC paramaters. For beta, we examine the standard errors of the estimates on which we based our estimates to infer uncertainty over the evidence on which we based our judgement. These are shown in the table below.

Table 6.14: Standard errors of equity beta estimates, end 2013

	Two year	Five year
Vodafone	0.054	0.031
Deutsche Telekom	0.052	0.031
Orange	0.070	0.037
Telefonica	0.080	0.046

Source: Bloomberg and Europe Economics calculations.

To infer one standard deviation above our point estimate of asset beta, we calculated upper confidence intervals for equity betas on the basis of these standard errors and then unlevered them. In line with our analysis of the level of beta itself, we place most weight on two year betas and we place particular weight on Vodafone's beta. This suggests an upper confidence limit on asset beta that is 0.05 above our point estimate.

On the debt premium, the primary source of uncertainty is over the extent to which an Irish operator would attract a higher debt premium than an equivalent operator in a core Eurozone country. We do not have a firm basis on which to assess uncertainty over this figure, so for our calculations we use the latest estimate of this premium which was 55 basis points. Of this, 25 basis points are already incorporated in

our point estimate so our upper confidence limit on the debt premium is 0.3 per cent above our point estimate..

The table below summarises our assessment of the uncertainty over the individual WACC parameters.

Table 6.15: Uncertainty on individual parameters

Parameter	Upper confidence limit above point estimate
Nominal risk-free rate	+0.1%
Asset beta	+0.05
Debt Premium	+0.3%

Source: Europe Economics calculations

Taken together, these suggest a 66 per cent upper confidence limit for the mobile WACC that is six per cent above our point estimate. This increases the point estimate of the pre-tax WACC to 8.7 per cent.

7 Fixed Line WACC

This section analyses the appropriate WACC for an efficient fixed-line operator. This control is applicable to Eircom, which recently went through Examinership and has emerged with a distorted capital structure, including a negative book value of equity and a very high gearing level. In view of this fact, the analysis below considers Eircom's particular financial position as well, but the end WACC is estimated for an efficient Irish operator.

7.1 Gearing

7.1.1 Eircom's actual gearing

By any measure, Eircom is very highly geared. Table 7.1 presents measures of Eircom's actual gearing in fiscal year (FY) 2012. These are the ratio of net debt to the sum of net debt and market capitalisation and the ratio of net debt to mean capital employed. Additionally, Eircom's debt covenants contain reference to certain leverage ratios, such as the ratio of net debt to EBITDA[53], which can be interpreted as another measure of Eircom's gearing.

Table 7.1: Measures of Eircom's actual gearing

	FY 2012 (€ m)	Net Debt / (Net Debt + Total Equity)	Net Debt / MCE	Net Debt / EBITDA
Net Debt	2,035			
Total Equity	-476			
Mean Capital Employed (MCE)	1,199			
EBITDA	542			
Gearing		131%	170%	3.75

Source: Eircom response to data request; Eircom June 2013 bondholder accounts; Eircom 2012 historical cost separated accounts.

In FY 2012, Eircom held net debt of €2,035m on its balance sheet. Total equity was negative, as assets were less than total liabilities. The deficit in shareholder equity amounted to €476m. Mean capital employed in regulated wholesale access operations, taken here as the regulatory capital value for Eircom's regulated fixed-line operations, was €1,199m in 2012. Finally, according to its June 2013 financial accounts to bondholders, Eircom's EBITDA in FY 2012 was €542m.

On the basis of these figures, Eircom's net debt over enterprise value level of gearing is around 131%. Its level of gearing measured as net debt of MCE is even higher at 170%. The ratio of net debt to EBITA is

[53] EBITDA stands for earnings before interest, tax, depreciation, and amortisation.

3.75, which is within Eircom's debt covenants but still represents a high level of gearing. For comparison, the ratio of net debt to EBITDA for BT Group in FY 2012 was around 1.7.

Eircom itself recognises this high gearing, writing in their June 2013 financial accounts for bondholders that "[Eircom's] substantial leverage and debt service obligations could adversely affect [Eircom's] business and prevent [Eircom] from fulfilling [Eircom's] obligations".[54]

From the point of view of the regulatory WACC it does not make sense to think of gearing as being greater than 100 per cent, since we are seeking a weighted average of returns to debt and equity. For example, using the ratio of net debt to mean capital employed would imply that the cost of capital was equal to 1.7 times the cost of debt, even when returns would be required only for debt holders. In the case of Eircom, it is likely that there is value in its equity in excess of books values. We therefore interpret this evidence as suggesting that Eircom's gearing is very high, but not in excess of 100 per cent as suggested by these calculations.

7.1.2 Precedent on fixed-line gearing

We analyse precedent in recent fixed-line determinations or proposals in various European countries as a guide to what an efficient level of gearing for a fixed-line incumbent might be. Table 7.2 presents the levels of gearing used in those determinations.

Table 7.2: Gearing precedent in European fixed-line determination

Determination	Gearing
Ireland (2008)	40%
Belgium (2010)	40%
Portugal (2012)	42.52%
France (2013)	40%
Norway (2013)	40%
Sweden (2013)	30-50%
UK (2013 proposal)	40%

Note: Swedish determination gave range for components and point estimate for WACC only; midpoint of the Swedish range is 40%.
Source: Various regulatory determinations.

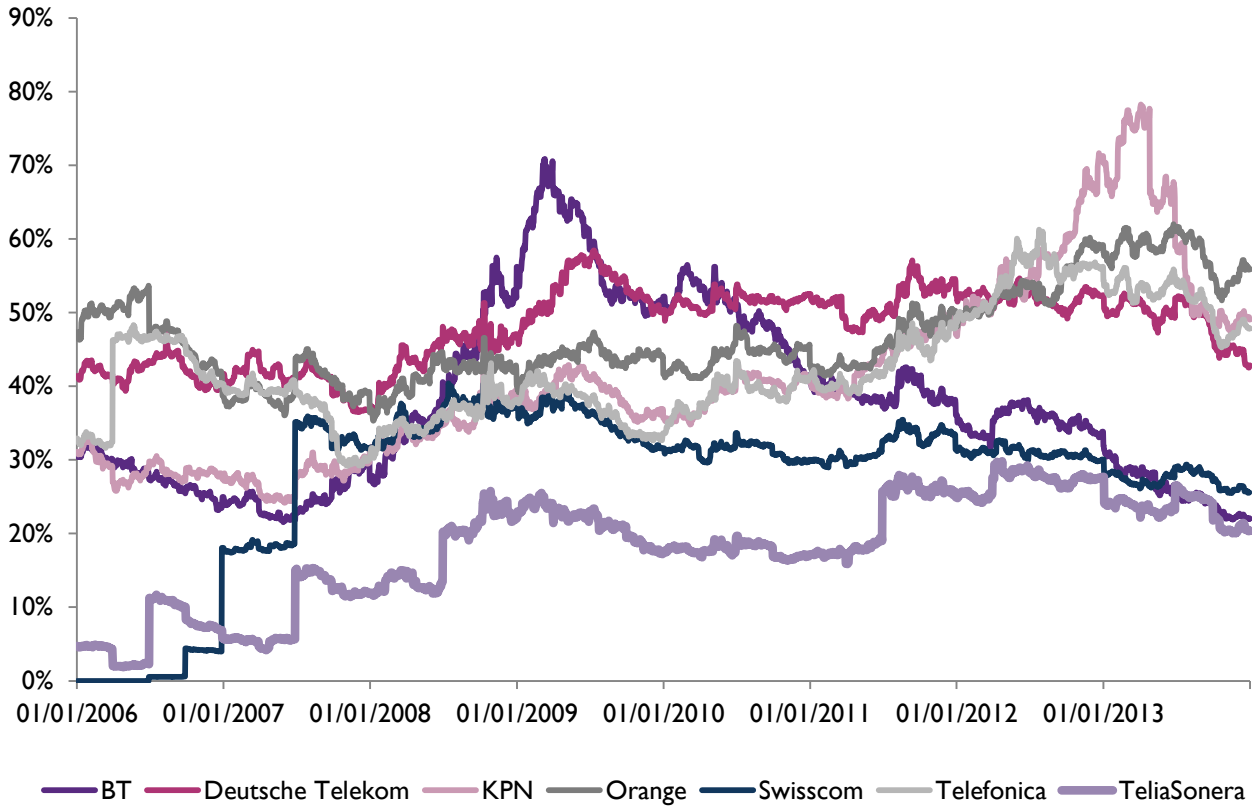
A range around 40 per cent has been common in many determinations. As a range, 30 per cent to 50 per cent has been given by the Swedish regulator, PTS. This was the same range given in the 2008 Eircom determination[55]. In short, evidence from regulatory precedent suggests that the appropriate level of gearing could vary from 30 per cent to 50 per cent, with 40 per cent generally favoured within this range.

7.1.3 Comparator company gearing

Figure 7.1 plots the gearing of select fixed-line comparators between 2006 and 2013. Prior to the recession, gearing varied between (roughly) 30 per cent and 50 per cent. With the recession, the gearing level of several companies increased markedly. However, this primarily an effect of the falling value of companies' market capitalisations during the contraction of stock markets. Since around the middle of 2011, there has been a divergence in gearing levels among fixed-line companies. Some, such as BT, Swisscom, and TeliaSonera have seen their gearing levels fall and cluster around 20% to 30%. Other companies, such as Deutsche Telekom, KPN, Orange, and Telefonica have not experienced falls in gearing and, in some cases, have geared up even higher. These patterns represent a potential widening of the range of an acceptable level of gearing.

[54] Eircom (2013) "Annual report for bondholders year ended June 30, 2013", p. 26.
[55] ComReg (2008) "Eircom's cost of capital" ComReg Doc No. 08/35, p. 30.

Figure 7.1: Gearing of select European fixed-line incumbents



Source: Bloomberg; Europe Economics calculations.

Looking at a broader range of companies, there appear to be some persistent differences in the gearing of European fixed-line incumbents. Some companies, including Belgacom, Telenor, Elisa Oyj, and TeliaSonera have recently been geared at below 30 per cent. By contrast, Deutsche Telekom, KPN, Orange, Telefonica, and Telekom Austria have been geared at above 40 per cent or even 50 per cent.

Table 7.3: Gearing among European fixed-line operators

Company	Gearing	Moody's		Fitch		S&P	
		Rating	*Outlook*	*Rating*	*Outlook*	*Rating*	*Outlook*
Belgacom	19.9%	A1	Stable	-	-	A	Stable
BT	22.0%	-	-	BBB	Stable	BBB	Stable
Deutsche Telekom	42.8%	Baa1	Stable	BBB+	Stable	BBB+	Stable
Elisa Oyj	23.8%	Baa2	Stable			BBB	Stable
KPN	49.1%	Baa2	Negative	BBB-	Stable	BBB-	Stable
Orange	55.9%	Baa1	Stable	BBB+	Negative	BBB+	Negative
Swisscom	25.6%	A2	Stable	-	-	A	Stable
TDC	35.0%	Baa2	Stable	BBB	Stable	BBB	Positive
Telefonica	47.8%	Baa2	Negative	BBB+	Negative	BBB	Negative
Telenor	16.8%	A3	Stable	-	-	A-	Positive
Telecom Italia	70.0%	Ba1	Negative	BBB-	Negative	BB+	Negative
Telekom Austria	57.7%	Baa2	Stable	-	-	BBB-	Stable
TeliaSonera	20.4%	A3	Stable	A-	Stable	A-	Stable

Source: Bloomberg; Europe Economics calculations.

Companies' actual gearing ranges from less than 20 per cent to 70 per cent. However, we note that the companies with low gearing levels generally have credit ratings that are in excess of our target credit rating (comfortable investment grade), while Telecom Italia does not have an investment-grade credit rating. Taking into account those companies with credit ratings in the range of our target rating suggests a gearing range of around 25 to 60 per cent.

7.1.4 Assessment of gearing evidence

By several measures and the company's own admission, Eircom's gearing is very high. Gearing calculated as net debt over enterprise value and net debt over regulatory capital value show Eircom's gearing in excess of 100 per cent. Clearly this is not an efficient capital structure, but, if efficiently run, Eircom should move towards an efficient capital structure as time goes on.

From a regulatory perspective, there are competing concerns when assessing Eircom's gearing. On the one hand, ComReg should not reward, condone, or fix in regulatory precedent Eircom's previous financial decisions and unsustainably high level of gearing. Instead, ComReg should provide Eircom with incentives to operate efficiently. On the other hand, imposing upon Eircom — via the WACC — an efficient level of gearing that is substantially different from its current level of gearing could pose problems for the company's financeability.

Recall that regulatory precedent suggests a range of 30 to 50 per cent, with 40 per cent generally favoured within the range. Companies' actual gearing levels were in the range of 25 to just over 60 per cent. Given the wide range of actual gearing levels, we lean more on precedent in our choice of gearing level. We therefore believe that appropriate notional gearing level for an efficient fixed-line operator would be in the range of 30 to 50 per cent, and we select a point estimate of 40 per cent within this range.

7.2 Equity Beta

7.2.1 Eircom's previous determination

In the 2008 Eircom fixed-line WACC determination, Eircom's equity beta was judged to be between 0.67 and 1.39 with a point estimate of 1.02.[56] Table 7.4 presents estimates for Eircom's asset beta that were assessed in the context of the 2008 review.[57]

Table 7.4: Estimates for Eircom's asset beta for the 2008 determination

	Low	Midpoint	High
Direct statistical estimation	0.28	0.49	0.69
Third-party estimates	0.31	0.41	0.51
Peer comparison	0.56	0.64	0.71
Implied fixed-line comparators	0.44	0.56	0.67
Regulatory precedent	0.50	0.65	0.80
Simple average	0.42	0.55	0.68

Source: Oxera; ComReg.

Evidence used to justify the equity beta included comparison with other fixed-line incumbents in Europe, regulatory precedent, and estimation of Eircom's actual beta from market data. This latter estimation was done on data prior to Eircom's acquisition by Babcock & Brown Capital Ireland Holdings Limited (BCMIH) in 2006, which meant that, at the time, market data on Eircom was relatively recent and informative. Given

[56] ComReg (2008) "Eircom's cost of capital" ComReg Doc No. 08/35.
[57] Adapted from: Oxera (2007) "eircom's cost of capital", p. 24.

the amount of time that has passed since Eircom has been a listed company, we do not use historical market data to estimate Eircom's betas directly. Instead, we rely on regulatory precedent and comparator analysis to estimate the fixed line beta.

7.2.2 Precedent on beta

Table 7.5 contains evidence on unlevered betas used in recent European fixed-line determinations.

Table 7.5: Beta precedent in European fixed-line determination

	Unlevered Beta
Ireland (2008)	0.57
Belgium (2010)	0.50
Portugal (2012)	0.42
France (2013)	0.48
Norway (2013)	0.55
Sweden (2013)	0.46-0.65
UK (2013 consultation)	0.60

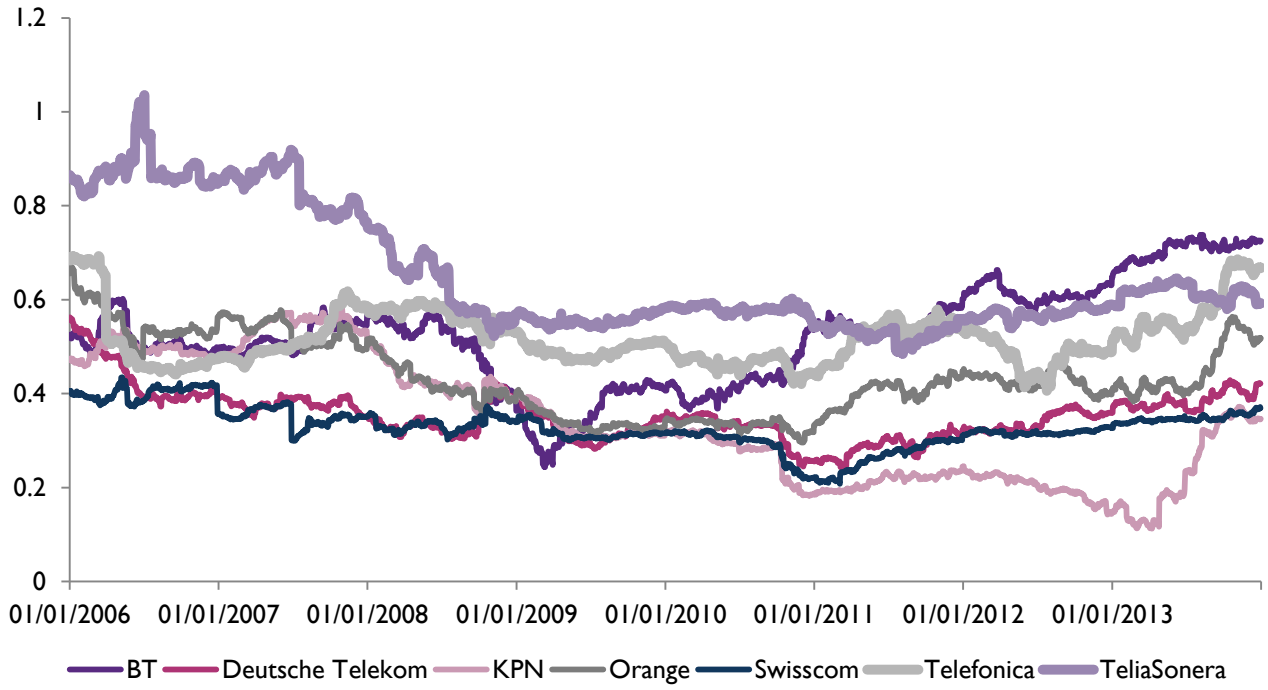
Notes: Equity betas only reported for Portugal, France, and Sweden; asset beta calculated as figure implied by equity beta and gearing for these countries; range for Sweden calculated assuming a 40% gearing.
Source: Various regulatory determinations.

In the 2008 Eircom determination, ComReg settled on a point estimate beta of 0.57. In subsequent determinations in other European countries, the point estimate beta has tended to be lower with the exception for the UK. A range of precedent betas based on point estimates gives 0.42 at the low end (Portugal Telecom in Portugal) to 0.60 (BT in the UK).

7.2.3 Comparator company betas

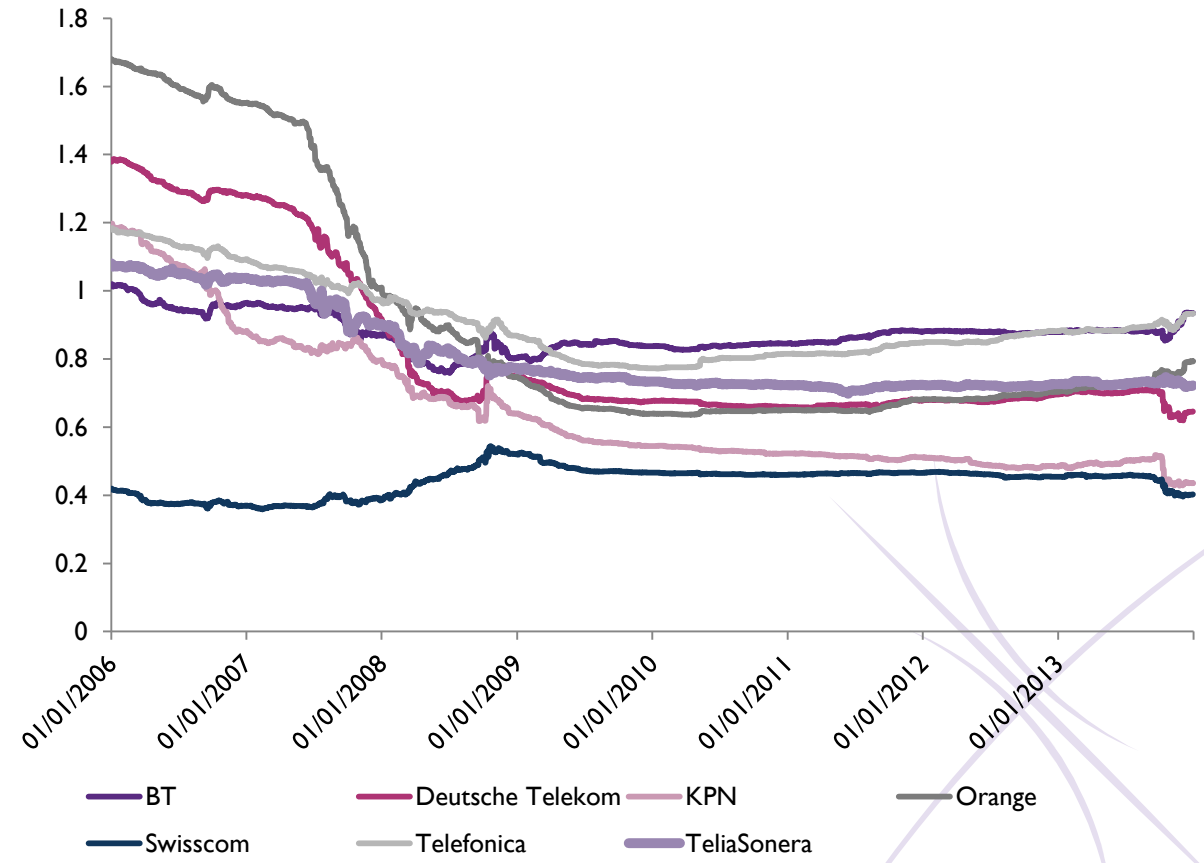
Figure 7.2 presents two-year rolling unlevered betas for selected European fixed-line incumbents calculated on the MSCI Europe index. Prior to the financial crisis and recession, TeliaSonera stood out as the firm with the highest unlevered beta, followed by Telefonica and Orange. Swisscom, by comparison, had a relatively low beta. Betas began to converge slightly through the crisis and subsequently widen after around mid-2010. Betas have in general been rising since then. We note that in general most observations have fallen between 0.4 and 0.6.

Figure 7.2: Two-year rolling unlevered betas of selected European fixed-line comparators



Source: Bloomberg; Europe Economics calculations.

Figure 7.3: Five-year rolling unlevered betas of select European fixed-line incumbents



Source: Bloomberg; Europe Economics calculations.

In Table 7.6 we show two-year rolling betas for European fixed-line providers, with debt betas of zero and 0.1. The unlevered beta estimates range from around 0.3 to around 0.6, with few outliers on either end of that range. The inclusion of a debt beta of 0.1 tends to increase the asset betas compared with asset betas calculated with a debt beta of 0. The increase tends to be small, though, and the directional impact on equity beta is not consistent across companies. In our view there is little benefit associated with including a non-zero debt beta.

Table 7.6: Two year asset and equity betas under zero and 0.1 debt beta assumptions

	Unlevered Beta		Equity Beta at 50 per cent gearing	
	Zero Debt Beta	*0.1 Debt Beta*	*Zero Debt Beta*	*0.1 Debt Beta*
Belgacom	0.484	0.504	0.968	0.908
BT	0.725	0.747	1.450	1.394
Deutsche Telekom	0.421	0.464	0.842	0.828
Elisa Oyj	0.463	0.487	0.926	0.874
KPN	0.346	0.395	0.693	0.691
Orange	0.516	0.572	1.032	1.044
Swisscom	0.369	0.394	0.738	0.689
TDC	0.315	0.350	0.629	0.599
Telefonica	0.667	0.715	1.334	1.330
Telenor	0.482	0.499	0.964	0.897
Telecom Italia	0.388	0.458	0.776	0.816
Telekom Austria	0.286	0.344	0.572	0.588
TeliaSonera	0.595	0.616	1.191	1.132

Source: Bloomberg; Europe Economics calculations.

Examining the five-year rolling betas in Figure 7.3, we see that the five-year betas have been higher than precedent and two-year rolling betas. After coming down significantly up to the crisis, they have remained broadly stable up to present. Among the seven operators presented in Figure 7.3, only two have five-year betas below 0.60. Although the five-year betas would be high by regulatory standards, we interpret them as suggesting that any point estimate should be at the higher end of the range suggested by the two-year evidence and regulatory precedent.

Analysis of European fixed-line incumbents' market data suggests a range of 0.3 to 0.6 would be broadly appropriate. The midpoint of this range, 0.45, may be slightly low in light of the five-year beta evidence, which suggests moving at the upper end of this range. As such, we believe a reasonable point estimate would be 0.5 on the basis of market data.

7.2.4 Beta disaggregation

Since at least 2005,[58] Ofcom has disaggregated BT Group's beta into a beta for BT Group's regulated copper access network operations ("Openreach") and a beta the rest of BT Group's operations.[59]

It is an implication of the Modigliani-Miller theorem that, for any company, business line or project with both debt and equity, its overall systematic risk is given by its asset beta, which is a weighted combination

[58] Ofcom (2005) "Ofcom's approach to risk in the assessment of the cost of capital".

[59] We have applied a similar methodology in our assessment of Ofcom's disaggregation of BT Group's beta. See: Europe Economics (2013) "Disaggregating the BT Group asset beta". Available at: http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Sky_and_TalkTalk_Group_Europe_Economics_report.pdf

of the betas of its equity and debt, where the weights are the economic values of debt and of equity, as a proportion of the sum of the economic values of debt and equity:

$$\beta_A = g * \beta_D + (1 - g) * \beta_E$$

In the same way, for a group that comprises two business lines, X and Y, the group-level asset beta will be a weighted combination of the asset betas of each business line, i.e.

$$\beta_{Group} = w_x * \beta_x + w_y * \beta_y$$

with weights determined by the economic value of the assets in each business line (which we denote by X and Y for the value in each business line), i.e.

$$w_x = \left(\frac{X}{X+Y}\right) \text{ and } w_y = \left(\frac{y}{x+y}\right)$$

We have examined the possibility of conducting such a disaggregation analysis for fixed-line. We have performed this analysis for Orange, because this is the only one of our major fixed-line comparators for which we have a separation between wireless and wireline businesses in their accounts. Ideally, this would be done for a broad range of measure of economic value, but in the present case we only have this split for revenue. This gives a split of 61.35 per cent wireless operations to 38.65 per cent for wireline operations . We therefore disaggregate our two year estimate of Orange's unlevered beta of 0.516 on this basis,using our proposed mobile unlevered beta of 0.55. This suggests a wireline asset beta of 0.46.

7.2.5 Assessment of beta evidence and the cost of equity

In assessing the evidence on the unlevered beta, we note the following:

- Regulatory precedent suggests 0.42 to 0.6 is appropriate for a European fixed-line incumbent.
- Market data on listed European fixed-line incumbents suggests a slightly wider range, from 0.3 to 0.6. We note, however, that unusually low outliers may drag down the range. Additionally, data on five-year rolling betas suggest that the higher end of the range would be appropriate.

On the basis of this evidence, we estimate that a range of 0.4 to 0.6 with a point estimate of 0.5 would be appropriate for an efficient fixed-line operator. This is broadly consistent with evidence from our disaggregation of Orange's asset beta. Given the lack of market data on Eircom, we have no strong reason to deviate from this estimate, as we did in the case of gearing. With a central unlevered beta estimate of 0.5 and a 40% gearing level, our point estimate for the equity beta is 0.83. Combining our nominal risk-free rate of 4.09 per cent and the ERP of 5 per cent, the total cost of equity calculated with the CAPM is 8.3 per cent.

7.3 Debt Premium

7.3.1 Eircom's current cost of debt

As discussed previously, Eircom is currently very highly geared. One consequence of this high gearing, as well as its recent default, is a relatively high cost of debt. High gearing increases both the specific probability of default and the debt beta (i.e. the extent to which the probability of default is correlated with the wider economy). Examination of Eircom's current cost of debt should bear these considerations in mind.

This high cost of debt raises concerns, from a regulatory perspective, about Eircom's financeability. On the one hand, the regulator does not want to condone, reward, or fix in regulatory precedent Eircom's

distorted capital structure and past financial difficulties. On the other hand, setting Eircom's regulatory WACC and cost of debt at an efficient level could make it difficult for Eircom to finance itself.

By way of understanding how Eircom's current cost of debt differs from our estimate of the efficient cost of debt, we analyse Eircom's actual debt financing costs. Table 7.7 contains information on Eircom's post-examinership borrowings over two fiscal years.

Table 7.7: Eircom's net debt liability values, maturities, and average interest rates on debt

	FY 2012	FY 2013
Outstanding amount of non-intra-company net debt (€ m)	2,035	2,060
Average maturity of debt (years)	5	4.15
Average interest rate on debt	10.78%	10.55%

Source: Eircom response to data request.

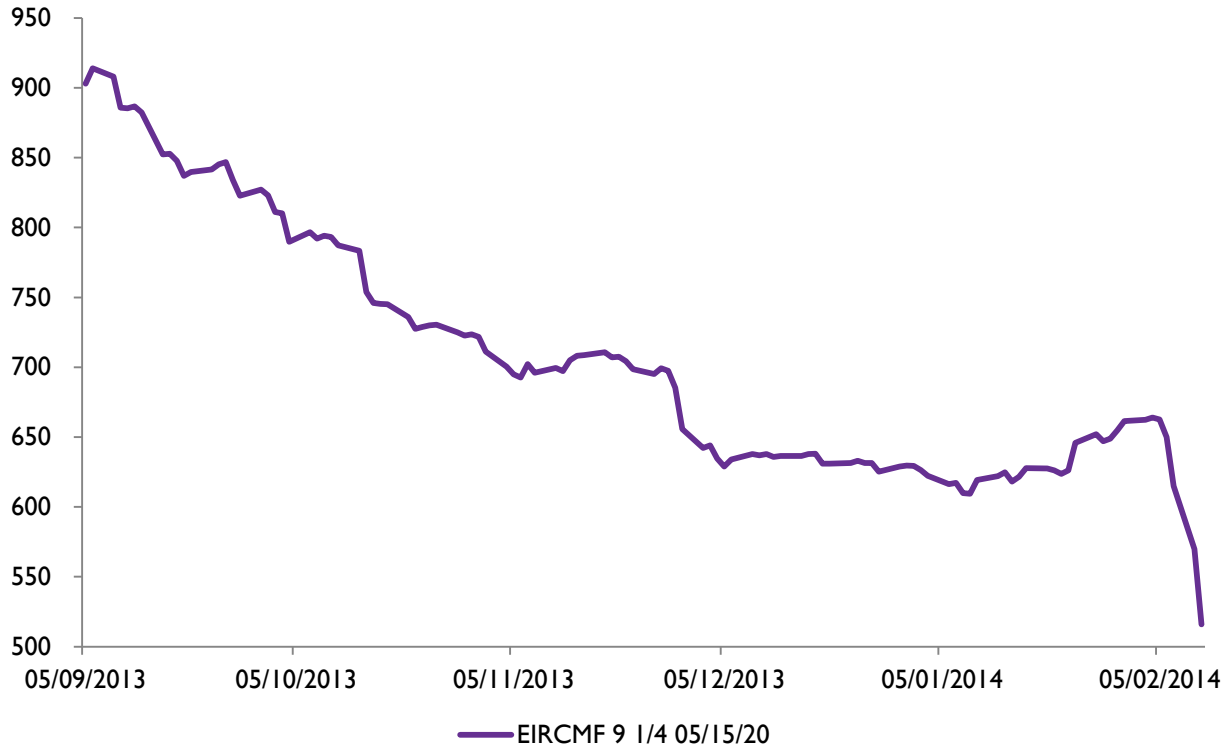
In FY 2012, Eircom had €2,035m in outstanding non-intra-company net debt at a coupon rate of 10.78 per cent. This rate is close to the yield to maturity on the discounted cash flows at the time of issuance.[60] Average maturity on the debt was 5 years. FY 2013 saw Eircom's non-intra-company net debt position increase slightly to €2,060m, but the average coupon rate fell to 10.55 per cent. This is a weighted average composed of 85 per cent of the 10.78 per cent debt from FY 2012 and 15 per cent of new debt with a 9.25 per cent coupon rate.

The spread of Eircom's 9.25 per cent senior secured notes over a benchmark German government bond is plotted below. At the time of issuance, the debt premium — measured as the spread over the appropriate German government bond — on Eircom's bond was around 900 bps. This premium came down steadily over the course of 2013. On 11 February, 2014, Moody's upgraded Eircom's credit rating from Caa1 to B3 with a stable outlook.[61] The ratings upgrade was met with a sharp fall in the debt premium on Eircom's 2020 9.25 notes. Moody's justified its upgrade by citing the improving Irish macroeconomic environment, Eircom's progress in executing its business plan, and Eircom's strong cash flow prospects. The debt premium fell to around 515 bps and has stabilised around that level since then. In short, Eircom's debt premium estimated on its 2020 9.25 per cent notes has fallen almost 400 basis points in just under a year.

[60] Information provided by Eircom during conversations. The 10.78 per cent rate was calculated by discounting the contractual cash flows back to the debt's market value on 11th June, 2012. The actual cost of financing was 3.049 per cent + 3-month Euribor - Cash Pay + 1 per cent PIK ("payment in kind"), which was an artificially low rate imposed by the court following Examinership. This is a "floating rate" obligation, where the coupon rate on the debt is linked to an interest rate that can change over time (in this case, Euribor). With Euribor in June 2012 equal to 0.66 per cent, the realised cost of debt on the date the discounted cash flow (DCF) was conducted would have been around 4.7 per cent, and a value as of end 2013 would have been around 4.3 per cent. Both of these rates are below the yield implied by the DCF valuation. Nonetheless, we consider it more appropriate to analyse Eircom's market cost of debt as captured by the yield to maturity, rather than the coupon rate on the debt. Additionally, it is not clear whether Eircom will be able to secure a below-market cost of debt again in the future. With that said, we note that Eircom is seeking to extend the loan on which the below-market cost of debt was granted from an expiry date in 2017 to an expiry date in 2019. See: "Eircom seeks extension to payment terms of its debt", *Irish Times*, 7th February, 2014, http://www.irishtimes.com/business/sectors/technology/eircom-seeks-extension-to-payment-terms-of-its-debt-1.1683447.

[61] https://www.moodys.com/research/Moodys-upgrades-eircoms-rating-to-B3-stable-outlook--PR_292364

Figure 7.4: Debt premium on Eircom's bond



Notes: Spread over benchmark German government bond
Source: Bloomberg

Still, the debt premium on Eircom's debt is high by precedent and comparator company standards. It is informative, however, to understand and bear in mind Eircom's actual financial position when considering other strands over evidence on the debt premium.

7.3.2 Precedent on the debt premium

In Table 7.8, we present evidence on the debt premium for fixed-line incumbents from regulatory precedent.

Table 7.8: Debt premium precedent in European fixed-line determination

	Debt Premium (bps)
Ireland (2008)	190
Belgium (2010)	170
Portugal (2012)	279
France (2013)	100
Norway (2013)	150
Sweden (2013)	125 – 175
UK (2013 consultation)	170

Source: Various regulatory determinations.

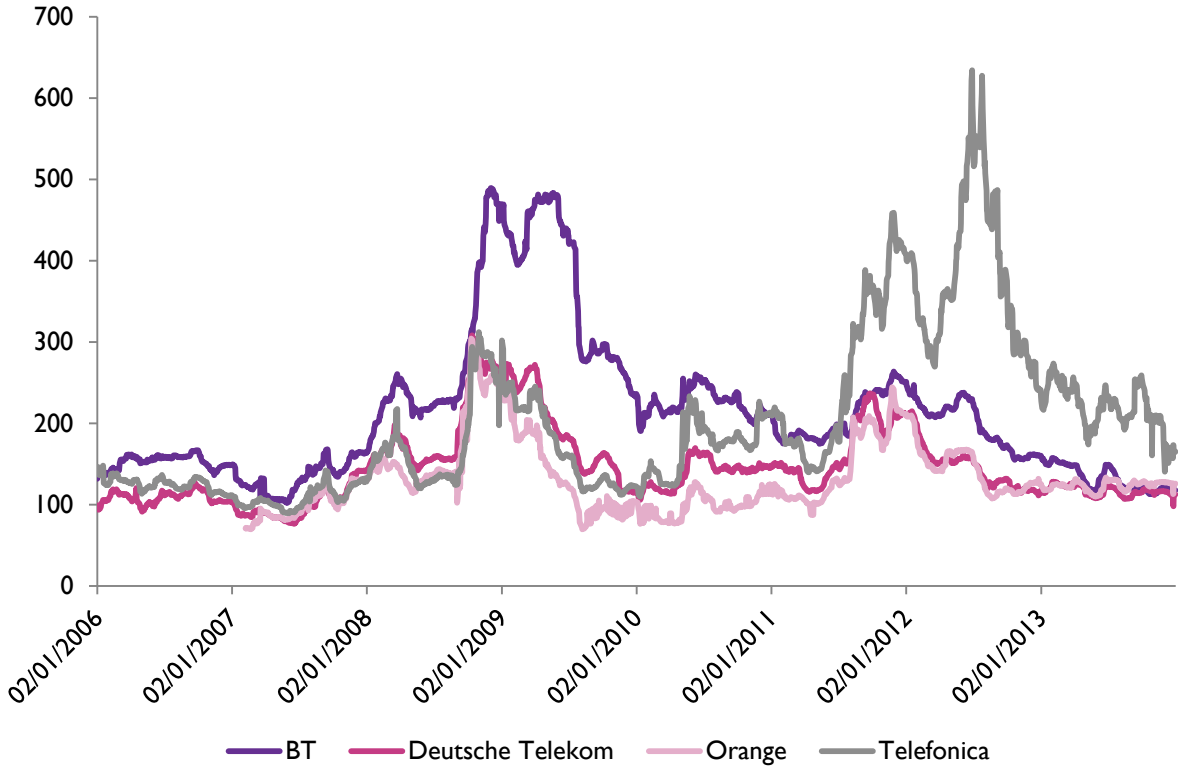
Eircom's debt premium at 2008 determination was 190 bps. Since then, regulatory determinations have judged the debt premium for their domestic fixed-line incumbents to be lower with the exception of Portugal, in which ANACOM, the Portuguese regulator, gave a debt premium of 279 bps. With the exception of the Portuguese determination, the debt premium has fallen between 100 and 190 bps, suggesting this is an appropriate range for the debt premium for an efficient fixed-line incumbent. In

recognising that more of the debt premia have been on the upper end of this range, we select a point estimate of 150 bps from the precedent evidence, slightly higher than the mid-point of the range.

7.3.3 Comparator company debt premia

Figure 7.5 plots the average spread of select fixed-line comparators' bond yields against their respective benchmark government bonds between 2006 and 2013.[62] In the years leading to the recession, spreads fluctuated between 75 and 175 bps. When the financial crisis was in full effect, the levels of observed spreads increased significantly, with debt premia in the area of 300 bps being rather common and even approaching 500 bps in the case of BT. During the sovereign debt crisis, debt premia became elevated again. Since then however fixed-line incumbents' spreads appear to have stabilised around 100 to 200 bps.

Figure 7.5: Debt premia of select European fixed-line incumbents



Source: Bloomberg; Europe Economics calculations.

Taking into account the convergence of debt premia at lower levels since the middle of 2012 and the clustering of the majority of operators' debt premia at a 115-155 basis point range while also considering that at particular times, debt premia can increase significantly above normal levels, we feel that a range of 100-200 basis points is the most appropriate. Our point estimate would be the mid-point of this range, at 150 basis points.

7.3.4 Assessment of debt premium evidence and the cost of debt

Eircom's debt premium at the 2008 price control was 190 bps. Since then:

[62] For Eurozone countries, the benchmark is German Bunds. For BT, the benchmark is UK gilts; for Swisscom, Swiss government bonds; for TeliaSonera, Swedish government bonds.

- Eircom has gone through examinership and re-emerged with a high cost of debt. The cost of debt estimated on its current borrowings would be around 515 bps.
- Regulatory precedent has been largely within a 100 to 190 bps range, with Portugal being an outlier.
- Market data on fixed-line incumbents suggests that between 100 and 200 bps range is appropriate and would cover some downside risk associated with increases in the debt premium.

In light of this evidence, we suggest a point estimate of the debt premium of 1.50 per cent. With the addition of 0-75 basis points for the "Irish operator" premium estimated earlier in this report, this suggests a debt premium range of 1.5 to 2.25 per cent, with a point estimate of 1.75 per cent.

7.4 Overall WACC for a Hypothetical Efficient Fixed Line Operator

Table 7.9 gives our estimates of the WACC for a hypothetical efficient fixed line operator. Combining the generic parameters estimated previously with the specific parameters estimated in this section, we arrive at a 8.1 per cent nominal pre-tax WACC without aiming up.

Table 7.9: Low, high, and point estimate for Eircom's WACC

	Low	High	Point Estimate
Tax rate (%)	12.5	12.5	12.5
Real risk-free rate (%)	1.75	2.50	2.30
Inflation (%)	1.50	2.0	1.75
Nominal risk-free rate (%)	3.28	4.55	4.09
Equity risk premium (%)	4.60	5.25	5.00
Gearing (%)	40	40	40
Asset beta	0.40	0.60	0.50
Equity Beta at notional gearing	0.67	1.00	0.83
Nominal post-tax cost of equity (%)	6.3	9.8	8.3
Nominal pre-tax cost of equity (%)	7.2	11.2	9.4
Debt Premium (%)	1.50	2.25	1.75
Nominal pre-tax cost of debt (%)	4.8	6.8	5.8
Nominal Vanilla WACC (%)	5.7	8.6	7.3
Nominal pre-tax WACC (%)	6.3	9.4	8.0

Source: Bloomberg, Europe Economics calculations

As discussed above, we believe it is appropriate to aim up on our central estimate of the WACC. To infer the appropriate degree of aiming up, we examine uncertainty around individual WACC parameters. For beta, we examine the standard errors of the estimates on which we based our estimates to infer uncertainty over the evidence on which we based our judgement.

Table 7.10: Standard errors of equity beta estimates

Company	Two year	Five year
Belgacom	0.047	0.029
BT	0.065	0.040
Deutsche Telekom	0.052	0.031
Elisa Oyj	0.058	0.039
KPN	0.141	0.039
Orange	0.070	0.037
Swisscom	0.039	0.025
TDC	0.056	0.052
Telefonica	0.080	0.046
Telenor	0.053	0.038
Telecom Italia	0.114	0.049
Telekom Austria	0.088	0.051
TeliaSonera	0.055	0.028

Source: Bloomberg, Europe Economics calculations

To infer one standard deviation above our point estimate of asset beta, we calculated upper confidence intervals for equity betas on the basis of these standard errors and then unlevered them. In line with our analysis of the level of beta itself, we place most weight on two year betas. This suggests an upper confidence limit on asset beta that is 0.05 above our point estimate.

On the debt premium, the primary source of uncertainty is over the extent to which an Irish operator would attract a higher debt premium than an equivalent operator in a core Eurozone country. We do not have a firm basis on which to assess uncertainty over this figure, so we use the latest estimate of this premium which was 55 basis points. Of this, 25 basis points are already incorporated in our point estimate so our upper confidence limit on the debt premium is 0.3 per cent above our point estimate.

The table below summarises our assessment of the uncertainty of individual WACC parameters.

Table 7.11: Uplifts for WACC point estimate

Parameter	Upper confidence limit above point estimate
Nominal risk-free rate	+0.1%
Asset beta	+0.05
Debt Premium	+0.30%

Source: Europe Economics calculations

Taken together, these suggest aiming up our point estimate of the WACC by six per cent. This increases our point estimate of the pre-tax WACC from 8.0 to 8.5 per cent.

8 Broadcasting WACC

This section estimates the specific parameters for Market A (the market for wholesale access to national terrestrial broadcast transmission services) and Market B (the market for wholesale access to DTT Multiplexing Services).[63] Collectively we refer to these markets as "broadcasting" for short. We begin with discussing issues relevant to the two broadcasting markets, including our view on how to analyse Market A and Market B together, the recent debate about the viability of a commercial DTT television platform in Ireland, and differences among regulators in their approach to regulating DTT broadcasting.

Following that, we will assess evidence on gearing, equity betas, and the debt premium used in calculating the broadcasting WACC, using evidence primarily from regulatory precedent and comparator industries. Finally, we present our range and point estimate for the broadcasting industry WACC.

8.1 The WACC in Market A and Market B

In July 2013, ComReg identified two operators as having significant market power ("SMP") in DTT services markets. ComReg describes the first market, Market A, as a "wholesale market where an upstream terrestrial transmission network provider supplies a transmission and distribution service via its towers / masts infrastructure and relevant associated facilities (including transmission and distribution equipment, buildings etc.) in order to enable the broadcast of national analogue terrestrial radio signals to end-users and the broadcast by a 'Multiplex Operator' of its digital terrestrial broadcasting signals to end-users."[64] 2rn (formerly RTÉNL) operates in this market. 2rn is a fully-owned subsidiary of RTÉ, the state-owned public broadcaster, and operates at arm's length from the parent organisation.

The second market, Market B, is a "wholesale market which operates downstream from Market A, whereby a DTT Multiplex Operator, using wholesale inputs purchased (or self-supplied) in Market A, combined with carriage on its own DTT multiplex supplies a managed digital multiplexing service to terrestrial downstream TV broadcasters enabling the transmission of their DTT broadcasting signals to end-users."[65] RTÉ operates in this market.

ComReg determined that Market A and Market B should be subject to price controls and that the WACC would be a key input into determining the relevant controls. From this view, a WACC for both Market A and Market B is necessary to calculate the appropriate price control in each market. It is our view that, for regulatory purposes, the same WACC should be applied to both Market A and Market B. This is due to a number of reasons.

First, there is not a sufficiently robust basis upon which to estimate the WACCs separately. Several companies are involved both in running DTT transmission assets (Market A) and DTT multiplexing (Market B). Some European operators, such as Arqiva in the UK or Teracom in Sweden, operate in both markets outside of Ireland. For example, in their 2005 SMP decision PTS Sweden noted that their SMP investigation and subsequent regulatory decisions related to access to the DTT broadcasting network, which

[63] For background on Market A, Market B, and the reasoning behind subjecting them to price regulation, see: ComReg (2013) "Market review: broadcasting transmission services in Ireland" ComReg Document No 13/71.
[64] Ibid., p 4.
[65] Ibid., p 4.

encompassed both access to the transmission assets and, where necessary, to the DTT multiplex.[66] A single WACC was estimated for broadcasting and subsequently applied.

Furthermore, companies that only operate the DTT multiplex and are not involved in operating the transmission assets are highly varied and, to our knowledge, no pure play DTT multiplex operators exist. Indeed, many DTT multiplex operator comparators suffer from the same analytical shortcomings as RTÉ. For some operators, no market data is available since they are statutory corporations (e.g. BBC in the UK) or privately owned (e.g. TDF Group in France). Among those DTT multiplexers that are publicly listed, DTT multiplexing is a small part of their very diverse television or telecommunications operations (e.g. ITV in the UK or Portugal Telecom in Portugal). In other cases, DTT multiplexes are operated by diversified consortia composed of companies operating in several different industries (e.g. RiksTV in Norway).[67]

Finally, we see no strong conceptual reason to believe that exposure to changes in the larger economy would impact a DTT transmission assets operator and a DTT multiplexer differently. The WACC remunerates investors for systematic risk only. For there to be a difference in the WACC, there would need to be a difference in exposure to systematic risk between DTT transmission assets operators and DTT multiplexers. It is intuitive to think that demand for DTT transmission asset services (Market A) and the ability to transmit via those assets using the multiplex (Market B) are highly correlated and respond to systematic risks in similar ways. What is more, as the operators in the two markets are wholesalers with the similar end-customers,[68] we see no reason to think that costs and thus supply would respond differently to systematic risks either.[69]

We note that RTÉ and 2rn have the full backing of the Irish state and, in general, such backing is likely to lower what would be RTÉ's and 2rn's actual costs of capital. However, we retain our approach of estimating the appropriate cost of capital for an efficient operator without state backing. This is because the purpose of the price control is to mimic the constraints that would be present in a competitive market. A hypothetical efficient operator in a competitive market would not have state backing, so the fact that RTÉ and 2rn have such backing is irrelevant to the level at which their return should be capped. We therefore proceed to estimate the cost of capital of a hypothetical efficient broadcast operator without state backing.

8.2 The Viability of Commercial DTT Services

RTÉ and 2rn are public service corporations that do not seek to make a return for investors, as a private company would. However, given the lack of market information for RTÉ and public service corporations in general, it is necessary to estimate WACC parameters using data on for-profit companies.

The Broadcasting Authority of Ireland has recently published a report arguing that a commercial DTT service in Ireland is unlikely to be economically viable.[70] ComReg has asked us to consider whether this argument would have any impact on the WACC for 2rn and RTÉ, given that we estimate their WACCs from companies in industries whose commercial viability is not in doubt.

---

[66] Swedish Post and Telecom Authority (2005) "Ärende SE/2005/0188: Programutsändningstjänster i Sverige Yttrande enligt artikel 7.3 i direktivet 2002/21/EG [Case SE/2005/0188: Programs Broadcast Services in Sweden Opinion under Article 7.3 of Directive 2002/21/EC]".

[67] This last example is particularly pertinent in the Irish case, as the three bidders for Irish DTT multiplexing licenses in 2008 were all consortia with members from different industries. See: Oliver & Ohlbaum Associates (2013) "Prospects for commercial digital terrestrial television in the Republic of Ireland", p 13.

[68] We note that they do not have the exact same customer base. 2rn's customers include analogue radio stations and mobile phone companies in addition to RTÉ's Market B customers.

[69] This is especially true considering that the revenues of Market A and Market B are fixed, with the final charge being the revenue amount divided equally among the number of customers. Were costs to increase, the charge structure allows for a high degree of cost pass-through and low revenue risk.

[70] Ibid.

We do not believe the commercial viability of DTT services would have an impact on the regulatory WACC, particularly in the context of public service DTT broadcasting. The WACC compensates investors for investment in existing assets. If the scope for commercial viability of DTT were falling, existing assets would still require remuneration. Additionally, to our knowledge the DTT services offered by 2rn and RTÉ will continue as public services even DTT services ceased to be an attractive commercial proposition and, as operators with SMP, will require a regulatory WACC and thus remuneration.

If falling DTT uptake by consumers of public service DTT broadcasting were to result in 2rn and RTÉ changing to a different distribution platform (e.g. cable, satellite, etc.) for public service broadcasting, then ComReg could respond to a change in the distribution platform by reducing or eliminating the depreciation allowance in the price cap calculations. This would allow 2rn and RTÉ to earn a return on the existing DTT broadcasting assets while the asset values are depreciated to zero at the end of their useful lives.[71] The cost of capital itself would not change, but the remuneration of regulated assets would fall, as the WACC would be applied to an increasing small regulatory asset base.

8.3 Regulatory Approaches to Broadcasting

Regulatory precedent on broadcasting is scant. In the UK, Ofcom gave guidance on the WACC for broadcasting transmission assets in 2006[72], which was subsequently deemed as still appropriate by the Office of the Adjudicator – Broadcast Transmission Services in 2010.[73] On company-specific parameters, Ofcom received evidence arguing for figures that would either increase or decrease the WACC, drawing on qualitative evidence about the level of systematic risk a broadcaster faces and comparison with other industries. In the end, Ofcom settled on an equity beta of 1, which is the beta for a firm with the market level of risk, given the absence of robust arguments to deviate from the market average. For the debt premium and gearing, Ofcom relied on evidence from a then-recent BT determination and comparisons with other industries. In short, Ofcom was hesitant to come down strongly on either side of the arguments submitted to it, and instead opted to select cost of capital parameters from either the market average or broadly appropriate ranges.

PTS, the Swedish telecommunications regulator, was more willing to be informed by comparator industry analysis. In their 2007 and 2010 broadcasting WACC determination, ranges for the beta, debt premium, and gearing were all determined via comparison with other industries. Most straightforward comparisons were with tower and mast operators, of which there were few publicly listed. Similarities between broadcasting and other network or "network-like" industries led PTS to consider integrated telecommunications companies and network utilities, such as gas and electricity distribution. As we show below, PTS used equity betas outside of 1 for their WACC calculations and gearing and debt premia informed heavily by comparisons with other industries. In other words, the Swedish regulator has been more willing than Ofcom in the UK to set the WACC using comparisons with other industries.

In estimating the WACC for Irish broadcasting, we rely on past regulatory precedent and evidence from comparisons with tower and mast companies, integrated telecommunications companies, and network utility companies. We rely most on evidence from tower and mast companies, as we feel these are the most intuitive comparators to broadcasting. Nonetheless, we arrive at our final ranges and point estimates by considering the evidence in the round.

---

[71] Were the public service broadcasting platform to change before the DTT broadcasting assets were fully depreciated, the asset values could be written down to zero earlier than previously expected via an asset impairment.

[72] Ofcom (2006) "Terrestrial transmission market review".

[73] Office of the Adjudicator – Broadcast Transmission Services (2010) "Report for the period 1 July–30 September 2010".

8.4 Gearing

8.4.1 Use of notional versus actual gearing

Having examined book values for 2rn's / RTÉ', we have found that these are uninformative due to negative values of either equity or debt for each of financial years 2010-2012.[74] Given our general preference for use of notional gearing, and in view of the fact that it would be impractical to use a measure of actual gearing, we opt to use a notional gearing level for the broadcasting WACC. To determine the appropriate level of notional gearing we therefore examine regulatory precedent and gearing of appropriate comparator companies.

8.4.2 Precedent on gearing

The most relevant regulatory precedent comes from determinations in the UK and Sweden. Notional gearing in these determinations, covering years from 2006 to 2010, is shown in the table below.

Table 8.1: Notional gearing in European broadcasting regulatory precedent

Country	Regulated Entity	Year	Gearing Level
Sweden	Teracom	2010	30-50
UK	Arqiva	2009	35
Sweden	Teracom	2007	25-55
UK	Arqiva	2006	35

Source: Relevant regulator reports.

In the UK, Ofcom took into account BT's gearing (30 per cent), and the gearing of gearing of Arqiva and Crown Castle (approximately 20%), and utility operators (50 per cent). Ofcom argued that notional gearing of 30 per cent was appropriate on the basis of this evidence and this was reaffirmed in 2009.

In Sweden, PTS Sweden considered evidence from tower companies, integrated telecoms, and utilities. In its 2010 determination it argued that the range for gearing had narrowed.

Gearing in regulatory precedent has therefore ranged between 25 and 55 per cent.

8.4.3 Gearing in comparator companies

The most clearly relevant comparator companies for the broadcasting control are those operating in the tower and mast sector. Companies for which market data are available are:

- American Tower (United States).
- SBA Communications (United States).
- EI Tower (Italy).
- Crown Castle (United States).

Gearing (on the basis of net debt to the sum of market capitalisation and net debt) is shown in the figure below.

[74] We note that once this first set of regulatory historical cost accounts are published for 2rn and RTÉ, gearing could be calculated as net debt over the regulatory asset value. This cannot be done at the moment as the first set of historical cost accounts for these two businesses are not to be published until June 2014.

Table 8.2: Tower and mast company gearing, 2006-2013

Source: Bloomberg, Europe Economics calculations.

Among tower and mast companies, gearing has been between 20 and 40 per cent since around 2006, excluding the financial crisis and the sovereign crisis in Italy. American Tower and EI Tower have both been at the lower end of this range, while SBA Communications and Crown Castle at the higher end.

Table 8.3: Broadcast company gearing and credit ratings

Company	Gearing	Moody's		Fitch		S&P	
		Rating	*Outlook*	*Rating*	*Outlook*	*Rating*	*Outlook*
American Tower Corp	21%	Baa3	Negative	BBB	Stable	BBB-	Stable
EI Towers	19%	-	-	BBB	Stable	-	-
SBA Communications	32%	Ba3	Negative	-	-	BB-	Stable
Crown Castle	32%	Ba2	Stable	BB	Stable	BB	Stable

Source: Bloomberg, Europe Economics calculations

American Tower and EI Tower have investment grade credit ratings (BBB on Fitch), while SBA and Crown Castle are non-investment grade (BB- and BB on S&P, respectively). We have a preference for the lower end of this range with a view to financing within an investment grade credit rating.

8.4.4 Fixed-line telecommunications gearing

Section 5 sets out our analysis of gearing for fixed-line telecommunications. In general, the actual gearing of these companies was in the region of 30-50 per cent, in line with the range of regulatory precedent for broadcasting gearing.

8.4.5 Assessment of gearing evidence

Regulatory precedent and fixed-line telecoms gearing suggests an appropriate range for gearing of 30-50 per cent on the basis of recent precedent. However, we note that the gearing of the most appropriate comparators is in the range of 20 to 30 per cent. We place most weight on the gearing of these comparator companies. Further, of these comparators, we note that the two investment grade-rated companies have gearing of less than 30 per cent, whereas the two without investment grade ratings have gearing in excess of 30 per cent. This suggests that an appropriate level of gearing to maintain an investment grade credit rating would be less than the 30 per cent minimum range of precedent. Balancing these considerations in our choice of notional gearing, we believe it is appropriate to shade down from the lower end of regulatory precedent, and propose notional gearing of 25 per cent.

8.5 Debt Premium

To determine the appropriate debt premium for a hypothetical efficient broadcaster, we examine regulatory precedent and the debt premia of appropriate comparators.

8.5.1 Precedent on the debt premium

Regulatory precedent on broadcasting debt premia is shown in the table below.

Table 8.4: Regulatory precedent on broadcasting debt premia

Country	Regulated Entity	Year	Debt Premium
Sweden	Teracom	2010	1.25-1.75
UK	Arqiva	2009	1.0
Sweden	Teracom	2007	0.7-1.70
UK	Arqiva	2006	1.0

Debt premia in regulatory precedents range from 1 per cent to 1.75 per cent. In the UK, Ofcom gave a value of 1%, considering the (then) recent BT determination debt premium (also 1 per cent) and evidence on utility and BBB bond spreads. In Sweden, the debt premium determined by analysing tower company premia and general utility premia at different credit ratings.

8.5.2 Comparator company debt premia

We have examined data on spreads for tower and mast companies' bonds. Data available only back to 2011, so limited data on how spreads have evolved over time. We sampled only investment-grade bonds in domestic currency. The companies' spreads are shown in the figure below.

Figure 8.1: Tower and Mast company debt premia (bps)

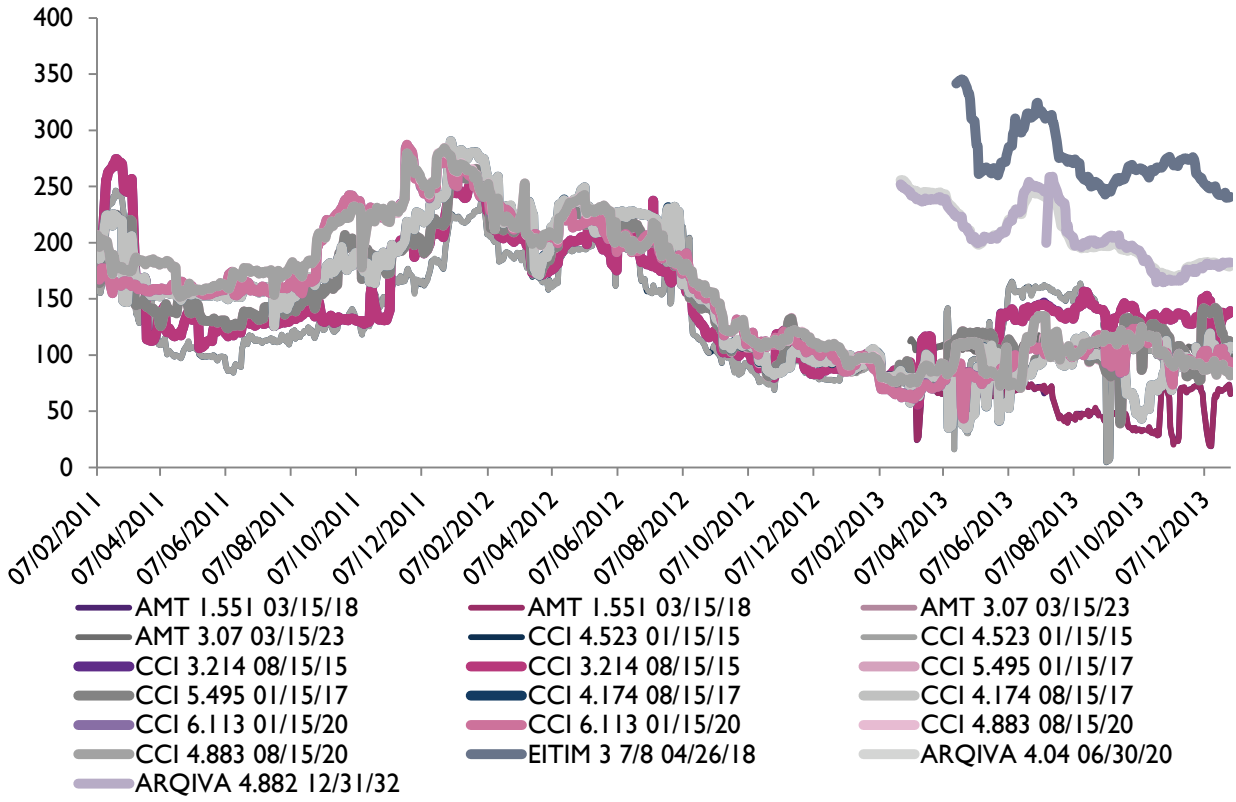


Table 8.5: Debt premia and credit rating for tower and mast companies

Company	Ratings	Debt Premium end 2013
American Tower	BBB/BBB-	82.36
Crown Castle	BB	106.54
EI Towers	BBB	240.90
Arqiva	BBB	180.80

Source: Bloomberg

Debt premia among tower companies have varied. Most bonds available for Crown Castle, whose debt premia have recently ranged between 100 bps and 140 bps. American Tower has lower premia (below 100 bps), but the bonds are AAA rated so a notional bond at comfortable investment grade rating would probably attract a higher premium. EI Tower's premium is high (250-300 bps), but this is the company's first debt issuance. Arqiva's premia have recently been around 180 bps. Overall, we believe this evidence is consistent with a range of 1.0-2.0 per cent for a debt premium for broadcasting.

8.5.3 Fixed-line telecommunications debt premia

Section 5 set out our analysis of fixed-line telecoms debt premia. Evidence from these companies debt premia also suggested a debt premium range of 1-2 per cent.

8.5.4 Assessment of debt premium evidence and the cost of debt

Evidence from regulatory precedent suggests a debt premium range of 0.7-1.75 per cent, while evidence from comparator bonds and fixed-line businesses suggests a range of 1.0-2.0 per cent. We believe that the

best estimate of a broadcasting debt premium is therefore around 1.5 per cent. However, we also believe that an Irish operator would likely have a higher premium by 0.00-0.75 per cent, with a best estimate of 0.25 per cent. We therefore believe a range of 1.5-2.25 per cent would be appropriate, with a point estimate of 1.75 per cent.

8.6 Equity Beta

8.6.1 Precedent on beta

Regulatory precedent on broadcasting debt premia is shown in the table below.

Table 8.6: Precedent on broadcasting beta (unlevered)

Country	Regulated Entity	Year	Unlevered Beta
Sweden	Teracom	2010	0.62
UK	Arqiva	2009	0.65*
Sweden	Teracom	2007	0.49-0.54*
UK	Arqiva	2006	0.65*

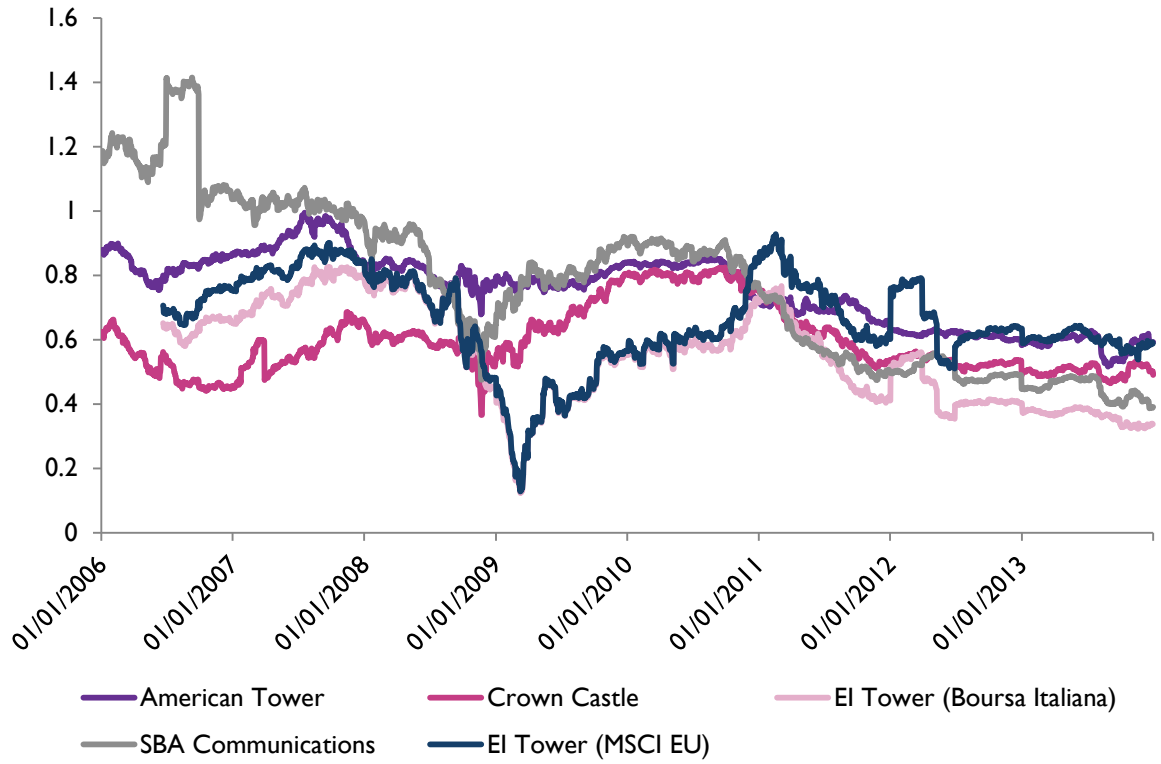
* Calculated from equity beta and gearing on assumption of zero debt beta.
Source: relevant regulator reports.

Precedent on beta is mixed. In its determinations for the UK broadcasting sector in 2009 and 2006, Ofcom provided no assessment of asset beta. Instead, they used the equity beta of the market as a whole, which is by definition 1. Given their gearing level of 35 per cent, this produces an asset beta of 0.65. Sweden, on the other hand, used comparator analysis to determine an appropriate beta. In Sweden, PTS Sweden, gave an equity beta range of 0.72 to 1.09 in 2007, which implies an asset beta of 0.49 to 0.54 under assumed gearing levels. In 2010, gave an asset beta of 0.62 based on comparison of other sector's asset betas. Asset betas in regulatory precedent have therefore varied from 0.49 to 0.65.

8.6.2 Comparator industry betas

We examine unlevered betas for the tower and mast sector, which we feel are the most relevant comparator companies for the broadcasting control. Two year unlevered betas for these companies are shown in the figure below.

Figure 8.2: Two year asset betas for Tower and Mast companies

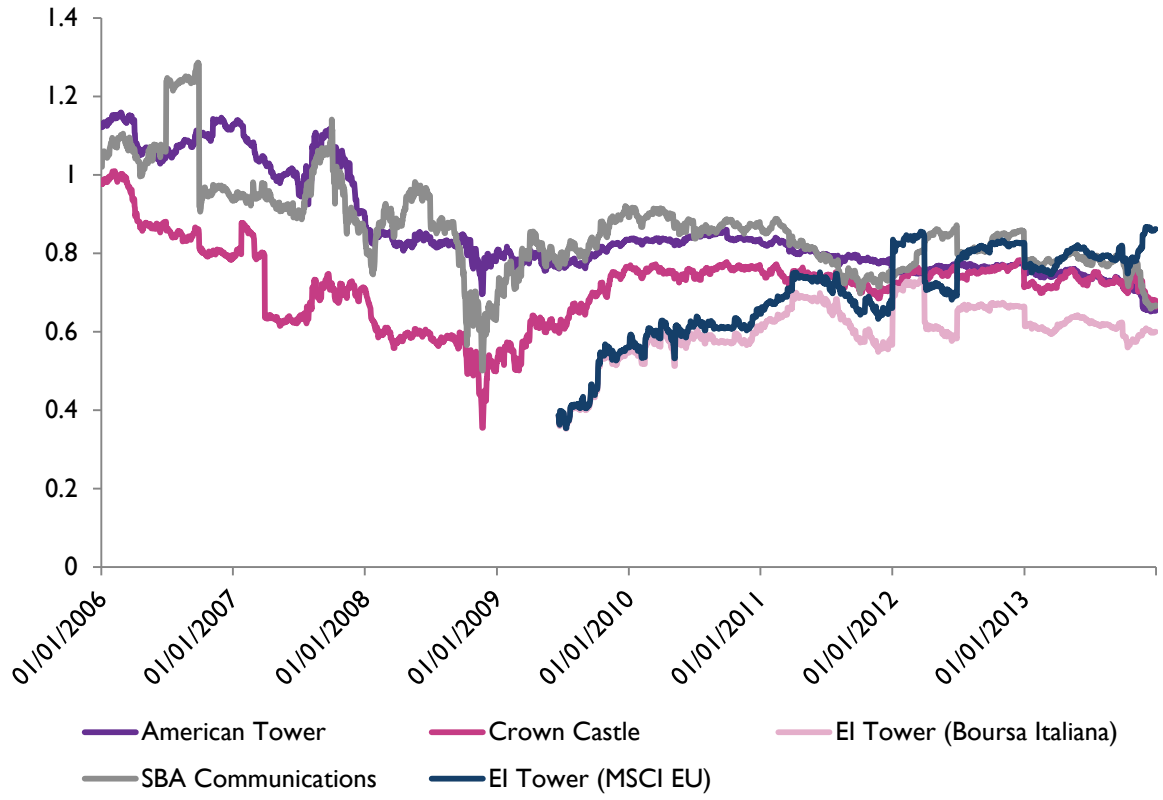


Source: Bloomberg and Europe Economics calculations.

Two year betas among tower and masts companies were generally higher pre-crisis than post-crisis. The most recent evidence suggests a range of approximately 0.40-0.60. We think it is unlikely that pre-crisis betas would be representative of a DTT broadcaster or multiplex operator now, as DTT technologies are now better understood and more widely used than pre-crisis.

We show betas based on five years of data in the figure below.

Figure 8.3: Five year asset betas for Tower and Mast companies



Source: Bloomberg and Europe Economics calculations.

Again, many betas were higher pre-crisis than post-crisis. We note that the most recent five year betas are generally higher than the two year betas, most being in the range 0.60-0.80.

Table 8.7: Asset and equity betas for tower and mast companies

	Unlevered beta		Equity beta at 25 per cent gearing	
2 year	*Zero Debt Beta*	*0.1 Debt Beta*	*Zero Debt Beta*	*0.1 Debt Beta*
American Tower	0.593	0.614	0.791	0.786
Crown Castle	0.501	0.531	0.668	0.675
SBA Communications	0.389	0.422	0.519	0.529
EI Tower (MSCI EU)	0.587	0.606	0.783	0.775
5 year	*Zero Debt Beta*	*0.1 Debt Beta*	*Zero Debt Beta*	*0.1 Debt Beta*
American Tower	0.655	0.676	0.873	0.869
Crown Castle	0.680	0.710	0.906	0.913
SBA Communications	0.667	0.700	0.890	0.899
EI Tower (MSCI EU)	0.862	0.881	1.149	1.141

Source: Bloomberg, Europe Economics' calculations.

8.6.3 Fixed-line telecommunications betas

Section 5 sets out our analysis of betas for fixed-line telecoms. Fixed-line companies' betas were also generally in the range 0.4-0.6.

8.6.4 Assessment of beta evidence

Regulatory precedent suggests an unlevered beta range of 0.49-0.65, with most recent precedent being in the upper part of this range. However, we note that two year unlevered beta estimates suggest a reduction in beta since the end of 2010, with a current range of around 04-0.6, which is a similar range to fixed-line telecoms. Although this is not reflected in the five year betas, we place more weight on the two year beta estimates, since we judge that these give the most appropriate trade-off between sufficient observations for steady beta estimates and an up-to-date estimate. Our overall range for unlevered beta is therefore 0.40-0.60, as suggested by the two year beta estimates. However, we believe it appropriate to attach some weight to precedent and the five year betas which are above this, and our point estimate is therefore in the upper part of this range. Our recommended unlevered beta for broadcasting is therefore 0.55. At notional gearing of 25 per cent, this equates to an equity beta range of 0.53-0.80, with a point estimate of 0.73.

8.7 Overall WACC for a Hypothetical Efficient Broadcaster

The table below shows our estimate of the overall WACC for a hypothetical efficient broadcaster.

Table 8.8: WACC range and point estimate for broadcasting controls

	Low	High	Point Estimate
Tax rate (%)	12.5	12.5	12.5
Real risk-free rate (%)	1.75	2.50	2.30
Inflation (%)	1.50	2.00	1.75
Nominal risk-free rate (%)	3.28	4.55	4.09
Equity risk premium (%)	4.60	5.25	5.00
Gearing (%)	25	25	25
Asset beta	0.40	0.60	0.55
Equity Beta at notional gearing	0.53	0.80	0.73
Nominal post-tax cost of equity (%)	5.70	8.70	7.80
Nominal pre-tax cost of equity (%)	6.50	10.00	8.90
Debt Premium (%)	1.50	2.25	1.75
Nominal pre-tax cost of debt (%)	4.80	6.80	5.80
Nominal Vanilla WACC (%)	5.5	8.3	7.3
Nominal pre-tax WACC (%)	6.1	9.2	8.1

Source: Bloomberg, Europe Economics calculations

As discussed above, we believe it is appropriate to aim up on our central estimate of the WACC. To infer the appropriate degree of aiming up, we examine uncertainty around individual WACC parameters. For beta, we examine the standard errors of the estimates on which we based our estimates to infer uncertainty over the evidence on which we based our judgement.

Table 8.9: Standard errors of equity beta estimates

Company	Two Year	Five Year
American Tower	0.081	0.039
Crown Castle	0.068	0.045
EIT	0.110	0.122
SBA Communications	0.055	0.051

Source: Bloomberg, Europe Economics calculations

To infer one standard deviation above our point estimate of asset beta, we calculated upper confidence intervals for equity betas on the basis of these standard errors and then unlevered them. In line with our analysis of the level of beta itself, we place most weight on two year betas. This suggests an upper confidence limit on asset beta that is 0.07 above our point estimate.

On the debt premium, the primary source of uncertainty is over the extent to which an Irish operator would attract a higher debt premium than an equivalent operator in a core Eurozone country. We do not have a firm basis on which to assess uncertainty over this figure, so we use the latest estimate of this premium which was 55 basis points. Of this, 25 basis points are already incorporated in our point estimate so our upper confidence limit on the debt premium is 0.3 per cent above our point estimate.

The table below shows our assessment of the uncertainty over individual WACC parameters.

Table 8.10: Uplifts for WACC point estimate

Parameter	Upper confidence limit above point estimate
Nominal risk-free rate	+0.1%
Asset beta	+0.07
Debt Premium	+0.30%

Source: Bloomberg, Europe Economics calculations

Overall, these suggest an uplift to the WACC point estimate of seven per cent. This is slightly higher the amount of aiming up for mobile and fixed line, and reflects higher uncertainty over the estimates of beta. This increases our point estimate of the pre-tax WACC from 8.1 to 8.7 per cent.