

**Paper 2: Indexation of the Cost of Debt and Inflation**  
**Prepared by First Economics for the Electricity DNOs****8 June 2012****1. Introduction**

First Economics was asked earlier this year by the electricity DNOs to review Ofgem's proposed approach to indexing the allowed cost of debt. Our review mainly identified issues that have already been brought to Ofgem's attention by the ENA and by the networks involved in the ongoing RIIO-T1 and RIIO-GD1 reviews – such as the suitability of the two iBoxx indices and the absence of allowances for things like fees – which we do not propose to revisit again here. However, we also identified problems with one aspect of Ofgem's calculation which, to our knowledge, has not received any attention to date: the transformation of the nominal iBoxx indices into a real cost of debt using gilt market break-even inflation.

The purpose of this report is to summarise our concerns for the benefit of Ofgem and its cost of capital consultants. The paper is organised into three main parts as follows:

- section 2 assesses the inflation adjustment that Ofgem is proposing to incorporate into its cost of debt index;
- section 3 puts forward several alternative ways of making this adjustment which we think are potentially more suitable than Ofgem's current approach; and
- section 4 concludes with a summary of our recommendations.

**2. 'Expected Inflation' in the Market for Government Gilts****2.1 Ofgem's RIIO methodology**

The allowed cost of debt in Ofgem's current proposals for the RIIO-T1 and RIIO-GD1 reviews is defined as a ten-year trailing average of:

the average yields on two selected iBoxx indices

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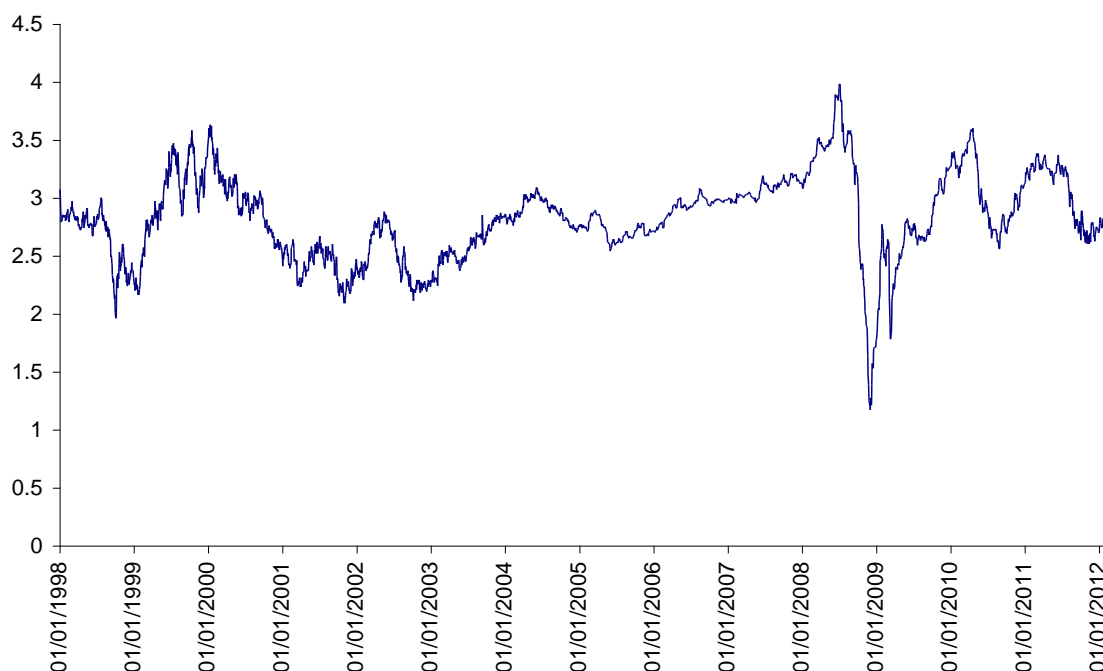
the difference between the yields on ten-year conventional gilts and ten-year index-linked gilts

The second of these terms is Ofgem's chosen adjustment for inflation and serves to transform the nominal iBoxx indices into a real cost of debt. In simple terms, the formula makes use of the assumption that the yields on conventional and index-linked gilts differ to the extent that investors expect future inflation to erode into the principal of the former but not the latter. By bringing this concept of 'break-even inflation' into the cost of debt formula, Ofgem is seeking to deduce the value of the real cost of debt using primary market data, thereby overcoming the absence of an index that identifies the real cost of debt directly.

**2.2 Robustness and plausibility**

Figure 1 shows the scale that the inflation adjustment has taken during the last 15 years.

**Figure 1: Gilt market break-even inflation, ten year borrowing, spot estimate (%)**



Source: Bank of England.

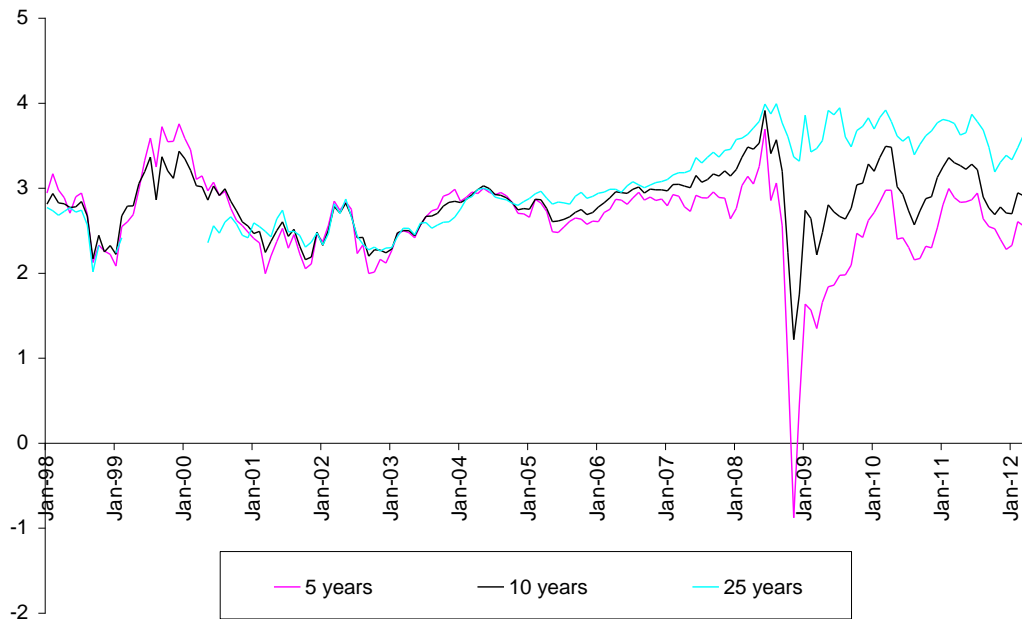
A visual inspection of this data indicates that gilt market readings of expected inflation have to be treated with a certain amount of caution. If one asks whether the data points in the chart reveal investors' expectations about future inflation at any given point in time, the answer has to be, at best: not always.

For one thing, the series is much more volatile than one might expect. The period between mid-2008 and mid-2009 is especially striking in this regard. The data is saying that just prior to the onset of the financial crisis in 2008 investors' expectations of average annual inflation over the next ten years were exceptionally high at around 4% per annum. Within the space of six months, however, expectations moved sharply downwards and investors came to expect inflation to average just 1% per annum over a ten-year period. Neither of these figures feels very credible. In an economy where the government has an inflation target and when an independent central bank is charged with setting monetary policy to deliver this target, it is possible that inflation might move sharply up or sharply down for a period of, say, 1-2 years. But it is highly unlikely that inflation would depart markedly from the target over longer horizons. For inflation to average out at either 4% or 1% over a period of ten years, it would have to be that the Bank of England was consistently overshooting or undershooting its target. Whilst this is not a wholly implausible scenario, it is very difficult to believe that the market consensus was that these were the central-case scenarios in mid-2008 and late-2008 respectively.

The intuitive doubt that this casts on the story told by figure 1 is further reinforced by a number of additional pieces of evidence. In figure 2 below we add two further lines to the chart to show gilt market break-even inflation over 5 years and over 25 years. The additional data points contain further implausibilities. Specifically, it is very hard to believe that investors were expecting out-turn inflation to come in at an average of 4% per annum over 25 years just prior to the start of the financial crisis or that inflation expectations edged up back to this level on several occasions

during 2009, 2010 and 2011. Nor is it credible to think that investors foresaw five years of deflation ahead of them in late 2008.

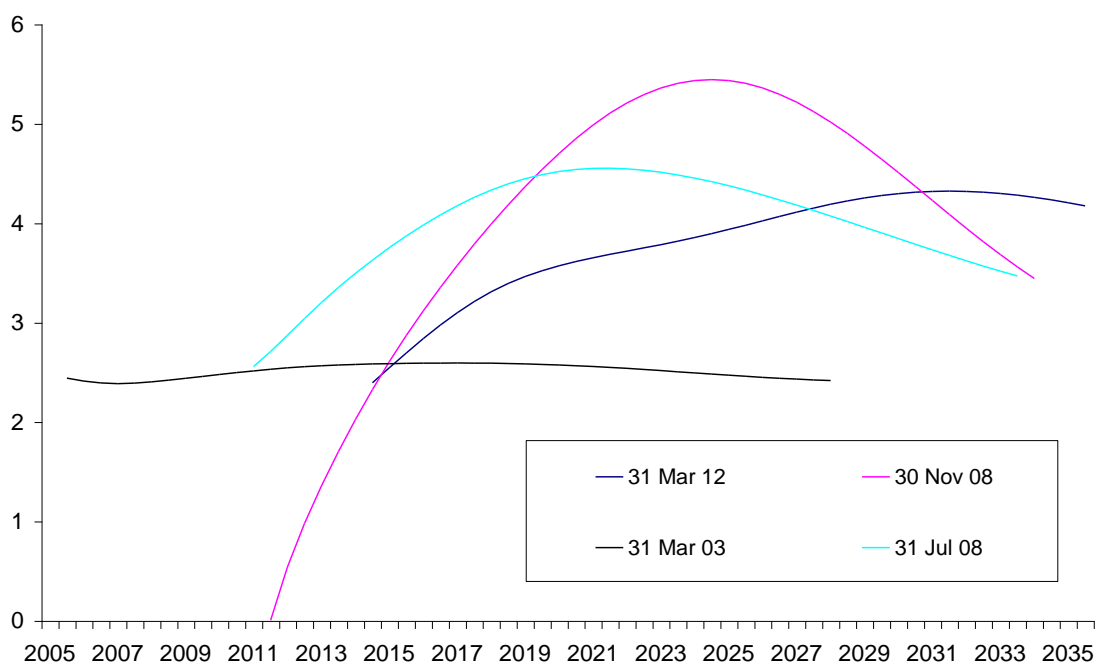
**Figure 2: Gilt-market break-even inflation, spot estimates (%)**



Source: Bank of England.

In figure 3 we show the forward inflation curves at four specific points in time. The March 2003 curve exhibits the sort of profile that one might expect to see a priori, but the other three curves look very odd. Once again, we have to question how it could be that the market is or was expecting inflation to rise beyond 4% for sustained periods of time, in these cases many years out in the future.

**Figure 3: Gilt market break-even inflation, forward curves (%)**



Source: Bank of England.

To corroborate the instinctive impression that something is awry here, one can look at other forecasts of future inflation at the dates we have selected. Extracts from the HM Treasury survey of independent forecasters, for example, are reproduced as table 4.

**Table 4: Average of independent forecasts of RPI-measured inflation (%)**

	Q3 2008 survey	Q1 2009 survey	Q2 2012 survey
2008	4.4	-	-
2009	3.2	(1.3)	-
2010	2.8	1.9	-
2011	2.9	3.0	-
2012	2.9	3.0	3.2
2013	-	2.8	2.6
2014	-	-	3.4
2015	-	-	3.7
2016	-	-	3.9

Source: HM Treasury.

The entries in this table show nothing like the profile in figure 3. Once again, whilst it is not implausible that the views of professional forecasters might differ from the views of actual investors, it is very difficult to believe that there could be differences on the scale that a comparison of figure 3 and table 4 exhibits.

### **2.3 Explanation: gilt market distortions**

The reason for the counter-intuitive character of the data almost certainly goes back to a phenomenon that has long troubled regulators undertaking cost of capital calculations.

In the past, the other use that regulators have tried to make of readings from the gilt market is as an indicator of the risk-free rate to be used within the CAPM calculation of the cost of equity. In theory, it should be that the yields on index-linked gilts reveal the return that equity investors expect they will need in the future when holding a risk-free asset. And 10 years ago it was common practice for a regulator to take exactly this level of return directly into their cost of capital analysis.

UK regulators have been very reluctant to follow this approach in recent times, however. The problem that they face was put by the Competition Commission in the following terms in its 2007 airports inquiry.<sup>1</sup>

... the Bank of England [has pointed] to distortions in the market for longer dated gilts, particularly as regards the effect of Minimum Funding Requirements and FRS17/IAS19 accounting requirements on pension funds' demand for long-term government bonds. This is seen as creating a mismatch between supply and demand, increasing demand at the long end of the market and depressing yields on long-term gilts substantially below those on short-term bonds.

In the presence of such distortions, the relatively low yields on longer dated index-linked gilts may not be an accurate estimator of the risk-free rate ...

<sup>1</sup> Competition Commission (2007), BAA Ltd – a report on the economic regulation of the London airport companies (Heathrow Airport Ltd and Gatwick Airport Ltd), Appendix F.

Having had regard to this evidence, we have decided not to place any weight on the redemption yields for index-linked gilts of more than ten years in maturity.

The Commission went further in its 2008 Stansted price control inquiry.<sup>2</sup>

In previous reviews, the source of our risk-free rate estimates was the redemption yield on government-issued index-linked gilts (ILGs). These are assets with negligible default risk and relatively insignificant inflation risk which are generally thought to give the best available indication of the return that investors would require in exchange for holding a truly risk-free asset.

The main challenge that we faced when using this data was the segmentation in the gilt market caused by regulatory and accounting rules which encourage pension funds to purchase long-maturity government debt. A number of observers believe that strong demand from this one specific type of investor has pushed down the yields of long-dated ILGs to the point where the returns that were on offer were attractive only to other pension funds. This is said to make the long-dated ILG yields an unreliable indicator of the risk-free rate for a typical equity investor and, in particular, for the marginal shareholder whose cost of capital we were trying to measure when estimating the rate of return that Stansted needs to earn.

...

One way of sense-checking yields on ILGs was to look at the forward rates built into prices. The forward curve constructed by the Bank of England showed that ILG yields in September 2008 priced in a return of less than 0.5 per cent after 15 years, justifying the view that long-maturity ILGs did not provide reliable risk-free rate estimates. However, it was also apparent that the ILGs priced in yields of less than 1.25 per cent after five years and yields of less than 0.75 per cent after eight years. Prima facie, this was evidence that the ten-year ILG benchmark was not a suitable indicator of the risk-free rate.

This view was confirmed to some extent by the gap between yields on nominal and index-linked gilts. The data implied that the market priced in a 2.7 per cent a year inflation rate during the next five years, but a 3.3 per cent a year inflation rate over the next ten years. In an era of inflation targeting this did not feel plausible. Accordingly, we thought that it was appropriate for us to place less weight on the ten-year ILG benchmark in this review.

Such views are consistent with the advice that Ofgem itself received from Smithers & Co in 2006.<sup>3</sup> The consultants in their report also made an explicit link between distorted gilt yields and implausible readings of break-even inflation.

The recent path of the implicit inflation forecasts lends some support to the widely held suspicion that indexed yields are providing an unduly depressed picture of forward-looking real returns (the usual explanation being the funding requirements on major pension funds). In 2003 the Bank of England's inflation target was officially lowered from 2 ½% to 2%, yet in the period since this change implicit inflation forecasts have risen rather than fallen, to a figure closer to 3%. The most likely explanation is that the gap between nominal and real yields is not purely a forecast of inflation, but also contains a risk premium element (or, put another way, that indexed bonds have traded at an increasing risk discount).

Since regulated companies issue barely any indexed debt this suggests that using indexed yields as a benchmark in setting the cost of capital may tend to bias the cost of debt downwards.

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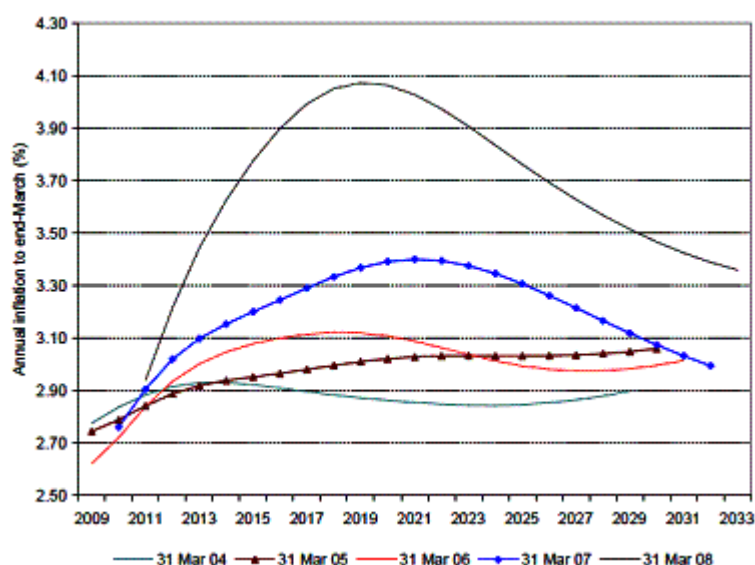
<sup>2</sup> Competition Commission (2008), Stansted Airport Ltd - Q5 price control review, Appendix L.

<sup>3</sup> Smithers & Co (2006), Report on the cost of capital.

More recently, Professor Gordon Hughes, chair of the Water Industry Commission for Scotland, has put forward the following critique.<sup>4</sup>

[The yield curves for nominal and index-linked gilts are] potentially a very unreliable source of information about inflation expectations. The Bank of England's notes on the yield curve warn of the difficulties – in particular, illiquidity in markets for certain maturities and types of bonds and the assumption that the inflation risk premium is zero. A related observation is that the implied rate of expected inflation can differ significantly across types of bonds at a particular date – e.g. for March 2008 the implied inflation was 3.94% for 10 year bonds using implied forward rates (series IUMAMIIF) and 3.42% using zero coupon rates (IUMAMIZC). The differential was negligible in March 2004 but had increased to 1.5% in October 2008. It is clear that either liquidity or other factors – such as the market preferences based on differences in tax treatment for different classes of investor – changed radically over this period. This would be a notable change if it reflected a genuine change in expectations about the future rate of inflation in the UK.

Figure 1 shows the implied annual rates of inflation derived from the Bank of England's yield curves for years from 2009 onwards as at 31st March 2004, 31st March 2005, etc. The calculations use data for medium and long dated gilts, so the projected rates of inflation only start 3 years ahead – i.e. from 2011 onwards for 2008 – and continue up to 25 years ahead. The striking feature of the figure is the sharp rise in annual inflation in the middle part of the next decade implied by the inflation projects for 2008 and, to a lesser extent, for 2007. It seems reasonable to question why and how inflation is expected to increase from about 2013 to the end of the decade. Without this increase, the average expected rate of inflation would be very stable over time – falling in the range 2.9 to 3.1%.



It is possible that the recent spike in inflation might have led to an increase in the expected rate of inflation over the very long run, but other evidence such as consensus forecasts does not suggest this. There are two possible explanations.

A. The inflation risk premium is not zero and it increased sharply in 2007-08, especially with respect to the variability of inflation looking 5 to 10 years ahead. The yield curves in Figure 1 are consistent with a fairly modest premium in 2008 of about 0.4% per year over the long term combined with much premium of up to 1% over the medium term.

<sup>4</sup> Hughes (2009), Understanding and addressing the pension liabilities of regulated utilities – a paper for the Regulatory Policy Institute.

B. Liquidity, tax and other market factors have affected both nominal and index-linked gilts of various maturities in different ways so that the method of inferring implied rates of inflation over different periods from nominal and index-linked yield curves cannot be relied upon. This is consistent with the observation that there are significant differences between implied inflation expectations for zero coupon and regular gilts of different maturities.

It is likely that both explanations have some validity.

Such conclusions are consistent with academic work that has looked at the proper interpretation of differences between the yields on conventional and index-linked gilts. The general consensus in this literature is that the differentials at most maturities represent more than just investors' expectations about future inflation, with most authors concluding that there is an unexplained and non-constant/time-varying component to the observed difference in yields. If Ofgem and its consultants are interested in exploring this literature in greater detail, we recommend Golden, Adams, Liu and Sorensen (2010),<sup>5</sup> Garcia and van Rixtel (2007)<sup>6</sup> and Deacon and Derry (1994)<sup>7</sup> as good entry points into the literature.

As a final observation, most of the literature, as well as the statements by regulators that we have cited, pre-dates the Bank of England's interventions into the gilt market under its programme of quantitative easing. These operations are deliberately intended to distort gilt prices, making it very difficult at the current time to justify making use of any sort of (supposed) market signals for the energy industry's regulatory purposes.

## **2.4 Summary**

On the basis of the analysis set out above, we do not think that gilt market break-even inflation is a robust or accurate enough measure to be included in Ofgem's new cost of debt index. We say this on the basis of:

- the many cautions that we read in the academic literature about the probable lack of correlation between break-even inflation and future inflation expectations;
- the inconsistency that there would be in using current gilt market readings in the setting of the allowed real cost of debt while ignoring these same readings on grounds of distortions and lack of robustness when calibrating the risk-free rate within the CAPM calculation of the cost of equity;
- the counter-intuitive data that the market has produced in recent years, especially since 2008; and
- our concerns that the Bank of England's programme of quantitative easing is likely to create continuing distortions for the foreseeable future.

All of these things imply individually that the data series Ofgem has been focusing on until now does not capture what the regulator actually wants to measure. Collectively, they suggest that Ofgem would be including essentially a random number into companies' revenue entitlements if it does not alter its proposals.

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<sup>5</sup> Golden, Adams, Liu and Sorensen (2010), Forecasting UK inflation: an empirical analysis.

<sup>6</sup> Garcia and van Rixtel (2007), Inflation linked bonds from a Central Bank perspective.

<sup>7</sup> Deacon and Derry (1994), Deriving expectations of inflation from the prices of UK government bonds.

### **3. Alternative Approaches**

In putting forward this critique, we are not arguing that Ofgem should abandon its proposals to index the cost of debt. We are arguing only that Ofgem should find some other way of transforming the nominal iBoxx indices into a real cost of debt.

We have put a number of suggestions to the DNOs in the course of our work.

A first alternative is to switch to a different measure of expected inflation. There are at least two options here:

- Consensus Economics is a respected source of economic forecasts. Its forecast horizon stretches to the ten years that Ofgem is interested in. Ofgem could very easily average this data and insert it into its cost of debt formula;<sup>8</sup> or, alternatively
- it might be sensible for Ofgem to allow for the historical wedge between RPI-measured inflation and the government's CPI-measured inflation target of 2.0% as a point estimate of expected inflation going forwards. This is essentially the approach that regulators have taken informally until now when converting bond market readings into a real cost of debt for regulatory purposes..<sup>9</sup>

As a second alternative, we have also explored with the DNOs the possibility that Ofgem might use out-turn rather than expected inflation to transform the nominal iBoxx index values into real equivalents. This would bring a degree of internal consistency with the mechanics of the indexation of the RAV, as the means by which DNOs are compensated for inflation. As such, it would keep the nominal cost of debt 'whole' in a way that would not be apparent if Ofgem were to use different measures of inflation in the allowed return and RAV calculations.

Finally, it is open to Ofgem to compensate the DNOs upfront for the expected difference between gilt market break-even inflation and a true measure of expected inflation. The study by Golden, Adams, Liu and Sorensen that we referred Ofgem to in section 3 puts the gap between these two measures at an average of around 30 basis points since 1997. Ofgem could very simply amend its cost of debt formula to include a new term which hardwires, say, a 30 basis points addition into the current benchmark values.

The mechanics of the above options are very straight-forward. Specific details are set out in the appendix.

### **4. Conclusions**

The DNOs have expressed different views to us on the merits of these approaches, hence we put forward all three options for Ofgem to consider ahead of its July initial proposals documents.

The most important thing from our perspective is that companies and customers should not be exposed to the risk and uncertainty that comes from using a distorted and discredited measure of expected inflation. If Ofgem does not alter its proposals, we see a real danger that allowed revenues in the new RIIO model will include windfall gains and windfall losses that are not justifiable on any economic grounds.

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<sup>8</sup> We note that Europe Economics did not consider the availability of Consensus Forecasts in their December 2010 advice to Ofgem.

<sup>9</sup> See, for example, paragraph 36 in appendix F to the 2007 Competition Commission airport inquiry report or paragraph 37 in appendix L to the 2008 Stansted inquiry report.



## Appendix

The adjustments that Ofgem would be required to make to its cost of debt formula if it were to switch to one of the alternative options set out in section 3 of the main body of the paper are highlighted in blue below.

**Table A1: Formula definitions**

	Current Ofgem approach	Option 1: Alternative definition of expected inflation	Option 2: Out-turn inflation adjustment	Option 3: Upfront differential
Nominal benchmark	Average yield on two selected iBoxx indices over the preceding ten years	Average yield on two selected iBoxx indices over the preceding ten years	Average yield on two selected iBoxx indices over the preceding ten years	Average yield on two selected iBoxx indices over the preceding ten years
Inflation	<i>less</i> Gilt market break-even inflation for ten-year bonds over the preceding ten years	<i>less</i> Expected RPI inflation over ten years as reported by Consensus Economics or Expected inflation according to the historical differential between RPI inflation and CPI inflation of 2.0%	<i>less</i> Out-turn RPI inflation over the preceding ten years	<i>less</i> Gilt market break-even inflation for ten-year bonds over the preceding ten years
Other adjustment				<i>plus</i> [30] basis points

The logic behind the first and the third options is straight-forward to understand. The second merits more detailed comment for the sake of complete clarity.

As a starting point, we note that the reason Ofgem requires a real rather than nominal rate of return is that the price control calculation compensates investors for the eroding effects of inflation via the indexation of the RAV rather than the in-year return.

The underlying, raw cost of capital in the sectors that Ofgem regulates is fundamentally a nominal value, however. It comprises payment for three distinct things: the pure time value of money; the additional effects of inflation; and the riskiness of the specific assets and activities that go into running a network business.

When RAVs index automatically in line with out-turn RPI-measured inflation, it becomes unnecessary for Ofgem to factor compensation for the second of these things into its allowed cost of equity calculation. It must focus instead only the first and the third items – i.e. the risk-free rate and the equity premium that investors require from regulated companies.

On the debt side of this calculation, the interest that companies pay to lenders is more often than not measurable only as a single all-in nominal figure (because companies issue relatively little index-linked debt and debt investors therefore still largely take inflation risk). Ofgem has to recognise in its revenue control calculation that some of the interest that networks pay is reimbursed via the indexation of the RAV and must therefore strip out RPI inflation from observed yields so as to identify only the residual real cost of debt for insertion into the allowed return.

If Ofgem were to put out-turn rather than expected inflation into its cost of debt formula, it would effectively synchronise the calculation of the allowed cost of debt with the roll forward of the RAV. This means that the benchmark nominal cost of debt, as measured by the iBoxx indices, would automatically be kept 'whole' – i.e. there would be no scope for DNOs to earn higher/lower profits for shareholders when out-turn inflation, which Ofgem adds to RAVs, inevitably turns out to be higher/lower than gilt market break-even inflation, which Ofgem is proposing to factor into its cost of debt index.

This approach can therefore be thought of as saying that Ofgem should think of the cost of debt as a nominal variable and ensure that its chosen nominal benchmark feeds through in full to the prices that customers pay companies. By comparison, Ofgem's current cost of debt formula focuses first and foremost on the identifying and remembering the prevailing cost of borrowing in real or index-linked terms over a historical period of ten years.

It could be argued that the former approach is more appropriate in an industry in which most debt has been arranged in nominal terms and index-linked issuance is comparatively limited. However, the impact of past and future inflation volatility would need to be considered further if Ofgem were minded to pursue this option; for the avoidance of doubt, the wedge between the nominal and real cost of debt has a material impact on cashflow/financeability and investors are not indifferent between additions to the RAV and in-year returns.