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Estimating the cost of capital for NERL

A report prepared for the Civil Aviation Authority (CAA)

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Contents

1. Executive summary

PwC has been commissioned by the CAA to estimate the appropriate cost of capital for NATS En Route Plc (NERL) for RP2 (2015-2019). This report sets out our overall views on the cost of capital that is appropriate for setting allowed revenues for NERL over RP2, consistent with the form of regulation proposed under the SES II framework.

A market based WACC approach is appropriate

When setting allowed revenues for NERL, we consider a weighted average cost of capital (WACC) based approach to be appropriate, with the cost of equity and cost of debt parameters estimated with reference to market information. While NERL is partly-state owned, its source of financing (or ownership) should not determine allowed returns, Rather, required returns should be driven by the underlying risk of the business. NERL also needs to generate a sufficient return to reward its private shareholders adequately for the risk they bear given their part ownership of the business.

Publicly owned and financed air traffic operators should also aim to earn a return commensurate with the risks. If such businesses are financed using public funds with a lower rate of return, for example a government borrowing rate, this does not reduce the risk within the business which is borne by the ultimate owners of the business. Therefore, we consider the WACC to be an appropriate benchmark in setting the commercial returns the business should earn that are commensurate with its risk profile.

The economic environment is improving

Our overall approach for calculating the cost of capital for NERL is broadly consistent with the approach we used for the Designated Airports. Since we published our report for the Designated Airports in October 2013, there has been a sustained improvement in economic conditions, with a higher (expected) GDP growth estimate for Q4 2013 as well as higher revised expectations for GDP in the short to medium term based on survey evidence. There has also been a commensurate improvement in confidence levels, as measured by PMI surveys. Financial markets have continued to respond strongly to the economic improvement, with long term government bond yields rising by over 100 basis points since October. However, the yields on corporate bonds have remained broadly flat over this period. In relation to inflation, our analysis suggests that the 2.8% estimate used for airports continues to be appropriate for the assessment of the cost of capital for NERL for RP2.

Notional gearing assumption of 60%

Compared to airports and other regulated sectors, the CAA has traditionally been more prescriptive in setting the capital structure for NERL. In RP1, the CAA used a target notional gearing estimate of 60% and a gearing cap of 65% for NERL. These operated together with a clawback to remove the tax benefit from gearing above 60 per cent. We consider this approach to be appropriate for RP2, and recommend using a notional gearing assumption of 60% together with a cap at 65% with a clawback mechanism. The 60% gearing assumption is consistent with NERL's actual gearing, broader regulatory evidence and a target credit rating of A-.

NERL's allowed cost of debt should incorporate the benefit of implicit government support

NERL benefits from implicit government support. This is partly a consequence of its part-public ownership structure, but also because NERL operates critical UK infrastructure. This support is reflected in the rating ascribed to NERL's debt financing. In order to avoid over-rewarding NERL's private shareholders, we consider an approach which incorporates the benefit of government support into the cost of capital assessment as appropriate. This means we calculate the cost of debt with reference to the credit rating that incorporates government support – an uplift of two notches from A- (stand-alone) to AA-. This leads to a lower cost of debt and lower overall charges, while rewarding investors fairly and allowing the CAA to fulfil its financing duty with respect to NERL.

The real cost of debt of 2.4% to 2.5% is largely driven by NERL's existing debt facilities

We assess both the cost of embedded debt and cost of new debt (similar to our approach for Designated Airports). For embedded debt, we review historical average yields on (10-15 year) A and AA rated benchmark indices (as well as a hypothetically constructed AA- index) and the yield to maturity at issuance on NERL's only currently outstanding bond. We give more weight to NERL's outstanding bond to calculate a cost of embedded debt of 2.5%. For the cost of new debt, we also review the current yields on benchmark indices and NERL's traded bond, again combining the two to calculate an overall cost of new debt range of 1.5% to 2.0%. Similar to our approach for airports, this range incorporates an uplift of around 0.7 percentage points for the expected upwards trend for yields on corporate bonds. For the overall assessment of the cost of debt, we combine the cost of embedded and new debt giving 80% weight to embedded debt and 20% to new debt issuance over RP2, taking account of the relatively low financing needs for the business over RP2. We also include a fee allowance of 10 basis points for NERL, which leads to an overall real cost of debt of 2.4% to 2.5%. This is lower than the range used by the CAA for NERL in RP1, mirroring the market-wide reduction in cost of debt.

Our range of total equity market returns (TMR) is 6.25% to 6.75%

Our assessment of the range for total equity market returns (TMR) of 6.25% to 6.75% is the same as the range we used for Designated Airports, and lower by around 25 basis points compared to the range used by the CAA for NERL in RP1 (2010). Compared to long term studies which suggest real equity returns on average of 7%, we consider three reasons for a reduction. There are:

(i) a cyclical downturn in return expectations across all asset classes. As the economy improves this adjustment should moderate;

(ii) a permanent reduction in expected equity returns. A number of academic studies have suggested future equity returns are unlikely to repeat some of the gains made historically; and

(iii) the increase in inflation as measured by the RPI, as a consequence of calculation changes which have increased the size of the formula effect. This will increase total nominal returns (through the indexation of the RAB) without a commensurate increase in actual inflation, and one way of adjusting for this change is to reduce real returns through a corresponding downward adjustment to the real TMR assumption.

Our overall range is informed by these three effects and is consistent with forward looking estimates of the TMR. The composition between the risk-free rate and equity market risk premium is different compared to our views at the time of publication of our report on Designated Airports. Given the continued increase in yields on government bonds, we have revised upwards our range for the risk-free rate to 0.75% to 1.25% based on analysis of current and forward market expectations (with a mid-point of 1.0% compared to 0.75% for Designated Airports). This implies an EMRP estimate of 5.5%, which is 25 basis points lower than the 5.75% estimate we used for Designated Airports. The proposed EMRP estimate is consistent with historical and forward looking evidence on EMRP. The movement within the component parts represents a mechanical adjustment and in principle has little consequence for overall equity returns.

A NERL asset beta of 0.49 to 0.52 reflects aeronautical risks and NERL's risk sharing mechanism

We have calculated the equity (and asset beta) for NERL using a combination of qualitative and quantitative approaches. Our overall view is that NERL's beta sits within the range for the beta for UK airports (which are more exposed to demand risk, particularly given the volume risk-sharing mechanism for NERL) and utility companies (which face very low demand risk exposure). We consider the airport betas (set at Q6) as a useful benchmark to capture NERL's exposure to aeronautical risk (particularly relatively higher demand risk exposure) and use the evidence on utilities as an indicator of NERL's risk profile without demand risks (or very little exposure to demand risk). We analyse NERL's risk sharing mechanism to gauge where NERL is located within this spectrum. We calculate an overall asset beta range of 0.49 to 0.52 for NERL for RP2. We use a debt beta of 0.1.

Overall pre-tax, real WACC ranges from 5.6% to 6.2%

Table 1.1 brings together our views on the cost of debt and the cost of equity and presents our overall weighted average cost of capital (WACC) estimates for NERL. We use an effective corporate tax rate of 36% for NERL. We report a range for the WACC under our preferred current market approach and, as a sense check, the mid-points of our estimates for the WACC based on the long-term returns based approach. Under our current market approach, our analysis suggests a real pre-tax WACC range of 5.6% to 6.2%. For our long terms returns based approach, our analysis suggests a real pre-tax estimate of 5.8%.

Table 1.1 Overall WACC estimate

WACC (%)	**NERL**	
Approach 1 – current market	**Low**	**High**
Total equity returns (TER)	6.25	6.75
Real risk-free rate (%)	0.75	1.25
EMRP (%)	5.50	5.50
Asset beta	0.49	0.52
Debt beta	0.10	0.10
Gearing (%)	60	60
Equity beta	1.08	1.15
Tax rate (%)	36.0	36.0
Cost of embedded debt (real, %)	2.5	2.5
Cost of new debt (real, %)	1.5	2.0
Embedded (new debt) split (%)	80/20	80/20
Cost of equity (real, post-tax, %)	6.7	7.5
Cost of equity (real, pre- tax, %)	10.5	11.7
Cost of debt (real, pre-tax, including fees, %)	2.4	2.5
WACC (real, post-tax, %)	3.6	4.0
WACC (real, vanilla, %)	4.1	4.5
WACC (real, pre- tax, %)	5.6	6.2
Approach 2 - long-term returns	**Mid-point**	
Real risk-free rate (%)	1.5	
EMRP (%)	5.0	
Asset beta	0.49	
Debt beta	0.10	
Gearing (%)	60	
Equity beta	1.08	
Cost of equity (real, post-tax, %)	6.9	
Cost of equity (real, pre- tax, %)	10.8	
Cost of debt (real, pre-tax, %)	2.5	
WACC (real, post-tax, %)	3.7	
WACC (real, vanilla, %)	4.3	
WACC (real, pre- tax, %)	5.8	

Source: Datastream, Dealoigc, Bloomberg, various regulatory determinations, DMS (2013), Barclays Equity Gilts Study (2013), Fernandez et al (2013) and PwC analysis.

2. Introduction

2.1. Background

The Civil Aviation Authority (CAA) is currently preparing its draft determination for the NATS price control review for Reference Period 2 (RP2). The price control will set the cost of capital and efficiency target for NATS (En Route) plc (NERL) for the five year period 2015-2019 and therefore will determine the prices which NERL can charge customers over this period.

For NERL, the CAA updated its price control proposals for RP1, also referred to as CP3 (2011-2014), to take account of the economic regulation of European air navigation service providers through the Single European Sky II (SES II) programme. This contains a pan-European performance and common charging framework and came into effect in January 2012. The CAA's regulatory framework for NERL for the last three years of RP1 was designed to be compliant (to the extent possible) with SES II, with added clarifications across specific areas where differences remained[1].

The CAA has to fulfil its regulatory duties under the Transport Act 2000 and the UK's obligations under the SES II framework for RP2. In relation to SES II, this will require expanding the use of performance targets or "key performance areas" (KPAs), which include targets for safety, capacity, environment and cost efficiency. This means there were will be number of areas where the RP2 price control will differ compared to the previous price controls.

A key part of the regulatory process for setting charges for air traffic services remains the estimation of the appropriate weighted average cost of capital (WACC). This sets the level of allowed return on capital investment and remunerates providers of capital for their investments and the risk associated with those investments. The CAA has commissioned PwC to estimate the appropriate WACC for NERL for RP2.

Table 2.1 below sets out the CAA's previous determinations for NERL's cost of capital.

[1] For instance, one area where differences remained is the treatment of inflation. In the UK, Retail Prices Index (RPI) inflation is traditionally used in regulatory (RPI-X) price controls, but the European SES II regulations require the Consumer Prices Index (CPI) to be used. For the RP1 price control period, the CAA produced nominal costs by using forecasted RPI inflation and then calculated real determined costs by adjusting these nominal prices using forecasts for CPI inflation. The CAA also proposed permitting hedging costs to take account of the risk involved with the possible differences between the RPI and the CPI measures of inflation.

Table 2.1 Previous CAA determinations for NERL cost of capital

Input	CP1 (2001 – 2005)		CP2	CP3/RP1
	Low	High	2006-2010	2011-2014
Gearing	50%	50%	64%	60%
Cost of debt	4.70%	5.60%	3.90%	3.60%
Risk-free rate	3.5%	3.8%	2.50%	1.75%
EMRP	3.5%	5.0%	4.81%	5.25%
Asset beta	0.55	0.55	0.6	0.6
Debt beta	0	0	0	0.1
Equity beta	1.10	1.10	1.67	1.35
Cost of equity (post-tax)	7.35%	9.30%	10.52%	8.8%
Vanilla WACC (real)	6.03%	7.45%	6.28%	5.7%
Tax rate	17%	17%	11%	27%
Pre-tax WACC (real)	6.76%	8.38%	6.75%	7.0%

Source: CAA regulatory determinations.

2.2. Scope of this report

This report presents our estimates for an appropriate WACC for NERL. This report draws upon recent academic and empirical evidence on the cost of capital, regulatory determinations in other sectors and up to date information from capital markets. In particular, we draw heavily on our recent advice to the CAA on determining the appropriate WACC for Designated Airports for Q6.

Our overall approach, unless explicitly stated otherwise, is consistent with our approach adopted in the context of airports. For instance, we continue to use the CAPM to estimate an appropriate cost of equity and combine this with the cost of debt to calculate an overall WACC. In forming our view on the appropriate WACC we take account of current financial market expectations for future trends in the cost of financing that may influence the cost of capital for NERL over the course of RP2. In addition, we take account of factors that are specifically relevant for NERL, such as differences in the regulatory frameworks for airports and for air traffic services including (but not restricted to) volume risk sharing mechanisms.

It is ultimately for the CAA to decide the appropriate figure for the WACC to incorporate into its draft and final determinations. Our task has therefore been to provide a suitable range for the WACC to inform the CAA's decisions. We have sought to provide an appropriate range which is not unhelpfully wide. This means that it is possible that the actual WACC lies outside this range.

2.3. Structure of this report

We have structured this report in a similar way to our report on the cost of capital for Designated Airports. We start by setting out the approach for setting allowed returns for NERL and then review the broader macroeconomic environment. We then present our estimation of the WACC, starting with a review of capital structure, then the cost of debt followed by the cost of equity. In forming our views on the cost of capital parameters, we take account of historical, current and forward looking financial and economic market data.

Our cut-off date, unless stated otherwise, for the underlying market data is 30 December 2013.

The remainder of this report is structured as follows:

- Section 3 set out our views on the appropriateness of the WACC in the context of regulating NERL and hence determining the allowed revenues.
- Section 4 provides an overview of the economic context for setting the cost of capital for NERL over RP2.

- Section 5 sets out our approach and estimate for gearing for NERL for RP2.
- Section 6 presents our approach and overall views on the appropriate range for the cost of debt for NERL in RP2.
- Section 7 sets out our methodology and estimate for the overall cost of equity for NERL in RP2, with a detailed assessment of the total equity returns as well as the component parts of the cost of equity, calculated using the capital asset pricing model (CAPM).
- Section 8 describes our assumption on modelling tax for the purpose of calculating the cost of capital.
- Section 9 presents our overall view on the WACC for NERL in RP2.

These Sections are followed by a number of Appendices which set our evidence and methodology for estimating various components of the cost of capital in more detail.

3. Methodology for estimating the allowed returns

This Section reviews the relevance of the WACC in assessing investors' required returns in the context of determining the allowed revenues for NERL for RP2. It includes comparison with other European air traffic control operators, where ownership structures differ.

3.1. Conceptual basis for the WACC

The weighted average cost of capital (WACC) reflects the returns required by different providers of capital (namely debt and equity investors) for being exposed to risk when investing in a company or an investment. It is widely used across the investor community, the financial markets and the regulated sectors for assessing investors' return requirements, determining hurdle rates and assessing the allowed revenues in the context of regulatory price control determinations. The WACC sets out those returns which are commensurate with the risk of the business, and is calculated by taking a weighted average of the cost of equity and the cost of debt capital, where the weights represent their respective proportions in the overall capital structure. Generally, the WACC can be estimated using the following formula[2]:

$$WACC=Ke*(1-g)+Kd*(g)$$

Where: Ke is the cost of equity; Kd is the cost of debt; and g is gearing (the proportion of debt capital in the overall capital structure).

The cost of equity is typically estimated using the capital asset pricing model (CAPM). The CAPM is the most widely used approach for estimating the cost of equity, for both regulators and practitioners alike. Indeed, most (if not all) regulatory determinations in the UK rely on the CAPM framework to estimate an appropriate range for the cost of equity. In the context of the current analysis, we use the CAPM to estimate the cost of equity for NERL for RP2, consistent with our approach for the Designated Airports for Q6.

The CAPM assumes that equity investors require their investment as a minimum to yield the return available on risk-free instruments (usually proxied by yields on government bonds). Added to this risk-free rate of return, equity investors expect a premium for the risk involved in a particular equity investment – estimated as the product of the generic equity market risk premium (EMRP) and the equity beta for the particular investment. The EMRP represents the incremental expected return investors require to compensate them for the additional risk associated with investing in the equity market as a whole, rather than in risk-free instruments. The equity beta is a measure of the riskiness of a particular equity investment relative to the equity market. In particular, it is a measure of the degree of 'systematic risk' for a particular investment.

A key aspect of the CAPM framework is that it distinguishes between specific risks and systematic risks. Specific risks are those which are unique to an investment. Systematic risks affect all equity investments to a greater or lesser extent. The model assumes that equity investors can "diversify away" exposure to specific risks (by holding a well-diversified portfolio of investments) and hence they do not affect required returns – which only reflect exposure to systematic risk. However, it is important to note that the consideration of specific risk is an important aspect in the calculation of the expected cash flows, which form a central part of ant piece determination. Under the CAPM framework, the cost of equity is defined as follows:

$$K_e=R_f+\beta(EMRP)$$

[2] The WACC can be estimated on a pre- or a post-tax basis. The cost of equity is by default calculated on a post-tax basis whereas the cost of debt is calculated on a pre-tax basis. The combination of the post-tax cost of equity and the pre-tax cost of debt is often referred to as the Vanilla WACC.

Where: Ke is the cost of equity; Rf is the risk-free rate; β is the equity beta; and EMRP (Equity Market Risk Premium) = (Rm - Rf), where Rm is the return on the equity market.

The cost of debt represents the returns required by providers of debt capital and compensates them for their exposure to default risk. Firms are contractually obliged to make interest payments on debt obligations, and these payments have priority over any dividends for shareholders. Moreover, interest payments on debt are tax-deductible. Typically, debt financing therefore represents a cheaper source of financing compared to equity; however, as companies gear up, the cost of (new) debt increases to reflect the increased risk exposure for providers of debt capital. This also leads to a higher cost of equity as the equity holders, relying on residual cash flows after debt payments, face greater risk.

Under the RPI-X based approach to regulation in the UK, the WACC is a key determinant in setting regulatory prices across a range of sectors, including water, energy, telecoms and airports, and is used as a tool to incentivise firms to undertake and finance efficient investments. This approach allows regulated firms to earn an economic return on efficient investments, with firms keeping any benefits associated with more efficient financing during the course of a price control period. Using the WACC to set appropriate economic returns for commercial owners of regulated companies has a long established track record in the UK and has been adopted across international regulated industries. It attracts private sector capital, incentivises operational efficiency, encourages efficient risk allocation (where companies bear risks they are equipped to manage) and should result in consumers paying efficient, economic prices for regulated services.

In the context of NERL, similar to other regulated sectors, we consider a WACC based approach represents the most appropriate framework for assessing appropriate returns.

3.2. Relevance of ownership structures on the approach to assessing WACC

In July 2001 the Department for Transport set up a Public Private Partnership (PPP) structure for NATS, with the Airline Group, a consortium of seven UK-based airlines, being the private sector partner. This gave the Airline Group operational control and a 46% share of NATS[3]. The PPP arrangement was adopted for NATS (among other reasons) to safeguard the interests of the taxpayer and to allow the business greater freedom to invest outside normal public sector spending constraints. This arrangement is unique to the UK and differs from ownership structures for air traffic operators across Europe (which are mostly 100% publically owned). NERL continues to operate as a PPP, but this is not the case, for example, in Germany where DFS Deutsche Flugsicherung GmbH is owned by the state or in Spain where Aeropuertos Españoles y Navegación Aérea (Aena) is a public entity.

While the *source* of financing does vary across different air traffic operators, underlying volatility in revenue and cost drivers, regulatory framework and other operational risk parameters are broadly comparable. It is not the source of finance which should determine allowed returns, rather the risks of the business. So NERL needs to make a sufficient return to reward private shareholders adequately for the risk they bear given their part ownership of the company.

Publicly owned and financed air traffic operators should also aim to earn a return commensurate with the risks they bear. If such public operators are financed using public funds which are treated as having a lower (e.g. government) borrowing rate, this does not reduce the risk within the business; rather the prices paid by the airlines and their customers are lower than they should be given the risk of the investment, and instead risk is borne by the ultimate owners of the business – i.e. taxpayers.

The benefit of appraising and regulating NERL on the basis of the business risks it faces is that this sets economically efficient prices to users which are fully reflective of business risks. This sets an appropriate pricing benchmark, regardless of ownership. Therefore, we consider that NERL should continue to be treated as a commercial business and a commercial WACC should be used to set revenues over RP2.

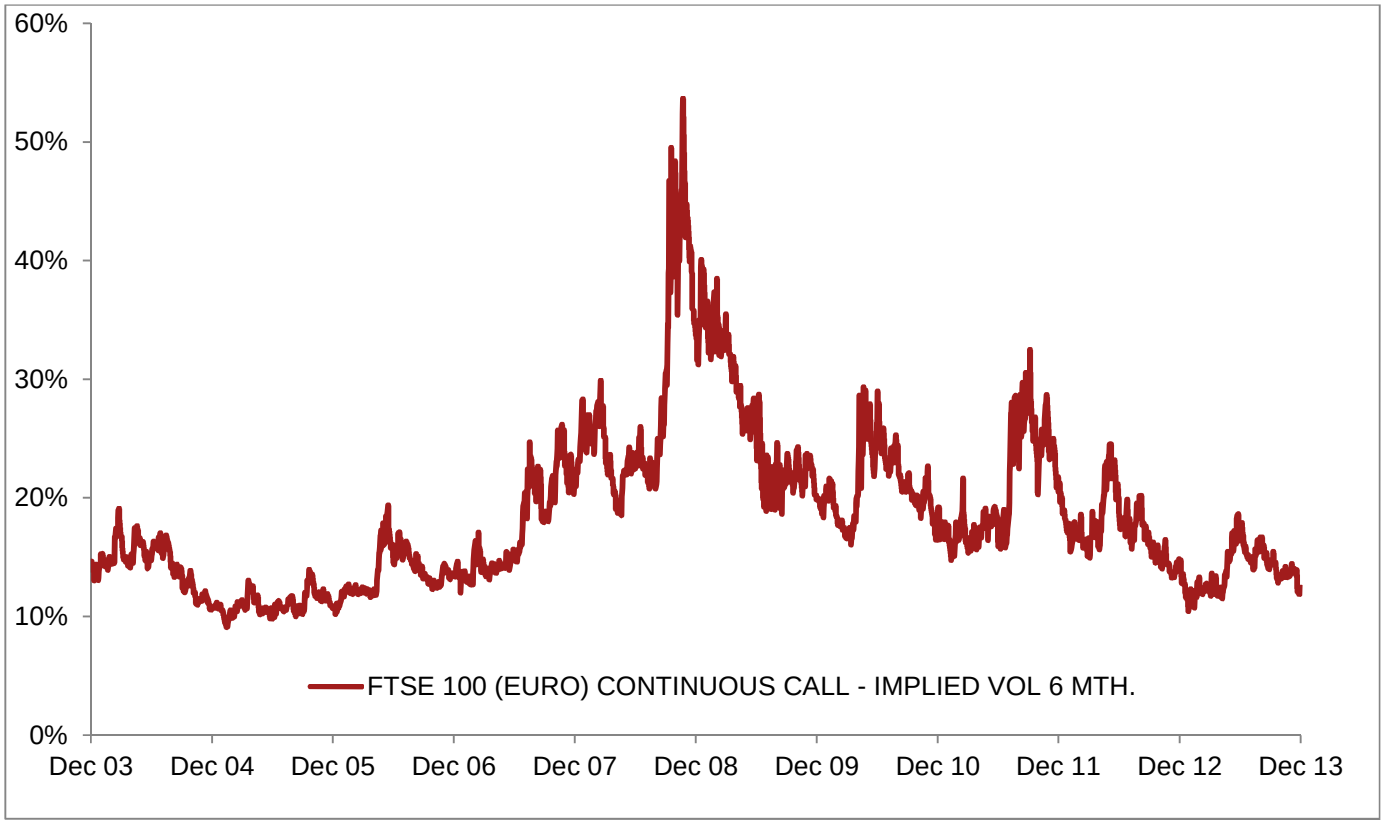
[3] Proceeds were nearly £800 million, of which £65 million came from the Airline Group and the rest from bank loans that were repayable by NATS itself.

4. Economic overview

The CAA's decision for setting NERL's charges in 2010 was taken during a period of high market volatility, as illustrated in Figure 4.1. Since the CAA's decision, some financial market stability has been restored, but the world's major economies have experienced a substantial economic contraction followed by a sluggish recovery.

In this Section we review the economic recovery and unprecedented monetary policy response, with particular emphasis on the potential impact on the cost of capital. In particular, we highlight the implications for the accuracy with which the cost of capital can be estimated given recent, current and possible future economic conditions and how this is incorporated into the WACC estimate. We follow this with our view on the appropriate RPI and CPI inflation estimates for RP2.

Figure 4.1 UK equity market volatility



Source: Datastream and PwC analysis.

4.1. GDP growth

Since the onset of the financial crisis GDP growth has, on the whole, been weak. Annual UK GDP growth averaged around 1.7% between 2008-2011, significantly lower than the average of 4.6% per annum in 2005-2008 (the same period pre-crisis)[4]. In 2012 growth was flat in the UK, whilst in the Eurozone, the UK's main export market, the economy contracted. However, since the start of 2013 economic conditions have improved,

[4] ONS (2013), "Quarterly National Accounts Tables, Q2 2013", available at http://www.ons.gov.uk/ons/taxonomy/index.html?nscl=Main+Aggregates+of+National+Accounts#tab-data-tables

with higher than expected GDP quarter-on-quarter growth of 0.3% in Q1 2013, 0.7% in Q2 2013[5], 0.8% in Q3 2013 and 0.7% in Q4 2013. This growth is expected to continue into the short to medium term in the UK (as well as the Eurozone), as reflected in estimates from Consensus Economics published in October. These suggest GDP growth estimate of 2.2% for 2014. There are broadly similar estimates by the OBR and the IMF (although the latter is slightly lower)[6]. These estimates are presented in Table 4.1 and Table 4.2 below.

Table 4.1 Consensus Economics UK and Euro zone growth forecasts

Year	2014	2015	2016	2017	2018	2019-2023
UK	2.2%	2.3%	2.2%	2.1%	2.0%	2.1%
Eurozone	0.9%	1.3%	1.5%	1.5%	1.5%	1.4%

Source: Consensus Economics October 2013.

Table 4.2 OBR and IMF UK real GDP forecasts

Year	2014	2015	2016	2017	2018
OBR	2.4%	2.2%	2.6%	2.7%	2.7
IMF	1.9%	2.0%	2.0%	2.1%	2.5%

Source: OBR (2013), Economic and Fiscal Outlook, December and IMF (2013), World Economic Database, October.

Although GDP growth forecasts have increased for the short term, there are still medium term risks to the economy. For example, the economy may still be constrained by continued fiscal tightening, high household debt levels and weak trading with Eurozone partners. This suggests that medium term growth expectations are still subject to considerable uncertainty.

4.2. Monetary policy

Throughout RP1, the Bank of England's base rate has been held constant at 0.5%. In addition, the UK central bank has also assisted economic recovery through unconventional monetary policy, including Quantitative Easing (QE), an approach that has also been adopted overseas in countries such as the US. The Bank of England's QE programme predominantly focuses on purchasing Government bonds[7], with varied maturities (particularly those with medium to long term maturities). It has represented a significant economic stimulus (totalling around £375 billion currently since initiated in 2009) but, with the economy recovering, it is unclear how long such an expansive monetary policy is likely to remain in place.

4.3. Impact of the economic environment on the cost of capital

Bond yields

The theoretical and empirical links between the sustainable GDP growth rate and the risk-free rate are well established. For example, Europe Economics[8] found a statically significant correlation between government bond yields and GDP growth. This, they suggest, could imply that changes in the sustainable growth rate are positively correlated with changes in the in the risk-free rate. Academics and practitioners often use expectations of GDP growth as a proxy for the risk-free rate in the future. Typically, the risk-free rate rises during periods of strong economic performance and falls when GDP growth is less strong.

[5] ONS (2013), "Preliminary Estimate Of GDP - Gross Domestic Product by Gross Value Added industry of output", available at http://www.ons.gov.uk/ons/datasets-and-tables/data-selector.html?cdid=IHYQ&dataset=pgdp&table-id=PREL

[6] IMF (2013), World Economic Database, October.

[7] See Bank of England Quarterly Bulletin Q3 2011, 'The United Kingdom's quantitative easing policy: design operation and impact', page 200.

[8] Europe Economics (2013), "Heathrow Airport's cost of capital", February.

As discussed in detail in our report for the CAA on the cost of capital for Designated Airports, the financial crisis led to significant volatility in government and corporate bond markets. The yield on Sovereign debt and (high rated) corporate debt increased during the financial crisis but fell quickly with the support of the QE programme.

More recently, the yields on government and corporate bonds have increased, which may, in part, be explained by the recent improvement in underlying macroeconomic fundamentals for the UK economy and expectations of bringing forward the tapering of the QE effect. These appear to have strongly influenced investor confidence and the appetite for risk, thus reducing flight to quality effects (and expectations of the impact of QE itself) which had supported lower yields on government bonds and solid investment grade rated corporate bonds.

Despite the improvement in economic conditions, there is still considerable uncertainty surrounding medium term growth expectations, suggesting yields on government bonds might continue to remain below historic norms for some time. This suggests the use of a low risk-free rate and cost of debt in conventional cost of capital calculations for RP2.

Equity returns

Equity markets witnessed an extended period of increased uncertainty following the financial crisis. During periods of such increased market uncertainty, investors usually become more risk averse and the premia required for investing in risky assets increases. In this situation, the EMRP increases whilst the yield on government securities typically decreases. The overall expected return on equity is however more stable than the underlying component parts of the total equity market return - the risk-free rate and the EMRP (see for example Smithers and Co (2003)[9]. Any deviation of short-term equity returns is also expected to be corrected as returns revert to the mean overtime, as suggested by Fama and French (2002)[10].

As set out above, an explicit objective of QE was to reduce yields across a range of bonds, directly in the case of government bonds, and more indirectly for corporate bonds. As a result, the cost of issuing new corporate debt has fallen. However, QE has also had a number of broader economic effects, particularly in relation to equity markets. Firstly, lower government bond yields would, all else equal, increase the present value of future dividends, thus raising equity prices'[11]. Evidence for this includes (a) a recent Bank of England paper[12] suggesting asset prices may have been supported by as much as 20% as a consequence of QE and (b) that the period during which the Bank of England first launched the QE programme coincided with a strong increase in UK equity returns. Secondly, investors who held government securities which were purchased by the Bank of England under the QE programme would be expected to reallocate the cash into other asset classes, such as equities or corporate bonds, to maintain efficient portfolios. Thirdly, increased capital flows into equity markets would improve liquidity and provide access to capital funding, supporting a lower cost of equity in principle.

Although there is no consistent long term relationship between GDP growth and equity market returns[13], evidence by O'Neill, Stupnytska & Wrisdale (2011)[14] and Europe Economics (2013)[15] suggest that trends in GDP growth in conjunction with broader business cycle movements, including changes in inflationary expectations and the monetary policy regime, do impact equity return expectations. We discussed this evidence in detail in our April 2013 report for the CAA on Designated Airports.

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[9] Smithers and Co Ltd (2003), "A Study into certain aspects of the cost of capital for regulated utilities in the UK", a report prepared for OFT, CAA, OFWAT, Ofgem, Oftel, ORR and OFREG.

[10] Fame, E and French, K (2002), "The Equity Premium", Journal of Finance, April, volume 2, page 650-656.

[11] Joyce M, Lasaosa, A, Stevens, I and Tong M, (2010) 'The Financial Market Impact of Quantitative Easing', Bank of England working paper 393, page 26.

[12] Ibid, page 206.

[13] See for example Dimson, Marsh and Staunton (2005).

[14] O'Neill, Stupnytska & Wrisdale (2011), "Linking GDP growth and equity returns", GSAM.

[15] Europe Economics (2013), "Heathrow Airport's cost of capital"

Taking into account the evidence of lower equity market volatility and relatively low expected GDP growth in the medium term, we would expect a period of relatively lower equity market required returns during the course of RP2 compared to previous determinations. However, as the economy recovers the case for the cyclical element of this reduction is less clear.

4.4. Inflation

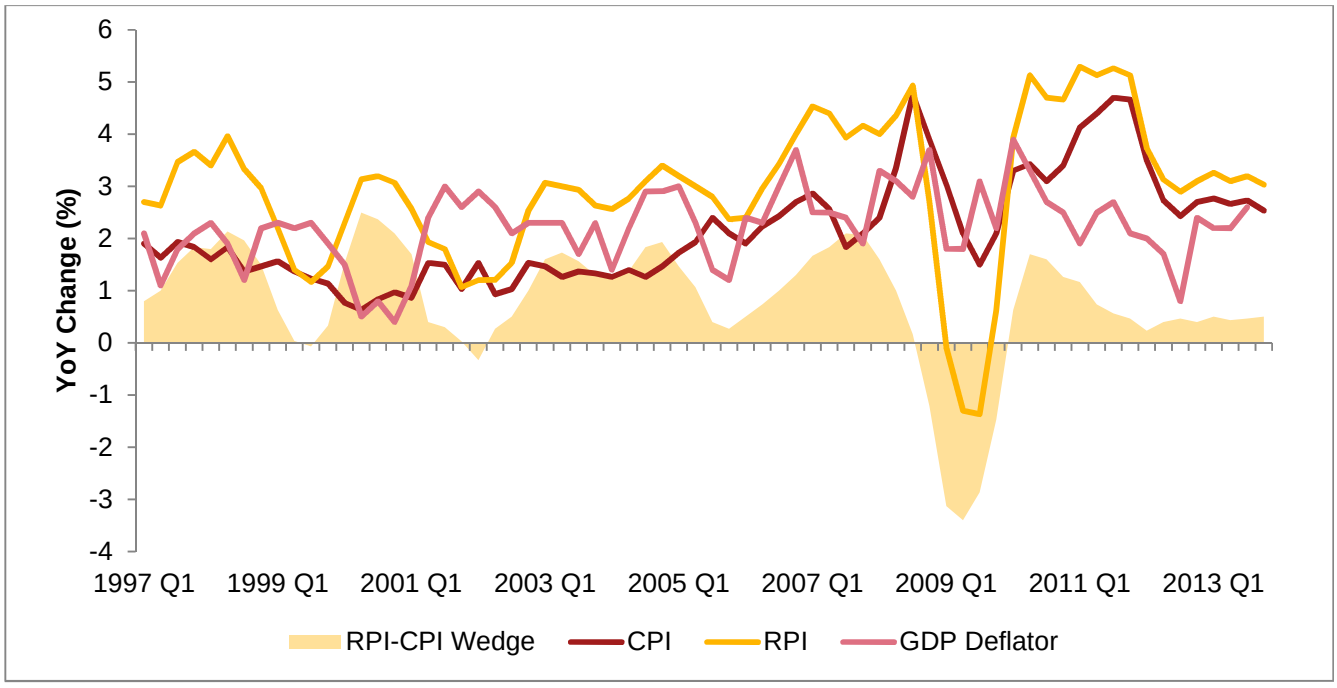
In this Section, we examine a number of sources and reference points to estimate inflation over RP2. We review a number of different inflation metrics including RPI, CPI and the GDP deflator and in each case analyse historical trends and forecasts. We also review implied inflation expectations based on the difference between nominal and real yields on government bonds.

There are some areas of the price control regulation that will require adjustment to be compliant with SES II. One area is inflation. In the UK, Retail Prices Index (RPI) inflation is traditionally used in setting price controls, but the European regulations require the Consumer Prices Index (CPI) to be used. For the RP1 price control period, the CAA produced nominal determined costs by using forecasted RPI inflation and then calculated real determined costs by adjusting these nominal prices using forecasts for CPI inflation. The CAA also permitted hedging costs to take account of the risk involved with the possible differences between the RPI and the CPI measures of inflation. For RP2, the CAA has proposed using the CPI as specified by the SES II regulatory framework for the assessment of costs, but will convert required revenues into a RPI based price control and will continue to use RPI for the basis of indexing the RAB. This means investors are compensated for inflation through RPI indexation, and therefore the real return requirement should be expressed in relation to RPI.

Historical analysis of inflation

The annual inflation rates for 1998 to 2013, according to the CPI, the RPI and the GDP deflator, are shown in Figure 4.2 below.

Figure 4.2 CPI and RPI, 1998 to 2013



Source: ONS

We can observe the following:

- The most recent estimate for the CPI (as of December 2013) suggests inflation of 2.0%, in line with the Bank of England target rate.

- The most recent estimate for the RPI (as of December 2013) is 2.7%, implying a wedge of around 0.7 percentage points, which is close to the long-term average difference between the RPI and CPI of around 0.8 percentage points.

- The most recent (as of Q3 2013) inflation estimates based on the GDP deflator are slightly lower than inflation estimates based on CPI and RPI. Inflation based on the GDP deflator has broadly averaged around 2.2% over the last 3 years. On average, historically GDP deflator inflation has been higher than CPI inflation as globalisation has put downward pressure on consumer goods prices relative to the prices of other goods in the economy.

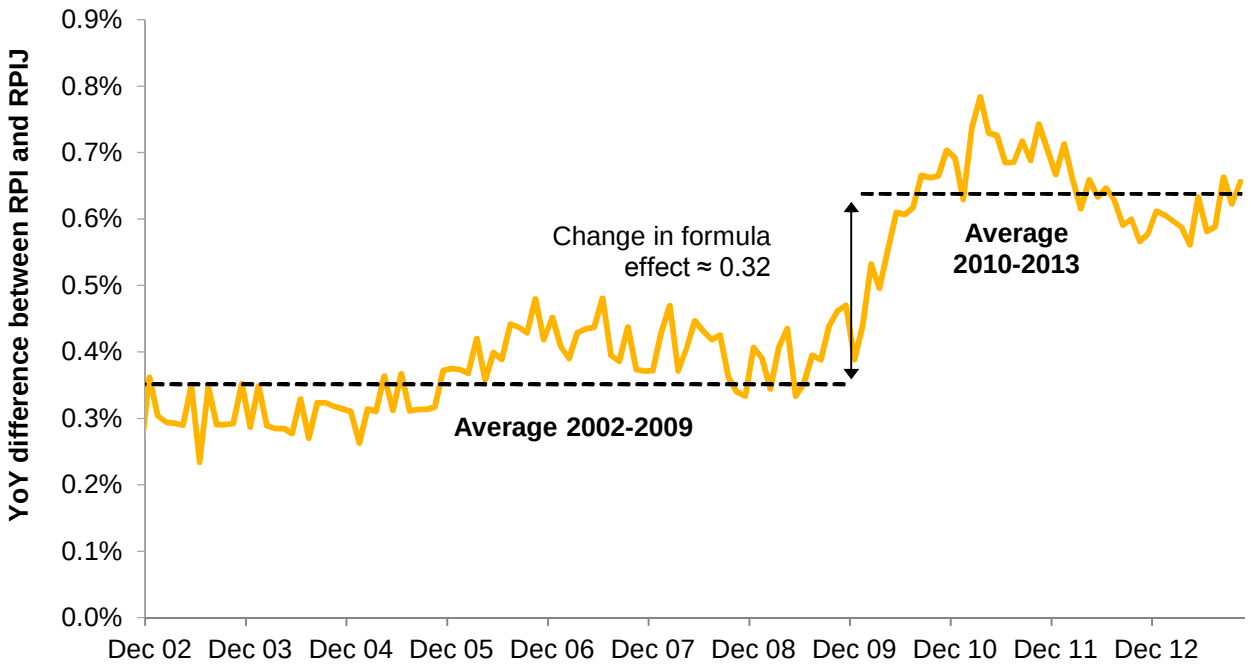
Changes to ONS calculation of RPI

In January 2010, the Office of National Statistics (ONS) changed the way it compiled RPI by introducing an improved measurement of the prices for clothing and footwear. This increased the dispersion of price data, and as a result, the so-called "formula effect" (the difference between CPI and RPI resulting from the differing methods of calculating each index) increased[16].

Separately, in 2012, the ONS consulted on whether there should be a change to the way the RPI is calculated to bring the calculation method, but not the coverage, in line with CPI. Specifically, the proposed RPIJ measure would use the same geometric mean ("Jevons") calculation for price changes rather than the arithmetic mean ("Carli") calculation method used for the RPI. However, in its final recommendations the ONS left the calculation of the official RPI unchanged.

By comparing movements in the RPI and RPIJ, we can isolate the impact associated with the 2010 change in the RPI calculation. Figure 4.3 below shows this change, which represents a permanent increase in the formula effect of around 0.32 percentage points with the total formula effect from January 2011 to October 2013 increasing to an average of 0.63 percentage points.

Figure 4.3: YOY Differential between RPI and RPIJ



Source: Office for National Statistics (November 2013), PwC Analysis

[16] ONS (2011): *CPI and RPI: increased impact of the formula effect in 2010.*

This change has led to an increase in measured RPI, but with little impact on CPI, or the overall nominal returns required by investors. This means continued use of an RPI-index linked price control and RPI linked capital return with updated forecast RPI assumptions, but with real returns calculated on a historic basis could risk over-rewarding investors.

It would not be practical to use a different, or adjusted measure of inflation in the price control, so the real cost of capital must be calibrated to this new higher basis of calculating RPI. This is simple in the case of debt, because we can use up to date forecasts of RPI to calculate the real cost of debt. It is also simple in the case of forward looking techniques to assess the cost of equity which use up to date forecasts of RPI, but historical measures of real returns do not adjust for this effect. We therefore incorporate this effect into our assessment of total equity market returns in Section 7.1.

Forecasts for inflation

This section reviews current forecasts for inflation. For RPI this will include the impact of the ONS changes set out above. HM Treasury's summary of the most recent independent forecasts for 2014 for CPI and RPI are shown in Table 4.3 below. For 2014, the average forecast suggests CPI inflation of 2.4% and RPI inflation of 3.1%, a wedge of around 0.7 percentage points. However, these results should be interpreted with caution because of the wide spread between the high and low end estimates, implying a high degree of uncertainty around these estimates. Nonetheless, these forecasts suggest that CPI inflation and RPI inflation estimates are broadly expected to remain near their current level (as of December 2013).

Table 4.3 CPI and RPI – HMT's summary of independent forecasts (January 2014)

Inflation forecasts (%)		March	
Forecasts for 2014	**Average**	**Low**	**High**
CPI (%)	2.4	1.6	3.7
RPI (%)	3.1	2.3	4.0

Source: HM Treasury.

Table 4.4 shows inflation forecasts published by the OBR, which look further ahead than those published by the Treasury. These forecasts show that the OBR expects the CPI and RPI to diverge, consistent with the table above. RPI inflation is expected to increase to above 3%, suggesting the OBR expects the RPI-CPI wedge in the future will likely be larger than the long term average.

Table 4.4 CPI and RPI – OBR's forecasts (December 2013)

Inflation forecasts (%)	2013	2014	2015	2016	2017	2018
CPI (%)	2.6	2.3	2.1	2.0	2.0	2.0
RPI (%)	3.1	2.9	3.3	3.6	3.7	4.0

Source: OBR

Implied inflation

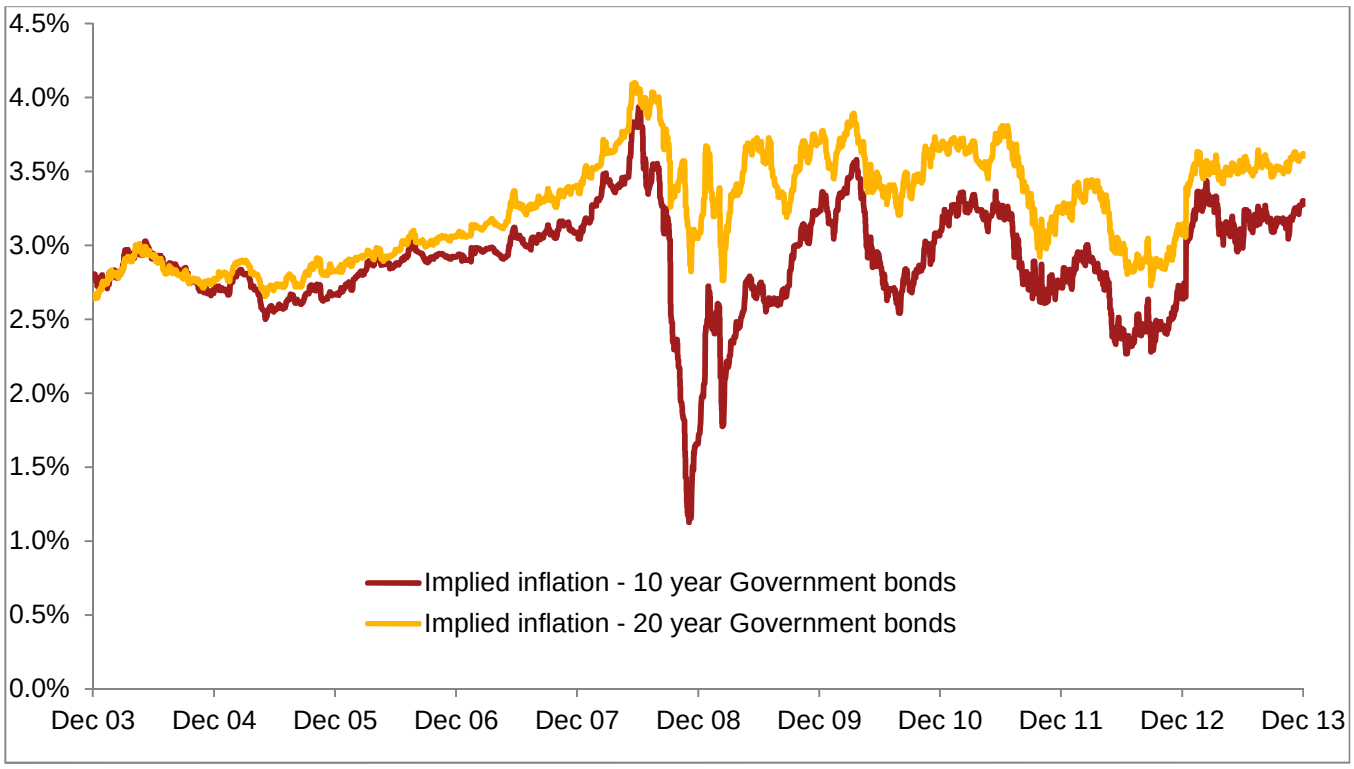
Expectations of future RPI inflation can also be determined by examining the difference in yields between nominal and index-linked government bonds. This is because an index-linked government bond provides the holder with a fixed real yield and inflating principal[17]. However, as the difference between indexed and non-

[17] See 'Notes on the Bank of England UK Yield Curves', Bank of England, 2002, for more details. Available online at http://www.bankofengland.co.uk/statistics/yieldcurve/notes%20on%20the%20bofe%20uk%20yield%20curvesV2.pdf.

indexed bond yields may reflect factors other than inflation expectations, care needs to be taken when using this approach.

The difference between nominal and real yields for 10 and 20 year UK government securities is shown in Figure 4.4. Since late 2007, this difference has been relatively volatile, declining sharply towards the end of 2008 as yields on (nominal)UK government securities declined sharply (relative to ILGs) because of a loss of investor confidence in financial markets and a flight to quality into government securities. Since 2009, the implied inflation estimates have risen but are still volatile, although to a lesser extent than during the peak of the financial crisis. Currently, implied inflation estimates based on 20 year government bonds are higher than comparable estimates based on 10 year government bonds.

Figure 4.4 Implied inflation estimates



Source: Datastream.

Conclusion on inflation

For our RPI inflation assumption in RP2 we use an RPI estimate of 2.8% and a CPI estimate of 2%. These estimates combine historical trends, implied inflation from government bonds (allowing for a small inflation risk premium[18]) and forecast estimates. The 2.8% estimate is consistent with current data on RPI reported by Office for National Statistics as well as the OBR's expectation of implied RPI inflation in 2014. However, it is lower than long term forecasts for RPI (for example those produced by the OBR) as our proposed approach combines the expected trends in CPI with an estimate of the long term wedge between the CPI and the RPI. The 2% CPI estimate is consistent with the long term expectations of the OBR and the Bank of England. It also implies a RPI-CPI wedge of 0.8 percentage points, which is close to the historical wedge between RPI and CPI inflation.

[18] The average inflation risk premium between 1997 and 2007, as calculated by the Bank of England, was 0.3%. Bank of England, *Quarterly Bulletin*, 2012 Q3, Volume 52, no. 3.

5. Gearing

This Section sets out our views on the appropriate gearing assumption for NERL for RP2. We first review CAA's approach in RP1, then set out our approach for estimating gearing. We then analyse NERL's actual gearing, review the regulatory precedents on gearing assumptions across various sectors, and finally conclude with our overall view on the appropriate gearing assumption for NERL for RP2.

In the context of regulatory determinations, gearing is generally estimated as net debt divided by RAB and is used in the WACC calculation to weight costs of the different sources of financing, debt and equity.

5.1. CAA's approach in CP3

When setting the cost of capital for NERL for RP1, the CAA used a two tier approach that included a gearing target of 60% and a gearing cap of 65%, which operated together with a clawback to remove the tax benefit from gearing above 60%. The target gearing assumption was aimed at representing an appropriate assumption for NERL, as the CAA noted:

"In arriving at the appropriate level of the target and cap, (the CAA) reached its judgement based on the residual cash available for distribution; a margin of 5 per cent consistent with NERL's current financial strategy and gearing of 65 per cent consistent with an underlying credit rating of A-/A3 facilitating access to finance on acceptable terms." [19]

The CAA considered this approach to be appropriate (as opposed to a prohibition on gearing exceeding the cap), "*as it allowed NERL to temporarily increase gearing above the cap in order to ride out financial difficulties but it clearly limits, in a flexible and targeted way, NERL's ability to stay above the cap to only as long as is necessary"* [20]. Additionally the CAA noted:

"The CAA remains of the view that it is appropriate to regulate finance directly in order to meet its statutory duties. Specifically, the CAA considers that placing restrictions on NERL's financial structure can further the interests of users while securing that NERL will not find it unduly difficult to finance its licensed activities and imposing the minimum of restrictions consistent with the exercise of the CAA's regulatory functions.....The CAA does not agree that the level of the cap has a material impact on NERL's operating flexibility, not least because NERL's current gearing of 57 per cent sits below the level of the CAA's proposed cap of 65 per cent. The CAA also does not agree that a gearing cap could be described as an encumbrance or a de facto second tier of management for the same reason." [21]

The CAA has therefore been more prescriptive in guiding capital structure, compared to the notional gearing assumptions used by other regulators. As a consequence, we would expect NERL's actual gearing to fluctuate around the 60% figure, but financing/investment needs and efficient debt issuance may result in NERL deviating from this 60% figure for extended periods. We continue to recommend using a notional gearing assumption, informed by the actual gearing for NERL, supported by observations on the target credit rating and financeability ratios, and a review of regulatory precedents and the capital structures adopted by regulated firms in other sectors.

[19] CAA (2010), "NATS (En Route) plc price control: Formal proposals for the control period 3 (2011-2014): under Section 11 Transport Act 2000", page 57, October.

[20] CAA (2010), "NATS (En Route) plc price control: Formal proposals for the control period 3 (2011-2014): under Section 11 Transport Act 2000", page 68, October.

[21] CAA (2010), "NATS (En Route) plc price control: Formal proposals for the control period 3 (2011-2014): under Section 11 Transport Act 2000", page 63, October.

5.2. NERL's actual gearing

Table 5.1 below shows the evolution of NERL's actual gearing over recent years. It has remained broadly stable (or declined slightly) over the course of RP1 and is currently lower than the target gearing of 60% set by the CAA in CP3.

Table 5.1 NERL's gearing (Net debt/RAB)

	Year (31st March)				
	2009	**2010**	**2011**	**2012**	**2013**
NERL's gearing (%)	59.2	57.4	54.0	55.6	51.6

Note: Gearing is estimated as net debt divided by average RAB for the year.

Source: Regulatory and Annual Accounts.

5.3. Target credit rating and market evidence

In forming a view on the appropriate gearing for NERL, we have targeted a stand-alone credit rating A-. This is consistent with the CAA's target stand-alone rating for NERL, its financeability analysis of the business and NERL's current stand-alone rating. This suggests that there is sufficient headroom to maintain the current stand-alone rating at higher gearing of 60%.

We also review gearing on selected A- rated utilities with the results summarised in Table 5.2 below. This suggests a notional 60% assumption is broadly consistent with the gearing for other A- rated utilities of 58%.

Table 5.2 Gearing across UK utility companies

Company	**Net Debt/RAB (%)**	**Credit rating**
Heathrow	68% (senior only)	A-
Scottish and Southern Energy	55%	A-
National Grid Electricity Transmission	57%	A-
National Grid Gas	52%	A-

Source: Regulatory Accounts.

5.4. Regulatory precedents

In its assessment of the cost of capital for Heathrow and Gatwick in 2013 (Q6), the CAA used a notional gearing estimate of 60% for Heathrow and 55% for Gatwick, which it considered was consistent with a target credit rating of BBB+/A-[22]. Evidence on gearing assumptions across other regulated sectors over the last 4-5 years is summarised in Table 5.3 below and supports a range of 50% to 65%, with Ofgem's final determination on the RIIO Gas distribution price control in December 2012 (as well as DPCR5) being at the top end of this range. We review the relative risk of the business in the Section 7, but generally consider NERL to have a medium level of risk compared to other regulated sectors, so a 60% notional gearing assumption for NERL is consistent with this range.

[22] CAA (2013), "Economic regulation at Heathrow from April 2014: notice of licence", January.

Table 5.3 Regulatory precedent on gearing

Regulator	Gearing (%)
CAA March 2008 (Q5 Heathrow and Gatwick)	60
ORR October 2008 (PR08, CP4)	60
CAA March 2009 (Q5 Stansted)	50
Ofwat November 2009 (Water and sewerage)	57.5
Ofgem December 2009 (DPCR5)	65
CC August 2010 (Bristol Water)	60
CAA December 2010 (NERL)	60
Ofcom July 2011 (WBA)	50
Ofgem November 2011 (TPCR4 rollover)	60
Ofcom April 2012 (ISDN)	50
Ofgem December 2012 (RIIO gas distribution)	65
ORR October 2013 (PR13, CP5)	62.5
CC November 2013 (Northern Ireland Electricity, Provisional Findings)	50
CAA January 2014 (Q6 Final Determination) – Heathrow	60
CAA January 2014 (Q6 Final Determination) – Gatwick	55
Ofwat PR14 Risk and Reward Guidance	62.5%

Source: Final regulatory determinations.

5.5. PwC view on appropriate gearing

Our analysis suggests that NERL's actual gearing is broadly consistent with the target notional gearing assumption of 60%, but we note that the business has some flexibility in its current gearing. The 60% assumption is also consistent with the evidence on regulatory precedents and the average across other utility companies with A- rating. We therefore conclude that the 60% assumption is appropriate for RP2.

6. Cost of debt

In this Section we set out our estimate for the appropriate cost of debt for NERL for RP2. The cost of debt compensates debt investors for providing debt financing and bearing the risk of default. When estimating the cost of debt, regulators, such as the CAA, typically make a distinction between the cost of embedded and the cost of new debt before forming an overall view on the appropriate cost of debt which combines the two in a given proportion. Where the cost of debt has fallen, this approach protects companies from the cost of efficiently incurred historic debt issuance, while also allowing customers to benefit from current and future (lower) interest rates. The cost of embedded debt represents the current cost of previously issued debt, whereas the cost of new debt reflects a forward looking cost associated with debt financing in the future (over the RP2 price control period).

Typically, the cost of embedded debt can be estimated with reference to the yield to maturity (YTM) at issuance for currently outstanding bonds. The cost of new debt is estimated with reference to traded yields or benchmark indices[23]. Regulators also provide an explicit allowance for debt arrangement and commitment fees (combined as issuance fees) to compensate companies for the transaction cost of raising debt financing.

In RP1, the CAA set a cost of capital of 3.6% for NERL. This was based on a 70%/30% split for embedded (3.6%) and new debt (3.25%) and included a 10 basis point allowance for debt issuance fees. The CAA's proposed estimate was based on a target credit rating of A- and was fixed over the duration of the price control review period.

6.1. Approach towards estimating the cost of debt

The cost of debt for NERL should be an appropriate blend of efficiently incurred costs of debt issued during previous price control periods and the new efficient costs of debt over the course of RP2. Given the CAA's explicit duty to ensure NERL can finance itself, it is appropriate to allow NERL to recover the cost of efficiently incurred embedded debt. Consistent with the CAA's approach in RP1, our approach focuses on estimating the cost of debt for NERL for RP2 with reference to its actual financing costs. Our relative weights for embedded debt and new debt reflect the need for refinancing (or new financing) over the course of RP2. To the extent that NERL does not require significant re-financing over the course of RP2 we consider it appropriate to use a high ratio of embedded debt to new debt.

An important consideration in estimating the cost of debt is the treatment of the implicit government guarantee i.e. investors' expectation that NERL would receive extraordinary government support in case of financial distress, given both its strategic national importance and partial government ownership. NERL's current rating is AA-, which incorporates a two notch uplift for the implicit guarantee compared to its stand-alone credit rating of A-[24].

There are a number of different conceptual approaches for dealing with the implicit government guarantee and the estimation of the cost of debt. These can broadly be grouped across the following:

- **Incorporate the guarantee** – under this approach the cost of (debt) capital for NERL is estimated incorporating the benefit of implicit government support. Essentially, the cost of debt would be calculated

[23] The cost of debt can be estimated directly with reference to traded yields on a company's bonds or benchmark indices. It can also be estimated by adding the spread on a company's bond (or a comparable rating instrument) compared to the benchmark indices to the risk-free rate. In principle, both approaches are appropriate and should yield broadly similar results. However, given the current macroeconomic environment and continued uncertainty associated with trends in the risk-free rate (proxied by the yield on government bonds) we believe that the direct estimation approach should be preferred.

[24] Standard & Poor's (2013), "UK Air Traffic Controller NATS (En Route) Outlook Revised to Negative After Similar Action on UK: AA- Rtg Affirmed", RatingsDirect, September, December

based on an AA- rating. This yields a lower estimate for both the cost of debt and WACC, compared to a standalone situation (where the benefit from the implicit support in terms of cheaper financing is removed). This approach would lead to lower charges for the provision of air traffic services. Customers (i.e. airlines) benefit from the implicit guarantee but the owners of the business (investors) do not benefit from the guarantee. The government is also not compensated for the provision of its implicit support.

- **Commercial approach** – under this scenario NERL is treated as a stand-alone commercial entity without incorporating the benefit associated with the implicit government support. Therefore, the cost of debt is estimated assuming a rating of A- without the two notch rating support. Using this approach would lead to a windfall benefit for investors, without the government explicitly drawing any benefit (compensation) from the provision of implicit support. Moreover, consumers (airlines) would not benefit as the regulatory cost of capital would be higher compared to the treatment above where the pricing incorporates the benefits associated with government support (as set out in the scenario above).

- **Commercial approach including additional fee for the government guarantee** – This approach is similar to the commercial approach set out above but rather than the benefit from the government's implicit support accruing to investors (or owners), the government is explicitly paid a fee for the provision of the implicit support (similar to an insurance premium). The cost of capital for the business is estimated using the stand alone credit profile level (and thus remains unchanged from the commercial approach set out above) but the value of the benefit associated with the guarantee is passed on to the government as a separate payment. Airline customers pay a fair economic price which reflects the benefit to them of continuity of service should NERL go into financial distress and the government intervenes. There are a number of different approaches for estimating the cost of provision of implicit support. A number of academics and practitioners have looked at the cost associated with the provision of such guarantees for financial institutions[25]. Additionally, the difference between the cost of capital estimate under the scenario with and without the government support (the two approaches above) can also provide a reasonable estimate of the value of the guarantee.

The different approaches lead to different allocations of the benefit of government support across stakeholders (consumers, investors and the Government). The preference towards any approach thus is driven by underlying regulatory objectives. In the past, the CAA has not made any explicit adjustment for the provision of implicit government support for NERL (which is different to the approach ORR takes for Network Rail where there is an explicit quantification of the benefit of its public ownership model[26]). In our view, given the CAA is not considering setting a formal quantification of implicit government support, we consider the approach which incorporates the benefit of government support into the cost of capital assessment is appropriate. This leads to a lower cost of debt and lower charges, rewards investors fairly while still allowing the CAA to fulfil its financing duty with respect to NERL. Customers effectively receive the service continuity benefit of the government guarantee without effectively paying for it. When estimating the cost of new debt, we therefore, focus on an AA- rating and assume NERL finances itself using long term debt of 10-15 year maturity debt.

In summary, when estimating the embedded debt, we review the following:

- The historical average of the yield on 10-15 year maturity AA- rated benchmark debt; we construct the AA- rated index using the A and AA rated benchmarks, and

- The yield to maturity at issuance that NERL has been able to achieve on its debt portfolio, benchmarked against comparable issuances at the time from other sectors.

When estimating the cost of new debt, we review the following:

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[25] For example, Moody's (2011), "Quantifying the value of Implicit Government Guarantees for Large Financial Institutions", January and Bank of England (2012), "The Implicit Subsidy of Banks", Financial Stability Paper No.15, May and Frank, J and Acharya (2010), "Capital Budgeting at Banks: The role of Government Guarantees", June.

[26] ORR (2013), "Periodic Review 2013: Final Determination of Network Rail's Output and Funding for 2014-2019", page 496, October.

- The current yield on 10-15 year maturity A and AA rated benchmark debt. Given NERL's current rating of AA-, we focus on these indices and also refer to the AA- benchmark (see details below); and

- The current yield on NERL's one traded bond.

We have also reviewed the indexation approach used by Ofgem for assessing the cost of debt in its RIIO price control model[27]. This uses a 10 year trailing average of the iBoxx debt indices for A and BBB credit rated bonds with maturities over 10 years. Like the embedded debt approach it includes both historical debt costs and, in the way it rolls forward, new debt financing costs. We are aware that views on the appropriateness of debt indexation approach vary. For the purpose of financing NERL, we consider that its financing (both existing and potential future needs) is more bespoke than for other utility sectors, and given its small size and infrequent debt issuance programme, a rolling refinancing profile assumption is less applicable. We therefore do not consider the debt indexation approach to be appropriate for NERL for RP2.

6.2. Cost of embedded debt

The cost of embedded debt reflects the cost during RP2 for previously issued debt financing. It can be observed directly from the yield to maturity (YTM) at issuance on NERL's own bond and by reference to historical yields on comparable rated benchmark indices. It is also useful to cross check the YTM at issuance across other comparable businesses to ensure only efficiently financed debt is included in the cost of debt assumption. As NERL's business plan suggests limited need for any new debt financing over RP2, the overall cost of debt assumption is heavily influenced by NERL's embedded debt costs. Table 6.1 below shows the YTM at issuance for NERL's bond as well as evidence on debt issued by other utility companies at the time, with broadly similar ratings and maturity. The YTM at issuance on NERL bond maturity in March 2026 with a £600m face value at issuance was 5.4%, which is consistent with the evidence across other issuances at the time.

Table 6.1 Yield to maturity at issuance NERL and other utilities

Issuer	Issue date	Maturity date	Issuance amount	YTM at issuance	Coupon	Coupon frequency	S&P rating
National Grid Co plc	Sep 2003	Sep 2008	400	4.2	4.1	Annual	n/a
National Grid Co plc	Mar 2003	Dec 2010	250	4.9	4.8	Annual	n/a
NATS (En Route) plc	Aug 2003	Mar 2026	600	5.4	5.3	Semi-annual	AA-
United Utilities Group plc	Jun 2003	Jun 2018	150	4.7	4.6	Semi-annual	n/a
Southern Water Services (Finance) Ltd	Jul 2003	Mar 2026	350	5.5	6.6	Annual	A-
Southern Water Services (Finance) Ltd	Jul 2003	Mar 2029	350	5.2	6.2	Annual	A-
South East Water Ltd	Jul 2004	Mar 2029	166	5.6	5.6	Annual	BBB

Source: Dealogic, PwC Analysis.

In Section 6.3 below, we set out the historical 5 and 10 year average yield on 10-15 year AA and A rated benchmark indices which ranges between 5.2% (AA) to 6.0% (A) (see Table 6.2). This suggests that NERL has been able to issue debt towards the lower end of the range for benchmark indices of comparable ratings. This is also consistent with evidence across the Designated Airports presented in our report for the CAA, where Heathrow and Gatwick on average had been able to issue debt at lower yields compared to the benchmark indices.

[27] Ofgem (2013), "Strategy decision for the RIIO-ED1 electricity distribution price control – Financial issues", March.

In estimating the cost of embedded debt, we think it is more important to focus on NERL's own outstanding bond. As NERL is a unique asset with relatively transparent financing arrangements, the CAA is able to set a cost of debt which is appropriate for NERL. This contrasts to sector regulation with differing financing arrangements, where regulators typically take a more wide ranging benchmark approach to setting the cost of debt rather than basing it on actual financing costs.

Overall, our analysis suggests that a nominal embedded cost of debt of 5.4% is appropriate. Adjusting for our inflation assumption of 2.8% using the Fisher equation, this produces a real cost of embedded debt of 2.5% over RP2.

6.3. Cost of new debt

NERL's current business plan shows there is no significant capital funding requirement over RP2 and the RAB is projected to decline over the control period. This suggests limited need for any new debt over RP2. However, NERL has indicated[28] that it will issue another fixed rate nominal bond towards the end of the upcoming control period with a notional value of around £100m. Therefore, the proportion of new debt in our overall cost of debt should be small, consistent with the NERL actual financing requirements.

The cost of new debt can be estimated directly with reference to redemption yields on benchmark indices with comparable ratings to NERL, or alternatively in relation to NERL's own traded bonds. We combine the two to estimate the cost of new debt.

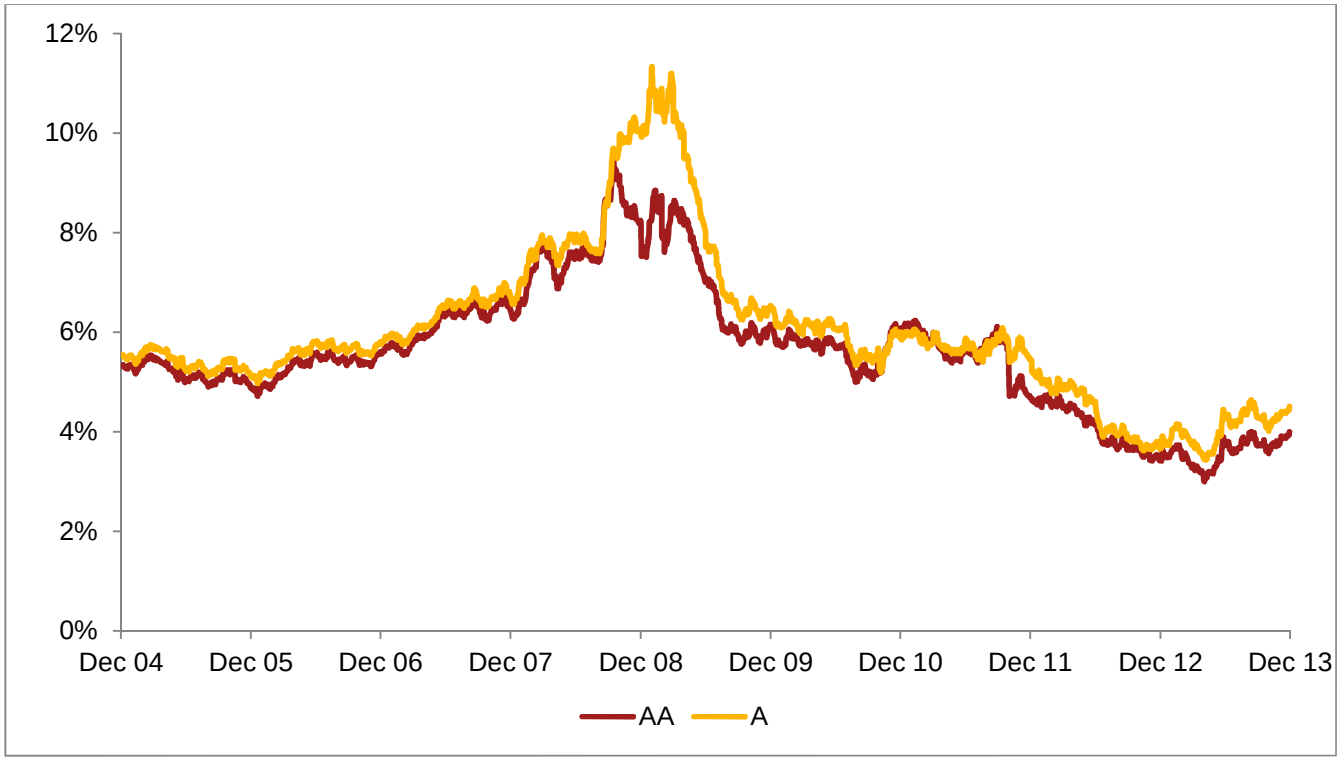
6.3.1. Evidence from benchmark indices

NERL's current rating is AA-, so we focus on A and AA rated benchmark indices. Figure 6.1 below shows the evolution of yields on 10-15 year maturity A and AA rated benchmark indices over the last few years. The yield on these benchmarks increased significantly during the peak of the financial crisis due to elevated levels of market uncertainty, but they subsequently declined as a consequence of continued macroeconomic weakness, the flight to quality effects and monetary support from the Bank of England.

More recently, as macroeconomic conditions have improved and with expectations of tapering of the QE programme (see the section on the risk-free rate for details), yields on benchmark indices are now on an upward trajectory.

[28] NATS En Route Plc Business Plan, Financing assumptions.

Figure 6.1 Yield on benchmark corporate bond indices



Note: Chart shows non-gilt redemption yields for 10-15 year maturities.

Source: Datastream.

Table 6.2 below sets out the average yield on 10-15 year maturity A and AA rated benchmark indices across different time periods. The current yields of 3.97% (AA) and 4.48% (A) are higher than the one year average estimates of 3.59% (AA) and 4.06% (A) – reflecting the upwards trajectory in recent months. The long term averages (3-5 year) are higher than spot estimates as they incorporate the impact of the financial crisis on yields on corporate debt (among others the flight to quality effects as discussed above). We also estimate the redemption yields for an AA- rated benchmark which is estimated as a weighted average yield of the A and AA rated indices where we give a 75% weight to AA and a 25% weight to the A rated benchmark. The current spot yield on this AA- rated benchmark is 4.10%.

Table 6.2 Average yield on AA, A and BBB rated indices

Nominal Yield (%)	10 – 15 year AA rated	10 – 15 year A rated	10-15 year AA-
Current rate (30th December 2013)	3.97	4.48	4.10
6 month average	3.77	4.30	3.90
1-year average	3.59	4.06	3.71
2-year average	3.84	4.23	3.94
3-year average	4.44	4.74	4.51
5 year average	5.21	5.70	5.33
10 year average	5.61	5.99	5.70

Source: Datastream, PwC Analysis.

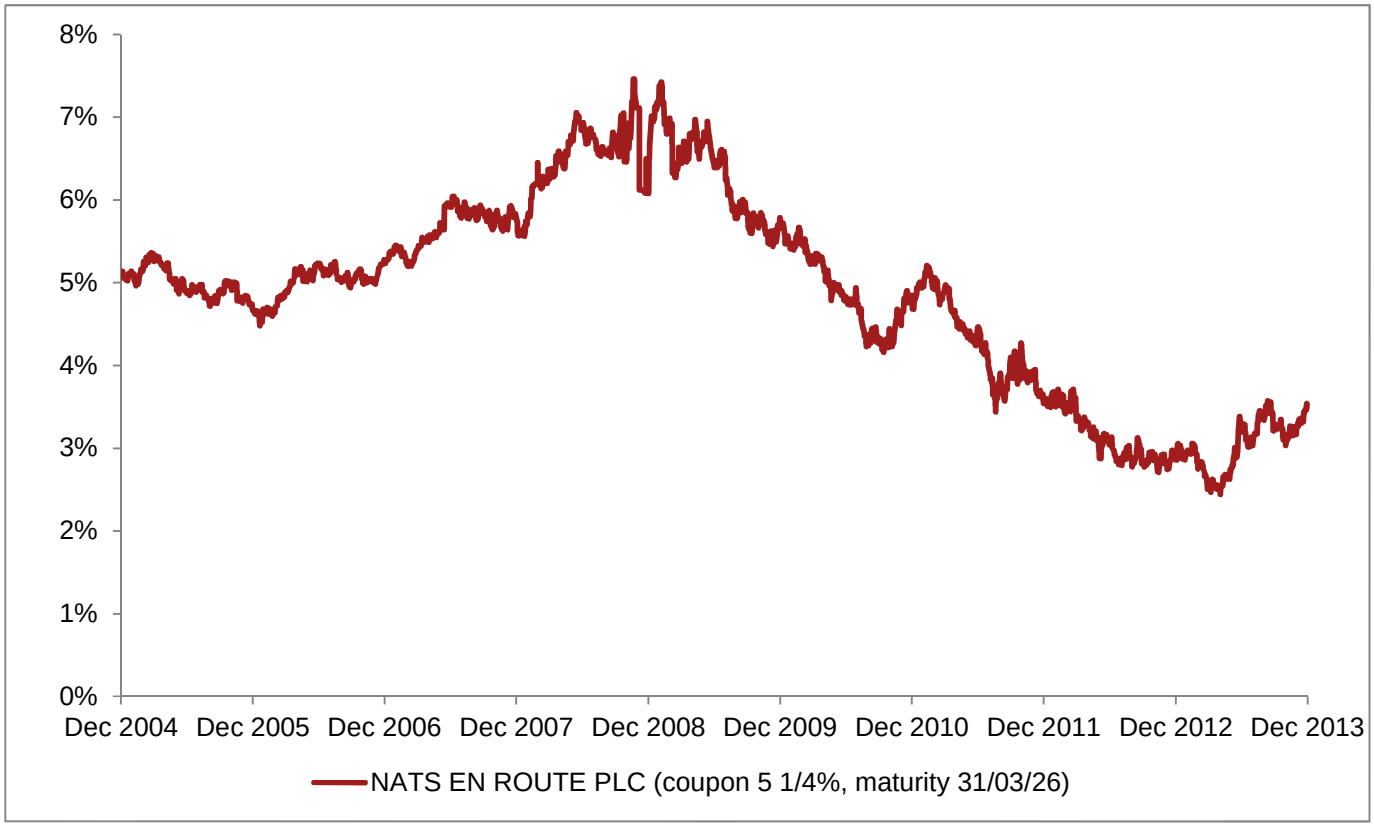
Yields on A and AA rated benchmark indices suggest a current nominal cost of debt of 4.0% to 4.5%, which, adjusted for our RPI inflation assumption of 2.8% using the Fisher equation, suggests a real cost of new debt of around 1.1% to 1.6%. The current real cost of debt based on the AA- rated index is 1.3%, which is within the range for the cost of debt based on A and AA rated benchmarks but closer to AA. While the yields on benchmark indices have increased more recently, they are still below long term historical averages and hence it might be imprudent to assume that they continue at such levels over RP2. Although it is inherently difficult to forecast the trends in yields on benchmarks or associated credit spreads, we can use forward yields on government bonds to ascertain the expected trends in yields on government bonds (the risk-free rate). As set out in the Section on the risk-free rate, the difference between the yield on current 10 year government bonds and the 10 year forward rate for June 2017 is around 85 basis points. Consistent with our work on Designated Airports we do not apply this full uplift, as we expect the unwinding of Quantitative Easing to have a greater impact on government bond yields, compared to corporate bond yields. This reduces our uplift to the cost of new debt to around 0.7 percentage points.

We combine the projected increase in the current estimates to calculate an overall cost of new debt based on benchmark indices of 1.8% to 2.3%.

6.3.2. Evidence from NERL's bond

As set out in the section on embedded debt, NERL currently has only one bond outstanding, which was issued in 2003 with a face value of £600m and a 23 year maturity. Figure 6.2 below shows the evolution of the yield on the bond over since 2003. The yield on NERL's bond was volatile during the financial crisis – similar to trends across other corporate bonds and benchmark indices. However, following the financial crisis the yield on the bond has been on a downward trend, which has only recently reversed slightly. The bond is currently trading at 3.52% as of 30 December 2013.

Figure 6.2 Yield on traded bond for NERL



Source: Datastream and PwC analysis.

Table 6.3 below shows the current and historical average yield for NERL's bond. The current rate of 3.52%, whilst higher than short term averages, is lower compared to longer term averages, reflecting the downward trends in yields on the traded debt of high rated corporates (such as NERL).

Table 6.3 Average redemption yields on traded bond – NERL

Nominal Yield (%)	Yield on traded debt (%)
Current (30th December 2013)	3.52
6 month average	3.27
1-year average	3.03
2-year average	3.08
3-year average	3.49
5 year average	4.34
10 year average	4.92

Source: Datastream, PwC Analysis.

The yield on NERL's bond is lower than the comparable yields on benchmark indices of A and AA (including AA-) rated indices, suggesting it is able to raise debt more efficiently compared to its AA- rating benchmark. Taking the 3.52% current yield and adjusting for RPI inflation (2.8%, using the Fisher equation) and adding the expected movement in corporate borrowing costs during RP2 (of around 0.7 percentage points), suggests a real cost of new debt of 1.4% - which is lower than the range of 1.8% to 2.3% based on benchmark indices.

In forming an overall view on the appropriate cost of new debt, we combine the evidence from NERL's traded bond and benchmark indices – giving more weight to the benchmarks and conclude that a range of 1.5% to 2.0% is appropriate for the cost of new debt for RP2.

6.4. Regulatory precedent

There have been a number of regulatory determinations on the cost of debt since RP1 across different sectors, as summarised in Table 6.4. The cost of debt markedly increased during the peak of the financial crisis as debt markets went through a volatile period. Based on regulatory precedents, the cost of debt ranges between 2.7% and 3.9%. While some of the numbers themselves might now be outdated, because of trends in debt markets, there is a visible trend towards lower cost of debt determinations by UK regulators (for example by Ofgem between 2011 and 2012, the CAA between Q5 and Q6, the ORR between CP4 and CP5 and Ofwat between PR09 and PR14 draft determination). The CC chose a point estimate of 3.4% for Northern Ireland Electricity in its provisional determination in November, which is slightly higher than the point estimate of 3.2% used by the CAA for Heathrow and Gatwick in its final determination for Q6[29]. Most recently, Ofwat used a point estimate of 2.75% for the real cost of debt in its draft determination for the appropriate WACC for PR14.[30]

We would expect these benchmarks to be higher than the cost of debt for NERL because of the differences in ratings assumed.

[29] CAA (2014), "Estimating the cost of capital: a technical appendix for the regulation of Heathrow and Gatwick from April 2014: Notices of the proposed licences", January.

[30] Ofwat (2014), "Setting price limits for 2015-2020 – risk and reward guidance", January.

Table 6.4 Regulatory precedent on the cost of debt

Regulator	Low (%)	Point estimate (%)	High (%)
CAA March 2008 (Q5 Heathrow and Gatwick)	-	3.55	-
ORR October 2008 (PR08, CP4)	-	3.38	-
CAA March 2009 (Q5 Stansted)	3.4	-	3.7
Ofwat November 2009 (Water and sewerage)	-	3.6	-
Ofgem December 2009 (DPCR5)	3.3	3.6	3.7
CC August 2010 (Bristol Water)	-	3.9	-
CAA December 2010 (NERL)	-	3.6	-
Ofcom July 2011 (WBA)	3.4	-	3.9
Ofgem November 2011 (TPCR4 rollover)	-	3.25	-
Ofcom April 2012 (ISDN)	3.4		3.9
Ofgem December 2012 (RIIO gas distribution)	-	2.9	-
ORR October 2013 (PR13, CP5)	-	3.0	-
CC November 2013 (Northern Ireland Electricity, Provisional Determination)	-	3.4	-
CAA January 2014 (Q6 Final Determination) – Heathrow	2.78	3.2	3.45
CAA January 2014 (Q6 Final Determination) – Gatwick	2.95	3.2	3.58
Ofwat PR14 January Draft Determination	2.70	2.75	2.90

Note: Ofgem and Ofcom report the debt premium, which has been added to their underlying estimate for the risk-free rate to estimate the cost of debt.

Source: Various regulatory determinations.

6.5. PwC view on the overall cost of debt for NERL

Our analysis of the cost of debt is based on the cost of both embedded and new debt.

Our analysis of existing debt for NERL is based on historical averages of benchmark yields and the yield to maturity at issuance on debt issued by NERL. Our analysis suggests a real cost of embedded debt for NERL of around **2.5%**.

Our estimate of the cost of new debt is based upon:

- Current market evidence on real yields on AA and A rated benchmark indices (including the notional AA-rated) and incorporates a forward looking adjustment which suggests a range of around **1.8% to 2.3%**; and

- Current market evidence on the real yields on traded debt for NERL, including the forward looking adjustment, which suggests a point estimate of around **1.4%**.

Combining the two, placing more weight on the market indices, we narrow the range to **1.5% to 2.0%**.

In combining the cost of embedded and new debt, we use the proportions for embedded and new debt consistent with NERL's business plan which suggests a limited need for any new financing over RP2. We consider a weighting of 80% embedded and 20% new debt as appropriate. This is also consistent with the evidence presented by NERL where it argues that its overall refinancing requirement for RP2 is relatively small and on average will represent around 20% of net debt at the start of RP2. We estimate an overall cost of debt

(without fees) of 2.3% to 2.4%. We also include an allowance of 10 basis points for amortised issuance costs and associated fees. This is the same as the fee allowance used by the CAA for Heathrow and five basis points lower than the allowance for Gatwick (as well as our advice for Stansted)[31]. We consider this appropriate because NERL raised a significant amount of its debt finance needs (£600m) through one bond issue and this has a long dated maturity. The size of the issuance is more comparable to some of Heathrow's issuances and has a long period over which to amortise costs.

Therefore, our overall cost of debt estimate (including fees) ranges between **2.4% to 2.5%**.[32]

[31] CAA (2014), "Economic regulation at Gatwick from April 2014: notice of the proposed licence", January.

[32] Note: The 2.4% to 2.5% represents rounded range. We add the 10 basis point estimate to the cost of debt range (without fees) of 2.32% to 2.42% - which yields an all in cost of debt of 2.42% to 2.52%.

7. Cost of equity

This Section sets out our approach and range for the cost of equity estimate we consider to be appropriate for NERL for RP2. We start by setting out our total equity market returns (TMR) estimate and then analyse the component parts of equity market returns under the CAPM framework (namely risk-free rate (RFR) and the equity market risk premium (EMRP)). We then analyse the equity beta in order to present our overall estimates for the range for the cost of equity. Our methodology for the generic market parameter estimates (i.e. the TMR and its component parts the RFR and EMRP) is the same as that in our report for the CAA on the Designated Airports. Our approach towards estimating the beta focuses on a relative risk analysis of NERL's risk profile against other regulated sectors and incorporates specific adjustments to reflect NERL's risk exposure.

In setting our views on the appropriate cost of equity for NERL for RP2, we consider two separate approaches based on the CAPM framework:

- Our primary approach represents equity market returns based on current market conditions. Essentially, this approach represents the returns currently required by equity investors to make investments, or retain investments in NERL; and

- Our alternative approach sets out a long term view of required equity returns. Under this approach, the required returns by equity investors are assumed to be consistent with a longer term or through-the-cycle view, and hence are based on calculations of longer term averages.

The outcomes for required equity returns differ under the two approaches and will depend on the timing within the economic cycle and prevailing financial market conditions. Our preferred methodology is to use returns that are based on a current market assessment as they represent the financing costs that are more applicable for the next five years of the RP2 price control review period. We use long term averages as a cross-check on estimates under the current market based approach.

7.1. Total equity market returns (TMR)

The TMR represents the returns available to investors for investing in the equity market as a whole, which are consistent with the aggregate risk profile of the equity market. As set out above in detail in Section 4, whilst the component parts of equity market returns can be volatile, the overall return for equity investors is generally considered to be more stable. Therefore, when determining the underlying component parts of the total equity market return, we consider it is preferable first to consider overall equity market returns and then consider how this can be divided into the RFR component and the EMRP. For a business with an equity beta of 1, there would be no need to deconstruct the total required equity market return, but unless NERL's equity beta is exactly 1 we need to carry out this deconstruction.

There are a number of different approaches for estimating the TMR. We have summarised below some of these approaches, and provide a range for the associated TMR estimates across each of these approaches. We provide details of our analysis and related evidence on TMR estimates across each of these approaches in Appendix 1.

Historical returns assessment – under this approach the TMR is estimated as the long term average (around 100 years or more) of historical equity market returns. This assessment provides the actual returns achieved in the market and uses this as a reasonable proxy for expected returns in the future. TMR estimates under historical approaches are reported by a number of different sources including DMS[33] and the Barclays Equity Gilts Study, and are quite sensitive to the methodology and inputs used, such as the method of averaging, the relevant time period of application, and geographic coverage. As set out in Appendix 1, analysis of (real) historical equity market returns (geometric average) suggests a slight downward trend in TMR since the financial crisis, with the most recent estimates (1900-2012) ranging between 5.0% (Barclays) and 5.2%

[33] Dimson, Marsh and Staunton (2013), "Global Investment returns sourcebook 2013", Credit Suisse, February.

(DMS). The geometric average estimates (as set out above) are lower than arithmetic averages (which is the preferred approach used by regulators in the UK) which suggests a range of around 5.0% to 7.0% over different holding periods between 1900-2010. We consider the top end of this range to be more appropriate and consistent with a shorter investment time period.

It is important to note that the historic assessments embed historic RPI. As set out in Section 4.4, there have been a number of changes to the calculation of RPI which have permanently increased the size of the formula effect. This means that RPI is likely to be higher in future than it would have been under the previous methodology (this is reflected in our assumption for RPI in Section 4). This RPI change will increase the rate of indexation of the RAB, but it has not increased investor nominal return requirements (disregarding other movements in the cost of capital calculation). This means that real returns do not need to be as high, so that overall nominal returns are maintained at the level prior to the ONS methodology changes. One way of incorporating this effect is to adjust the assessment of total historic (real) market returns for this effect. This would bring down the estimates by around 0.32%, based upon estimates from the ONS[34]. Forward looking approaches do not require such adjustment provided they use current estimates of RPI.

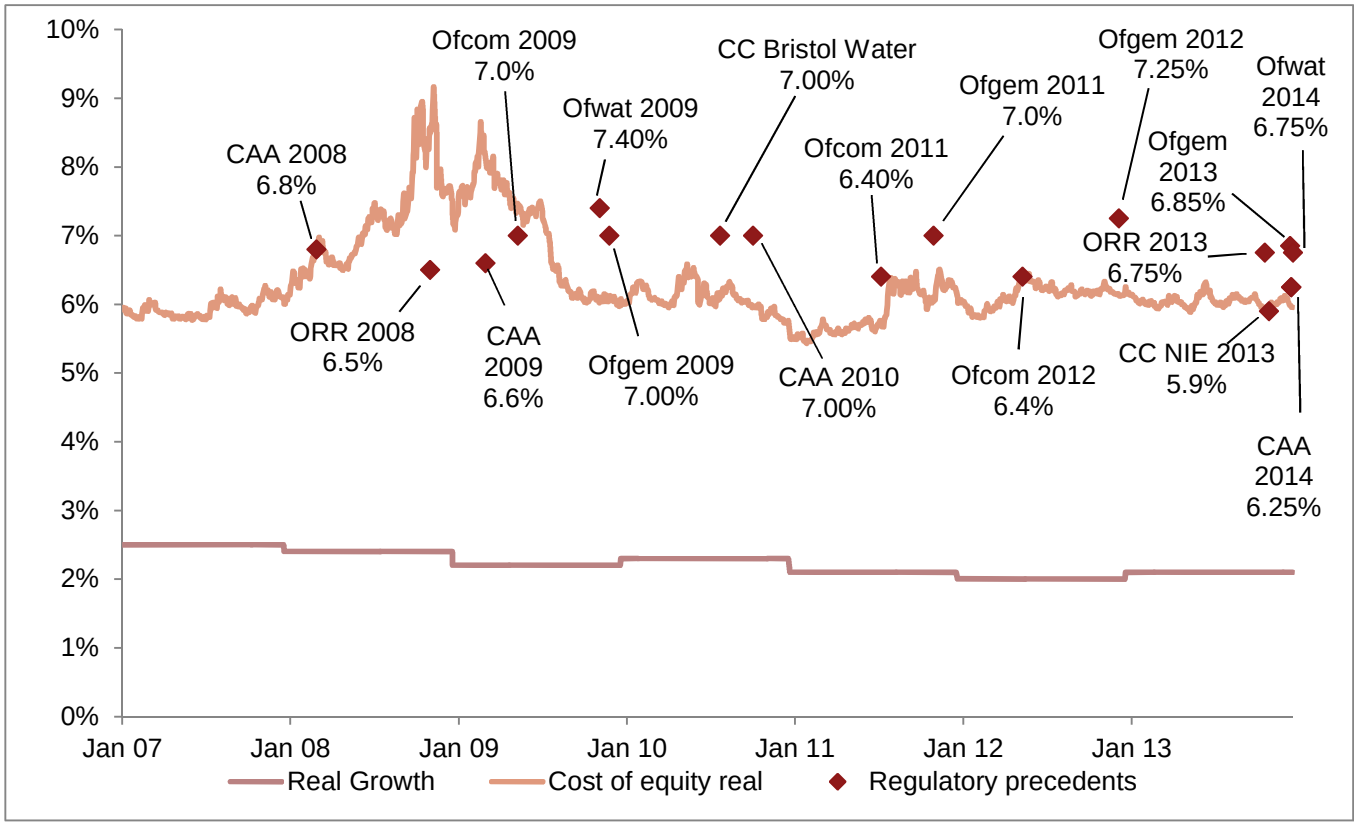
Forward looking approach – forward looking assessments of equity returns use market information provide an estimate of required future equity returns, for example using the divided growth model (DGM). To the extent that current market conditions are different to long term averages, for example where future expected economic growth is different to trend growth, analysis based on a forward looking assessment is likely to yield different results compared with historical approaches. As set out in Appendix 1, the market-wide implied cost of equity was volatile during the financial crisis; however it has settled in the range of 5.75% to 6.75% over the last few years.

In addition to DGM implied estimates, DMS also provide an assessment of forward looking equity market returns through adjusting historical equity returns. Applying a DGM type framework to the analysis set out by DMS (i.e. through adjusting components of historical equity market returns such as the dividend growth rate, dividend yield and price/dividend ratios) suggests a figure of 6.5%, at most, for real equity market returns.

Regulatory precedent – Another approach for benchmarking the range for the TMR is through analysis of regulatory decisions on TMR estimates. The CAA used a TMR estimate of 7.0% for NERL in RP1. Figure 7.1 below shows the range for the TMR estimates based on the forward looking (DGM) approach set out above with overlapping regulatory decisions over the last five to six years. The analysis of regulatory determinations suggests a range of 6.4% (Ofcom 2011) to 7.4% (Ofwat 2009) over the last 5-6 years, but recently regulatory determinations on the TMR are markedly lower than the top end of this range. The ORR in its recent determination for Network Rail (PR 13) used a TMR estimate of 6.75%, which is above the TMR range of 5.0% to 6.5% (with a point estimate of around 5.9%) used by the CC in its provisional determination for Northern Ireland Electricity in November 2013. Ofgem used a TMR estimate of 6.85% to assess the electricity distribution network operators' business plans for the RIIO ED1 price control. Similarly, the CAA in its final determination for Designated Airports for Q6 used a point estimate of 6.25% for the TMR. Most recently, Ofwat in its draft determination used a TMR range of 6.25% to 6.75%, with a point estimate of 6.75%. Overall, there has been a downward trend in the TMR figures used by UK regulators.

[34] ONS (2011), "Information note – CPI and RPI: increased impact of the formula effect in 2010", August.

Figure 7.1 Regulatory precedents on Total Market Returns



Source: Final regulatory determinations, PwC Analysis, Datastream

Combining evidence across the different approaches suggests that historical real returns on an arithmetic basis are broadly comparable to the forward looking cost of equity estimates implied from the DGM model. Both are somewhat lower than the regulatory precedents, but the more recent regulatory precedents seem to be consistent with evidence of declining TMRs. Our analysis of historical and forward looking techniques suggest a slight reduction in TMR estimates compared to RP1 and we therefore conclude that a range of **6.25% to 6.75%** for the TMR is appropriate. This is towards the top end of the range of historical estimates and focuses on shorter term holding periods. However, it is between 0.25 and 0.75 percentage points lower than the 7.0% previously estimated by the CAA for NERL for RP1, and in essence reflects (i) the small reduction in forward looking returns as a consequence of current economic conditions, (ii) a likely permanent reduction in expected returns in comparison to historical estimates and (iii) the impact of the changes to the calculation of RPI. This range is consistent with our range for the TMR in our advice to the CAA on the cost of capital for the Designated Airports.[35]

We now turn to the component parts of the TER.

7.2. Risk-free rate (RFR)

The RFR represents the returns available on risk-less investments, with zero or very low probability of default. Under the CAPM framework, the RFR is one of the generic parameters (along with the EMRP) i.e. it does not depend on, or vary with, company specific information when assessing the cost of equity and is typically estimated with reference to yields on government bonds. The nominal RFR can be directly estimated from

[35] Note in our final report to the CAA on the cost of capital for Designated Airports, we proposed a range of 6.25% to 6.75%, the CAA opted to choose a point estimate towards the bottom-end of the range.

yields on government bonds of appropriate maturity and the real RFR can be estimated by adjusting the nominal RFR for inflation or through analysis of yields on index-linked gilts (ILGs).

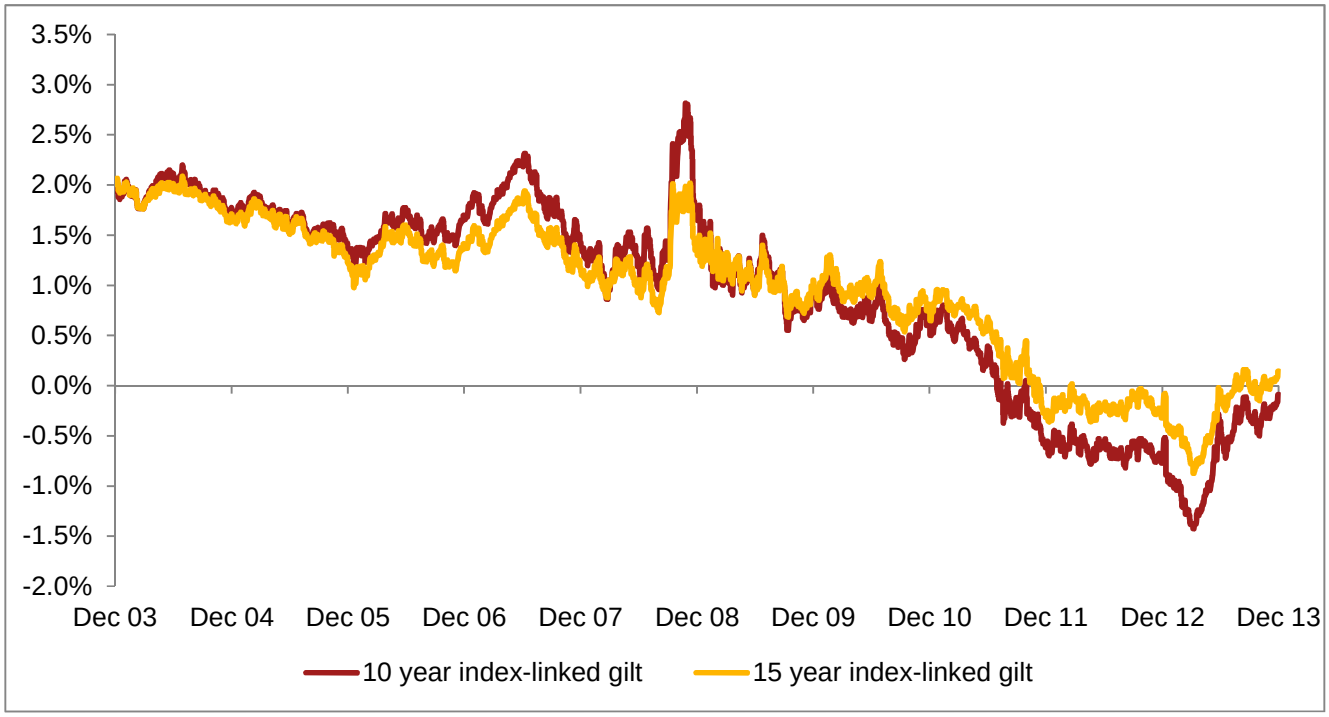
We estimate the real RFR based on both current market and long term returns, analysing evidence across ILGs and government bonds. We focus on government debt of 10-15 year maturity as this is consistent with a long term investment horizon of equity investors in infrastructure assets. Our analysis of the RFR in the main body of the report briefly presents our overall approach and underlying estimates, with the additional details provided separately in Appendix 2.

7.2.1. Evidence on index-linked Gilts (ILGs)

The yields on ILGs provide a direct estimate of the real RFR[36], and are often used as evidence when estimating the RFR for a cost of capital determination. In 2010, the CAA estimated the real RFR for NERL with reference to yields on 3, 5 and 10 year maturity ILGs. When advising the CAA on the appropriate cost of capital for the Designated Airports, we used yields on ILGs of 10-15 year[37] maturity when estimating the RFR. We continue to focus on these maturities for determining the appropriate RFR estimate for NERL for RP2.

Figure 7.2 below shows the evolution of yields on ILGs over the last 10 years. As set out above in Section 4, yields were particularly volatile during the financial crisis; however, they have since declined as a consequence of the flight to quality effects as well as the indirect impact of the Bank of England's QE programme on ILGs (the primary focus of which was on nominal government bonds). More recently, the yields have also increased as macroeconomic fundamentals have improved and there are increasing expectations of the QE stimulus coming to an end. The current yields (as of 30 December 2013) on 10 and 15 year maturity ILGs are -0.11% and 0.11%, respectively, with long term average (10 year) of around 1.0% (for details see Appendix 2).

Figure 7.2 Trends in yields on index linked gilts



Source: Bank of England and PwC analysis.

[36] Index-linked bonds are not totally insulated from inflation risk because of the timing of coupon payments.

[37] PwC (2013), 'Estimating the cost of capital in Q6 for Heathrow, Gatwick and Stansted, A report prepared for the Civil Aviation Authority (CAA)', April, page 51.

Whereas the historical performance of bond returns is a useful guide to the returns that have been achieved, and the current yield is a good guide of the returns that can be achieved at the moment, the best estimate of how future returns will move can be obtained from the market pricing implied in forward rate curves. As set out in detail in Appendix 2, our analysis of forward rates suggests the yields on ILGs are likely to increase by around 55 basis points over the next 2-3 years for 10-15 year maturity ILGs, as some of the flight to quality effects (and the implicit QE impact) unwind in conjunction with expectations of an improvement in economic conditions. We incorporate this forward rate adjustment to current yields to determine our estimate for expectations of yields on ILGs in the future.

Overall, our estimates for the RFR under the current market approach as well as the long-term returns approach using ILG information are summarised below:

- Current yields on ILGs range between -0.11% to 0.11% for 10-15 year maturity gilts. Incorporating an uplift of around 0.55%, consistent with evidence from forward rates, suggest forward looking rates of around 0.44% to 0.66%.

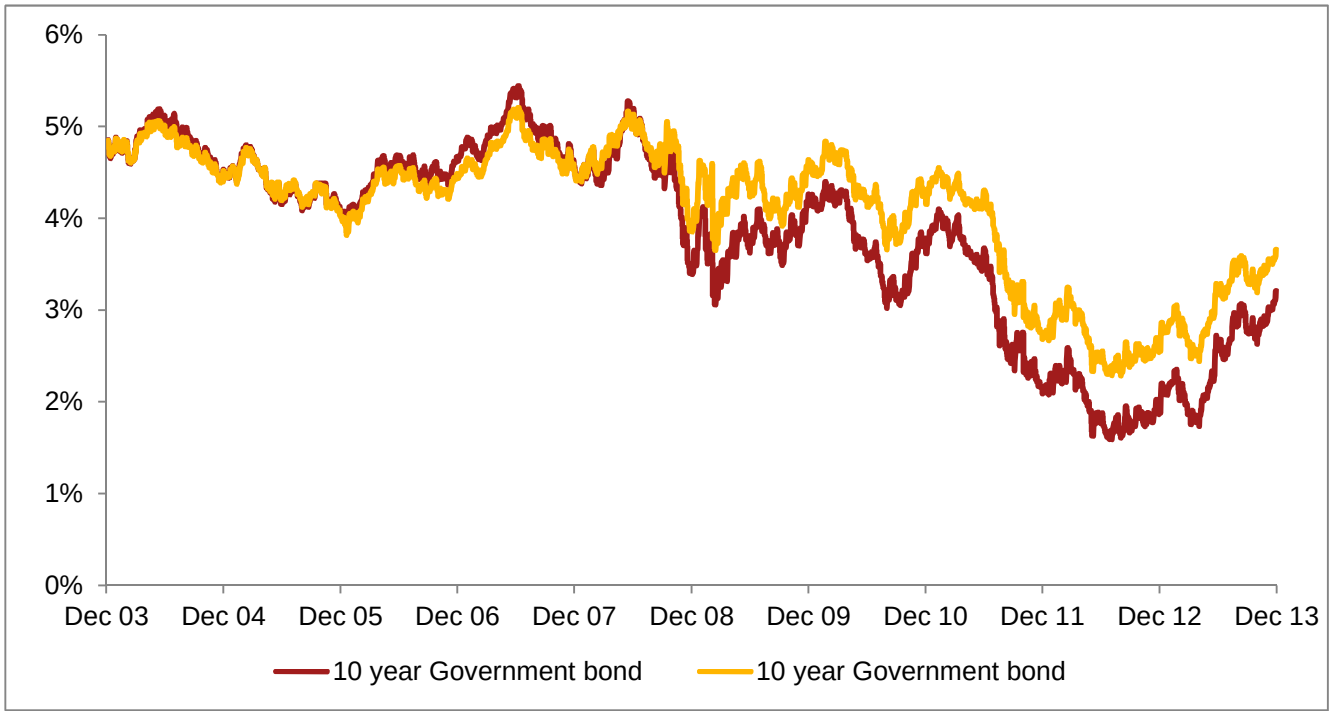
- Long-term average ILG yields have been around 1.0% over the last 10 years (for 10-15 year gilts), with markedly higher 20 year averages (see Appendix 2 for details).

7.2.2. Evidence on Government bonds

Yields on ordinary, non-index linked UK government bonds provide estimates for the nominal RFR. In principle, these can be adjusted for expected inflation to estimate the real RFR, providing a useful cross-check on real RFR estimates calculated using yields on ILGs. As set out in Section 4, we use an inflation estimate of 2.8% when converting from nominal to real yields.

Figure 7.3 below shows the evolution of yields on nominal government bonds of 10-15 year maturities over the last 10 years. Similar to evidence on ILGs, yields on nominal government bonds have generally declined since the onset of the financial crisis, as a consequence of flight to quality affects and QE programme. However, they have increased more recently as a consequence of improving macroeconomic fundamentals.

Figure 7.3 Trends in yields on Government bonds



Source: Bank of England and PwC analysis.

The current yields on 10 and 15 year maturity government bonds are 3.16% and 3.61% (as of 30 December 2013), respectively, with long term averages (10 year) of around 3.8% to 4.1%. Similar to ILGs, we look at evidence on forward rates to incorporate expectations of reversion in yields as some of the effects that have depressed yields historically gradually wind down and the economic conditions continue to improve. Our analysis of forward rates suggests an expected reversion of around 85 basis points across 10-15 year maturity debt. We incorporate this in our assessment of the real RFR under our current market approach.

Taking account of the overall evidence on nominal government bonds, our appropriate estimates for the RFR under the current market approach and the long term returns approach are summarised below:

- Current evidence on the yields on 10-15 year maturity nominal Government bonds suggests current estimates of around 3.16% to 3.61%. Taking account of adjustments implied in the forward rates, suggests an uplift of around 85 basis points – thus leading to a range of around 4.0% to 4.5% for the nominal risk-free rate. Adjusting for our RPI inflation assumption of 2.8%, this leads to a real risk-free rate of around **1.2% to 1.7%**.

- Long term historical returns (10 year) have averaged around 3.8% to 4.1% across 10-15 year bonds, although these have been reduced by the lower yield over the past 5 years. Adjusting for inflation, this implies real yields of around **1.0% to 1.3%**.

Our overall estimate for the range of the real RFR for NERL for RP2 is slightly above the range used by the CAA for the Designated Airports in Q6, reflecting the broader trends in government debt markets overtime.

7.2.3. Regulatory precedent

In its previous determination for NERL in 2010, the CAA used a real RFR estimate of 1.75%. This falls within the range of the regulatory precedents (based on final determinations) for the real RFR over the last 3-4 years of 1.40% (Ofcom July 2011) to 2.50% (CAA Heathrow and Gatwick in Q5) – as set out in Appendix 2. Historical evidence on regulatory precedents for the RFR suggests markedly higher estimates compared to actual yields on ILGs and (inflation adjusted) nominal government bond yields around the time of the final determinations, indicating that regulators often give more weight to long term averages and/or explicitly adjust for market distortions and/or incorporate an expectation of a reversion in yields back towards 'normal' levels. However, recent estimates for the real RFR across various regulatory determinations point towards lower estimates compared to historical averages, that are more in line with current market evidence. For example, the CC in the case of Northern Ireland Electricity used a real RFR of 1.3%. Whilst still slightly above current implied rates it is nonetheless lower than the regulatory precedents. Ofgem used a slightly higher real RFR estimate of 1.6% to assess electricity distribution network operators' business plans for the RIIO ED1 price control. Similarly, the CAA, in its final determination for the Designated Airports for Q6, used a range of 0.5% to 1.0% (with a point estimate of 0.5%). This was markedly lower compared to regulatory precedents but consistent with current market expectations of trends in the real RFR over the course of the price control review at that point in time. More recently, Ofwat in its draft determination for the water sector used a range for the real RFR of 0.75% to 1.25% - with a point estimate of 1.25%.

7.2.4. Overall view

In forming an overall view on the real RFR, we consider both the evidence from real and nominal government bonds and combine the two to present a plausible range for the real RFR, across our preferred current market approach as well as the approach focusing on assessment of long term returns. Our analysis suggests:

- **Current market approach** – evidence on the current real RFR estimates based on ILGs suggest a range of around **0.44% to 0.66%** whereas evidence from RPI inflation adjusted nominal government bonds suggests a range of around **1.2% to 1.7%**. Combing the estimates across the two approaches, giving slightly more weight to evidence from nominal government bonds, leads to a real RFR range of **0.75% to 1.25%**, with a mid-point of **1.0%**. This allows for future increase in yields during RP2, as suggested in current forward rates.

- **Long term returns approach** – historical average (10 year) real RFR estimates based on ILGs suggest a figure of around **1.0%**, whereas evidence from nominal government bonds suggests a range of around

1.0% to 1.3%. Recent regulatory determinations have been as high as **2.0%**. Combining the overall evidence, we consider a range of **1.0% to 2.0%**, with a mid-point of **1.5%** for the real RFR as appropriate.

Our proposed RFR estimates in the current market approach are considerably lower than the regulatory precedents as this approach is based purely on evidence from the current low interest rate environment. Gilt yields may, in time, revert back to higher levels, but we suggest (consistent with our advice to the CAA for Designated Airports in Q6) that regulators follow this trend rather than assume low interest rates are a short term phenomenon.

In using a low RFR assumption, by historical standards, it is critical that we use a consistent EMRP, to which we turn next.

7.3. Equity market risk premium (EMRP)

The EMRP represents the returns required by providers of equity capital, over and above the RFR, commensurate with the risk of investing in the equity market as a whole. It is a key assumption in the cost of equity calculation, and with the RFR forms the generic components of the CAPM framework. As we have set the TER at 6.25% to 6.75% and the real RFR at 0.75% to 1.25% (using our preferred current market approach) by implication our derived EMRP estimate is 5.50%. However, it is helpful to sense check this figure with other evidence on the EMRP.

The size of the EMRP is contentious as it cannot be directly observed in the market and therefore must be estimated. EMRP estimates vary widely across the academic and empirical literature, but in principle the approach to estimation can be divided into two main categories: ex-post (historical) analysis and ex-ante (forward looking) analysis. We provide a brief review of the EMRP estimate across each of these approaches below, for our current market and long term returns based approach, setting out the underlying analytical details in Appendix 3. Under our current market and long term returns approaches, we combine the RFR assumption (set out above) with an appropriate EMRP assumption ensuring consistency with our TER estimate. When focusing on current market rates for the RFR, we give more weight to ex-ante EMRP estimates, as they are forward looking and are consistent with the current low RFR environment. When looking at long term returns for the assessment of the RFR (and hence the cost of equity), we prefer evidence on ex-post (i.e. historical) EMRP estimates as they are more indicative of long term trends.

Historical (ex-post) approaches – This approach represents the additional returns equities have made over and above the RFR historically (usually over a very long term period, in excess of 100 years). Whilst EMRP is inherently a forward looking concept, historical approaches generally tend to provide reasonable expectations for the future. A number of different academics and practitioners report market evidence on ex-post EMRP estimates, including Dimson, Marsh and Staunton (DMS)[38] and Barclay's Equity Gilts Study, which are both widely quoted in regulatory price control determinations as well other market returns' assessment. The current evidence (1900-2012) on ex-post EMRP estimates[39] from DMS and Barclays Equity Gilts Study suggests a range of 3.6% to 5.1%, which is slightly lower than the comparable estimates from 1900-2010 of around 3.9% to 5.2%, reflecting a slight decline in ex-post EMRP estimates overtime. Overall, we consider the range of 3.6% to 5.1% as appropriate for the historical EMRP.

Forward (ex-ante) approaches – These approaches rely on market pricing information and/or expectations of future market trends to inform current views on the appropriate EMRP. There are a number of different approaches for calculating ex-ante EMRP estimates, including the DGM model, survey based evidence and adjusting historical estimates for forward looking expectations (for example as undertaken by DMS). As set out in detail in Appendix 3, our analysis of ex-ante EMRP estimates based on the (single-stage) DGM model

[38] Credit Suisse, 'Global investment returns yearbook 2013'.

[39] For the purpose of this report we focus on EMRP estimates relative to bonds, because it is easier to compare with our Government bond return assumptions. Another important estimation is the choice between geometric (GM) or arithmetic mean (AM) for the analysis of historical returns. The GM return is similar to a buy and hold strategy whereas the AM return is equal to the average of all the single year returns over the holding period. Whilst in practice both can be used, for price control purposes regulators tend to place more weight on the AM figures, reflecting the relatively short time periods covered by price control determinations.

suggests a range of 5.0% (using 15 year government bonds) to 5.5% (using 10 year government bonds), which is consistent with comparable (ex-ante) EMRP estimates from survey evidence reported by Fernandez (2013)[40] of 5.5% and Welch (2009)[41] of 5.0% to 6.0%[42]. However, we consider that the implied EMRP estimates from the DGM approach tend to provide better EMRP estimates as the underlying assumption on the benchmark RFR for EMRPs based on survey evidence are not explicitly stated. Additionally, Credit Suisse in their Global Investment Returns Yearbook (2012) suggest an implied (forward-looking) EMRP estimate of 6.1% for the UK, which is based on historical adjusted EMRP estimates reported by DMS and are consistent with the outputs from the DGM analysis. Overall we consider a range of 5.0% to 6.0% as appropriate for ex-ante EMRP, with a point estimate of 5.5%.

Regulatory precedent – Regulatory precedents provide a useful benchmark for the analysis of EMRP estimates, although it is worth noting that regulators typically rely on historical EMRP estimates when assessing the appropriate cost of equity for regulatory price control determinations. This reflects their long-term focus when setting return requirements. In its previous determination for NERL in 2010, the CAA used an EMRP estimate of 5.25%, which is towards the top-end of the range of 2.5% to 5.4% for the EMRP estimates used by other regulators over the last 3-4 years (based on final determinations). The CC in the context of Northern Ireland Electricity used an EMRP range of 4.0% to 5.0%. Ofgem used an EMRP estimate of 5.25% to assess the electricity distribution network operators' business plans for the RIIO ED1 price control. In its final determination for the Designated Airports, the CAA used an ex-ante EMRP estimate of 5.75% and a long term EMRP estimate of 5.0%. Lastly, Ofwat, in its risk and reward guidance for water and sewerage companies, used an EMRP estimate of 5.5%.

Table 7.1 below summarises the overall evidence on the EMRP across the different sources set out above and we subsequently set out our views on the EMRP across our two approaches:

Table 7.1 Summary evidence on the EMRP

	Ex-post DMS	Ex-ante (survey evidence)	Ex-ante (Credit Suisse)	Ex-ante DGM (PwC)	Overall ex-ante EMRP range
EMRP (%)	3.6 – 5.0	5.0 – 6.0	6.1	5.0-5.5	5.2-6.1

Source: DMS, Fernandez (2013), Global investment returns yearbook 2013, Barclays Equity Gilt Study and PwC analysis.

- **Current market approach** – we use the higher ex-ante EMRP range of 5.0% to 6.0%, with a mid-point of 5.5%, under our current market approach, as this is consistent with the current low RFR environment. Combining our point estimate for the ex-ante EMRP (of 5.5%) with our range for the RFR (of 0.75% to 1.25%) leads to the TER range of 6.25% to 6.75%, consistent with our analysis above in Section 7.1. The 5.5% estimate is in the middle of the range of ex-ante evidence but somewhat higher than comparable estimates from previous regulatory determinations (with the exception of the CAA in Q6) as our current market approach includes a lower RFR assumption. Our 5.5% assumption for the EMRP is lower than the estimate used by the CAA for Designated Airports – but this adjustment maintains a consistent overall TMR assumption.

- **Long term returns assessment** – under this approach we use evidence on ex-post EMRP estimates, consistent with the long term historical nature of the assessment. Analysis of ex-post evidence suggests a range of 3.6% to 5.1% for the EMRP. For the purpose of our long term returns based approach we use a

[40] Fernandez, P, Aguirreamalloa, J and Linares, P, (2013) 'Market Risk Premium and risk-free rate used in 51 countries in 2013: a survey with 6,237 answers', IESE Business School, June. The 2012 survey suggested the same EMRP estimate of 5.5%, with a range of 5.3% to 5.6% - for details refer to: Fernandez, P, Aguirreamalloa, J and Avendaño, L, (2012) 'Market Risk Premium used in 82 countries in 2012: a survey with 7,192 answers', IESE Business School, June.

[41] Welch, I (2009), 'Views of Financial Economists on the Equity Premium and other Issues', The Journal of Business, October, page 500-540.

[42] The range reported by Welch (2009) is slightly higher than the EMRP based on survey evidence reported by Fernandez in 2012, possibly as a consequence of increased equity market volatility at the time.

point estimate towards the top-end of this range of 5.0%, which is consistent with regulatory benchmarks and other stakeholder views. Combining this with our point estimate for the real RFR of 1.5% results in total market returns of 6.5%.

7.4. NERL Beta

Using the CAPM framework, investors are only compensated for bearing systematic risk i.e. risk that is correlated with the market. The degree of systematic risk associated with any particular investment depends on the relationship between movements in returns on that investment and returns on the market portfolio. This is captured by the equity beta. Whilst the equity beta reflects the overall business and financial risk for a firm, it can be adjusted for the effects of leverage (or financial risk) to estimate the asset beta, which reflects the business risk of the firm (independent of any financing arrangements).

Typically, the equity beta is estimated by regressing the returns on a stock on the benchmark index. However, for businesses that are not listed (such as NERL), it is not possible to calculate a direct estimate of its equity beta. This problem is usually overcome by calculating the equity betas of businesses with comparable operations and/or risk profiles. The equity betas for the comparable businesses can then be adjusted for their respective capital structures to estimate the asset betas (un-levered equity betas). These can then be re-levered at the proposed gearing level to estimate the appropriate equity beta. NERL does not have any direct listed comparators, and so we require a broader approach which investigates equity risks across regulated sectors.

7.4.1. The CAA's approach in RP1

In RP1 the CAA used an asset beta estimate of 0.6, which was unchanged from its CP2 decision. This was based on advice from Europe Economics of an appropriate range for the asset beta of 0.5 to 0.6. Europe Economics estimated the equity and asset betas with reference to comparators including UK airlines, utility and Airports. They also referred to regulatory precedents for the asset betas, most importantly, the CAA's most recent decision at the time for Designated Airports. In forming an overall view on the appropriate range, Europe Economics also took account of some of the qualitative risk drivers for NERL. They assumed a debt beta of 0.1 when estimating the re-levered beta.

7.4.2. Beta estimation methodology

In this Section we set out our approach to estimating NERL's beta for RP2. We first carry out a qualitative review of NERL's risk, relative to other regulated businesses. We specifically focus on airports (Heathrow and Gatwick particularly) as they operate in a similar market and also face similar exposure to aeronautical risks as NERL. Although there are a number of factors that differentiate risk exposure for NERL compared to airports (as discussed below), we nonetheless consider CAA's recent regulatory determination on airports (Q5 and Q6) as a useful starting point for setting the beta for NERL. More importantly, there is added credibility in airport beta estimates as the CC has also reviewed them as part of its review leading into the Q5 determination[43]. Market to asset ratio (MAR) estimates based on transactions in the airport sector also provide evidence of the appropriateness of the betas for airports, as set out in our report on the cost of capital for Designated Airports for the CAA[44]. We note NERL's beta at the time of RP1 decision did not face similar scrutiny from the CC and there is a paucity of data from transactions in the sector which can provide useful guide on the appropriateness of the beta estimate at the time of the RP1 decision (these has only been one transaction in late 2013 when Thomas Cook, TUI, Lufthansa and Virgin Atlantic sold their combined stake in NERL to the British Pension Fund Universities Superannuation Scheme (USS) at an implied MAR of 1.14).

Overview of NERL's systematic risk drivers

Table 7.2 below provides an overview of NERL's key systematic risks compared to other sectors, particularly airports, along with the most recent regulatory estimates for the asset betas. NERL's asset beta of 0.60 at the time of the RP1 decision was, on average, higher than those in other regulated sectors and close to the beta

[43] CC (2008), "Stansted Airport Ltd: Q5 price control review", October.

[44] PwC (2013), "Estimating the cost of capital for Designated Airports, A reported prepared for the CAA", September.

estimate set by the CAA for Stansted in Q5[45] and Ofcom's determination of 0.51-0.65 for the rest of BT Group[46]. Whilst traditional utilities (water, electricity and gas distribution and transmission) face little or no demand risk, this is different to airports where the demand for travel is more closely related to the broader macroeconomic and financial environment. Moreover, for airports, there is no explicit regulatory protection that reduces exposure to volume risk. The demand risk exposure for the rest of BT Group (particularly BT retail) is also likely to be higher than that for Heathrow and Gatwick.

In contrast to Designated Airports, the regulatory framework for NERL has a revenue risk sharing mechanism which limits volume risk exposure. This qualitative review suggests that NERL faces lower systematic risk than airports (and the rest of BT's business) but higher than traditional utilities.

[45] CAA (2009), "Economic regulation of Stansted Airport 2009-2014: CAA Decision", March.

[46] Ofcom (2011), "WBA Charge Control - Statement", July.

Table 7.2 Overview of key systematic risks for NERL and other companies

	NERL (RP1) (December 2014)	Airports (January 2014)	BT (July 2011)	Electricity/Gas companies (December 2009, 2012/2013)	Water (November 2009)
Asset beta	0.6	0.47-0.61	0.6	0.24-0.34 (DPCR5) Gas distribution (RIIO-GD1, 2012) 0.32, electricity transmission (RIIO-T1, 2012), 0.38, Gas transmission (RIIO-T1, 2012) 0.34.	0.4
Demand risk	Exposed to broad aeronautical market risk	Range of exposure to demand risks depending on degree of spare capacity and airport users	Telecoms industry with considerable demand risk	Low demand variability, but greater than water	Low demand variability
Regulatory regime	Revenue cap	Price cap	Price cap	Revenue cap	Revenue cap
Volume risk sharing	Sliding scale volume risk sharing, so NERL bears all risk for small variation, but no risk of large volume swings	Airports bear the full risk of any unexpected deviations between forecast and actual volumes	No sharing of volume risk	Electricity and gas companies bear the full risk of any unexpected deviations between forecast and actual volumes, in both the distribution and transmission markets	Water companies do not bear volume risk for serving households or small businesses because of the revenue correction mechanism (RCM)
Operating leverage	High proportion of fixed costs	High proportion of fixed costs	Some scalability in network infrastructure	High proportion of fixed costs	High proportion of fixed costs
Other	Extraordinary government support may be provided if NERL were to get into financial distress. No regulatory protection against bad debts. NERL can pass on pension deficit repair costs. Particularly sensitive to IT costs	No regulatory protection against bad debts. Airports are responsible for financing pension deficit repair costs. Airport operators bear OPEX and in-period CAPEX under/over performance	BT bears all pension deficit repair costs as well as OPEX and in-period CAPEX under/over performance	No regulatory protection against bad debts. Electricity and gas companies are not responsible for financing pension deficit repair costs. Companies bear 25% of the cost of any unexpected deviations between forecast and actual levels of CAPEX and OPEX	Some regulatory protection against bad debts through a Notified Item (NI) above materiality threshold. Risk sharing around pension deficit repair costs. Water companies bear 100% risk for any unexpected deviations between forecast and actual OPEX, but none for CAPEX

Note: The asset betas for electricity transmission and distribution represent derived estimates.

Source: Regulatory determinations.

Methodology for beta estimation

Because there is a lack of direct comparators, we use a step-by-step approach to estimate NERL's asset beta.

- Firstly, we start out by analysing NERL's exposure to aeronautical risks (including exposure to demand risk) by benchmarking these to the risk exposure faced by the UK Airports. As set out above, we consider an appropriate starting point for our analysis is the regulatory determination (Q5) on Designated Airports (and Final determinations for Q6) as they operate in the same sector and are exposed to broadly similar aeronautical risks. We use the weighted average of the asset betas across UK Airports, as NERL is exposed to UK-wide aeronautical risks.

- Secondly, we consider the regulatory regime for NERL and how this compares with the regulatory regimes in other sectors (including airports, electricity and gas transmission and distribution and water) particularly in relation to the treatment of demand risk. We group sectors as those which face little or no exposure to demand risk. We combine this little or no demand risk benchmark with the aeronautical benchmark to estimate an overall beta for NERL which is consistent with its exposure to demand risks. We calculate the weights by simulating the proportion of volume risk that is likely to be borne by NERL in future regulatory periods.

- Thirdly, we consider the operating leverage of NERL and compare this with the operating leverage of Designated Airports. This informs us on whether there is any need for further adjustments to NERL's estimated beta.

- Finally, we compare NERL with other regulated sectors across a number of others risk drivers (such as IT risks, the likelihood of government support, bad debts risks, pensions risks and cost risks) and consider whether there is a need for any further adjustments to the asset betas derived in steps 1 to 3 above.

7.4.3. Aeronautical risks

As with the Designated Airports, NERL's primary customers are airlines. The charging structure for NERL is determined by the weight of the aircraft and distance flown (chargeable service units), which is comparable to the charging structure for airports which is based on a combination of factors including the number of passengers as well as aircraft weight and size (for example in relation to parking fees). Because of the link in broader charging structures, NERL and UK airports are both exposed to aeronautical demand risk. The magnitude of demand risk is lower compared to airlines who face additional yield and loading risks (as reflected in their typically higher equity betas).

Therefore, in the absence of any regulatory and/or other risk mitigants (see discussion later), demand risk exposure for NERL is to a large extent is comparable to that of the UK airports. There is a spectrum of risk across UK airports. The CAA and CC, in previous determinations, have assessed that Heathrow, with limited spare capacity, has lower systematic risk than Stansted, which has more spare capacity and is therefore more exposed to both upward and downward demand movements.

To estimate a 'starting' asset beta for NERL, we need to estimate a weighted average asset beta across all UK airports. To estimate the weighted average asset beta, we use weights based on passenger numbers across the various UK airports and use the asset betas based on CAA's Q6 determination, assuming an asset beta of 0.61 is appropriate for all the non-Designated Airports (consistent with Stansted and therefore not capacity constrained). We use both the mid-points within the range as well as the implied point estimate used by the CAA for the WACC estimate used in the regulatory determination. To create our range, the bottom-end is based on the mid-points within the CC/CAA ranges whereas the top-end is based on the implied point estimate used by the CAA for each airport.[47]

[47] Our point estimates are based on CAA's Q6 decision on the WACC for Heathrow and Gatwick, whereas for Stansted we use the Q5 decision.

Table 7.3 below shows the number of passengers and the asset beta, as determined by the CAA, for the Designated Airports as well as all the other airports in the UK. Our analysis suggests a weighted average asset beta range of 0.55 to 0.59 across the UK airports, which we consider to be appropriate for a business operating in the aeronautical sector with exposure to demand risk. This figure is also based upon regulated benchmarks (as opposed to unregulated airports), which is also consistent with NERL.

Table 7.3 Passenger numbers and asset betas for busiest airports in the UK

Airport	Total passengers in 2012	Market share in 2012	Asset beta (mid-point)	Asset beta (point estimate used in the decision)
Heathrow	70,037,417	31.3%	0.47	0.50
Gatwick	34,235,982	15.3%	0.52	0.56
Stansted	17,472,699	7.8%	0.61	0.65
Others	101,982,908	45.6%	0.61	0.65
Weighted average			**0.55**	**0.59**

Note: Market share is based on the number of passengers in 2012 for the 40 busiest airports in the UK. The 'other' category consists of the 40 busiest airports in the UK in 2012 excluding Heathrow, Gatwick and Stansted.

Source: UK CAA Statistics 2012, CAA notice of the proposed licences Heathrow and Gatwick and PwC analysis.

In the next sub-section(s), we consider specific factors which influence the relative risk positioning of NERL compared to other sectors and hence the appropriate assumption for its asset beta.

7.4.4. Regulatory regime

NERL is regulated using a revenue cap. Its revenue depends on the extent to which actual service units differ from forecast service units. For example, during RP1, if actual service units were to vary (positively or negatively) from forecast by:

- less than 2%, then NERL would bear all the risk;
- between 2% and 10%, then NERL would bear 30% of the additional risk in excess of 2%; or
- more than 10%, then NERL would bear none of the additional risk in excess of 10%.

This mechanism is based on the Single European Sky (SES) initiative, a common EU framework for regulating air traffic operations. Before the SES initiative, NERL bore 50% of any increase/decrease in revenue arising from a difference between actual and forecasted volume. However, under the current framework NERL is exposed to variations of up to 10% in volumes and protected against larger, more significant, deviations.

Designated Airports, by contrast, have price caps based on a RPI-X approach and bear the full risk of any deviations between forecast and actual volumes. In principle, these deviations can be considerable as the demand for air travel is driven by broader economic and other trends (although the only deviation relevant for the asset betas are those associated with the economic trends). Hence whilst NERL is protected from exposure to volume risk within the regulatory regime airports do not benefit from such a provision. As set out in detail in our report for the CAA on the cost of capital for Designated Airports, there is significant exposure to demand risk within the Designated Airports.

Electricity and gas transmission and distribution companies are typically regulated based on a revenue cap. Although they bear the full risk of deviations between forecast and actual volumes, in practice demand is generally stable implying little or no exposure to demand risk. This is also true for water companies which are also regulated through revenue caps. Here the volume risk exposure is even lower due to the revenue correction mechanism (RCM) within the water regulatory framework which means that any deviation in forecasts and actual revenues is automatically corrected at the start of the next price control review (although this is only applicable for households and small business customers).

Therefore, the balance of evidence on the form of regulation and implications for exposure to demand risk suggests that NERL's asset beta should be below that of our UK airports benchmark (which are exposed to

demand risk) but higher than that of regulated utilities (which bear or little or no exposure to demand risk). In the next section, we set out the estimates for the betas of utilities based on market evidence as well as regulatory precedents. We then subsequently determine the relative positioning of NERL between airports and utilities betas, through analysis of NERL's exposure to volume risk.

Evidence on beta across the utilities sector

To determine an average asset beta for utility companies we use market data to derive the average asset beta for a selection of utility companies and check this against recent regulatory determinations on asset betas across different sectors.

Table 7.4 shows the 1 year average of the five year monthly equity and asset beta estimates for selected publically listed utility companies (as of 30 December 2013). The average asset beta across the representative sample is 0.33.

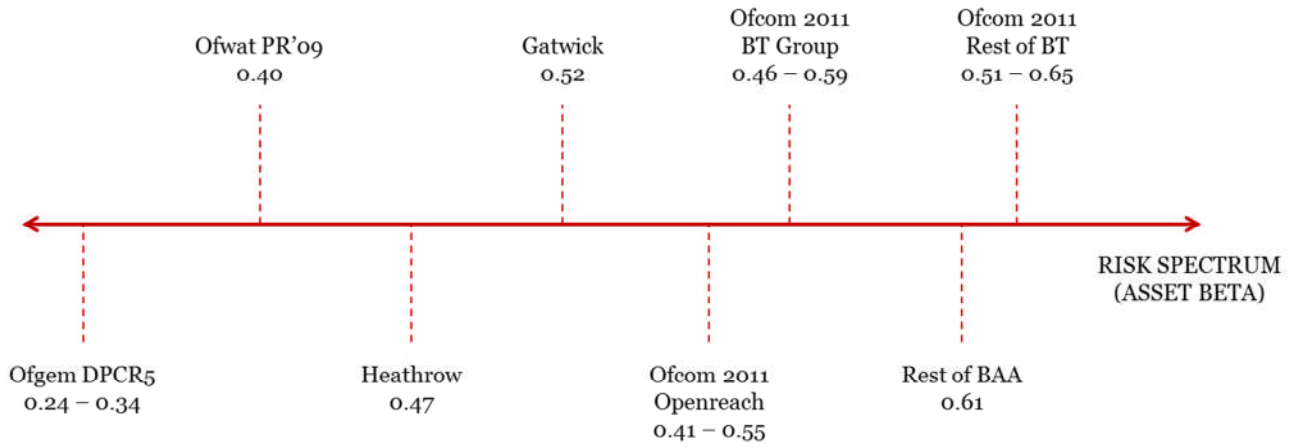
Table 7.4 Utility companies betas (1 year average of 5 year monthly betas)

Company	Equity beta	Gearing	Asset beta
United Utilities Group	0.57	59%	0.41
Severn Trent	0.48	57%	0.29
Pennon Group	0.65	53%	0.27
National Grid	0.57	56%	0.36
Average			**0.33**

Source: Datastream, Capital IQ and PwC analysis. Unlevering to calculate asset beta uses a debt beta assumption of 0.1.

Figure 7.4 below shows a risk spectrum setting out the regulated asset betas across different sectors, disaggregated where available. Regulatory precedents on asset betas vary across the different sectors; however, they are lower than comparable estimates for the Designated Airports, reflecting the lower exposure of utilities to demand risk.

Figure 7.4 Regulatory determinations on asset betas



Source: Competition Commission

Ofgem used an asset beta of figure of 0.24-0.34 for energy transmission and distribution companies in DPCR 5. For RIIO, the (derived) asset betas for gas distribution and transmission fall within this range, but the asset beta for electricity transmission was slightly higher. Ofwat used an asset beta of 0.40 for water and sewerage companies in PR09, but this was reduced to 0.3 in its Risk and Reward guidance (without a debt beta) and the CC used a figure of 0.35 (with a debt beta) for utilities in its NIE draft determination. Regulatory determinations for low demand risk utilities are slightly higher than the current empirical assessment provided

above. Overall, combining market evidence on betas with the regulatory precedents, we consider that an appropriate estimate for the asset beta of utility companies with low demand risk is 0.35.

Relative positioning of NERL

As noted above, before the SES initiative, NERL bore 50% of volume risk; however, under the current volume risk sharing mechanism, the overall share of volume risk borne by NERL is less clear. The CAA conducted analysis on the impact of the current volume risk sharing mechanism on NERL in July 2010, the results of which were summarised by the CAA in "NATS (En Route) plc price control review for control period 3 (2011-2014): Implications of SES II". In this report, the CAA concluded:

"It is clear to the CAA that the new risk sharing arrangement does not point unequivocally in one direction or the other and should not therefore materially alter the overall profile of risk"

This statement suggests that the overall share of volume risk borne by NERL under the current risk sharing mechanism remains broadly unchanged and is approximately 50%. However, for the purpose of our report, we have undertaken some additional analysis of the volume risk sharing mechanism for NERL using more recent data. We have used historical information for the difference in forecast and actual service units to allocate the revenue differentials to NERL and its customers based on the risk sharing mechanism in the regulatory framework. It is important to note that we did not use the precise methodology of the SES, which would have required more detailed data on revenue, service units and determined costs than we had available. The details of the analysis are set out in Appendix 4.

Table 7.5 below presents the key findings from our analysis, showing NERL's exposure to demand risk (the deviation in NERL's revenue due to a difference between actual and forecast volume). Over the last six years, our analysis suggests that NERL exposure to demand risk averaged around 63%, suggesting that NERL bears approximately two-thirds of volume risk under the current risk sharing mechanism. This is slightly higher than the 50% risk sharing between NERL and customers in CP2. However, this result is highly sensitive to which years are included in the analysis – for example the exclusion of 2009/10 and 2010/11 (when the percentage difference between actual and forecast service units was highest) increases the average to 80%. In forecasting the share of volume risk borne by NERL in future price control periods, we consider it appropriate to give less weight to 2009/10 and 2010/11 as this period was particularly affected by the global financial crisis (leading to significant reduction in demand for travel)[48] and unlikely to recur with the same frequency in a 6 year period. Therefore, we consider that NERL's exposure to demand risk lies between the 63% to 80% range, with 70% as a reasonable estimate.

Table 7.5 Analysis of SES volume risk sharing mechanism

Year	Deviation in service units (percentage of forecast)	Revenue deviation: amount retained by NERL (£m)	'Revenue deviation: amount passed through to customers (£m)	Percentage of revenue deviation retained by NERL	Percentage of revenue deviation passed through to customers
2006/07	3.3%	6.8	2.5	73%	27%
2007/08	5.6%	11.3	9.2	55%	45%
2008/09	0.2%	18.6	0.0	100%	0%
2009/10	(12.9%)	(2.9)	(5.5)	34%	66%
2010/11	(17.7%)	(6.3)	(18.9)	25%	75%
2011/12	(2.3%)	(2.5)	(0.3)	90%	10%

Note: This analysis is for illustration only and does not use the precise methodology of the SES, which would require more detailed data on revenue, service units and determined costs than we have available.

Source: NERL's regulatory accounts and PwC analysis.

[48] CAA (2010), 'NATS (En Route) plc price control review for control period 3 (2011-2014): Implications of SES II', paragraph 2.16

We combine our estimates for the share of volume risk borne by NERL (70%) and its customers (30%) with estimates for the average asset betas for businesses with volume risk exposure (Airports, 0.55-0.59) and businesses with little or no exposure to volume risk (regulated utilities, 0.35). Our overall analysis provides an asset beta range for NERL of 0.49-0.52. We now look at other drivers of systematic risk before concluding on an overall view on the appropriate asset beta for NERL.

7.4.5. Operating leverage

Operating leverage is a driver of systematic risk exposure. Businesses with a higher proportion of fixed costs in the overall cost base (i.e. higher operating leverage) generally tend to face higher systematic risk exposure. This is because as demand fluctuates costs are less able to change and hence the profit volatility is higher. The CC has looked at the impact of operational leverage on asset betas (and overall systematic risk exposure) in the context of analysing risk differentials between water and waste water services in the Bristol Water case[49]. In its analysis of the appropriate cost of capital for Bristol Water, the CC concluded that there is evidence to suggest that water-only companies (WoCs) might be more operationally geared (lower proportion of revenues being accounted for by operating cash flows i.e. the sum of return and depreciation) compared to water and sewerage companies (WaSCs) implying higher systematic risk exposure for water only businesses. To account of differences in operational gearing, the CC uplifted Bristol Water's asset beta by 18% compared to WaSCs. It noted that the higher operational gearing results from differences in characteristics between WoCs and WaSCs – in particular, from WoCs not providing a capital-intensive waste-water service and some tending to have lower RCVs for historical reasons, rather than from WoCs' small size[50].

We review a number of different metrics used to indicate differences in cost structure and operating leverage comparing NERL to Designated Airports. In principle, as stated above, it is difficult to obtain precise estimates of operating leverage, because costs are not typically identified as being either fixed or variable in accounting data. Table 7.6 below shows CAPEX as a proportion of RAB over the last four years for NERL and the Designated Airports. In terms of asset development, this shows NERL has been relatively stable and is broadly comparable to Gatwick (other than 2009) and higher than estimates from Heathrow and Stansted.

Table 7.6 CAPEX as a percentage of RAB

Year	2009	2010	2011	2012
NERL (%)	13.6	12.0	9.6	10.9
Heathrow (%)	7.6	7.5	6.9	7.6
Gatwick (%)	6.6	10.4	11.7	10.9
Stansted (%)	8.4	2.2	1.5	1.4

Note: Calculated using CAPEX and closing RAB figures for all years.

Source: Regulatory accounts.

Table 7.7 below shows CAPEX as a proportion of OPEX over the last four years for NERL and the Designated Airports. This shows that NERL has higher OPEX intensity, with the exception of Stansted.

Table 7.7 CAPEX as a percentage of OPEX

Year	2009	2010	2011	2012
NERL (%)	36.2%	39.9%	35.5%	37.5%
Heathrow (%)	76.4%	84.1%	85.4%	96.3%
Gatwick (%)	36.9%	62.6%	86.6%	85.2%
Stansted (%)	72.6%	21.0%	15.6%	13.6%

[49] Competition Commission (2010), "Bristol Water Plc – A reference under section 12(3)(a) of the Water Industry Act 1991", August.

[50] Ibid.

Source: Regulatory accounts.

We also look at OPEX as a proportion of RAB as another metric for estimating operational intensity. As set out in Table 7.8 below, the ratio of OPEX to RAB has remained broadly stable over the last 4-5 years, although it is higher for NERL than for airports.

Table 7.8 OPEX as a percentage of RAB

Year	2009	2010	2011	2012
NERL (%)	37.5%	30.1%	27.1%	29.0%
Heathrow (%)	9.9%	8.9%	8.1%	7.9%
Gatwick (%)	17.9%	16.6%	13.5%	12.8%
Stansted (%)	11.7%	10.5%	9.9%	10.4%

Source: Regulatory accounts.

These metrics suggest that NERL has higher operational cost intensity, but it is difficult to conclude that this leads to a higher operational leverage. The CC approach set out above would suggest that this leads to higher operational leverage, because it treats operational costs as fixed. However, for NERL, some of its operational costs may vary with output (e.g. employment of air traffic controllers). Where such operational costs can be scaled to output, even over relatively long-time periods, then operational costs may reduce operational leverage. This reveals that the categorisation of costs into opex and capex, which is helpful from an accounting perspective, reveals little about the long-term economic relationships between cost and output.

We also consider there are conceptual problems with making an adjustment to the asset beta on the basis of the size of the annual accounting profit in relation to revenue. The required economic return should be set in relation to demand risks and the way costs risks interact with those demand risk, and not in relation to the size of an accounting profit. Not only does this risk becoming a circular calculation, it also presumes that finance costs are a variable cost, which is unlikely in the case of debt.

We therefore do not adjust the asset beta on account of operational leverage differences. We turn next to a number of other risk considerations which could potentially influence the asset beta for NERL.

7.4.6. Other considerations

In this sub-Section, we compare NERL with other regulated companies on a number of qualitative dimensions, namely IT risks, the likelihood of extraordinary government support, bad debt risks, pensions risks and the treatment of unexpected CAPEX or OPEX under/overruns. This enables us to refine our estimate of NERL's asset beta calculated above, in order to form an overall view on NERL's asset and equity betas. We briefly look at each of these risk drivers below.

Information technology (IT) risks

IT costs represent a large proportion of total costs for NERL compared to other regulated businesses such as airports and/or utilities, given the software intensive nature of the business and the significant IT infrastructure investments by NERL. Fluctuations in IT capital and ongoing costs are therefore likely to affect NERL to a greater extent than they affect airports and other utility companies.

IT costs tend to be cyclical i.e. they are strongly correlated with the market and move in the same direction to the overall state of the economy (or, more accurately, GDP). Therefore, when the economy is improving, IT costs tend to increase and hence have a negative impact on profits. However, when the economy is slow (or deteriorating), IT costs are lower and hence have a positive impact on profits. So while IT costs are cyclical, their impact on NERL's profits is counter cyclical.

Since IT costs are likely to be a larger proportion of total costs for NERL than for other regulated companies, they are likely to reduce the cyclical variability of profits to a greater extent for NERL than for other companies. However, other companies are also likely to face other costs which are cyclical – for example energy costs – so it

is not clear how NERL's asset beta would be affected relative to other industries on account of these different costs. Also, it could be argued that NERL's dependence on IT actually increases its overall risk, given the fast-moving nature of the technology industry and the pace of innovation, which introduces a further risk dimension, which is not present in infrastructure utilities, such as water. These risks should be accommodated in cash flow modelling, but to the extent that these may not be fully reflected this would suggest an uplift to the required return.

Likelihood of extraordinary government support

The provision of air traffic control is considered to be vital to the UK aviation industry and the wider economy. NERL is the sole provider of this service within the UK (and for air traffic passing over the UK). Therefore, it may be considered that NERL provides an 'essential service' and hence in the event of financial distress is likely to benefit from additional government support (in the form of emergency funding if necessary). This possibility has been recognised by Standard & Poor's, which states the following in its June 2013 RatingsDirect report for NERL:

"There is a "high" likelihood that the U.K. government would provide timely and sufficient extraordinary support to NERL in the event of financial distress."

As set out in the cost of debt Section, this is likely to influence the cost of debt financing. However, the "high" likelihood of extraordinary government support could also reduce the level of systematic equity risk faced by NERL's shareholders, albeit in a more subtle way. A number of academics have looked at the impact of implicit government support on the beta for businesses which may benefit from implicit government support (particularly following the financial crisis and implicit state support for financial institutions). For instance, Professor Franks and Acharya have looked at the impact of government guarantees on the required return on equity of banks, arguing that the measured equity betas of banks suggest low business risk which is inconsistent with their actual risk profile[51].

Compared to NERL, other regulated businesses are unlikely to receive similar levels of support from the UK government, drawing instead on continuity of service arrangements, such as the special administration regime in airports. This suggests that the asset beta for NERL could be lower than our proposed estimate, as shareholders are shielded from some (extreme) downside risk.

Bad debts risk

Bad debts are another source of risk for NERL. This risk is systematic as customers are likely to default during period of an economic downturn[52]. NERL, as well as other regulated business typically have allowances for bad debt in regulatory determinations, but are exposed to any volatility in outturn estimates compared to forecasts.

However, we do not consider bad debt risk as a significant risk for NERL. This is helped by the powers of the CAA to secure payment from international airlines, where necessary, by restricting the onward passage of aircraft.

Pension risks

The risk around pension deficit repair costs is likely to be systematic because the performance of most pension funds depends largely on stock market investments, which in turn depend on broader economic conditions. Table 7.8 below summarises the treatment of pension costs in recent regulatory determinations.

[51] Franks, J and Acharya, V (2010), "Capital Budgeting at Banks: The Role of Government Guarantees", June.

[52] See our April 2013 report for the CAA titled "Estimating the cost of capital in Q6 for Heathrow, Gatwick and Stansted".

Table 7.8 Precedents on the treatment of pension deficit repair costs

Regulator	On-going pension service costs	Deficit repair costs	Cost of Capital
CAA (NERL – RP1)	Allowed: cash basis	Full pass through to customers	CAA stated that pass-through arrangement for cash costs should reduce the cost of capital
CAA (Airports)	Allowed: cash basis	Price review assumed the pension scheme was in balance	No adjustment
Ofgem (RIIOs)	Allowed: cash basis	Allowed all 'efficient and economic' deficit repair costs	No adjustment
Ofwat (PR09/PR14)	Allowed: cash basis	Allowed 50% of deficit repair costs (based on 10/15 year recovery)	No adjustment
CC (Bristol Water)	Allowed: cash basis	Allowed 90% of deficit repair costs (based on 15 year recovery)	No adjustment

Source: Regulatory determinations.

The treatment of pension deficit repair costs for NERL is therefore comparable to other regulated low risk utility sectors (e.g. water and energy). Whereas airports and telecoms activities tend to retain pensions risk, there is more pass through in the case of water and energy activities. As NERL does not bear pensions risk there is a possibility that our estimates incorporate some additional pension risk from using the airport comparators (and could therefore be too high).

During our work for Ofcom on the impact of pensions risk on asset beta we suggested that there may be an impact of up to 0.1 on the asset beta, but there were significant estimation uncertainties surrounding this figure, and this was in the case of BT which had a particularly large pension scheme[53]. Any impact for NERL would therefore likely be small.

Measure of traffic

For CP2, the CAA used distance (or, more precisely, revenue kilometres with no weight factor) as the charging volume unit for NERL. However, for RP1 and RP2, it is required to use chargeable service units (CSUs) to comply with the SES framework. CSUs are dependent on aircraft weight as well as distance. Therefore, reverting from distance to CSUs adds variance in average aircraft weight as an additional source of variation in revenues for NERL.

For RP1, the CAA noted that the change from distance to CSUs constituted an argument for a small increase in the cost of capital for NERL. This suggests that our own estimate of NERL's cost of capital for RP2 should be higher as well. However, we do not adjust our estimate from sub-section 7.4.5 for this risk because our estimate has been determined relative to airports, which also incorporate aircraft weight in overall charging structure.

Risk of industrial action

Finally, NERL may also be subject to a greater risk of industrial action during RP2. This is because NERL is proposing substantial reductions in headcount as part of its cost efficiency targets. If, as a consequence, NERL's

[53] PwC (2010), "Ofcom Pension Review – Adjusting BT's beta to account for pension risk", October.

employees take industrial action, there could be disruption to NERL's services and therefore a loss of revenue. This is not a systematic risk, and if relevant should be incorporated into cash flow projections.

Conclusion

In this Section we have set out a number of other considerations that could possibly impact our proposed estimates for the asset beta for NERL. In some cases there is no clear need for an adjustment, and there are offsetting factors. Where there are systematic risk factors that are particularly relevant for NERL (for example, the level of government support and pensions risk), compared to other business, the evidence is unclear on the magnitude and relevance of the precise impact.

Directionally these would reduce our estimate and we suggest the CAA takes this into consideration when deciding the overall point estimate for the cost of capital for NERL.

7.4.7. PwC's view on the appropriate beta for NERL

We conclude that our range for NERL's asset beta as set out in Section 7.4.4 above should not be adjusted further to account for other risk factors discussed in Section 7.5.6 above and hence use an asset beta range of **0.49 to 0.52** for NERL.

To estimate NERL's equity beta, we use a debt beta of 0.1[54], consistent with the academic evidence and regulatory precedent, and a gearing estimate of 60% as set out in Section 6 above. This results in an equity beta range of **1.08 to 1.15**.

7.5. PwC's view on the appropriate cost of equity

Table 7.9 below brings together the overall evidence on the different parameters and presents our cost of equity estimates (pre- and post-tax). Our tax assumptions are set out in Section 8. We report a range for the cost of equity under our preferred current market approach and a mid-point of our estimates for the cost of equity based on the long term returns based approach.

Our analysis suggests a real pre-tax (post-tax) cost of equity of **10.5% to 11.7%** (6.7% to 7.5%) for NERL under our current market approach. For the long term returns based approach, our analysis suggests a mid-point for the real pre-tax (post-tax) cost of equity of 10.8% (6.9%) for NERL.

[54] For details of why a debt beta of 0.1 is consistent with the academic evidence, see Appendix C of our April 2013 report for the CAA titled "Estimating the cost of capital in Q6 for Heathrow, Gatwick and Stansted". Our gearing estimate is notional.

Table 7.9 Cost of equity estimates

Cost of equity (%)	**NERL**	
Approach 1 – current market assessment	**Low**	**High**
Total equity returns (%)	6.25	6.75
Risk-free rate (%)	0.75	1.25
EMRP (%)	5.50	5.50
Asset beta	0.49	0.52
Debt beta	0.10	0.10
Gearing (%)	60	60
Equity beta	1.08	1.15
Cost of equity (post-tax) (%)	**6.7**	**7.5**
Cost of equity (pre- tax) (%)	**10.5**	**11.7**
Approach – 2 – long-term returns assessment	**Mid-point**	
Risk-free rate (%)	1.5	
EMRP (%)	5.0	
Asset beta	0.49	
Debt beta	0.10	
Gearing (%)	60	
Equity beta	1.08	
Cost of equity (post-tax) (%)	**6.9**	
Cost of equity (pre- tax) (%)	**10.8**	

Source: Datastream, Dealoigc, Bloomberg, various regulatory determinations, DMS (2013), Barclays Equity Gilts Study (2013), Fernandez et al (2013) and PwC analysis.

8. Tax

An allowance for tax needs to be either reflected in the WACC (i.e. the WACC is set on a pre-tax basis) or it can be treated as a separate allowance (for example as a cash cost similar to OPEX). Regulators adopt different approaches – for example, the CAA, in the case of airports, uses a pre-tax WACC, whereas Ofwat/Ofgem generally allow a separate cash allowance for tax.

For NERL, the CAA has historically taken account of the projected actual tax payments over the course of the price control period, considering capital allowances as well as other tax credits. It then assesses an effective tax rate for the price control period to estimate the required pre-tax WACC (still based upon a notional capital structure).

The NERL financial model used to support the price control setting calculated an effective tax rate of 36%. We use this estimate when calculating the overall range for NERL's cost of capital.

9. Overall WACC

Table 9.1 brings together our views on the cost of debt and the cost of equity and presents our overall weighted average cost of capital (WACC) estimates for NERL. We report a range for the WACC under our preferred current market approach and the mid-point of our estimates for the WACC based on the long term returns based approach. Under our current market approach, our analysis suggests a real pre-tax WACC range of 5.6% to 6.2%. For our long term returns based approach, our analysis suggests a real pre-tax estimate of 5.8%.

Table 9.1 Overall WACC estimate

WACC (%)	**NERL**	
Approach 1 – current market	**Low**	**High**
Total equity returns (TER)	6.25	6.75
Real risk-free rate (%)	0.75	1.25
EMRP (%)	5.50	5.50
Asset beta	0.49	0.52
Debt beta	0.10	0.10
Gearing (%)	60	60
Equity beta	1.08	1.15
Tax rate (%)	36.0	36.0
Cost of embedded debt (real, %)	2.5	2.5
Cost of new debt (real, %)	1.5	2.0
Embedded (new debt) split (%)	80/20	80/20
Cost of equity (real, post-tax, %)	6.7	7.5
Cost of equity (real, pre- tax, %)	10.5	11.7
Cost of debt (real, pre-tax, including fees %)	2.4	2.5
WACC (real, post-tax, %)	3.6	4.0
WACC (real, vanilla, %)	4.1	4.5
WACC (real, pre- tax, %)	5.6	6.2
Approach 2 - long-term returns	**Mid-point**	
Real risk-free rate (%)	1.5	
EMRP (%)	5.0	
Asset beta	0.49	
Debt beta	0.10	
Gearing (%)	60	
Equity beta	1.08	
Cost of equity (real, post-tax, %)	6.9	
Cost of equity (real, pre- tax, %)	10.8	
Cost of debt (real, pre-tax, %)	2.5	
WACC (real, post-tax, %)	3.7	
WACC (real, vanilla, %)	4.3	
WACC (real, pre- tax, %)	5.8	

Appendices

Appendix 1 – Total equity market returns

In this Appendix, we set out our analysis and associated evidence on the TMR across the three approaches discussed in Section 7.1 above. We look at each of them in turn below.

A1.1 Estimating total market returns – historical approaches

Table A1.1 below shows the historical (long-term) real returns over different time periods as reported by DMS and Barclays, calculated on a geometric average basis. Long run historical real equity market returns are around 5.2% based on the DMS study and 5.0% based on the Barclays study. These are slightly lower than comparable estimates before the financial crisis – 5.6% for DMS and 5.3% for Barclays – reflecting the peaking of equity markets in 2007 and the subsequent negative returns following the financial crisis. The current estimates are also lower than 1900-2010 estimates, reflecting the impact of the Euro sovereign debt crisis on uncertainty in equity markets. Whilst markets improved in 2012, they are still short of pre-crisis levels.

Table A1.1 UK long-run real equity returns (geometric average)

Source	1900-2001	1900-2006	1900-2010	1900-2012
DMS (real geometric average)	5.4%	5.6%	5.3%	5.2%
Barclays EGS (real geometric average)	5.3%	5.3%	5.1%	5.0%

Source: Global investment returns yearbook 2013, Barclays Equity Gilt Study 2013.

The holding period of return is a key determinant of long run equity returns. In Table A1.2 we present different holding periods' returns ranging from one year up to 20 years, as reported by the Competition Commission in its report on the "Northern Ireland Electricity Limited price determination"[55] based on Credit Suisse Global Investment Sourcebook 2010 and data from Dimson, Marsh and Staunton[56]. A holding period return of 1 year is equivalent to an arithmetic average of annual returns. Hence, the table shows that returns based on arithmetic averages are higher than those based on geometric averages. Given the relatively short period of the price control, UK regulators have tended to prefer arithmetic averages.

[55] Competition Commission (2013), "Northern Ireland Electricity Limited Price Determination", Table 13.7, page 13-39, November. A similar analysis although slightly dated is also reported in Competition Commission (2012), "Aggregates, Cement and Ready-Mix Concrete Market Investigation - current cost accounting profitability assessment for cement".

[56] DMS (2010), "Global investment returns yearbook 2010", February.

Table A1.2 UK real equity returns by holding period (CC, 1900-2012)

	Equity return in per cent (annualised)			
	Simple	**Overlapping**	**Blume**	**JKM**
UK market, DMS data				
1-year holding period	7.1	7.1	7.1	7.0
2-year holding period	7.5	7.0	7.1	7.0
5-year holding period	6.7	6.8	7.0	6.8
10 year holding period	6.4	6.8	6.9	6.6
20 year holding period	6.7	6.9	6.8	6.1
UK market, Barclays data				
1-year holding period	6.9	6.9	6.9	6.8
2-year holding period	7.2	6.7	6.8	6.8
5-year holding period	6.2	6.4	6.8	6.6
10 year holding period	6.0	6.4	6.7	6.3
20 year holding period	5.9	6.4	6.5	5.8

Notes: 'Simple': The mean is calculated from the formula (Σ(Rt+h/Rt)/(110-h))1/h where h is holding period, Rt is value of returns index at the end of year t and the expression is summed for (110-h) values of t for which non-overlapping data is available. 'Overlapping': The mean is calculated from the formula (Σ(Rt+h/Rt)/(110-h))1/h where h is holding period, Rt is value of returns index at the end of year t and the expression is summed for (110–h+1) values of t for which overlapping data is available. 'Blume': The Blume unbiased estimator is a weighted average of the arithmetic and geometric mean. 'JKM': The JKM small sample efficient estimator is calculated from the estimated mean and variance of lognormal returns.

Source: Competition Commission (2013), "Northern Ireland Electricity Limited Price Determination", Table 13.7, page 13-39, November.

In summary, historical approaches tend to suggest a real equity return between 5% and 7%. However, consistent with evidence based on recent regulatory determinations as set out later in this Appendix, we consider the top end of this range to be more appropriate for use in price control purposes.

A1.2 Estimating total market returns – forward looking approaches

The dividend growth model (DGM) can also be used to calculate forward looking estimates of the TMR. The DGM assumes that the current share price of a quoted business is equal to the present value of all future expected dividend payments. Therefore, the cost of equity implicit in the share price can be determined as follows, given the current market share price and future dividend growth rate expectations:

$$\mathbf{Ke=((Do\ [1+g])/Po)+\ g}$$

Where:

K_e is the post-tax cost of equity;

D_o is the current dividend;

g is the dividend growth rate (assumed to be constant); and

P_o is the current share price

The DGM can be applied to the equity market as whole as well as for individual equities. As such, using the equation above and alternative plausible assumptions on the key variables (dividend yield and real growth rate) we have estimated the implied real return on equity for the UK market from 2007 to 2013. We have taken the time series data on dividend yield for the FTSE 100 from Datastream and then used the expected UK real

growth rate reported by Consensus Economics for each year – choosing the final year from the Consensus forecast in each case. In undertaking this analysis, we have assumed that the GDP growth rate is equal to the dividend growth rate and that the final year GDP growth forecasts from Consensus Economics represent trend growth. We have also assumed a share buyback yield of 0.5%[57], which we add to the dividend yield when calculating the TMR. Table A1 below shows the GDP growth rate assumption reported by Consensus Economics for each year, in each case representing the assumption for the year furthest out in the forecast, which is the figure used in the analysis. Results of our analysis are shown in Figure 7.1 in the main body of the report above as a time series of the expected real return on UK equity market over the last 5-6 years and suggests a range of 5.75% to 6.75% for the TMR. Our analysis of forward looking estimate for the TMR based on a two-stage DGM suggests a range of 6.0% to 6.5% for the cost of equity over the last few years – which is consistent with the estimate 5.75% to 6.75% range based on the single stage DGM model.

Table A1.3 Real GDP growth forecasts (final year of forecasts)

Year	2007	2008	2009	2010	2011	2012	2013
GDP growth (%)	2.5	2.4	2.2	2.3	2.1	2.0	2.1

Source: Consensus economics (October 2013)

A forward looking estimate of equity returns is also provided by DMS, which analyses components of historical equity returns and then considers expectations for the future on the basis of these individual components. DMS identifies component parts which are consistent with those used in the DGM analysis, including the real dividend growth rate, expansion in the price/dividend ratio, the average dividend yield and fluctuations in the real exchange rate. For the UK, DMS found that the following factors could explain long-term geometric average UK equity returns: the geometric average dividend yield (4.63%), the expansion in the price/dividend ratio (0.2%) and the real dividend growth rate (0.44%). This provided a total of 5.27%[58], whereas the arithmetic mean would be around 6.77%, or 1.5% higher. In a forward looking context, the rerating of valuation ratios cannot be assumed to be repeated, so the figures would have to be reduced by 0.2%. In addition, DMS suggests that it would be imprudent to assume the rapid expansionary periods of the 20th century could be repeated, which again leads to a reduction in likely future returns for equity.

A1.3 Estimating total market returns – regulatory precedents

Figure 7.1 in the main body of the report sets out the evidence on TMR estimates used by various regulators over the last 4-5 years. Regulatory precedents on the real equity market returns have ranged from 6.4% (Ofcom 2011) to 7.4% (Ofwat 2009). In its previous determination for NERL in 2010, the CAA used an EMRP estimate of 5.25%, which is towards the top-end of the range of 2.5% to 5.4% for the EMRP estimates used by other regulators over the last 4-5 years (based on final determinations). Notably, Ofgem in its determination for RIIO-GD1 in December 2012 set a real equity market return of 7.25%, higher than comparable evidence from the DGM which suggests a cost of equity of around 6.2%, over 1% lower. However, more recent regulatory estimates for the TMR are somewhat lower. The CC in the context of Northern Ireland Electricity used a TMR range of 5.0% to 6.5%. Ofgem used a figure of 6.85% to assess electricity distribution network operators' business plans – but it noted that a direct translation of the CC decision in NIE would suggest a return of 6.00% and is consulting on whether to change its methodology in light of this. In its final determination for the Designated Airports, the CAA used a TMR range of 6.25% to 6.75%, with a point estimate of 6.25%, and a long-term EMRP estimate of 5.0%. Lastly, Ofwat, in its draft determination for water and sewerage companies used a TMR range of 6.25% to 6.75%, with a point estimate of 6.75%.

[57] Our analysis of FTSE index companies suggests a current buy-back yield of around 1%. However, we consider this may be distorted by the current business environment which is currently resulting in strong operational cashflows, high corporate cash balances and low business investment. In order to achieve long-term growth (as assumed in the DGM), some of the current return through share buybacks may be required for investment purposes, so an appropriate forward-looking buyback yield may be lower. For this reason, we use a lower figure of 0.5%.

[59] Office of Rail Regulation (ORR) (2013), 'Periodic Review 2013: Draft determination of Network Rail's outputs and funding for 2014-19', June.

Appendix 2 – Estimating the risk free rate

In this Appendix, we set out our analysis and evidence on the risk free rate. Our overall view on the appropriate risk-free rate is based on evidence from index linked gilts (ILGs), nominal Government bonds and recent regulatory precedents. We look at each of these in turn below.

A2.1 Estimating the risk free rate – index linked gilts (ILGs)

Table A2.1 below shows the current (as of 30/12/13) and historical average yield on 10 and 15 year maturity ILGs. The current yield estimates of -0.11% and 0.11% on 10 and 15 year maturity gilts are higher than the one year average on yields across these maturities of -0.68% and -0.26% respectively – reflecting relative improvements in underlying macroeconomic fundamentals since early 2013, however, the long-term averages are significantly higher. For example, the 10 year average on 10 year maturity gilts is 0.92 %, compared to a spot estimate of -0.11%.

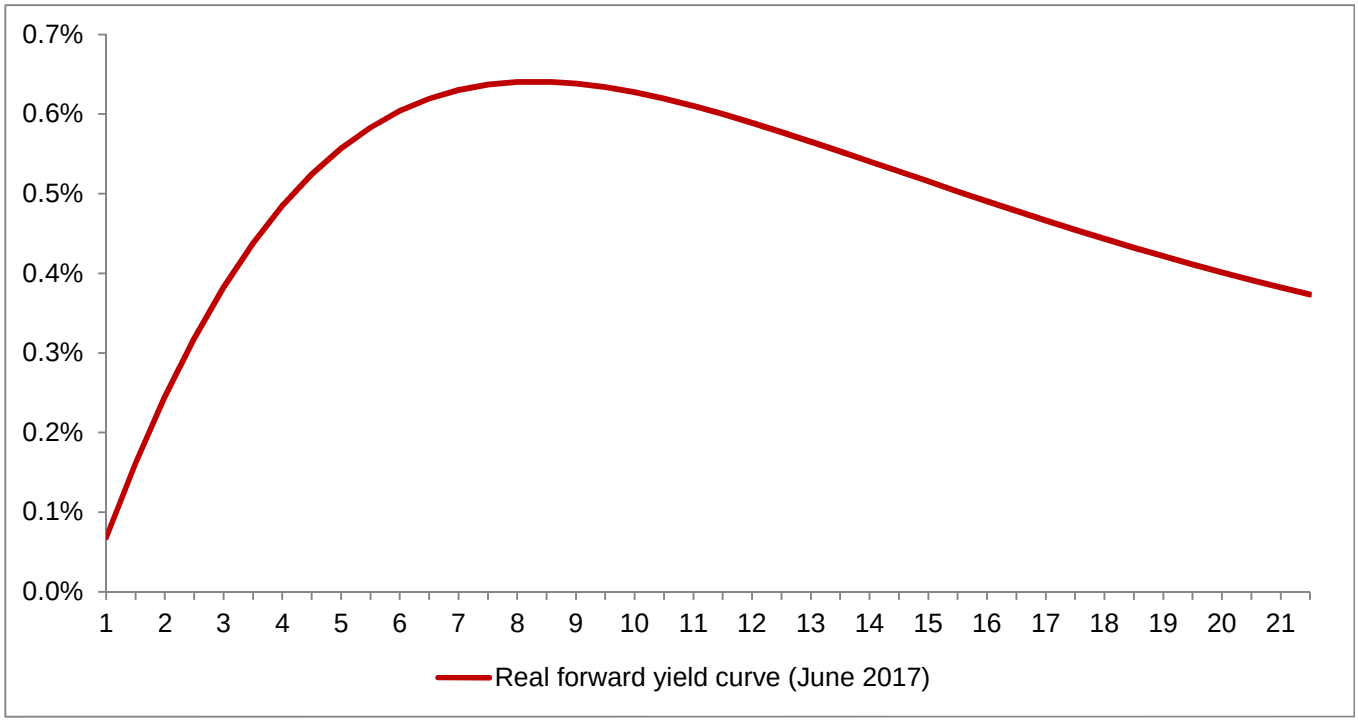
Table A2.1 Historical average yield on index-linked gilts

Real risk-free rate (%)	10 year	15 year
Current yield	-0.11	0.11
1 year average (%)	-0.68	-0.26
3 year average (%)	-0.41	-0.03
5 year average (%)	0.12	0.39
10 year average (%)	0.92	0.96
20 year average (%)	2.53	2.62

Source: Datastream and PwC analysis.

The likely trends for the underlying RFR in the future are inherently difficult to predict from historical data. However, evidence on forward rates can provide a useful guide for expected trends in the future. Figure A2.1 below shows the current implied forward rate curve in June 2017, around half way into RP2. The forward rates are considerably higher than current yield on 10-15 year maturity gilts. For example, the 15 year forward rate is close to around 0.52% in June 2017, compared to a spot estimate of 0.11 – implying an increase of around 40 basis points. Similarly, the 10 year forward rate is around 0.63% compared to a 10 year spot rate of around -0.11% implying a reversion of around 74 basis points. Based on an analysis of forward yields, there are clear expectations of an upwards trend in yields on ILGs. On average, the forward curve data suggests an increase of around 55 basis points in yields on ILGs between now and June 2017, two and a half years into RP2.

Figure A2.1 Real forward curve



Source: Bank of England and PwC analysis.

A2.2 Estimating the risk free rate - nominal government bonds

Estimates for the nominal RFR are provided by yields on ordinary, non-index linked UK Government bonds. These can then be adjusted for expectations of inflation to estimate a real risk-free rate. Table A2.2 below shows the current and historical average yield across 10-15 year maturity nominal Government bonds. The current yield estimates of 3.16% and 3.61% are markedly higher than short to medium-term averages (1-4 years) on 10-15 year maturity bonds, respectively; however, they are lower than longer-term averages. For example, the 10 year average on 10-15 year bonds ranges from 3.8% to 4.1%. The 20 year average on 10-15 year bonds ranges is significantly higher than the 10 year average, reflecting the downward trend in yields on government bonds over the latter half of the last decade, particularly following the financial crisis. Indeed, the historical averages of yields on government bonds over the last 4-5 years have been lowered by a prolonged period of low returns following the financial crisis.

Table A2.2 Historical average yields on government bonds

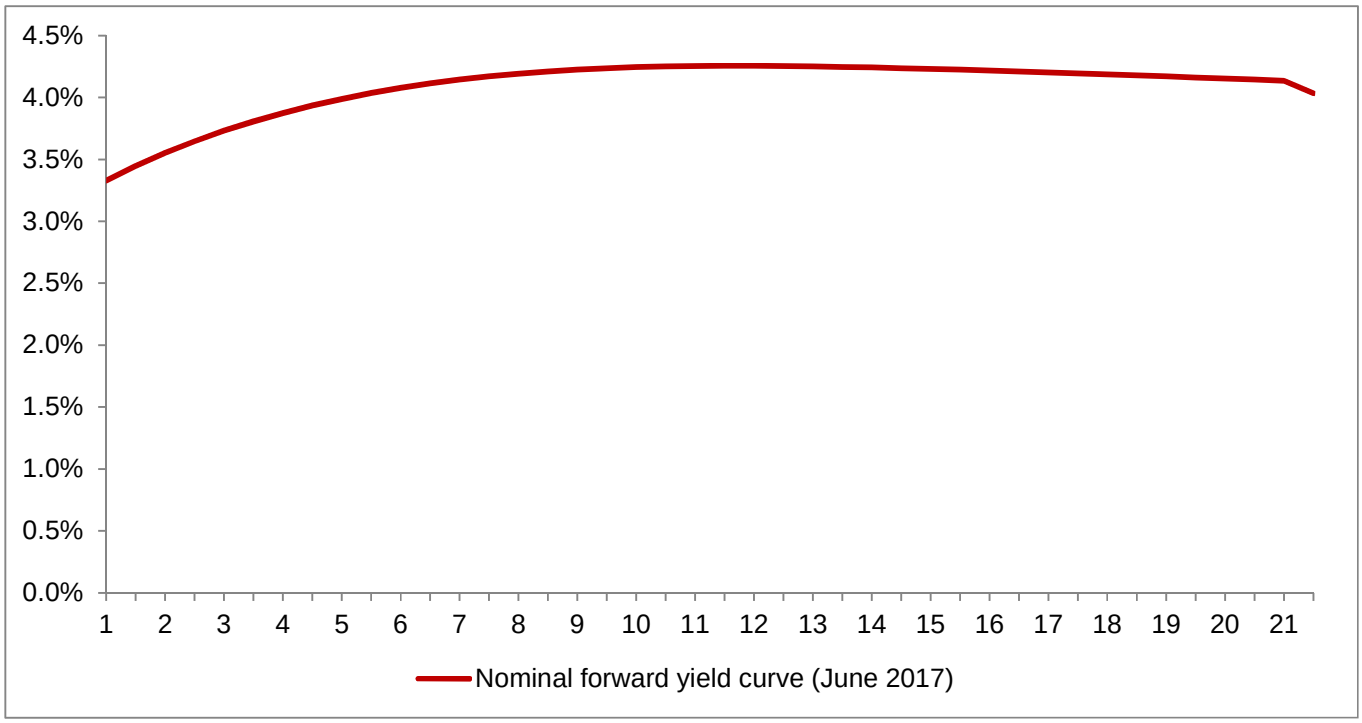
Real risk-free rate (%)	10 year	15 year
Spot rate	3.16	3.61
1 year average (%)	2.46	3.09
3 year average (%)	2.50	3.14
5 year average (%)	3.02	3.61
10 year average (%)	3.83	4.10
20 year average (%)	6.03	6.15

Source: Bank of England and PwC analysis.

Forward rates can provide a useful guide to expectations of future yields on nominal Government bonds. The current implied forward rate curve for nominal Government bonds in June 2017 is shown in Figure A2.2 below. Across all maturities, the forward rates in June 2017 are higher than current yield estimates. For example, the

15 year forward rate is close to around 4.23% in June 2017, compared to a spot estimate of 3.61% – implying an increase of around 62 basis points. Similarly, the 10 year forward rate is around 4.24%, compared to a 10 year spot rate of around 3.16% implying an increase of around 108 basis points. On average, evidence from forward rates on 10-15 year maturity government bonds implies a likely uplift of around 85 basis points between now and June 2017.

Figure A2.2 Nominal forward curve



Source: Bank of England and PwC analysis.

A2.3 Estimating the risk free rate - regulatory precedent

Table A2.3 below shows the regulatory precedents (as well as the approach) on the risk-free rate over the last 4-5 years. The CAA used a risk-free rate assumption of 1.75% for NERL in CP3, which is broadly consistent with range implied by the evidence on regulatory precedents of around 1.0% to 2.5% (based on final determinations). In its most recent determination for Network Rail[59], ORR used an estimate of 1.75% for the risk-free rate.

Table A2.3 Evidence on recent regulatory precedents

Regulator	Decision Date*	RFR (%)		Basis for regulatory decision
		Low	High	
CAA March 2008 (Q5 Heathrow and Gatwick)	11/03/2008	2.50	2.50	Focused on 3, 5-10 year ILGs, both spot and historical estimates, combined with evidence from forward rates going into Q5.
ORR October 2008 (CP4)	15/10/2008	1.70	2.35*	Looked at a combination of ILGs and deflated nominal yields of various maturities.

[59] Office of Rail Regulation (ORR) (2013), 'Periodic Review 2013: Draft determination of Network Rail's outputs and funding for 2014-19', June.

Regulator	Decision Date*	RFR (%)		Basis for regulatory decision
		Low	High	
CAA March 2009 (Q5 Stansted)	13/03/2009	2.00	2.00	Focused on 3-5 and 10 year ILGs, both spot and historical estimates, combined with evidence on forward rates going into Q5.
Ofwat November 2009 (Water and sewerage)	15/11/2009	2.00	2.00	Consistent with long-run historical yields on 5-10 year ILGs.
Ofgem December 2009 (DPCR5)	07/12/2009	2.00	2.00	Focused on historical 10 year ILG yields.
CC August 2010 (Bristol Water)	15/08/2010	1.00	2.00	Current ILG yields of around 1% were used as the lower bound due to 'market distortions' and the top-end was based on regulatory precedents.
CAA December 2010 (NERL)	15/12/2010	1.75	1.75	Focused on ILGs of predominantly of 5 year maturity, with evidence reported across spot and historical estimates.
Ofcom July 2011 (WBA)	20/07/2011	1.40	1.40	Focused on 5-10 year averages on 5 year ILGs.
Ofgem November 2011 (TPCR4 rollover)	28/11/2011	2.00	2.00	Based on updated Smithers Report.
Ofcom April 2012 (ISDN)	12/04/2012	1.40	1.40	Same as July (2011)
Ofgem December 2012 (RIIO gas distribution)	17/12/2012	2.00	2.00	Looked at long-term evidence ILG which suggested a figure of 2%.
ORR November 2013	31/10/2013	1.75%	1.75%	Combination of evidence, but more focus on long-term averages.
CC Northern Ireland Electricity – November 2013 provisional findings	08/11/2013	1.0	1.5	Current and long-term historical evidence on yields on Government debt.
CAA Q6 – January final determination	10/01/14	0.5	1.0	Current market evidence and forward rate expectations.
Ofwat PR 14 – Risk and reward guidance	27/01/14	0.75	1.25	Current market evidence and forward rate expectations.

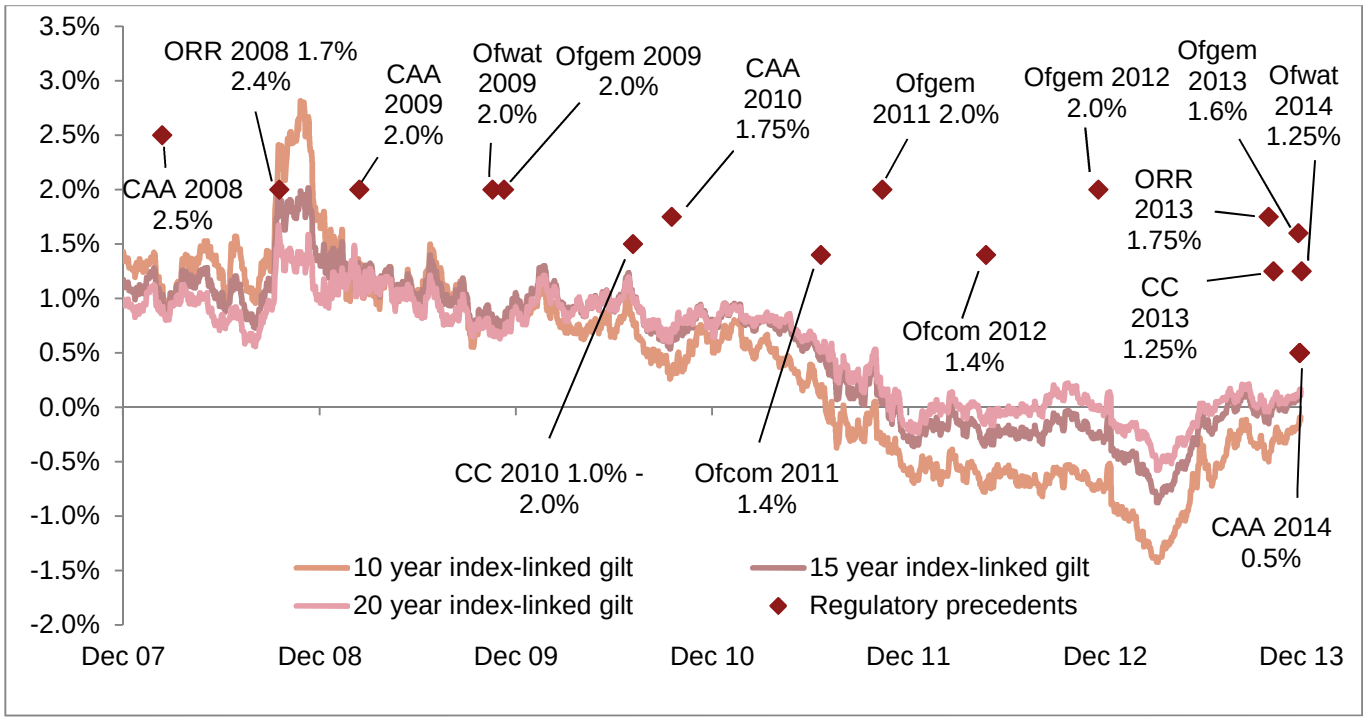
** Note: We use the mid-month spot value when the precise date for the decision is not specified. ORR figures are based on CEPA's analysis conducted on behalf of the ORR.*

Source: Regulatory determinations.

Figure A2.3 below shows the evolution of yields on 10-15 year maturity index-linked gilts as well as the various regulatory determinations on the appropriate RFR included in Table A2.3 above. As shown in this figure, UK regulators have tended to use RFR estimates that were markedly above the spot estimates at the decision dates, often giving more weight to long-term averages and/or explicitly adjusting for market distortions and/or incorporating an expectation of a reversion in yields back towards 'normal' levels. However, the trend in the selection of the RFR has been slightly downward, largely as a consequence of persistently low current rates

which have lowered historical averages. For example, the CC in the case of Northern Ireland Electricity used a risk-free rate of 1.3% - whilst still slightly above current implied rates it is nonetheless lower than the regulatory precedents on the risk-free rate. Ofgem used a slightly higher risk-free rate estimate of 1.6% to assess electricity distribution network operator's business plans for RIIO ED1 price control. Similarly, the CAA, in its final determination for the Designated Airports for Q6, (based on advice from PwC) used a range of 0.5% to 1.0% (with a point estimate of 0.5%) - which was markedly lower compared to regulatory precedents but consistent with current market expectations of trends in the real RFR over the course of the price control review at that point in time. More recently, Ofwat in its draft determination for the water sector (advised by PwC), used a range for the risk-free rate of 0.75% to 1.25% - with a point estimate of 1.25%.

Figure A2.3 Regulatory precedents compared to spot estimates



Source: PwC Analysis, Bank of England, Various regulatory determinations.

Appendix 3– Estimating the equity market risk premium

In this Appendix, we set out the evidence on the EMRP. We look at both historical and forward looking approaches, based on a combination of academic and empirical sources, as well as recent regulatory precedents on the EMRP.

A3.1 Historical (ex-post) EMRP

Historical EMRP estimates are derived from actual equity returns (over and above the RFR) and are typically reported by a number of different academics and practitioners. For example Dimson, Marsh and Staunton (DMS)[60] publish a yearly update where they analyse long-term trends in equity returns as well as the ex-post EMRP estimates across a range of different countries which is widely used by regulators and market practitioners. Table A3.1 below shows the ex-post EMRP estimates (relative to bonds), based on DMS and the Barclays Equity Gilts Study. For DMS, current evidence on the ex-post EMRP suggests a range of 3.7% to 5.1%, whereas the Barclays study supports a value of around 3.6%. Overall, combining evidence from the DMS and Barclays study, we consider a range of 3.6% to 5.1% as appropriate for the ex-post EMRP.

Table A3.1 Long run UK EMRP estimates

Source:	1900-2008	1900-2009	1900-2010	1900-2012
DMS	3.6%-5.0%	3.9%-5.2%	3.9%-5.2%	3.7%-5.1%
Barclays EGS	3.7%	3.8%	3.9%	3.6%

Source: Global investment returns yearbook 2013, Barclays Equity Gilt Study.

A3.2 Forward looking (ex-ante) EMRP

The forward looking (ex-ante) estimates for the EMRP can be estimated using the DGM model. As set out in Appendix 2 above, by rearranging the basic DGM equation we can estimate the implied cost of equity using assumptions on dividend yield, long-term dividend growth rate etc. The implied EMRP can then be estimated by subtracting the risk-free rate from the return on equities. For the purpose of current analysis, we estimate the times series of implied nominal UK equity market returns[61] similar to our approach above by using nominal UK GDP growth rate (estimated as the sum of the real UK GDP growth forecasts from Consensus Economics for the final year of forecasts and the long-term inflation forecasts from consensus economics) and the FTSE 100 dividend yield (adjusted for share buy-backs). From this nominal cost of equity estimate, we subtract the yield on 10 and 15 year maturity UK government bonds to separately estimate the implied EMRP based on 10 and 15 year maturity gilts. Our DGM approach suggests a range for the current EMRP of between 5.0% (using 15 year government bonds) and 5.5% (using 10 year government bonds) as set out in Table A3.2 below. The top-end of our proposed range is slightly lower than the evidence reported by Credit Suisse in their Global Investment Returns Yearbook (2012), in which they suggest an implied (forward-looking) EMRP estimate for the UK of 6.1%.

[60] Credit Suisse, 'Global investment returns yearbook 2013'

[61] For simplicity we use nominal equity market returns as we estimate the risk-free rate using the benchmark yield on nominal government bonds.

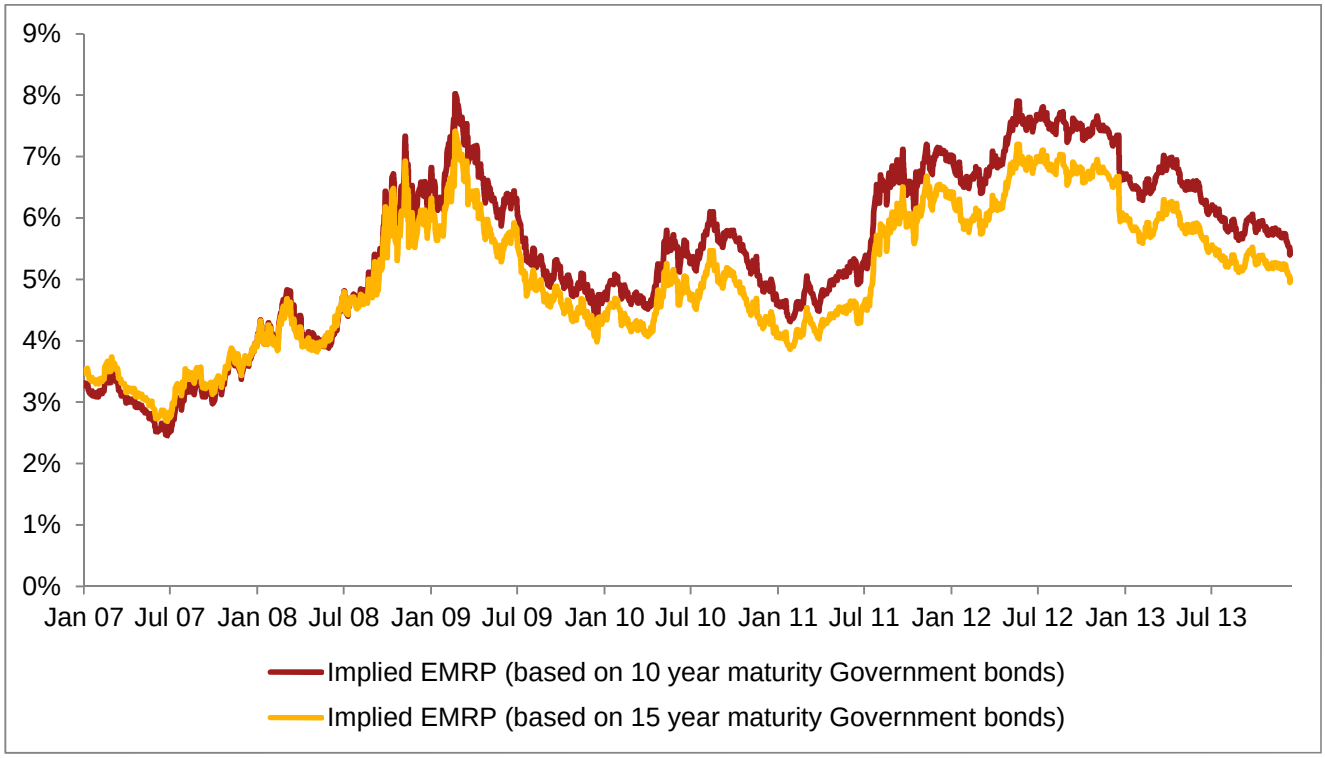
9.1.1. Table A3.2 Implied EMRP estimates

EMRP estimates (%)	10 year maturity gilts	15 year maturity gilts
Implied EMRP	5.5	5.0

Source: Consensus economics, Bank of England, Datastream and PwC analysis.

Figure A3.1 below shows the evolution of our implied EMRP estimate over the last several years. As discussed above, the EMRP was very volatility during the peak of the financial crisis, declining subsequently in early 2009 and remained relatively low till mid-2011. However, after that period, it increased markedly (as a consequence of the broader market uncertainty perhaps due to sovereign debt crisis) and currently ranges between 5.0% to 6.0%.

Figure A3.1 Implied EMRP estimates



Source: Dealogic, Bank of England, OBR, Consensus Economics and PwC analysis.

Survey based evidence also provides a useful source for ex-ante EMRP estimates. The most frequently quoted source is the survey undertaken by Fernandez and Avendano at the IBBE School, which has a particularly large sample size and includes estimates for the appropriate EMRP by academics, analysts and companies[62]. The results from their 2012 survey, set out in Table A3.3 below, suggest a figure for the UK of around 5.3% to 5.6%. Their 2013 survey evidence is the same as 2012 with an average EMRP estimate of 5.5%. A number of other academics and practitioners have also undertaken similar surveys: for example, Welch (2009)[63] took a survey of the EMRP used by finance or economics professors which suggested a range of 5.0% to 6.0%.

[62] Fernandez, P, Aguirreamalloa, J and Avendaño, L, (2012) 'Market Risk Premium used in 82 countries in 2012: a survey with 7,192 answers', IESE Business School.

[63] Welch, I (2009), "Views of Financial Economists on the Equity Premium and other Issues", The Journal of Business, October, page 500-540.

Table A3.3 Survey responses for the EMRP used in 2012

	Mean EMRP estimate			Standard Deviation		
	Analyst	Company	Academic	Analyst	Company	Academic
US	5.0	5.5	5.6	1.1	1.6	1.6
UK	5.4	5.3	5.6	1.7	1.3	3.1

Source: Fernandez et.al (2012).

A3.3 Regulatory precedent on EMRP

Regulators typically use historical EMRP estimates are to assess the appropriate cost of equity for price control determinations. Table A3.4 below sets out the recent evidence on regulatory precedents for the EMRP used by various regulators over the last 4 to 5 years, including the CAA at the time of CP3. The EMRP estimates have ranged from 2.5% to 5.4% (based on final determinations). In its most recent determination for Network Rail, ORR's used a point estimate for the EMRP of 5.0%. The CC in its provisional finding for Northern Ireland Electricity used an EMRP range of 4.0% to 5.0%. Ofgem used an EMRP estimate of 5.25% to assess electricity distribution network operator's business plans for RIIO ED1 price control. In its final determination for the Designated Airports, the CAA used an ex-ante EMRP estimate of 5.75% and a long-term EMRP estimate of 5.0%. Lastly, Ofwat, in its recent Risk and Rewards guidance used an EMRP estimate of 5.5%.The CAA's proposed estimated for Designated Airports was higher than regulatory precedents as it gave more weight to current market evidence, similar to our analysis in the context of NERL.

Table A3.4 Regulatory precedent on the EMRP

Regulator	Decision Date*	EMRP (%)	
		Low	High
CAA March 2008 (Q5 Heathrow and Gatwick)	11/03/2008	2.5	4.5
ORR October 2008 (CP4)*	15/10/2008	4.0	5.0
CAA March 2009 (Q5 Stansted)	13/03/2009	3.0	5.0
Ofwat November 2009 (Water and sewerage)	15/11/2009	5.4	5.4
Ofgem December 2009 (DPCR5)	07/12/2009	3.0	5.0
CC August 2010 (Bristol Water)	15/08/2010	4.0	5.0
CAA December 2010 (NERL)	15/12/2010	5.25	5.25
Ofcom July 2011 (WBA)	20/07/2011	5.0	5.0
Ofgem November 2011 (TPCR4 rollover)	28/11/2011	5.0	5.0
Ofcom April 2012 (ISDN)	12/04/2012	5.0	5.0
Ofgem December 2012 (RIIO gas distribution)	12/04/2012	5.25	5.25
ORR PR13 October 2013	31/10/2013	5.0	5.0
CC NIE November 2013 (provisional findings)	08/11/2013	4.0	5.0
CAA Designated Airports Q6 January 2014 (final determination)	10/01/14	5.75	5.75
Ofwat PR14 Risk and Reward Guidance January 2014	27/01/14	5.5	5.5

Note: ORR uses CEPA's lowest and highest suggested EMRP estimates.

Source: Regulatory Determinations.

Appendix 4 – Analysis of the share of volume risk borne by NERL

In this Appendix, we set out our methodology for analysing the share of volume risk borne by NERL. In Sub-Section 7.4.4, we combine the result of this analysis with estimates for of the asset betas for companies with (i) higher exposure to volume risk (airports) and (ii) little/no volume risk exposure (utilities) to derive a reference point for the asset beta of NERL.

Our methodology for analysing the share of volume risk borne by NERL involves three stages:

- Firstly, we collected data on forecast and actual levels of service units and revenue for NERL for the last six years. This data is shown in Table A4.1 below.
- Secondly, we split the 'excess' (actual minus forecast) revenue between NERL and its customers according to the difference between actual and forecast service units.
- Thirdly, we calculated the percentage share of 'excess' revenue that was allocated to NERL and its customers.

It is important to note that we did not use the precise methodology of the SES, which would have required more detailed data on revenue, service units and determined costs than we had available.

Table A4.1 Analysis of SES volume risk sharing mechanism – source data

Year	Revenue: forecast (£m)	Revenue: actual (£m)	Service units: forecast	Service units: actual
2006/07	556.3	565.6	10,071	10,400
2007/08	573.2	593.7	10,279	10,850
2008/09	585.0	603.6	10,578	10,601
2009/10	585.9	577.5	10,975	9,564
2010/11	619.8	594.6	11,389	9,377
2011/12	672.2	669.4	9,886	9,655

Source: NERL regulatory accounts.

Table A4.2 below present the key findings for our analysis. The last two columns of Table A4.2 show the percentage share of 'excess' revenue that was allocated to NERL and its customers. The penultimate column of this table has an average of 63%, suggesting that NERL has absorbed approximately two-thirds of volume risk under the current risk sharing mechanism, with the remained passed to customers. However, this result is highly sensitive to which years are included, with the exclusion of 2009/10 and 2010/11 (when the percentage difference between actual and forecast service units was at its largest) causing the average of the penultimate column rising to 80%. For forecasting the share of volume risk borne by NERL in future price control periods, we consider it appropriate to apply less weight to 2009/10 and 2010/11 because these two years were significantly affected by the recent recession[64]. Therefore, we estimate that NERL will bear 70% of volume risk in future price control periods, if the current volume risk sharing mechanism continues to apply.

[64] CAA (2010), 'NATS (En Route) plc price control review for control period 3 (2011-2014): Implications of SES II', paragraph 2.16

Table A4.2 Analysis of SES volume risk sharing mechanism – key findings

Year	'Excess' service units (percentage of forecast)	'Excess' revenue retained by NERL (£m)	'Excess' revenue passed through to customers (£m)	Percentage of 'excess' revenue retained by NERL	Percentage of 'excess' revenue passed through
2006/07	3.3%	6.8	2.5	73%	27%
2007/08	5.6%	11.3	9.2	55%	45%
2008/09	0.2%	18.6	0.0	100%	0%
2009/10	(12.9%)	(2.9)	(5.5)	34%	66%
2010/11	(17.7%)	(6.3)	(18.9)	25%	75%
2011/12	(2.3%)	(2.5)	(0.3)	90%	10%

Note: This analysis is for illustration only and does not use the precise methodology of the SES, which would require more detailed data on revenue, service units and determined costs than we have available.

Source: NERL regulatory accounts and PwC analysis.

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