

Ofcom's approach to risk in
the assessment of the cost of
capital

Final statement

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Section 1

Executive summary

Introduction

- 1.1 This statement sets out Ofcom's views on a number of issues relating to risk and return, in particular the returns appropriate for companies regulated by Ofcom. It marks the conclusion to two Ofcom consultations:
 - Ofcom's approach to risk in the assessment of the cost of capital, 26 January 2005 (http://www.ofcom.org.uk/consult/condocs/cost_capital/) – “the first consultation”; and
 - Ofcom's approach to risk in the assessment of the cost of capital, 23 June 2005 (http://www.ofcom.org.uk/consult/condocs/cost_capital2/) - “the second consultation”
- 1.2 This statement focuses on Ofcom's approach to estimating companies' weighted average cost of capital and discusses Ofcom's regulatory approach to real options. These factors can directly affect financial outcomes for firms in the communications industry, being a key input used by Ofcom in its analysis relating to, for example:
 - *ex ante* duties, such as setting charge controls and price caps;
 - *ex post* duties, such as conducting competition analysis, when considering stakeholder complaints relating to allegations of anticompetitive conduct; and
 - valuing the future cash flows that are associated with, for example, licence applications.
- 1.3 Estimating a reasonable rate of return is therefore a key part of Ofcom's duties in regulating the communications industry, and the financial implications for the firms concerned may be significant.
- 1.4 Ofcom's wide ranging Strategic Review of Telecoms (“the telecoms review”) drove the decision to examine the issues covered in this statement. In the telecoms review, Ofcom set out as a fundamental regulatory principle that Ofcom should promote a favourable climate for efficient and timely investment and stimulate innovation, in particular by ensuring a consistent and transparent regulatory approach. This statement is intended as a significant step in achieving this aim. The telecoms review also proposed that regulation should be targeted on ensuring real equality of access to enduring economic bottlenecks, creating the scope for deregulation in other areas. On the 23 June 2005 Ofcom published details of the regulatory settlement intended to achieve this, of which the cost of capital is a necessary part.
- 1.5 Mindful of these regulatory duties and objectives, there are a number of key considerations that Ofcom will take into account when calculating a reasonable rate of return. The most important of these considerations are:

- the impact on incentives for companies to invest. Where investments are risky, it is important that regulated returns reflect the degree of risk that companies face in making investments
- the scope for investment by competing network providers. If there is a prospect of effective competition as a result of investment by competing providers, it is important that regulation does not harm such prospects; and
- the need to protect consumers from excessive charging for services provided in markets in which there are enduring economic bottlenecks.

Scope of this statement

- 1.6 This statement deals with a broad range of issues related to estimating the cost of capital, including the appropriate value for the equity risk premium, accounting for variations in risk with a firm, and accounting for real options in a regulatory context.
- 1.7 However, it also has a particular focus on BT's cost of capital given its importance in the context of the telecoms review and in relation to a number of imminent Ofcom decisions e.g. valuing BT's copper access network, and the network charge controls. In particular this statement addresses BT's equity beta and discusses an appropriate equity beta for BT's copper access business. It concludes with Ofcom's final estimates of BT's costs of capital.
- 1.8 These BT specific issues are of direct relevance to BT, its competitors and customers. However, it is Ofcom's view that the analytical approach outlined in this statement should serve as a starting point for Ofcom's approach to risk and return in all the sectors that it regulates, including mobile communications and the audio-visual and audio broadcasting industries (where similar economic and policy considerations apply and subject to the availability of a comparable standard of evidence the same approach may apply).

Key conclusions

The appropriate value for the Equity Risk Premium

- 1.9 Under the Capital Asset Pricing Mechanism, the Equity Risk Premium ("ERP") reflects the extra return that investors require for investing in equities rather than a risk free asset. It is a stock market, rather than company-specific, factor.
- 1.10 Ofcom noted in the first consultation that the calculation of a forward-looking ERP entails a significant degree of judgement and a wide range of estimates can be derived by commonly-used estimation techniques. As explained in the first and second consultation, Ofcom considers that the downside risk associated with taking too low a value for the ERP (discouraging discretionary investment) is more detrimental to the interests of consumers than taking too high a value (leading to higher prices to customers) and has tended to the higher end of the possible range. But, given the need to protect consumers, it would not be appropriate for Ofcom to err too strongly in this direction.
- 1.11 Having reviewed its approach in this area and on review of the available evidence and responses on this issue Ofcom believes that values in the range 4.0% to 5.0% are reasonable. Within this range Ofcom takes the view that 4.5% is the appropriate value for it to use in estimating a company's cost of capital.

This represents a reduction of 0.5% from Ofcom's previously applied value of 5.0%. The basis for this decision is discussed in detail in Section 4 of this statement.

Ofcom's approach to modelling variations in risk within the firm

- 1.12 In the first consultation, Ofcom proposed that it should, in certain circumstances, reflect differences in risk between projects in its financial analysis, with differences in systematic risk modelled via cost of capital estimates, and differences in specific risk reflected in cash flow estimates
- 1.13 Ofcom believes that, under certain circumstances, it may be appropriate to reflect differences in risk within corporate groups in its financial analysis. In the context of systematic risk, this would mean allowing different costs of capital on different projects. One way to achieve this in practice would be to vary, or "disaggregate", the beta, the parameter that reflects the systematic risk of a particular company in the CAPM.
- 1.14 The basis for this decision is discussed in Section 5.

BT's group equity beta

- 1.15 Under the CAPM, a company's equity beta reflects the systematic risk that it faces relative to the average company in the market. In the first consultation, Ofcom based its analysis in relation to disaggregating BT's beta on a group equity beta estimate for BT of 1.3. In their responses to the first consultation, some of the companies that depend on BT for wholesale inputs argued that the use of this figure was inappropriate, based on an analysis of more recent evidence in this area, and that Ofcom should revisit its estimate of this parameter.
- 1.16 In the second consultation Ofcom presented further analysis on the level of BT's group equity beta. After consideration of responses to the second consultation Ofcom takes the view that the appropriate value for BT's group equity beta is 1.1.
- 1.17 The basis for this decision is discussed in Section 6.

Disaggregation and BT's copper access beta

- 1.18 Ofcom and, previously, Oftel have traditionally assessed the cost of capital at a company-wide level.¹ However, companies commonly make investment decisions at a project or activity level, and reflect variations in systematic risk between different activities.
- 1.19 In the first consultation, Ofcom proposed that it should reflect some of the most important of these variations in systematic risk in its financial analysis. In particular, Ofcom proposed disaggregating its estimate of BT's equity beta in order to reflect Ofcom's view of the differing levels of systematic risk faced by different parts of BT's business.

¹ With some exceptions, for example in the past Oftel made adjustments to BT's group equity beta in order to strip out the impact some of its higher risk activities, notably its - now divested mobile network business Cellnet/O2.

- 1.20 Stakeholder responses to this proposal were divided. A number of firms, particularly those that have invested in the furthest-reaching network infrastructure, were opposed to assessing risk at a project level, with BT and the cable companies particularly opposed to estimating the risk of BT's copper access business on a standalone basis. Competitors and customers of the incumbents were, broadly speaking, in favour of assessing risk at a disaggregated level and therefore estimating a distinct equity beta for BT's copper access business.
- 1.21 The strongest argument cited by stakeholders against estimating an equity beta for BT's copper access business was that, in the absence of pure play comparators (i.e. companies that only offered copper access services); a beta for BT's copper access business could not be estimated with any reliability. In their responses to the first consultation, BT, argued that each of the pieces of evidence used by Ofcom to assess the level of systematic risk faced by BT's copper access business were flawed, and that this meant that the use of a single group estimate was preferable.
- 1.22 In the second consultation, Ofcom carried out further analysis of this issue and consulted on this new evidence. Having assessed stakeholder responses to both the first and second consultations, Ofcom remains of the view that it is appropriate to apply a disaggregated approach to beta estimation in relation to BT's copper access business. Ofcom's view is that it is reasonable to disaggregate BT's group beta of 1.1 into two components which broadly relate to BT's copper access network business with an equity beta of 0.9 and the rest of BT (including retail calls, broadband, and leased lines) with an equity beta of 1.23.
- 1.23 The basis for this decision is discussed in Section 7.

BT's cost of capital

- 1.24 In carrying out its duties in relation to BT, Ofcom takes the view that it is appropriate to apply BT's copper access network business beta or the beta for the rest of BT as appropriate.
- 1.25 Based on Ofcom's views on the ERP and BT's beta, Section 8 provides an estimate of the weighted average cost of capital ("WACC") for BT's two component parts on a pre tax nominal basis (see Section 8 of this document for details):
- copper access network business –10.0%; and
 - the rest of BT – 11.4%.

Taking account of real options

- 1.26 If the riskiness of a firm's investment is modelled using the CAPM and Net Present Value (NPV) analysis, then, as outlined in Section 3, the systematic risk faced by investors is taken into account via an estimate of the firm's Weighted Average Cost of Capital (WACC). Cash flows should be calculated in such a way as to ensure that the rewards from successful investments within the portfolio are expected to be sufficient to pay for the losses associated with unsuccessful investments. This analysis does not, however, explicitly take into account the extent to which risk can be mitigated by the adoption of certain

investment strategies (e.g. investing later in order to “wait and see” how a market develops, or investing early in order to gain a first mover advantage). It may not, therefore effectively mimic the signals given by a competitive market with regard to risky, non reversible investments.

1.27 In the first consultation, Ofcom proposed that, under certain circumstances, it should take account of such factors by using a real options approach to financial analysis. In particular, Ofcom proposed that, in some cases, the option to wait and see which is surrendered when an investment decision is made may have a value that it is appropriate to take into account in its analysis. In the context of the most important current or near future regulated products, Ofcom's initial view was that the value of these options is likely to be greatest in the cases of:

- next generation access networks; and
- (to a lesser extent) next generation core networks.

1.28 Ofcom received responses from a number of stakeholders in relation to the issue of real options. These responses discussed both:

- the “theoretical” case for the use of a real options framework, and
- whether, and how, real options might be used as a policy tool in practice.

1.29 Section 9 of this document provides a summary of these responses. In the light of these responses Ofcom concludes that, going forward, its analysis should take account of the value of real options where appropriate. This section expands somewhat on the analysis set out in the first consultation by making clear that Ofcom's approach to taking account of real options would seek to reflect the conditions that would prevail under competition, not to underpin the investment decisions and returns of a dominant firm.

1.30 Ofcom proposes to assess the value of real options on a case-by-case basis, and encourages stakeholders to make submissions to Ofcom on this subject in cases where they feel that wait and see options have a significant value. Should the theoretical case for real options be demonstrated, Ofcom would then determine in consultation with stakeholders whether and how best to put this into practise. Ofcom considers that Next Generation Access may prove to be such a case and will consider this possibility in more detail as part of the Review of its forthcoming review of Ofcom's regulatory approach in this area.

Impact of Ofcom's conclusions

1.31 The overall net, financial impact on stakeholders of the conclusions in this statement are difficult to assess, since, from the perspective of each stakeholder, some implications would be favourable whereas others would be unfavourable:

- other things being equal, the return permitted (and hence prices) on all regulated prices for access products would go down owing to the use of a revised ERP; and
- in cases where a project or activity-specific approach to assessing risk is taken:

- the regulated returns permitted, and hence prices, on some lower (higher) risk investments would go down (up) owing to equity beta disaggregation, whilst the overall company cost of capital calculated under the CAPM would remain the same;
 - the regulated returns (and hence prices) allowed for some risky new investments could increase through disaggregation and taking account of the value of real options; and
 - the estimated cost of capital for BT will fall, because of lower estimates for the ERP, the risk free rate and the group equity beta.
- 1.32 Ofcom believes that its conclusions are consistent with, amongst others, its duties relating to the protection of consumers, the promotion of competition and encouraging efficient investment under the Communications Act and the regulatory principles set out in the telecoms review.

Section 2

Introduction

- 2.1 This statement sets out Ofcom's conclusions on the questions raised in two previous consultation documents:
- Ofcom's approach to risk in the assessment of the cost of capital, 26 January 2005 (http://www.ofcom.org.uk/consult/condocs/cost_capital/) - *first consultation*; and
 - Ofcom's approach to risk in the assessment of the cost of capital, 23 June 2005 (http://www.ofcom.org.uk/consult/condocs/cost_capital2/) - *second consultation*
- 2.2 There were twelve questions raised across these two consultation documents (questions 1-8 in the first consultation and 9-12 in the second consultation) and these are set out in Annex 2. The subsequent sections of this statement discuss the responses received from stakeholders and set out Ofcom's final view on the issues these questions address.
- 2.3 The rest of this section provides background explaining Ofcom's general duties and how they relate to the issues addressed in this statement, and then goes on to provide a high level overview of the two consultation documents and the responses received.

Cost of capital estimation and Ofcom's duties

- 2.4 In carrying out its functions to regulate the communications industry, Ofcom has, amongst other things, to make *ex ante* decisions over the appropriate level of charges for services in those parts of the sector where enduring bottlenecks that prevent the development of competition exist.
- 2.5 In addition, Ofcom has responsibility for *ex post* regulation of the sector to address complaints relating to issues such as excessive or predatory pricing.
- 2.6 Ofcom has to make decisions relating to charges in a way that prevents excessive pricing by dominant firms, but that also allows companies to earn a reasonable return on their investments.
- 2.7 A dominant firm's weighted average cost of capital ("WACC") typically forms the basis for calculating charges that permit the earning of a "reasonable" return, i.e. one that is sufficient to reward investors, but does not include monopoly profits, in these circumstances.
- 2.8 The cost of capital is also the rate at which firms substitute between present and future value. This means that it is the appropriate discount rate to be used in Net Present Value ("NPV") calculations when comparing company cash-flows over time. NPV calculations are widely used in a range of regulatory contexts, being relevant to both *ex ante* charge setting and *ex post* analysis.
- 2.9 Section 3(1) of the Communications Act ("The Act") sets out Ofcom's principal duty, namely to further the interests of citizens in relation to communications matters; and to further the interests of consumers in relevant markets, where

appropriate by promoting competition. Section 3(2), of the Act sets out a number of specific objectives that Ofcom is required to secure in carrying out its functions (focusing on goals that are specific to each of the sectors that Ofcom regulates). Section 3(3) of The Act requires Ofcom to, in all cases, have regard to the principles that regulatory activities should be transparent, accountable, proportionate, targeted, and consistent, and to otherwise reflect "best regulatory practice" as appropriate. Section 3(4) of The Act sets out certain matters to which Ofcom must have regard in performing its duties. Section 4 of The Act sets out Ofcom's duties for fulfilling Community obligations applies to certain functions of Ofcom, notably its functions under Chapter 1 of Part 2 of The Act. In particular, Section 4(3) outlines Ofcom's duty to promote competition.

- 2.10 Reference to Ofcom's duties is of particular importance in understanding Ofcom's decision making process in the presence of significant uncertainty. There are four examples of such cases in this statement: the discussion of the equity risk premium, estimating BT's group equity beta and determining the appropriate approach to beta disaggregation (with specific reference to BT's equity beta) and the discussion of the relevance of real options theory to regulation. In these areas, Ofcom is on occasion obliged to rely on a degree of judgement, and in making its decisions will have regard to its duty under The Act.
- 2.11 The matters in Section 3(4) of the Act are of particular relevance here, including the desirability of promoting competition and encouraging competition in relevant markets, and the interests of consumers in respect of choice, price, quality of service and value for money, as required by Section 3(5) of the Act.
- 2.12 Ofcom considers that the analysis and arguments outlined in this statement are consistent with its obligations under The Act. Ofcom's view is that a rigorous approach to modelling the relationship between risk and return will bring about significant for consumers and firms in accordance with Ofcom's duties.
- 2.13 Ofcom has considered its views on the issues discussed in this document in the context of its duties under the Act. The discussion of Ofcom's duties under Sections 3 and 4 of the Act carried out in relation to each of the final policy positions of this statement, when read in conjunction with the rest of this document, represents an Impact Assessment as defined by section 7 of the Communications Act 2003.
- 2.14 Impact Assessments provide a valuable way of assessing different options for regulation and showing why the preferred option was chosen. They form part of best practice policy-making and are commonly used by other regulators. This is reflected in Section 7 of the Act, which means that generally Ofcom has to carry out impact assessments in relation to proposals that would be likely to have a significant effect on businesses or the general public, or when there is a major change in Ofcom's activities. In accordance with section 7 of the Act, in producing the impact assessment in this document Ofcom has had regard to such general guidance as it considers appropriate, including its recent statement, *Better Policy Making: Ofcom's approach to Impact Assessments*, (http://www.ofcom.org.uk/about/accoun/policy_making/#content "Ofcom's impact assessment guidelines"). Ofcom is of the view that the assessment contained within this statement is consistent with the approach outlined in Ofcom's proposed impact assessment guidelines.

Ofcom's objectives

- 2.15 In the second consultation document of the Telecoms Review (http://www.ofcom.org.uk/consult/condocs/telecoms_p2/), Ofcom proposed seven regulatory principles, suggesting that Ofcom should:
- i. focus regulation on the deepest levels of infrastructure where competition will be effective and sustainable;
 - ii. ensure equality of access at those levels;
 - iii. as soon as competitive conditions allow, withdraw from regulation at other levels;
 - iv. promote a favourable climate for efficient and timely investment and stimulate innovation, in particular by ensuring a consistent and transparent regulatory approach;
 - v. accommodate varying regulatory solutions for different products, and where appropriate different geographies;
 - vi. create scope for market entry that could, over time, remove economic bottlenecks; and
 - vii. in the wider communications value chain, unless there are enduring economic bottlenecks, adopt light touch economic regulation based on competition law (i.e. regulate on an *ex post* basis) and the promotion of interoperability.
- 2.16 The approach adopted by Ofcom in determining the relationship between risk and return can play a key part in the translation of these proposed principles into regulatory policy.
- 2.17 In addition to its ongoing review of the telecommunications sector, Ofcom is today publishing decisions that require judgements about the cost of capital in relation to a number of communications markets:
- in valuing BT's copper access network², Ofcom's aim is to set out a list of principles designed to enable altnets to compete on an equal basis with BT in the provision of services that depend on the access network, in which enduring bottlenecks exist. The level of access charges is a key element of enabling competition in downstream markets; and
 - in the network charge controls³, Ofcom is setting BT's charges for a number of wholesale products, giving consideration to a number of issues including the impact of the introduction of "next generation" technology on BT's cost base.
- 2.18 The issues covered in this statement have a direct impact on these reviews, as well as others going forward in this and other sectors. Ofcom's view of the ERP, the appropriate way to account for variations in risk within a firm and estimating (BT's) beta are all important inputs in estimating any company's WACC.

² <http://www.ofcom.org.uk/consult/condocs/copper/value2/copper2.pdf>

³ <http://www.ofcom.org.uk/consult/condocs/charge/ncc.pdf>

However, this statement whilst dealing with a range of broad cost of capital issues does have a focus on BT's cost of capital and to this end a separate section setting out Ofcom's estimate of BT's cost of capital is included.

The first consultation

Outline of the consultation issues

2.19 The structure of the first consultation was as follows:

- a brief overview of the theory of risk and return (Section 3);
- an appropriate value for the ERP (Section 4);
- a discussion of variations in risk within the firm (Section 5); and
- a discussion of the significance of real options theory in the context of regulation (Section 6).

2.20 The first consultation asked for stakeholder views in each of these areas. The key questions that were asked can be divided into the following categories:

- "methodological" questions, i.e. ones not immediately concerned with any particular calculation or parameter values, in relation to Ofcom's approach to assessing risk at both a project and firm specific level (questions 2, 3, and 6);
- an appropriate value for the ERP (question 1);
- questions relating to Ofcom's approach in relation to assessing variations in systematic risk within BT, with a particular focus on the equity beta of BT's copper access network (questions 4 and 5); and
- questions relating to the applicability of real options theory to regulation (questions 7 and 8).

2.21 At a summary level, the key proposals in the first consultation were:

- a suggested range of 4.0% to 5.0% as a reasonable range for the ERP;
- Ofcom should, in certain circumstances, reflect differences in risk between projects in its financial analysis, with differences in systematic risk modelled via cost of capital estimates, and differences in specific risk reflected in cash flow estimates;
- Ofcom should calculate a distinct equity beta for BT's copper access business (suggested beta values being between 0.9 and 1.2, compared to a BT group average of 1.3); and
- real options theory is applicable to regulation in certain circumstances, and the financial analysis carried out by Ofcom should reflect the value of real options in such cases.

Responses to the first consultation

2.22 The closing date for responses to the first consultation was 5th April 2005. Ofcom received a number of responses to the first consultation, from the following stakeholder groups:

- “Incumbents”, i.e. firms that have an obligation to offer network access on cost orientated terms:
 - BT;
 - Crown Castle;
 - NTL broadcast;
 - Kingston; and
 - the mobile network operators.
- competitors/customers of the incumbents:
 - C&W;
 - Easynet;
 - UKCTA (sub group); and
 - Wanadoo
- cable companies:
- the cable companies, i.e.:
 - NTL; and
 - Telewest
- others, e.g.:
 - the BBC; and
 - various individuals/academics.

2.23 The views of stakeholders in relation to the key proposals outlined in the first consultation can, broadly speaking, be summarised as follows:

- incumbents argued in favour of higher values for the ERP, whilst competitors argued in favour of lower values;
- most of the incumbents were opposed to assessing risk at a project level. BT, and the cable companies, were particularly opposed to estimating the risk of BT's copper access business on a standalone basis. Competitors and customers of the incumbents (other than the cable companies) were, broadly speaking, in favour of assessing risk at a disaggregated level; and
- incumbents tended to be in favour of the use of real options theory in regulation, whilst competitors were opposed.

2.24 Additionally, the alternative fixed operators argued that Ofcom should revise its estimate of BT's group equity beta downwards, based on the new available evidence in this area.

This second consultation

Outline of the consultation issues

2.25 Following stakeholder responses to the first consultation, Ofcom decided to carry out further analysis regarding BT Group's equity beta, reflecting all of the available evidence. Additionally, Ofcom gathered further evidence in relation to its proposals for beta disaggregation. Ofcom therefore carried out a shorter second consultation in order to give stakeholders the opportunity to comment on this additional analysis.

2.26 The structure of the second consultation was as follows:

- a discussion of the appropriate value for BT Group's equity beta, and Ofcom's proposed range of values for this parameter (Section 3); and
- in relation to disaggregating BT's equity beta, a summary of stakeholder responses to the first consultation and Ofcom's revised proposals (Section 4).

2.27 The second consultation asked for stakeholder views in each of these areas. The key questions that were asked addressed the following issues:

- an appropriate value for BT's group beta (question 9);
- the standard of evidence available to Ofcom on the appropriate level of disaggregation of BT's equity beta and an appropriate value for the BT's copper access network and its overall WACC (questions 10, 11 and 12);

2.28 At a summary level, the key proposals in the first consultation were:

- a revision downwards of BT's equity beta down from 1.3 to 1.0, 1.1 or 1.2;
- an equity beta for BT's copper access network business of either a) 0.3; b) 0.2; c) 0.1; or d) 0.0 points below the group average;

Responses to the second consultation

2.29 The closing date for responses to the second consultation was 22nd July 2005. Ofcom received a number of responses to the second consultation, from the following stakeholder groups:

- "Incumbents":
 - BT;
 - Crown Castle; and
 - H3G.
- competitors/customers of the incumbents:

- C&W;
- Energis
- Easynet;
- UKCTA (sub group); and
- Land Securities PLC.
- cable companies:
 - NTL; and
 - Telewest.

2.30 The views of stakeholders in relation to the key proposals outlined in the second consultation can, broadly speaking, be summarised as follows:

- on BT's group beta:
 - customers and competitors of BT argued in favour of values towards the lower end of the range identified by Ofcom (e.g. a value of 1.0 rather than 1.1); and
 - BT and Telewest argued that Ofcom's downward revision of its estimate of BT's beta was either inappropriate or excessive
- on beta disaggregation:
 - customers and competitors of BT argued in favour of Ofcom's proposed approach, arguing in favour of greater disaggregation, i.e. one in which Ofcom's estimate of the equity beta of BT's copper access business was set some way below its central estimate of the beta for BT Group; and
 - the incumbents (particularly BT and the cable companies) argued that Ofcom should either, not disaggregate between copper access and the rest of BT or carry out a minimal level of disaggregation.

Responses dealing with issues falling outside the consultation questions

BT's WACC – parameter values

2.31 In their responses to both consultations, a number of stakeholders raised issues concerning aspects of the cost of capital estimation which fell outside of the specific consultation questions posed by Ofcom.

2.32 These additional issues related to the general choice of asset pricing model as well as more specific issues concerning certain inputs into BT's cost of capital e.g.

- the risk free rate; and
- BT's debt premium.

2.33 A discussion of these issues is provided in Section 8 of this statement in the context of calculating a WACC estimating for BT.

Other issues

2.34 T Mobile criticised Ofcom's continued use of the Capital Asset Pricing Mechanism ("CAPM"), rather than other asset pricing models. T Mobile argued that empirical performance was a key criterion by which asset pricing models should be judged. It argued that Ofcom's decision to overlook the relatively weak empirical performance of the CAPM was "not rational". Ofcom disagrees with T Mobile's view. As explained in Section 3 of the first consultation, the CAPM is the primary asset pricing model used by UK and international utility regulators and the Competition Commission and is widely used amongst practitioners and has a clear theoretical foundation. In its response, T Mobile argued that empirical performance was more important than these factors. In Section 3 of this statement Ofcom sets out why it continues to prefer to use the CAPM. However, Ofcom intends to monitor any new developments in this area with interest.

2.35 BT raised a number of issues around Ofcom's fundamental approach to setting price controls. Below we provide a summary of the issue raised by BT and Ofcom's thoughts subject to appropriate consideration on a case by case basis:

- *Current Cost Accounting ("CCA") and Historic Cost Accounting ("HCA") accounting* - BT argued that the accounting standard used by Ofcom, i.e. HCA or CCA, might have significant implications for the cost of capital, and that Ofcom's analysis should reflect this. Ofcom notes that applying the cost of capital to accounting costs, calculated on either a HCA or CCA basis, is only a proxy for estimating true economic costs, but the use of either should enable full cost recovery over time. Ofcom is not aware of any evidence to suggest that there is a strong relationship between regulatory asset valuation and the degree of risk, systematic or specific, faced by BT. Ofcom therefore considers that the choice of accounting standard does not directly appear to affect Ofcom's approach to risk in assessing the cost of capital.
- *Contract length for regulated products* - In its discussion of the value of real options, BT argued that, "The regulator prevents BT from committing customers to long contracts for regulated products", and that, "This exposes BT to risk regarding the scale of wholesale demand, increasing the need to maintain spare network capacity". Ofcom recognises that this will be a relevant issue in some circumstances, but also notes that locking wholesale customers in to overly long contracts (which may reduce BT's risk) has the potential for facilitating anticompetitive behaviour by incumbents. In this respect Ofcom is obliged to strike a balance between providing certainty for incumbents and encouraging competition. Ofcom additionally notes its approach to calculating access charges includes an allowance for a degree of "spare network capacity". In the future, Ofcom would welcome stakeholder views on this issue in the context of specific access pricing reviews.
- *Asymmetry of current price cap regime* – BT argued that, "the current regulatory regime is inherently asymmetric: it caps returns (e.g. by using CAPM to set target returns and periodic price cap reviews to reinforce and maintain downward pressure) but fails to incorporate the potential for failed or stranded investments". Ofcom's view is that that this issue, which may be

relevant in specific circumstances, is better addressed for example in the context of a specific price control where it could be a valid consideration – Ofcom is not aware that under-recovery of cost has been a problem for BT's current portfolio of wholesale access products. This would be in line with our case-by-case approach where a particular project incorporates the potential for risks such as stranded assets discussed in Section 5 of this statement.

- *Frequency of review of WACC estimates* - BT argued that Ofcom should provide more certainty regarding the frequency with which it reviews cost of capital estimates.
 - BT suggested that one line that might be taken by Ofcom was that, “rate(s) should be reviewed only every four or five years, in order to give certainty and avoid unnecessarily intrusive regulation”. Ofcom agrees with the view that, other things being equal, very frequent re-estimation of BT's WACC is not desirable and would not wish to revisit estimating BT's WACC unless it was demonstrated that there had been a material change in the circumstance of inputs. Ofcom would be likely to consider that the materiality of a change should be set against the length of time since the last review i.e. the shorter the time since the last review the higher the threshold for reviewing estimates.
- *Frequency of price control review* - BT argued that Ofcom should provide more certainty regarding the timeframe for price control reviews
 - BT argued that, other things being equal, price control reviews that relate to higher risk projects should take place on a more frequent basis. Ofcom agrees that in price control reviews where significant uncertainty exists there is merit in taking a relatively shorter time horizon to price controls. Therefore Ofcom's preferred approach to assessing the appropriate duration of price controls is to assess the length of each control on a case-by-case basis. Where a significant price control is expected to be reset, this might also provide a trigger to suggest a review of the estimate of the cost of capital (in line with the view discussed above concerning the length of time since the last review).
 - BT also asked for Ofcom's view on, “Whether any changes in external factors can ever justify re-opening the calculation on an ad hoc basis”. Ofcom notes that UK utility regulators have tended not to revisit price control reviews once a determination has been made. Ofcom agrees with this general approach, and would set a very high threshold to the exceptional nature of the circumstances that would need to occur before considering re-opening a price control determination (as opposed to re-estimating a company's cost of capital).
- *The cost of capital and capital non-intensive activities* - BT argued that Ofcom should provide more certainty regarding its method for assessing returns in capital non-intensive activities, where return on capital employed would not be likely to provide an appropriate basis for measuring profitability. Ofcom is willing to discuss this issue. However, Ofcom's view is that this is more appropriately addressed in the context of a specific issue in a price control or investigation.

Section 3

The theory of risk and return

Introduction

- 3.1 This section describes how different models seek to account for risk in estimating the rate of return required by investors, in exchange for bearing different levels of risk. Some aspects of this theory that are particularly relevant to Ofcom's current work are explored in more detail in subsequent sections.

Why companies reward investors

- 3.2 Investors (shareholders) lend their capital to a firm by purchasing its equity capital. Company managers are able to best serve the interests of shareholders by investing in projects that will generate a positive value. Doing so will maximise the current market value of the firm's outstanding shares, and hence shareholder wealth.
- 3.3 The text below describes some of the factors that influence the level of return that is demanded by a firm's shareholders. It uses a simple two-period example for ease of illustration, and assumes that the firm is entirely financed by equity, i.e. it has a gearing level of zero. The example first considers a scenario in which there is no risk, i.e. outcomes are certain, and later on discusses the impact of risk on the returns that are required by investors.

Rewarding investors where outcomes are certain

- 3.4 Risk, and the role it plays in the level of return required by investors, is the central theme of this document. However, the first factor that determines why investors require a return on their investment is unrelated to risk and exists even in a world of perfect certainty, i.e. where the future can reliably be predicted without error⁴. The so-called "first basic principle of finance" states that a pound today is worth more than a pound tomorrow, because the former can immediately be put to an economically productive use, so money has a time value. Investments are worthwhile only where returns are greater than those that investors could earn by investing in capital market securities rather than the firm. In a two period example, where an initial investment of C_0 taking place "now" is certain to lead to a net cash flow of C_1 in one year's time, the investment's NPV is calculated as:

$$NPV = C_0 + \frac{C_1}{(1+i)}$$

- 3.5 In this example, the discount rate, i , is determined by the time value of money, i.e. the safe interest rate, and the future cash flow, C_1 , is known with certainty.

Rewarding investors where outcomes are uncertain/risky

Sources of risk

⁴ A similar set of principles applies if investors are risk-neutral. Throughout this document, it is assumed, in line with standard theory, that investors are risk-averse.

- 3.6 In practice, future outcomes are not certain (although over very short term horizons they may be close to being completely certain, e.g. tomorrow's state of the world is more predictable than the state of the world in a years' time), i.e. they are subject to risk.
- 3.7 Economic theory has developed different approaches to modelling risk. Most models share a common assumption about how investors make financial decisions. These decisions are based on the concepts of portfolio investing and diversification. Two types of risk are typically identified, commonly termed systematic (market or undiversifiable) risk; and specific (diversifiable or idiosyncratic) risk.
- 3.8 Economists differentiate between these two different types of risk because commonly used portfolio-theory based models assume that investors can, and choose to, hold a diversified portfolio of investments. This means that those risks that are specific to any particular company or product are diversified away by investors. For example, a firm selling ice cream faces significant demand risk because of the possibility that there will be a rainy summer, but investors are able to mitigate this by also investing in firms that sell umbrellas, which will face increased demand under the circumstances that are adverse from the perspective of an ice cream seller. Risks that are specific to a particular company are therefore not priced into investors' required rates of return and hence company cost of capital estimates.
- 3.9 Some risks, however, cannot be diversified away by investors, since, to varying extents, they will have at least some impact on nearly all firms within the economy. Many of the main examples of systematic risks are factors that have an impact on demand, such as fluctuations in GDP growth (such as a recession or boom), oil prices, and interest rates.
- 3.10 As stated above, specific (diversifiable) risk relates to factors that are unique to a particular product or market, for example:
- despite buoyant growth in consumers' disposable incomes, and hence demand for goods and services in the economy as a whole, a particular new product may fail to become popular, or an existing popular product may cease to become popular; or
 - despite economy-wide productivity gains, the costs associated with a particular industry may increase because of, for example, a shortage of a particular labour or capital input that is indispensable to that industry, leading to increased production costs
- 3.11 Models based on portfolio theory (see below for a description of the most important of these) do not compensate equity investors for bearing specific risks, since investors are assumed to hold diversified portfolios of investments as described above.

Taking account of risk within the NPV framework

- 3.12 The formula set out after paragraph 3.4 is also used to calculate NPVs when outcomes are uncertain. It is, however, modified in two ways, since:

- the cash flows in period 1 are no longer known with certainty, and therefore must be estimated. The NPV formula is therefore based on expected future cash flows, denoted $E(C_1)$ in the equation below; and
- the discount rate, r , now includes an allowance for bearing systematic risk – so, rather than the risk free interest rate i used above, the relevant discount rate is the company weighted average cost of capital, calculated using a portfolio theory based model.

3.13 These two points are reflected in the revised equation below:

$$NPV = C_0 + \frac{E(C_1)}{(1+r)}$$

3.14 An important point to note is that, when assessing cash flows on an *ex post* basis, it should be recognised that there may be a discrepancy between the cash flows that are realised on an *ex post* basis and those that were expected on an *ex ante* basis. High cash flows that are realised on an *ex post* basis may partly reflect a reward for *ex ante* uncertainty, and, if correctly applied, the NPV framework offers investors a “fair bet”, in which the rewards from successful investments within the portfolio are expected to be sufficient to pay for the losses associated with unsuccessful investments, and additionally to allow an adequate return overall across the diversified set of investments.

The need for care in using the NPV framework to model risk

3.15 The NPV approach does not explicitly take into account the impact that the timing of investment may have on the level of risk that is faced by the firm. This issue is discussed in more detail in Section 6, which explains that, when a firm is faced with significant uncertainty, the option to “wait and see” before investing may be valuable, since important additional information relating to the factors that produce uncertainty will become available over time. This additional information is likely to be particularly valuable in mitigating specific risks, since, for example, in the early stages of a particular product's life cycle, future demand for it may be very hard to predict with any confidence. Later on in the product's life cycle, it will be possible to forecast the size of the relevant market with greater certainty.

3.16 This means that the ability to defer any investment commitment until such information is available may have significant value. This option must be weighed against, for example, any “first mover” advantage that may be gained by being first to market with a service. These and other related issues are discussed in more detail in Section 8.

The reward for bearing systematic risk

3.17 As outlined in the previous subsection, one of the fundamental principles of finance theory is that the rate of return that investors will require from investing in an asset increases as the investment becomes more risky. This principle is based on the assumption that investors are risk averse, and require compensation for any risk that they choose to bear rather than investing in risk-

free assets⁵. It can be argued that this theory has been borne out by historical data for all the world's major stock markets, which show that returns on different classes of asset do vary in practice, with riskier assets earning higher returns on average. The figure below shows historic returns for the equity market and government bonds. The higher average return to equity over the long term reflects the higher perceived risk associated with this type of asset.

Figure 3.1- Average annual nominal returns (arithmetic mean) from government bonds and equities over the period 1900 to 2003

Index	Bonds	Equities
UK	6.0%	11.4%
USA	5.2%	11.7%
World	5.0%	10.2%

Source: Dimson, Marsh and Staunton, *Global Investment Returns Yearbook 2004*, Tables 70 (p. 149), 74 (p. 155), and 78 (p. 161)

- 3.18 The level of compensation required by investors is commonly referred to as the company's cost of equity or debt capital. A company's weighted average cost of capital is simply the weighted average (with weights based on the proportion of its total financing that is accounted for by equity and debt capital respectively) of its cost of equity and cost of debt. The level of a company's cost of capital is equal to the expected return that could be gained from an alternative investment opportunity of equivalent risk that is available in the capital market, i.e. it is an opportunity cost.
- 3.19 In the context of this consultation, Ofcom is only concerned with its approach to determining a company's cost of equity, since it believes that there are currently a number of key issues to be considered in this area. The remainder of this section discusses some of the main determinants of the cost of equity, and how these are modelled in practice.

Approaches to modelling systematic risk

- 3.20 As outlined in the previous subsections, the existence of uncertainty has two implications for calculating the rate of return required by investors. The first of these is that calculations must be based on expected, rather than actual, cash flows. The second is that cash flows must be discounted using a risk adjusted cost of capital.
- 3.21 The models most commonly used to estimate the rate of return that equity investors expect in return for bearing risk (commonly referred to as "asset pricing models") are the CAPM, Arbitrage Pricing Theory (APT), and the Fama-French Three Factor Model. These are briefly described below:

⁵ There are numerous references for the standard textbook treatment of risk and return. These include *Principles of Corporate Finance* by Brealey and Myers (7th Edition 2003), and *The Real Cost of Capital* by Ogier, Rugman and Spicer (2004).

- CAPM – this is a one factor model where systematic risk is a function of the correlation between the returns to the firm and the returns to the stock market. Although it remains the most widely used of the asset pricing models, empirical tests of the CAPM carried out in recent years have in some cases called the robustness into question;
- APT – while the CAPM explains the difference in risk and return between companies by reference to a single factor, i.e. correlation with the market, the APT assumes that returns are best explained by a number of factors (which will typically include the return on the market portfolio). These typically include pervasive macroeconomic influences such as the volatility of oil prices, interest rates, exchange rates, and so on; and
- Fama-French Three Factor model – this model is, strictly speaking, a special case of the APT, but can also be thought of as an enhancement to the CAPM. Instead of one factor, this model has three: a market factor; a company size factor; and a book/market value factor. It is not easy to provide an underlying economic rationale for why these factors explain returns, but this model has, to some extent, been supported by the results of certain empirical studies.

3.22 Ofcom's approach, in line with the other UK economic regulators and the Competition Commission (CC), is to use the CAPM. This is also consistent with its wide use amongst practitioners. The CAPM has a clear theoretical foundation and its implementation is simple and well established relative to that of other asset pricing models. This was summarised by WM&M⁶ who concluded "In summary: the empirical shortcomings of the CAPM are known. Alternative models to address this issue have their own shortcomings - weak theoretical foundations and empirical challenges. In our view, there is at present no one clear successor to the CAPM for practical cost of capital estimation".

3.23 It is worth re-iterating that the CAPM, in line with portfolio theory, does not compensate equity investors for bearing unsystematic (company specific) risks. This follows from the fact that, as explained earlier, investors are assumed to hold diversified portfolios of investments, such that specific risks are diversified away, meaning that there is no reward in investors' rates of return for bearing them. The implication of this is that the cash flows to which the WACC should be applied are mean or expected values; they are the mean of a probability distribution of all possible outcomes.

3.24 Under the CAPM methodology, the cost of equity is built up from three main factors. These are:

- the risk free rate;
- the expected market equity risk premium; and
- the value of beta for the company in question.

⁶ Wright, Mason and Miles, 2003, "A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the U.K", Smithers & Co Ltd (available at http://www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/2012_jointregscoc.pdf)

- 3.25 The relationship between these factors can be summarised by the following formula (where RFR represents the risk free rate and ERP refers to the equity risk premium):

$$\text{Cost of equity} = \text{RFR} + (\text{ERP} \times \text{beta})$$

- 3.26 The risk free rate is simply the expected rate of return on a risk free investment. The expected equity risk premium is the expected return on equities over and above the risk free rate (that is, it is the expected reward for holding equities compared with the reward for holding risk free assets). The value of beta reflects the variability of returns of the equity of the company in question compared with the variability of returns on the equity market.

- 3.27 Similarly, the cost of debt can be expressed as (where the debt premium is the company specific risk premium for corporate debt above the risk free rate.)

$$\text{Cost of debt} = \text{RFR} + \text{Debt premium},$$

- 3.28 The WACC takes account of the cost of equity and the cost of debt by weighting each of these by the proportion of equity and debt⁷ respectively in a company's financial structures in the following way (where Gearing = Debt / (Debt + Equity)):

$$\text{WACC} = (\text{Cost of equity} \times (1 - \text{Gearing})) + \text{Cost of debt} \times \text{Gearing}$$

Summary

- 3.29 This section has outlined a number of key principles relating to risk and return, namely that investors require:

- a return that reflects the time value of money; and
- a return that rewards them for bearing systematic risk.

- 3.30 Sections 4 to 8 discuss Ofcom's view on a number of issues relating to how the rewards for bearing risk should be calculated, while Section 9 discusses some particular industry risks and explains how they can have implications for the use of NPV analysis within a real options framework.

⁷ This formula assumes that the *post-tax* cost of debt is used.

Section 4

The Equity Risk Premium

Introduction

- 4.1 As discussed earlier the ERP is a key parameter in the estimating the cost of capital. Under the CAPM, the ERP reflects the extra return that investors require as a reward for investing in equities rather than a risk free asset. It is a market, rather than company-specific, factor.
- 4.2 In the first consultation, Ofcom discussed the appropriate value for the ERP in a regulatory context. Based on its assessment of the available evidence, Ofcom proposed that:
- the available evidence suggested that the equity risk premium was likely to fall within a range of about 2.5% and 5%; and
 - based on its assessment of an appropriate balance between encouraging investment and short-run consumer protection (in the form of lower prices), 4% to 5% represented an appropriate range from a regulatory perspective.
- 4.3 Ofcom, sought stakeholder views on whether it should revise its estimate of the ERP downwards from 5.0% (last applied in setting the charge controls for Partial Private Circuits) to another value within the range of 4.0% to 5.0%. The following question was posed:

Question 1: Do you agree that 2% to 5% represents a reasonable range of values for the ERP? Within this range, do you agree that Ofcom should revise its central estimate downwards from 5% to 4.0% or 4.5%? Which of these is the most appropriate?

- 4.4 Ofcom based its proposals (in Question 1 above) on a wide range of empirical evidence, which it discussed in some detail in the first consultation. The five key sources of evidence used by Ofcom were (note that these classifications refer to methods of estimation rather than *ex ante* vs. *ex post* regulation):
- *ex post* estimation:
 - extrapolating historical risk premia;
 - extrapolating adjusted historical risk premia; and
 - *ex ante* estimation:
 - using the dividend growth model
 - surveys of academic and practitioner expectations; and
 - regulatory benchmarks
- 4.5 The views of stakeholders in relation to the proposals outlined in the first consultation varied widely. A summary of stakeholder responses, together with Ofcom's final view in the light of these, is set out in the remainder of this section.

Summary of responses

- 4.6 Some stakeholders argued in favour of higher values for the ERP than those proposed by Ofcom, whereas others argued in favour of lower estimates. All stakeholders agreed with the five sources of evidence identified by Ofcom, but, in some cases, disagreed with Ofcom's view on each source of evidence. Stakeholder views can be divided into the following categories:
- views regarding the range of values implied by each of the five sources of evidence used by Ofcom:
 - whether Ofcom had correctly interpreted the available data in order to arrive at a central range of values;
 - whether Ofcom had correctly identified all of the relevant data in relation to each source of evidence;
 - summary comments, including views as to the appropriate weighting of the five sources of evidence used by Ofcom
- 4.7 The section below begins by providing a summary of the comments of stakeholders in relation to each of the five types of evidence used by Ofcom and concludes with a summary of the overall conclusions made by stakeholders.

Ex post estimation: extrapolating historical risk premia

- 4.8 One method often used to estimate a forward-looking equity risk premium is to simply extrapolate the average risk premium actually realised in the past. Following its discussion of this method in the first consultation, Ofcom concluded that, "it would be appropriate to give weight to historic premia of between 4.0% and 5.0%. Within this range, more weight should probably be attached to values that are towards the higher end of this range, which are calculated on an arithmetic basis".
- 4.9 Professor Ian Cooper, writing on behalf of BT⁸ (Points raised in Professor Cooper's submission will be attributed to "BT" in the remainder of this subsection) argued that Ofcom's proposed range in relation to historical averages, "conclusion contrasts markedly with that reached by Ogier et al⁹. They report a range of 4.0%-8.0% based on historical evidence". BT noted that Ogier et al base their range on a wider set of historic data evidence, and that, "Ofcom gives more weight to geometric averages and adjusted averages than do other experts."
- 4.10 BT argued that Ofcom's range does not include the "statistic that would be used as the central estimate by many experts". BT referred to DMS (2004)¹⁰ (quoted by Ofcom in Figure 2, Section 4 of the first consultation) which reports the historic ERP as 5.3% for the UK and 5.1% for the world. T-Mobile proposed an

⁸ See BT's response to the first consultation, Annexes to main response, Annex 1: "The equity risk premium" by Professor Ian Cooper, London Business School

⁹ Ogier, Rugman and Spicer, 2004, "The real cost of capital", FT Prentice Hall

¹⁰ Dimson, Marsh and Staunton, 2004, "Global Investment Returns Yearbook 2004", ABN AMRO, London Business School

ERP of 6.0% for the world based on DMS (2004) and noted that “the use of a historical estimate should not be readily dismissed”.

- 4.11 BT criticised the weight put by Ofcom on estimates calculated using the geometric mean of historical returns. BT argued that, “the vast majority of experts argue that unadjusted geometric averages are not the correct ones to use in setting cost of capital for the application envisaged by Ofcom”. BT argued that the only relevance of the geometric mean is that it may form a starting point for making an estimate of the arithmetic mean, once an adjustment has been added to it.
- 4.12 Vodafone proposed an approach to the use of the geometric mean as described above. This is to use the geometric mean estimated from historic data and to add to this an adjustment factor for future volatility (“Volatility adjustment factor”). Vodafone proposed the use of the following formula (which can also be found in WM&M¹¹ and DMS (2002)¹² p.184) to estimate forward-looking premia:
- Ex ante arithmetic mean* = $\frac{1}{2}$ (forecast variance of returns) + *ex post geometric mean*
- 4.13 Using this approach, Vodafone estimated an arithmetic mean of 6.0% using DMS (2002) estimates for the geometric mean (4.8% for the UK and 4.9% for the world). and a volatility adjustment factor of 1.3% based on an average of the historic volatility of the FTSE All-Share Index since 1963 of 17.4% and the DJIA since 1900 of 14.3%.
- 4.14 Other stakeholders argued that the lower end of the range presented by Ofcom for historic risk premia was valid since it was appropriate to put weight on both the geometric and arithmetic means of past returns. UKCTA quoted Ofgem's (Electricity Distribution Price Control Review 2004) assessment of the difference between the arithmetic and geometric mean. UKCTA highlighted that “Ofgem successfully proposed a cost of capital which included an ERP of 3.5%”.
- 4.15 Vodafone expressed a preference for the use of global rather than country specific premia. One stakeholder proposed that the historic ERP from a range of countries should be taken into account to obtain a more balanced view. Taken into account both geometric and arithmetic means, it proposed a range of 4.0% to 7.0% for the historic ERP.

Ex post estimation: extrapolating adjusted historical risk premia

- 4.16 As explained in the first consultation, it has been widely argued that simply extrapolating historic average premia may not provide a reliable guide to the magnitude of future risk premia. With this in mind, authors such as DMS have estimated forward-looking risk premia based on adjusted historical averages.
- 4.17 In the first consultation, Ofcom argued that the available evidence pointed to a range of 2.0% to 3.0% for adjusted historical risk premia. This range was

¹¹ Wright, Mason and Miles, 2003, “A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the U.K”, Smithers & Co Ltd (available at http://www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/2012_jointregscoc.pdf)

¹² Dimson, Marsh and Staunton, 2002, “Triumph of the Optimists: 101 Years of Investment Returns”, ABN AMRO and London Business School

discussed by a number of stakeholders, with some, such as UKCTA and Easynet, in agreement with Ofcom's assessment, and others, as outlined below, disagreeing.

- 4.18 BT raised the issue of the magnitude and validity of the adjustments Ofcom has made to the raw ERP estimates based on historic data. BT argued that the "large adjustment" made by Ofcom in the first consultation had been "re-estimated by its authors as being much smaller". In addition BT pointed out that the authors themselves refer to these adjustments as being "simplistic" and "should not be taken too seriously". BT applied different adjustments to Ofcom and arrived at a range for the ERP of 4.2% (world) to 5.3% (UK) (in contrast to Ofcom's range for the adjusted ERP of 2.0% to 3.0%). These figures were based on adjustments of 0.3% for the UK and 0.8% for the world (in contrast to the 2.0% made by Ofcom in the first consultation). In addition, BT noted that other adjustments that might reasonably be made to historical premia could lead to figures that were higher than unadjusted historical averages.
- 4.19 Vodafone questioned the use of adjusted historical risk premia, and noted that other adjustments could be included that would lead to increases in the ERP. Vodafone noted that such adjustments could be included through its proposed approach to estimating arithmetic ERP, i.e. through the implicit forward looking volatility factor.
- 4.20 T-Mobile quoted DMS (2003)¹³ who suggested that, "a plausible, forward looking risk premia for the world's major markets would be on the order of 3.0% on a geometric basis, while the corresponding arithmetic mean risk premium would be around 5.0%".

Ex ante estimation: "implied" ERP

- 4.21 As explained in the first consultation, the ERP can be estimated without recourse to the analysis of historical data. Such estimation methods have been used in recent years by, for example the Competition Commission in the UK, which has recently put weight on such estimates¹⁴.
- 4.22 One such method is the use of "implied" risk premia based on forecasts of dividend growth. In the first consultation, Ofcom presented a range of ERP estimates based on this estimation with a midpoint of 3.5% to 4%.
- 4.23 BT pointed out that, "from the huge number of such studies, (relating to "implied" ERP) Ofcom reports only three". BT highlighted other studies carried out using the same technique give much higher estimates. It noted that these studies are sensitive to the method of the estimate of long-run dividend growth, "which is largely a matter of opinion". BT also raised the issue of whether estimates based on this approach should receive significant weight at all.
- 4.24 Some stakeholders argued that approaches of this type are "seriously flawed", since they rely on highly subjective input parameters, namely analyst expectations and an assumption of constant growth rates (in some models).

¹³ Dimson, Marsh and Staunton, 2003, "Global evidence on the equity risk premium", *Journal of Applied Corporate Finance*, 15(4) 27-38

¹⁴ See Vodafone, O2, Orange and T-Mobile: Reports on references under section 13 of the Telecommunications Act 1984 on the charges made by Vodafone, O2, Orange and T-Mobile for terminating calls from fixed and mobile networks (http://www.competition-commission.org.uk/rep_pub/reports/2003/fulltext/475c7.pdf)

Vodafone argued that the implied ERP can suffer from variability and volatility making it impractical as a basis for making investment decisions.

Ex ante estimation: surveys

- 4.25 As explained in the first consultation, another approach to ERP estimation is to use surveys carried out amongst academics and practitioners. In these surveys, participants are directly asked to quantify the returns that they expect from the equity market over a particular time horizon. These views may be based on some or all of the estimation methods discussed in the first consultation. In the first consultation, Ofcom argued that evidence of this sort pointed to an ERP of, based on the views of practitioners a range of 2% to 4%, and, based on the views of academics, a range from 3% to 7%.
- 4.26 BT made two criticisms of the survey evidence quoted by Ofcom in the first consultation. Firstly, BT highlighted, at a general level, the problems with “any survey” e.g. nature of the questions asked, the sample, the weighting of responses, and the calculation converting responses into an estimate of the ERP. Secondly, BT noted a systematic problem relating to the identity of survey respondents, and the context within which forecasts are made. BT quoted Ogier et al, “the answer you get from such a survey depends on the person you ask”, and added that estimates depend crucially on the question asked, and the context in which it is asked.
- 4.27 Other stakeholders questioned the reliability issues of survey evidence. In particular, C&W argued that, “we suggest that the results of the ‘academics’ survey should be treated with caution since it is such a clear outlier to the rest of the evidence presented, and the higher end of the range has been superseded by a later paper by the same authors with lower estimates”. Easynet noted that “few professional investors are immune from unrealistic short terms expectations of performance”. Vodafone argued that, “survey data is fraught with problems”.
- 4.28 BT noted that the PwC survey result of 3.0% quoted in the first consultation by Ofcom could be an estimate of a forward-looking geometric mean, “which should be used for central projections” and not in regulatory estimates of the cost of capital.

Regulatory benchmarks

- 4.29 In the first consultation, Ofcom argued that the range of ERP estimates adopted by UK's economic regulators and competition in recent years were consistent with a range of 2.5% to 5%.
- 4.30 BT identified two problems with the regulatory benchmarks used by Ofcom in the first consultation. Firstly, BT argued that, in some cases the final price controls set by regulators were based on ERP estimates at the upper end of the range cited by Ofcom in the first consultation. A similar argument was put forward by other stakeholders, including Telewest. Secondly, BT highlighted that in some cases regulators had used risk premia cited by Ofcom in conjunction with an interest rate much higher than the market rate. BT argued that this would imply an inconsistency with how Ofcom applies the ERP to the market rate (under the assumption that the ERP and the risk free rate are inversely related i.e. BT's submission assumed that as one goes up, the other goes down by exactly the same amount).

- 4.31 To take account of these issues, BT restated the regulatory benchmarks presented in the first consultation and on this basis argued that an appropriate range for the ERP is 4.2% to 5.8% when applied to a market risk free rate. BT argued that, if Ofcom wanted to come into line with other regulators, it should consider increasing its estimate.
- 4.32 Another respondent noted that Ofcom's evidence excluded the evidence from the ongoing CAA review of National Air Traffic Services, in which a range of 3.5% to 5.0% has been suggested, the CAA basing its proposals on an ERP of 4.5% (Ofcom notes that this falls within BT's updated range for regulatory decisions in the UK).
- 4.33 Some stakeholders suggested that Ofcom should consider international regulatory precedent, i.e. the ERP estimates used by overseas regulators. Ofcom was provided with a summary of international regulatory precedent, based on regulatory decisions between 1999 and 2003. This survey suggested that other regulators have used ERPs ranging from 3.5% to 8.5% in some cases. It was argued to Ofcom that most of these decisions fell within a range of 5.0% to 6.0%.

General comments

- 4.34 BT argued that 5.0% is a reasonable estimate, consistent with its interpretation of the evidence. BT notes that, in its opinion, "the statistic that is most relevant is the historical average UK risk premium of 5.3%". BT noted that this is the same as the current forward looking estimate given by a survey carried out by Bloomberg. BT noted that the adjustments for possible biases in these estimates could go either way and are hard to estimate. BT argued that the range of 2.0% to 5.0% outlined in the first consultation was not reasonable, the lower end of this range being derived from evidence that should not receive much weight, and therefore that values of 4.0% to 4.5% do not lie towards the top end of a valid range, but rather towards the bottom.
- 4.35 BT argued that there no new evidence suggesting a lower ERP had emerged since the publication of Ofcom's Partial Private Circuits Charge Control - Final Statement, published 30th September 2004¹⁵ ("the PPC statement"). BT noted that "Regardless of the evidence concerning the absolute level of the risk premium, it might be correct to revise downwards Ofcom's estimate if there is evidence that the risk premium has fallen recently. In fact, the evidence indicates the opposite".
- 4.36 Some stakeholders, including Telewest, argued in favour of a wider range for the ERP of 3.0% to 5.0%. In discussing this range, Telewest argued that, "... the low end represents most of the *ex ante* evidence, while the 5.0% takes into account most of the evidence from surveys. The bulk of the evidence suggests an ERP within this range, with just a few outliers at either end of the spectrum".
- 4.37 One stakeholder suggested a range of 2.5% to 4.0%, based primarily on taking out extremes and putting more emphasis on the geometric mean. Other stakeholders, including UKCTA, Easynet, NTL and C&W agreed with Ofcom's proposed range for the ERP of 2.0% to 5.0%.

¹⁵ http://www.ofcom.org.uk/consult/condocs/ppc_charge_control/

- 4.38 A number of stakeholders commented on Ofcom's justification for not proposing a point estimate of the ERP at the mid-point of the full range of values it identified in the first consultation, e.g. a mid point value of between 3.0% and 4.0%. NTL argued that, from its perspective as an infrastructure competitor to BT, that it agreed with Ofcom's view that the risk associated with setting too low a cost of capital for BT are greater than setting one that is too high. Telewest echoed this view and considered it appropriate for Ofcom to maintain its estimate of 5.0% with reference to Ofwat's and Ofgem's recent decisions to use an ERP in the high end of their ranges. UKCTA took the opposite view, however, and C&W commented that Ofcom's view given in the first consultation ultimately implied, "precedence to its (Ofcom's) objective to incentivise investment over consumer protection". C&W argued that Ofcom should consider revisiting this preference given the developing regulatory framework based on the acknowledgment that the copper access network represents an enduring economic bottleneck. C&W argued that this should result in an overall softening of Ofcom's focus on investment incentives and increasing importance of consumer protection. Easynet proposed an ERP of 3.5% based on Ofcom's presentation of the evidence.
- 4.39 NTL and C&W argued that Ofcom should carry out an assessment of the impact on wholesale/retail prices, and on incentives to invest, of using different ERP estimates.

Ofcom's views of the responses

- 4.40 Some stakeholders sought clarification from Ofcom concerning the basis for carrying out this review of the ERP. In this review Ofcom is considering all the evidence before it. Ofcom has examined all this evidence (including its predecessor's views on this evidence discussed at the end of this section), with consideration of its duties under the Act and in light of the Telecoms review which sets out a general regulatory strategy for Ofcom.

Ex post estimation: extrapolating historical risk premia

- 4.41 As explained above, BT noted that a range of 4.0% to 8.0% was an appropriate range for the ERP based on the survey of historical evidence set out in Ogier et al. This is based on a selection of historical evidence largely focussed on the US market.
- 4.42 In order to understand why this range is different from Ofcom's proposed range, for clarification it is worth quoting Ogier et al. They noted that "Depending on the time period selected, and whether an arithmetic or a geometric mean is adopted for calculation purposes, the historic approach produces figures in the range of 4.0% to 8.0% for the US, with similar or slightly lower results for the UK and other developed markets (according to the most recent research by Dimson, Staunton and Marsh)".
- 4.43 As discussed in the first consultation, Ofcom's view is that it is appropriate to focus its analysis of historic risk premia on world and the UK indices, and therefore put less weight on risk premia calculated relative to US indices than many historic studies (historically, many studies have focused on the US rather than other stock markets). It is also worth bearing in mind that Ogier et al note (page 79) that the UK ERP might be lower and refer the reader to the research by DMS.

- 4.44 As set out in the first consultation, Ofcom's view is that the recent work carried out by DMS "is widely regarded as being one of the most authoritative sources of historical estimates". This was because DMS (2002) sought to address some of the key methodological problems that previous studies had failed to deal with, such as survivorship bias. It is additionally important to note that many previous historical studies focused on evidence from the US.
- 4.45 Therefore in order to ensure an appropriate ERP range is defined i.e. not relying on US focussed studies and seeking to rely upon the most robust of studies Ofcom has based its range for the historic ERP on DMS (2004).
- 4.46 Ofcom's proposed range sought to capture the findings of DMS (2004) in relation to the geometric and arithmetic mean returns from the UK and world indices. The historic arithmetic mean (5.3% for the UK and 5.1% for the world) corresponds to the upper end of Ofcom's proposed range of 5.0%, whilst the historic geometric mean corresponds to the lower end of Ofcom's range, i.e. 4.0% (4.0% for both the UK and the world). Ofcom notes that the most recent point estimate of the arithmetic ERP calculated by DMS (2005)¹⁶, (which was published after the first consultation) report arithmetic means for the UK of 5.2% (a slight reduction from 2004 figure of 5.3%) and 5.1% for the world. The geometric means remain the same for the UK and the world at 4.0%. The upper end of Ofcom's range, a value of 5.0%, reflects these UK and world estimates of 5.2% and 5.1% respectively. In our view, 5.0% is a reasonable rounding of the two historic means for the UK and the world.
- 4.47 T-Mobile proposed an historic ERP of 6.0% based on the same DMS (2004) study. However, this estimate was based on a historic premium measured relative to bills. As outlined in the first consultation, Ofcom's view is that the ERP measured relative to bonds is the more relevant of the two. In addition T-Mobile appears to imply that Ofcom is not placing sufficient weight on historic averages. In fact, Ofcom places considerable weight on historic averages compared to other evidence.
- 4.48 BT argued that unadjusted geometric averages should not be used in setting the cost of capital for Ofcom's purposes. On the other hand, a number of stakeholders took the opposite view, (i.e. that the geometric mean should be preferred to the arithmetic mean). As outlined in WM&M, there are arguments in favour of using both of these methods in the context in which Ofcom applies its cost of capital estimates. The geometric average return is a useful measure of the return actually earned by investors, whilst the arithmetic average return additionally reflects the historically experienced volatility of returns. As outlined in the first consultation, Ofcom notes that the arithmetic mean is more widely used in an investment appraisal context, and consequently places more weight on estimates calculated using this method. However, Ofcom continues to put some (albeit a smaller amount) weight on the geometric average.
- 4.49 DMS (2002) and DMS (2003) demonstrate how to construct arithmetic returns using historic geometric means and a volatility factor, in the same way as suggested by Vodafone. DMS found that, for some countries (e.g. Germany, Japan, and Italy), the raw arithmetic mean is higher than their re-estimated arithmetic mean because historic volatility was, in their view, not a reliable guide to future volatility. For this reason, Ofcom is inclined not to put any weight

¹⁶ Dimson, Marsh and Staunton, 2005, "Global Investment Returns Yearbook 2005", ABN AMRO, London Business School

on the very high past arithmetic averages for some countries that were put forward as relevant benchmarks by some stakeholders. In the case of the UK and world indices, this adjustment makes a relatively small difference since, for these indices, historic and forecast future volatility are assumed by DMS to be relatively close together.

4.50 Vodafone presented a calculation of the arithmetic mean, built up from the geometric mean. It proposed an arithmetic mean of 6.0%, based on a volatility adjustment factor of 1.3%¹⁷, which implies a geometric mean of approximately 4.7%. This would appear to relate to the 4.8% for the UK or 4.9% for the world ERP estimated by DMS (2002). If the same volatility adjustment factor were to be applied to the latest DMS (2004) estimates of the geometric mean, 4.0% for the UK and 4.0% for world, then the arithmetic mean would be around 5.3%. This is very similar to the raw historic arithmetic means outlined above (see paragraph 4.46). Whilst Ofcom agrees that adding a term based on forward-looking volatility to geometric means is a valid approach, it considers that its usefulness in addition to the historic arithmetic mean is only likely to be significant when the volatility of returns has historically been uncharacteristically higher or lower than would be expected going forward.

4.51 As explained above, the issue of whether it is appropriate to consider a range for the ERP based on the historical experience of a number of countries was raised by more than one stakeholder, e.g. a range of 4.0% to 7.0% based on DMS was advocated by one stakeholder. Ofcom's view, as discussed in the first consultation, is that weight should be given to the world and UK historic ERPs. In our view, consideration of the ERP of other countries is accounted for in the world ERP. The world ERP allows country specific factors to be averaged out over a wide sample of countries.

Ex post estimation: extrapolating adjusted historical risk premia

4.52 As outlined in the first consultation, DMS made a series of adjustments to historic risk premia in order to estimate forward-looking risk premia. As explained in the first consultation, Ofcom's preferred approach is to put some weight on premia calculated using this method. As noted above, this approach attracted a number of comments from stakeholders.

4.53 The adjustments made by DMS were:

- *increased investor confidence/ re-rating of equities* – DMS observed that, since the early part of their sample period, there had been a significant increase in price/earnings ratios. DMS attributed this change to a long-term fall in the required risk premium for equity investment, and accordingly made an adjustment to historic realised premia; and
- *outperformed expectations* – DMS also adjusted historic premia to reflect those cases where equity returns had exceeded, or fallen short of, expectations at the time (based on the difference between actual realised dividends and a measure of expected dividends at the time based on a long-term dividend growth rate).

¹⁷ DMS (2002) apply volatility adjustments of 1.3% for individual countries and 1.0% for the world. In DMS (2003) these increase to 2.0% and 1.3% respectively.

4.54 In writing the first consultation, Ofcom referred to three studies carried out by Dimson, Marsh and Staunton: DMS (2002), DMS (2003) and DMS (2004) (referenced earlier in this subsection). All three of these estimates calculate risk premia based on the same underlying data set (with additional years of data included depending on their publication date). However, the "outperformed expectations" adjustment was only reported separately in the first of these sources, and the "re-rating equities" adjustment was only estimated and applied in the first two, i.e. it was not repeated in DMS (2004). However, DMS (2004) is purely a statistical study of investment returns and does not deal with the specific aim of offering a view on the forward looking ERP.

4.55 The three Figures below summarise the values published in the three studies referred to above:

Figure 4.1 Risk premia and adjustments, DMS (2002)

Measure	World	UK	US
Unadjusted AM	5.1	5.3	6.6
Unadjusted GM	4.0	4.0	4.6
Adjusted re-rating equities	1.2	0.6	1.4
Adjusted outperforming expectations	0.6	1.7	0.2

4.56 The data in the table above led DMS (2002) to conclude that the following ranges were appropriate for the geometric and arithmetic means for the US, UK and world:

- geometric mean 2.5% to 4.0%
- arithmetic mean a little below 4.0% to a little above 5.0%

4.57 The lower end of these ranges were based on a world ERP, with a US premium setting the upper end of the ranges (see DMS (2002) Figure 13-7). This means that, if the ranges were to be restated to focus on data relating only to UK and world indices, the corresponding figures would be a geometric mean of 2.5% to 3.0% and an arithmetic mean of about 4.0%.

Figure 4.2 premia and adjustments, DMS (2003)

Measure	World	UK	US
Unadjusted AM	4.9	5.1	6.4
Unadjusted GM	3.8	3.8	4.4
Adjusted re-rating equities	0.8	0.3	1.0
Adjusted outperforming expectations	n/a	n/a	n/a

4.58 As shown in the Figure above, DMS (2003) did not comment explicitly on the adjustments made in DMS (2002) for outperformed expectations. However, the authors did note that, "Further adjustments should almost certainly be made to historic risk premiums to reflect long-term changes in capital market conditions. Since in most countries, corporate cash flows exceeded investor expectations, a further downwards adjustment to the equity risk premium is in order..." This clearly suggests that DMS still considered their previous downwards

adjustments for outperformed expectations to be valid, without making a direct quantification.

- 4.59 DMS (2003) go on to note that, "...A plausible forward looking risk premium for the world's major markets would probably be on the order of 3% on a geometric mean basis, while the corresponding arithmetic mean risk premium would be around 5.0%". The Reader is then referred to "For illustrative estimates see Section 13.7 of our book {DMS (2002)}".
- 4.60 This quote demonstrates that DMS (2003) advocated making further adjustments to their historic averages beyond those for the re-rating of equities, since their recommended ranges make implicit allowances for factors that are not explicitly quantified elsewhere in the paper. Ofcom notes that the 5.0% figure at the upper end of the DMS (2003) range was based on US data. It is clear that this upper end of the range is very likely to include some allowance for a downward adjustment for outperformed expectations. If the range were to only reflect the UK and world premia, a lower upper bound would be appropriate).

Figure 4.3 Risk premia, DMS (2004)

Measure	World	UK	US
Unadjusted AM	5.1	5.3	6.6
Unadjusted GM	4.0	4.0	4.6
Adjusted re-rating equities	n/a	n/a	n/a
Adjusted outperforming expectations	n/a	n/a	n/a

- 4.61 The figure below summarises the estimates used by Ofcom in the first consultation. As already noted, since the publication of the first consultation, DMS and ABN AMRO have published its updated Global Investment Returns Yearbook, and the figures in this volume are virtually identical to those estimated in the 2004 edition (although the historic UK arithmetic premium is marginally lower in the 2005 edition than in 2004, at 5.2% compared to 5.3%)

Figure 4.4 DMS risk premia and adjustments used by Ofcom in the first consultation

Measure	World	UK	US	Source
Unadjusted AM	5.1	5.3	6.6	DMS (2004)
Unadjusted GM	4.0	4.0	4.6	DMS (2004)
Adjusted re-rating equities	0.8	0.3	1.0	DMS (2003)
Adjusted outperforming expectations	0.6	1.7	0.2	DMS (2002)

- 4.62 The above figure shows that, based on the most recently available data:

- the unadjusted arithmetic ERP for the UK/world indices is 5.3%¹⁸/5.1%;
- the unadjusted geometric ERP for the UK/world indices is 4.0%; and

¹⁸ As noted above, in DMS (2005), this figure is revised downwards to 5.2%

- depending on whether one or both of the DMS adjustments are used, a conversion of these historic premia into a forward-looking estimate could lead to a downward revision of up to 2.0%.

4.63 Ofcom's view is that it is appropriate to put some weight on the adjustments of the type made in DMS (2002) and DMS (2003), albeit less than should be placed on unadjusted historic premia, since the latter is a more widely recognised and arguably more objective measure. As discussed in the first consultation, these adjustments amount to a downwards adjustment of about 2.0%, pointing to a range of about 2% to 3% for the adjusted historic ERP. However, as argued by some stakeholders, the DMS adjustments, as recognised explicitly by DMS, are fairly crude, and can be viewed as subjective. Ofcom therefore considers it appropriate to revise the range associated with this source of evidence in the first consultation upwards. Ofcom's view is that a range of 3.0% to 4.0% is consistent with putting a modest amount of weight on the DMS adjustments. This range is somewhat lower than the range cited by DMS (2003) of 3.0% to 5.0%. However, as explained above, values in the upper end of this range reflect the US ERP which has experienced a higher geometric mean and relatively higher volatility (reflected in the difference between its geometric mean and arithmetic means of 2.0%, consistent with a higher volatility of returns than observed in the UK and world).

Ex ante estimation: "implied" ERPs and surveys

- 4.64 Ofcom agrees with those stakeholders that noted that estimates of implied ERPs are sensitive to the model and assumptions used, and that survey evidence can suffer from bias at a number of levels.
- 4.65 As a result Ofcom does not attach a great deal of weight to these estimation methods evidence (although given that such figures are used by practitioners on a relatively widespread basis, Ofcom does not dismiss such evidence completely as suggested by some stakeholders). The amount of weight that Ofcom has placed on *ex ante* implied ERPs and survey results is significantly less than it has placed on estimates based on historic data, and on regulatory benchmarking.

Regulatory benchmarks

- 4.66 Ofcom agrees that the "regulatory benchmark" range that it presented in the first consultation did not reflect certain instances in which regulators based their final cost of capital estimates on premia from the upper end of their proposed ranges (e.g. Ofwat and Ofgem). However, even taking this point into account, it is important to note that the available benchmarks still fall within Ofcom's proposed range of 2.5% to 5.0%, with values being more concentrated away from the lower end of this range than suggested in the first consultation.
- 4.67 In addition, Ofcom have given consideration to BT's reinterpretation of a selection of the regulatory benchmarks where they have sought to adjust the ERPs reported in the last consultation to take into account the situation where the regulator used a risk free rate that was higher than the prevailing market risk free at the time.
- 4.68 BT's reinterpretation is based on a suggestion that other regulators were assuming that the risk free rate falls when the ERP increases (or vice versa) so that total real equity returns are constant. In Ofcom's view, BT's overall high

level assumption concerning the link between the real risk free rate and the ERP has merit. However, it is also plausible that total real equity returns are not constant, and that instead the ERP can be considered to be constant and largely invariant to changes in the real risk free rate. This is Ofcom's view and is consistent with Ofcom's use of a market risk free rate. As highlighted in a number of stakeholder responses, many recent regulatory decisions have been based on an assumed real risk free rate that was above the prevailing market real risk free rate. This could be viewed as a way of controlling for the volatility of the observed real risk free rate, and interpreted as being consistent with a constant ERP and changing real equity returns. Ofcom's view is therefore that, whilst BT's interpretation is potentially relevant as one possible approach to interpreting past regulatory decisions, it does not cause Ofcom to change its proposed range.

- 4.69 With regards to the inclusion of international benchmarks suggested by some stakeholders, Ofcom does not consider it appropriate to include such estimates in its range for regulatory benchmarks. As discussed in the first consultation, Ofcom places most weight on UK and world ERPs, and regulators in other countries may have had a different view. In addition, country specific factors can be influential when regulators determine the appropriate ERP in their jurisdiction. Finally, if Ofcom were to put a significant amount of weight on the values implied by overseas regulatory decisions, it would need to be thoroughly persuaded by a study that covered an objectively selected sample of regulatory decisions across all sectors in a set of comparator countries selected on an objective basis.

General comments

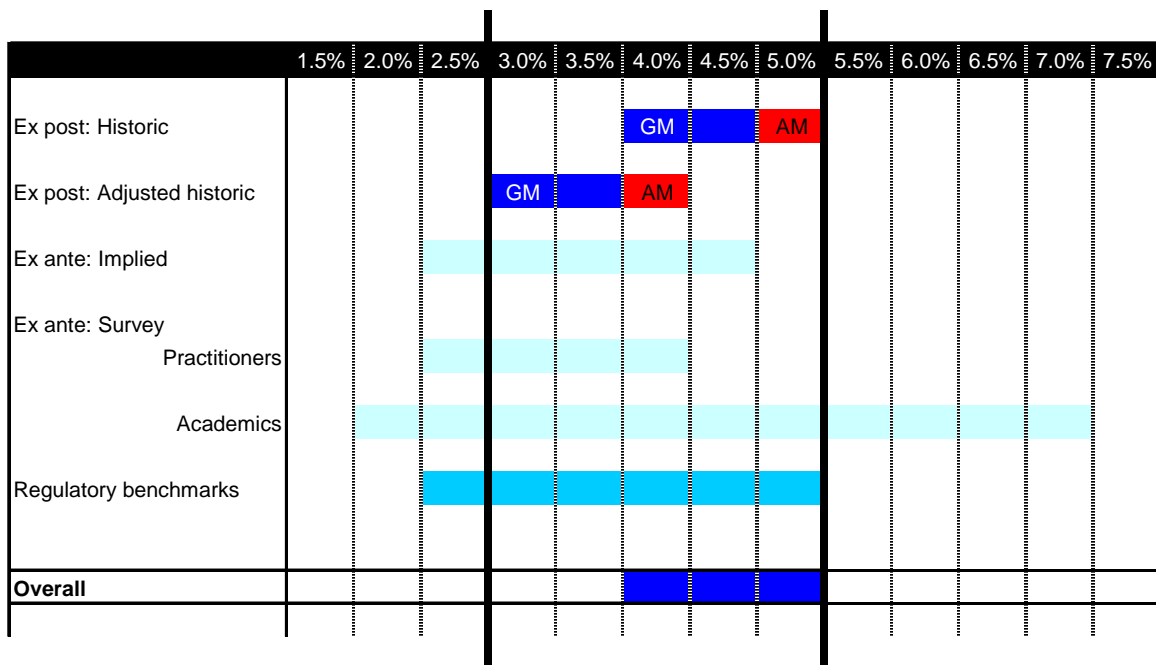
- 4.70 Before considering the impact of the above discussion in relation to the ranges of values implied by specific estimation methods, it is worth noting the point made by some stakeholders that Ofcom should conduct an impact assessment of its proposed changes to the ERP. Whilst such an assessment, if properly carried out, would undoubtedly be of interest, such a study would be very difficult to carry out in practice. In the first consultation Ofcom discussed how, in determining an appropriate range for the ERP, it balanced gains for consumers from lower prices (lower ERP) compared to the longer-term gains for consumers arising from increased investment incentives for firms. Whilst it may be possible to estimate the short-term impact on consumers of lower prices, estimating the gains from improved investment incentives does not readily lend itself to a straightforward quantification. The discussion in the first consultation (see para 4.23 onwards) in Ofcom's view constitutes a pragmatic discussion of the impact of a relatively high or low ERP. Whilst acknowledging that a more complicated approach would be possible, the difficulties inherent in attempting to translate, for example, the impact on competition of an extra half a percentage point on the ERP, leads Ofcom to take the view that the value of extending the scope of its impact assessment would be limited.

Ofcom's approach

- 4.71 The figure below reflects the changes to Ofcom's proposed ranges compared to those proposed in the first consultation and reflects the discussion above of responses. The revisions include:

- an upward revision to *Ex post*: Adjusted historic range - (2.0% to 3.0%) revised to (3.0% to 4.0%), reflecting a lower amount of weight being put on fuller downwards adjustments;
- the use of lighter coloured bars for the *Ex ante*: Implied or Survey ranges to reflect the relatively low weight placed on these sources of evidence;
- the use of slightly lighter coloured bars for the Regulatory benchmarks to reflect the relatively lower weight placed on these compared to the *Ex post* Historic and Adjusted historic estimates and relatively higher weight compared to the *Ex ante* Implied and Survey estimates; and
- an overall upward revision to the proposed range from (2.5% to 5.0%) to (3.0% to 5.0%).

Figure 4.5 Final summary of ERP evidence



4.72 Ofcom's view is that a range of 3.0% to 5.0% reflects a balanced view of the currently available evidence. Section 2 of this document provides a brief overview of some of Ofcom's key duties under Sections 3 and 4 of the Communications Act. In proposing the most appropriate values from within this range, Ofcom has, amongst other things, had regard to Section 3(4)(d) of the Communications Act 2003; i.e. to have regard to the desirability of encouraging investment and innovation in relevant markets when exercising its duties. Ofcom's duty to promote competition under Section 4 of The Act is also an important factor to consider (and it should be noted that competition at the retail level may provide a stimulus for innovation).

4.73 In the first consultation Ofcom outlined its belief that the downside of setting an ERP too low is worse than the downside of setting the ERP too high. Given Ofcom's revised range, one of the original proposals made in the first consultation of 4.0% is no longer consistent with Ofcom's broad policy bias towards a higher ERP - 4.0% is now in the middle of the overall range for the

ERP. Therefore it is Ofcom's view that 4.0% is not an appropriate value for the ERP in Ofcom's context.

- 4.74 In relation to an ERP of 5.0%, Ofcom's view is that this is also not appropriate. This is because 5.0% would represent in Ofcom's view a full bias towards investment incentives and no material consideration of consumer protection (with respect to prices). Whilst Ofcom is minded to give investment considerations more weight than consumer protection in this context it is not willing to dismiss its consumer protection obligations. Therefore in Ofcom's view an ERP of 4.5% represents a balance between a bias towards investment incentives and some consideration of consumer protection.
- 4.75 Finally, it is important to consider why Ofcom's estimate has changed, i.e. why it has departed from the values used in the past by Oftel and Ofcom as recently as September 2004. BT's response argues that this change of approach does not seem appropriate "On balance, there is no evidence that the market risk premium has fallen since Ofcom estimated it as 5%. If anything, the evidence points the other way".
- 4.76 Ofcom agrees that no major new evidence in this area has emerged since September 2004, and is not of the view that the underlying level of risk associated with investing in equities has changed since then.
- 4.77 However, as already discussed Ofcom is examining all this evidence (including its predecessor's views on this evidence discussed at the end of this section), with consideration of its duties under the Act and in light of the Telecoms review which sets out a general regulatory strategy for Ofcom i.e. tighter regulation of economic bottlenecks and a deregulatory stance elsewhere. Ofcom considers this to be a wide-ranging review and the last time such a review was carried out was in 2001. Therefore Ofcom considers the relevant question to consider is what changes in relation to the available evidence have occurred since 2001. In Ofcom's view the key changes that have happened since 2001 are:
- the availability of authoritative new evidence by DMS suggesting that previous estimates of historic risk premia were too high, being based primarily on US data, and using data sets in which average returns were higher (and also suffered from other faults such as survivorship bias, as explained in the first consultation). In 2001¹⁹ the available evidence on the arithmetic mean of unadjusted historical premia pointed towards estimates in the region of 7% or higher, rather than the 5.2% recently estimated by DMS (2005));
 - the estimation of forward-looking premia by DMS. Whilst Ofcom notes that these adjustments are crude in some respects, and is inclined to put more weight on unadjusted averages, its view is that these new estimates, being an important part of the influential new DMS work, should not be overlooked;
 - a shift of emphasis by some of the UK regulators (e.g. Ofgem and Ofwat) from using ERP estimates based on giving significant amounts of weights to

¹⁹ For example see Proposals for Network Charge and Retail Price Controls from 2001, Issued by the Director General of Telecommunications, February 2001 (<http://www.ofcom.org.uk/static/archive/oftel/publications/pricing/pcr0101.htm#Annex%20E:%20Cost%20of%20capital>)

forward-looking (lower) estimates to ones based on giving more weight to (higher) historic averages.

- 4.78 Between 2001 and today Ofcom has not made a significant change to relative amount of weight that it places on different estimation methods, although putting weight on the DMS adjusted historic data has inevitably meant putting somewhat less weight on other data sources such as unadjusted historic averages and regulatory benchmarks. Rather, the key change to Ofcom's ERP estimate has been the emergence of the DMS work, which Ofcom considers to be the single most authoritative source of estimated premia based on historic data. As explained above, this work points towards premia that are lower than most of the previously quoted estimates. As explained above, in 2001, Oftel put a significant amount of weight on historical estimates that were in the region of 7%. Ofcom's current view is that, given the availability of the DMS data source, putting any significant amount of weight on such high estimates would not be appropriate, even given a bias in favour of encouraging discretionary investment ahead of short-term consumer preference.

Section 5

Variations in risk within the firm

Introduction

- 5.1 In the communications industry, firms typically sell a range of wholesale and retail services in markets that may be characterised by widely varying cost and demand conditions. The extent of the systematic and specific risks that apply to firms in such cases will vary considerably across products and services, even where services run over a shared physical infrastructure. For example:
- BT provides a wide range of retail and wholesale activities, including well-established products such as voice call origination and termination, new products such as broadband services, and as yet undeveloped services that will be offered via 21st Century networks;
 - mobile network operators offer a wide range of services, ranging from mature services such as voice call origination and termination to ones that are still emerging, such as 3G data services; and
 - UK media companies are engaged in a wide range of activities in areas such as programming and broadcasting.
- 5.2 This means that it is appropriate to view some large companies such as BT as being a group that consists of a number of firms, or projects, each with its own unique risk profile, that operate together under common ownership.
- 5.3 Ofcom typically undertakes financial analysis (e.g. setting the charges for, or margins between, wholesale services) relating to a subset of these large companies. This Section discusses the methodology Ofcom will apply to financial analysis to reflect variations in risk within a company, and discusses how these variations might be modelled.

Rewarding project risk

- 5.4 Questions 2 and 3 of the first consultation asked whether Ofcom should reflect the differences in risk between projects within a company. Ofcom also asked how such extra (or reduced) rewards should be treated in future charge control reviews, in particular whether they should be treated as adjustments to the RAB (for adjusted cash flows) or a fixed or relative adjustment to the company cost of capital.

Question 2: Do respondents think that if projects with different risk profiles are to be rewarded differently, this should be through the cost of capital or the cash flows or should it depend on the types of risks involved? How would such extra (or reduced) rewards be treated in future financial analysis (e.g. at future charge control reviews)?

Question 3: Do respondents think that projects or business units with different systematic risks should be rewarded differently? If so, is it possible to establish a robust methodology by means of which the systematic risk of these projects could be assessed and the adjustment to the reward determined?

- 5.5 The initial view expressed by Ofcom in the first consultation was that, in cases where disaggregation is appropriate:
- different systematic risks should be reflected by adjusting project cost of capital estimates (using different project betas); and
 - the specific risks related to particular uncertainties should be reflected by means of adjustments to the relevant cash flows
- 5.6 The sections below summarise the responses of stakeholders to these issues, and Ofcom's policy in the light of these responses.

Summary of responses

- 5.7 The majority of stakeholders agreed with Ofcom's suggestion that it was correct in principle that divisions which faced more risk than the company as a whole should receive higher rewards. Many, however, expressed concern that, in practice, objectively estimating risks at a project-specific level would be prohibitively difficult.
- 5.8 One respondent strongly supported rewarding projects or business units with different systematic risks differently to avoid cross-subsidy between customers. It argued that any additional risk beyond the company average should be reflected in a project risk premium. It further argued that project betas should be determined in the same way as the company betas are often determined – by seeking comparable companies or asking financial/risk experts to produce a project risk profile.
- 5.9 BT suggested that “regulatory forbearance” in the case of higher risk projects might be an appropriate alternative to adjusting rates of returns or risks.
- 5.10 BT argued that the risk profile faced by different parts of its business reflected a single “telecommunications market risk” that was broadly constant across the company. BT identified a number of factors that lead to a similar level of risk being generated across BT, including the following:
- sector-specific technology shocks;
 - the USO means that much of its investment is not discretionary;
 - *ex ante* regulation means that planned or achieved rates of return may be reviewed;
 - *ex post* investigation under competition law means that BT needs to take care not to, “work on the basis of projected returns” that might imply anti-competitive intent on its part;
 - in many markets, prices are set by BT's competitors or related products so the price may bear no relationship to the underlying costs; and
 - BT may invest strategically to provide overall benefit to the firm even if the particular project is ‘bad’.
- 5.11 Easynet argued that project risk is strongly influenced by the market position of the firm, and that firms with Significant Market Power (SMP) will tend to face

less risk, particularly where SMP arises as a result of enduring economic bottlenecks. Easynet argued that variations in risk should be modelled via the cost of capital rather than cashflows, since the latter are difficult to estimate with any certainty on an *ex ante* basis. Easynet argued that it is very difficult to estimate project betas based on benchmarks, since BT's ownership of an economic bottleneck implies that meaningful comparators do not exist outside of BT. Easynet argued that the systematic risk of a project might be calculated based on estimates of income elasticities of demand for projects, together with assessments of the degree of market power enjoyed by BT with regard to the output of various projects. Easynet suggested that, where BT had SMP, demand would be inelastic with regard to income, and the project would face relatively little systematic risk.

- 5.12 NTL echoed the concerns raised by BT regarding the difficulties of objectively identifying projects with atypical risk profiles, and robustly assessing variations in risk. NTL argued that it might be easier to identify cash flows that relate to a specific project than to apply a different cost of capital but that investment in capital assets which are shared between projects with different risk profiles would further complicate any calculation. NTL also expressed a concern at the risk of "double-counting" if an accurate company beta is used but certain project cashflows are adjusted.
- 5.13 NTL expressed a concern that it would be difficult to develop a robust method for assessing systematic risk, and to objectively select projects that have a sufficiently different risk profile to warrant differential treatment. It was also concerned at the danger of companies gaming the inputs to any methodology to seek to secure a higher return. It considered that any increase in the efficiency of investment appraisal should be balanced against the additional regulatory burden from increasing the complexity of regulation.
- 5.14 Telewest expressed a concern that differences in risk between projects might be difficult to model in practice, and in particular noted the difficulty inherent in identifying risks as being specific or systematic. In relation to demand risk, Telewest expressed a concern regarding regulatory consistency in cases where outturn demand differs from initial *ex ante* expectations. Telewest expressed concern at the possible level of regulatory intrusion a disaggregated approach to assessing risk might entail, and suggested that Ofcom should set out a series of processes to minimise intrusion, and should only introduce adjusted returns in cases where ignoring differential risks would be likely to have a particularly detrimental impact on consumers.
- 5.15 Telewest identified the following conditions where it would be desirable to reward projects on a differential basis:
- assets and revenues can be separately and discretely identified; and
 - the ability to clearly and unambiguously identify that the systematic risk of assets is different from that being rewarded in the base case.
- 5.16 NTL Broadcast argued that the decision on whether cash flows or the cost of capital should be used to reflect variations in risk across projects depends on project-specific circumstances. It argued that the case for adjusting cashflows is stronger where project risks differ significantly from those of the company as a whole, or where it is difficult to estimate the effect of the risks on the cost of

capital. NTL Broadcast argued that it was common for corporations to make adjustments to cashflows in order to reflect specific risk factors.

- 5.17 NTL Broadcast and another respondent argued that specific as well as systematic risk is important for cost of capital estimation since it will have an impact on, for example, the appropriate level of gearing and the cost of debt, and will therefore affect the ability of the business to benefit from the tax advantage of debt. NTL Broadcast argued that the case for carrying out a disaggregated analysis is strongest in cases where differences in risk profiles are significant, and relate to large-scale activities. NTL Broadcast expressed a view that, where it was not possible in practice to assess on a project by project basis the particular project risk, the company risk profile should be used.
- 5.18 UKCTA argued that project specific variations in risk are best dealt with using the cost of capital, since this method allows actual cash flows to be reconciled to the company's records. It argued that adjusting cashflows entails more subjectivity, and is difficult to verify.
- 5.19 Vodafone argued that the correct way to deal with a project's cash flow uncertainty is through contingencies to the cash flows, and that these contingencies should be carried through charge control periods even if the uncertainty has been removed by subsequent information. It noted that using cost of capital estimates to reflect project specific variations in risk, in addition to being the less valid approach of the two approaches discussed by Ofcom in the first consultation, would not necessarily lead to a reduction in complexity, since any such adjustments would need to be applied consistently across multiple charge control periods.
- 5.20 Vodafone argued that there may be specific projects where it is possible to estimate a project beta separate from the company beta based on, firstly, the fixed/variable cost structure of the project relative to that of the company as a whole, and, secondly, the income elasticity of the project output relative to that of the company as a whole.
- 5.21 Vodafone emphasised the importance of recognising all non-diversifiable risk, and argued that project or activity betas should only be applied on a case by case basis where there is sufficient confidence in the result. Vodafone argued that, under an "asymmetric loss principle"²⁰ (see paragraphs 4.24 – 4.25 of the second consultation for Ofcom's view on this) it would be prudent to only use a project beta when it is estimated to be higher than the company beta.
- 5.22 Another respondent supported the view that projects with different risks should be rewarded differently, and argued that, in theory, companies should be indifferent between the two methodologies for achieving this. In practice, however, they believed that it was very difficult to estimate future cash flows, and therefore considered that the most robust method was therefore to use a differentiated cost of capital.
- 5.23 An additional view expressed by a number of respondents including UKCTA, Chris Goodall, and another respondent, was that variations in systematic risk within a company should also be reflected by means of project specific gearing

²⁰ Vodafone used this term in its response to the first consultation to describe situations where the consequences of under-investment if the cost of capital is set too low are more damaging than the outcomes associated with setting the cost of capital too high.

ratios. This suggestion reflects standard finance theory and the available empirical evidence (e.g. see Chapter 5 of Ogier *et al* for details). A firm with stable cash flows, i.e. one that faces low levels of systematic risk, will be more likely to take advantage of the tax advantages of debt. It will be in a position to commit to making more fixed payments to debtholders since the probability of it being unable to make these payments is lower than would be the case for a firm with less stable cash flows.

Ofcom's views of responses on project risk

5.24 A number of stakeholders noted the difficulty of assessing the risk associated with individual projects in practice, and also commented on the extent to which Ofcom's proposals with regard to calculating BT's WACC were also applicable to other companies within the sector. Ofcom recognises that such difficulties do exist, and as such would only propose adjusting the reward under certain circumstances. Ofcom's view, based on stakeholder responses and the principles outlined in the first consultation, is that the case for assessing risk on a project-specific basis is likely to be stronger under the following circumstances (the following list of conditions is non-exhaustive, and it is not the case that all need to be satisfied for a disaggregated approach to be appropriate – but the more that are satisfied, the more likely it is that a disaggregated approach will be appropriate):

- there are strong *a priori* reasons for thinking that the systematic risk faced by the project was significantly different from that faced by the overall company (e.g. different income elasticities of demand and/or stability of cash flows);
- there is evidence which can be used to assess variations in risk, e.g.:
 - it is possible to identify benchmark firms that are close to “pure play” comparators in terms of having similar risk characteristics to individual projects within the firm;
 - it is possible to use other quantitative analysis (such as quantified risk assessments or the analysis carried out by PwC on behalf of Ofcom²¹ to assess variations in risk);
 - data on the firm are available at a disaggregated level (e.g. via separated accounts); and
- correctly identifying variations in risk, and reflecting this in an adjusted rate of return, is likely to bring about significant gains for consumers.

5.25 Ofcom would propose to base any disaggregated analysis that might be suggested to it on an assessment, depending on the strength of *a priori* expectations and the availability of relevant evidence, similar to that carried out for BT during this review. In this context, it is important to distinguish between Ofcom's preferred treatment of systematic and specific risks (and see also paragraph 5.28 below).

²¹ See Disaggregating BT's Beta, June 2005, A report prepared for Ofcom by PricewaterhouseCoopers LLP
http://www.ofcom.org.uk/consult/condocs/cost_capital2/disaggregating.pdf

- 5.26 A number of stakeholders argued that the nature of the underlying assets, rather than end user demand, was key to determining whether risk should be assessed at a project specific level. Ofcom disagrees with this view. The cyclicity of both a project's cash inflows and cash outflows contribute to the level of systematic risk associated with the project. The more cyclical a project's cash inflows are, and the more fixed (or, indeed, counter-cyclical) its cash outflows are, the higher its beta will be. The type of assets used in a project clearly play an important part in determining the cash outflows associated with a project, and will therefore have some impact on its level of systematic risk (e.g. the systematic cost risk faced by two projects offering different services offered over networks constructed using similar capital and labour inputs may be similar to a degree). However, the nature of the underlying assets used in a project is unlikely to play any significant part in the risk associated with variations in a project's cash inflows, i.e. the extent to which demand specifically for that project is correlated with aggregate demand at an economy-wide level. Ofcom's view is therefore that the nature of the underlying assets is only one of the factors that determines systematic risk, and is of the view that the cyclicity of demand is a more important factor.
- 5.27 Ofcom agrees that industry-wide factors, such as the use of similar technologies and assets, may be relevant to a degree in determining the level of risk faced by different divisions within a company. However, as outlined in the first consultation, a key determinant of the level of systematic risk facing a project is the extent to which its returns, and expectations in relation to its returns, are correlated with the expected returns of the market. Ofcom's view is that the factors identified by BT as leading to a similar level of systematic risk being faced across BT group are unlikely to be key determinants of systematic risk.
- 5.28 In relation to NTL's arguments, Ofcom believes that the process of identifying particularly risky projects should focus on risks in relation to expected cash flows in the project assessment and therefore facilitate estimation of the cash flows. Modelling variations in specific risk should not introduce double-counting, since the company WACC should only reflect systematic risk under the CAPM approach. As explained in the first consultation, Ofcom's view is that it is not in principle appropriate to make adjustments to project discount rates in order to reflect specific risks.
- 5.29 Ofcom agrees that, where assets are shared between different services, some apportionment will be needed in the regulatory accounting treatment. Ofcom considers that its experience in the area of regulatory accounting will be useful to minimise "gaming" by incumbents, but recognises that it may have to pay particular attention to this issue given the additional complexity introduced by beta disaggregation.
- 5.30 Ofcom agrees that it may be difficult to reliably assess whether certain project risks are specific or systematic (or both). In these circumstances a combination of the two approaches to modelling variations in risk may be appropriate. Ofcom agrees that there is a need for consistency in regulatory approach to the reward of *ex ante* risk on a project even if later developments remove some of that risk (see comments above). Ofcom recognises that these proposals might lead to greater regulatory intrusion and because of this only advocates such an approach in the case of larger projects (see above for Ofcom's view on the circumstances under which the use of a disaggregated approach is likely to be appropriate).

- 5.31 Ofcom disagrees with the argument made by UKCTA that the inability to reconcile modelled cash flows to company accounting information provides a justification to limiting any project-specific adjustments to cost of capital estimates. Whilst this consideration may apply in some circumstances, in general the limitations of forecasting are such that actual achieved cashflows may deviate significantly from *ex ante* expectations for a variety of reasons. Ofcom's intention would be to make all such adjustments in a transparent fashion, in order to facilitate comparison with unadjusted cashflows, and, where relevant, company information. To the extent that the reconciliation of actual cashflows to accounting data is a useful exercise, it would be very easy to strip out any adjustments made to individual cost lines to reflect *ex ante* uncertainty.
- 5.32 Ofcom does not propose to model variations in systematic risk across projects by means of varying project gearing ratios. Viewing a company as an aggregation of individual projects, one would expect the project gearing ratio for low-risk projects to be higher, and hence, other things being equal, the project cost of capital lower. However while it is empirically observed that firms with relatively low asset betas tend to raise capital using a relatively high proportion of debt, as opposed to equity, finance, Ofcom is not aware of any established formulaic relationship between the two; systematic risk may only be one of the factors that determines the optimal gearing ratio for a firm or project. Ofcom's preferred approach in this and similar situations is to err on the side of caution in assessing risk at a project-specific level, only varying project betas in instances where the case for doing so is particularly compelling, and even in these cases, to assume relatively modest variations in the level risk faced by different divisions within a company. In Ofcom's view it would not be prudent for it translate a given difference between the equity betas of two different projects into a particular difference in optimal gearing. Ofcom's view is therefore that it is not appropriate at this time to attempt to model variations in risk via different gearing ratios. This is consistent with the approach previously used by Ofcom in calculating a gearing ratio to estimate BT's WACC where a different 'optimal' level of gearing was not argued for.
- 5.33 The arguments made by NTL Broadcast and another respondent imply that, potentially, variations in both systematic and non-systematic risk should be used as a basis for calculating a firm's debt premium. Ofcom agrees that non systematic risk has an impact on corporate bond yields, but also notes that in accounting for specific risk Ofcom there is an argument to suggest that the debt premium on the CAPM should be based on expected payments to debtholders, i.e. the promised yield multiplied by the probability that the firm will not default. This suggests that the impact of specific risk on the debt premium will be less pronounced.

Ofcom's approach

- 5.34 Having considered responses from stakeholders, Ofcom remains of the view that, in some circumstances, it is appropriate to reflect project-specific variations in risk in its financial analysis. Given the practical difficulties in implementing this approach in practice, as outlined in the previous section, Ofcom's expectation is that such a disaggregated approach would be used in a relatively small number of circumstances.
- 5.35 The decision of whether to adjust the project cost of capital or allow a contingency in the cashflows (or a combination of the two) should be considered on a project by project basis in line with the principles set out in the

first consultation and summarised earlier in this section. The assessment of project or divisional risk should reflect all the available information, potentially including companies with similar risk profiles to the project or division concerned, quantified risk assessments, and, where available, evidence relating to income elasticities of demand and the degree of operational leverage of the project.

- 5.36 Where the disaggregated approach spans multiple charge control periods, we would normally expect any adjustment to the project cost of capital to be a premium (or discount) to the company's cost of capital, and so reflect any changes to the overall WACC in the charge review. In future charge controls, prices should generally be set to allow revenues to be generated that are consistent with the risks that were expected to occur in that control period. This will mean that out-turn revenues might generate returns different from the WACC, reflecting the fact that, *ex ante*, expected returns and the WACC are equal, but, *ex post*, this might not be the case.

Variations in specific risk - Optimism Bias

- 5.37 The first consultation asked stakeholders to comment on whether initial appraisals of projects with high specific risk tend to underestimate the true expected costs of the project (whether they exhibit optimism bias) and if so how to estimate the true cost and determine any adjustment to the required reward.

Question 6: Do respondents agree that initial appraisals of projects with high specific risk tend to underestimate the true expected costs of the project? If so, how should the true expected cost of the project be assessed and any adjustment to the required reward determined.

- 5.38 The views of stakeholders in relation to this issue, together with Ofcom's view in the light of these, are outlined below.

Summary of responses

- 5.39 A number of stakeholders either did not believe that there was a bias in the initial project appraisal, or else believed that the company concerned should bear the consequences of any such error. In addition, respondents were concerned at the opportunities for gaming arising from any adjustment made to correct for optimism bias, and expressed scepticism that the regulator would be able to assess the true expected costs of a project any better than the company concerned.
- 5.40 One respondent suggested that an independent assessment of projects should be carried out upfront to challenge a company's modelling.
- 5.41 BT commented that the relationship between expected and outturn costs depends on how prudently the project is carried out, and the ability of management to control costs, and that high risk projects should include explicit risk analysis. Where there is a risk that investment will not deliver adequate returns (possibly due to technological obsolescence), this should be taken into account by increasing the cost of capital or allowing recovery over a shorter time period. BT saw the key being to ensure that the expected return is aligned with the cost of capital.

5.42 NTL Broadcast argued that certain projects with high specific risk do underestimate the true expected costs particularly when these risks are outside management control. These are likely to be due to low probability events with high impact such as:

- delays and costs associated with new technologies;
- changes in customer specifications;
- changes in regulatory or legislative requirements; and
- increasing costs from third party contractors.

5.43 NTL Broadcast suggested that where the changes are clearly outside of management control that they should be contractually dealt with as and when they occur and the costs passed through to customers only if they occur.

5.44 Telewest and Vodafone also thought that optimism bias occurred. Telewest suggested that it should be dealt with by adding a contingency to the best or central case estimates of the project's capital costs.

Ofcom's approach

5.45 Ofcom does not believe that it would be appropriate for it to commit to using a "formulaic" approach, such as adding a contingency to cost forecasts, or using different cost of capital estimates, for projects with high specific risk in all cases. Such an approach might give rise to negative incentive effects, and also the size of any such adjustment would be essentially arbitrary, and therefore not in line with Ofcom's objective of evidence-based regulation.

5.46 Ofcom recognises that there may be some projects (especially those that face risks that are outside of the company's control) where it is neither practical nor efficient for the company to try to price these risks into the investment, and where a pass-through mechanism or specific contractual re-opener may be more appropriate. In such cases, Ofcom will consider whether the company should still face a proportion of those risks (i.e. it would not be fully insulated from the effects) to provide it with an incentive to reduce the likelihood or impact of the event occurring.

Section 6

BT's group beta

Introduction

Beta estimation

- 6.1 The value of a company's equity beta reflects movements in returns to shareholders (as measured by the sum of dividends and capital appreciation) from its shares relative to movements in the return from the equity market as a whole. It increases with a company's debt to equity ratio (gearing), since a higher level of gearing implies higher volatility in the returns to shareholders
- 6.2 Equity beta estimation is usually carried out in order to estimate what the relationship between a firm's returns and those of the market will be on a forward-looking basis. Expectations of this sort are very difficult to measure though, so equity beta values for a company are typically calculated by regressing data on past returns against the past returns associated with an appropriate market index.
- 6.3 In using historical data to estimate a company's beta on a forward-looking basis, there are a number of potentially contentious issues to consider in appraising the usefulness of beta estimates (aside from the issue of estimating the risk of individual projects within a company, which was discussed at some length in the first consultation). These issues must sometimes be traded off against each other, since no single estimate will typically score highly against all criteria. Contentious issues include the following:
- the statistical properties of estimates, for example:
 - reliability of estimates (e.g. lower standard errors can be obtained by, for example, using a sample containing more data points via higher frequency data or longer data windows, and estimates calculated using monthly data can be susceptible to significant variations depending on which day of the month is used for beta estimation);
 - parameter stability – if beta estimates change over time, then it may not be appropriate to use estimation methods that rely on long run historical data windows. This will be particularly true if, for example, data windows span important events such as major acquisitions and divestments; and
 - other technical issues (these include heteroscedasticity, autocorrelation, and asynchronous trading bias – see Issues in Beta Estimation for UK Mobile Operators, The Brattle Group, July 2002 for details).
 - the need to measure risk relative to an appropriate index (e.g. domestic or international).
 - other issues that are relevant from a policymaker's point of view, e.g.:
 - issues relating to the stability of estimates (e.g. if some estimation methods provide results that are very unstable over time, then putting a relatively large amount of weight on estimation methods that provide

more stable results may be desirable in order to provide a stable climate for investment); and

- the usefulness of relying on well known, published, data sources (such as the LBS RMS data or similar).

6.4 Taken together, these issues mean that a wide range of estimation methods may be used in beta estimation. Ofcom's preferred approach is to give weight to a number of different estimation techniques, which, it believes, strike an appropriate balance amongst the issues outlined above.

6.5 Some of the key practical estimation issues that arise based on the objectives identified above are:

- choice of data frequency (daily , weekly, or monthly);
- estimation period (how many years' worth of data to use, and over which period); and
- the need to measure risk relative to an appropriate index (i.e. regressing company returns against either a domestic or international market index).

6.6 Each of these issues is discussed in the context of the available evidence on BT group's equity beta in the text below.

Data frequency

6.7 A key issue in beta estimation is the frequency of data to be used. Either daily or monthly (or indeed weekly) returns are commonly used to calculate equity beta estimates. The relative merits of these estimation techniques are summarised in the Competition Commission's 2003 report on mobile call termination (http://www.ofcom.org.uk/static/archive/oftel/publications/mobile/ctm_2003/index.htm), and discussed at some length in a paper written by The Brattle Group on behalf of Oftel, *Issues in Beta Estimation for UK Mobile Operators*, The Brattle Group, July 2002.

6.8 Advantages of using daily data in beta estimation include:

- obtaining greater statistical accuracy (shown by lower standard errors);
- the option of using shorter data windows in cases where parameters appear to be unstable; and
- the fact that beta estimates based on monthly returns are often sensitive to the day of the month on which data points are taken (e.g. in the PPC statement Ofcom set out evidence showing that beta estimates for BT fluctuate widely across values depending on which day of the month is used).

6.9 Disadvantages of using daily data in beta estimation include:

- statistical problems that may result from using daily data, notably "non synchronous trading bias" (see the Brattle Group's 2002 paper for details). However, these problems can be mitigated by the use of statistical

corrections, e.g. a "Dimson adjustment" (including additional lag and lead terms in regression analysis); and

- the fact there is no widely recognised published source of beta estimates using daily data (such as the LBS RMS beta which is based on monthly data).

6.10 Given the degree of uncertainty involved (caused, for example, by being unable to isolate the relevant components of BT's overall activities, and ensuing difficulties in interpreting statistical tests), a degree of judgement is required in deciding how to arrive at a single estimate or range of estimates for beta. Ofcom's view is that a prudent approach is to place a degree of weight on both daily and monthly estimation techniques, subject to statistical robustness of estimates, particularly given that published sources tend to focus on the latter estimation method. The most appropriate estimation method will be dependent on the statistical properties of the data set used, and may depend (see below) on the data window used – in cases where a short data window is preferable, the use of monthly data will not be appropriate, since there will be insufficient data points available for calculating robust estimates.

Data window

6.11 An issue closely related to that of data frequency is the appropriate data window to use for estimation. For example, the published LBS RMS beta estimates are calculated from monthly observations, using 5 years of data, whereas - using data of a higher frequency - it is possible to obtain robust estimate betas based on a single year's worth of data (or perhaps less).

- The trade-off involved in selecting the appropriate data window is between:
- the need to reflect the most recent possible data in order to obtain a proxy for future values (which favours the use of shorter estimation periods); and
- the desirability of obtaining low standard errors of estimation by including many observations (which favours the use of longer estimation periods).

6.12 Ofcom's view is that, (at least when using daily data) it is appropriate at present to use a relatively short window. This is because the beta for BT has appeared to be unstable in recent years. This is illustrated in Figure 2 above.

Appropriate index

6.13 In traditional cost of capital analysis the risk of a stock has been estimated relative to its domestic market. However, given the increasing prevalence of non-UK investment within the portfolios of UK investors, there may be increasingly strong grounds for estimating risk relative to an international portfolio (see *Issues in Beta Estimation for UK Mobile Operators*, The Brattle Group, July 2002). Ofcom's view is that some weight should therefore be given to beta estimates measured against international indices in addition to domestic ones.

The second consultation

6.14 Question 9 of the second consultation asked for stakeholder comments with regard to an appropriate estimate of BT Group's equity beta.

Question 9 – Do stakeholders agree that Ofcom should revise its central estimate of BT's equity beta downwards from 1.3 to 1.0, 1.1, or 1.2? Which of these figures is the most appropriate?

- 6.15 In the second consultation, Ofcom proposed to use a lower estimate of BT's equity beta than the figure of 1.3 that had been estimated in the 2004 PPC statement. The basis for this proposed change was that the estimation methods which had been used to calculate the previous estimate of 1.3 now produced lower values. If Ofcom were to apply the same weighting to each of these estimates, then its central estimate of BT's equity beta should also be lower. A central value of 1.1 was proposed by Ofcom in its WACC calculations at the end of the second consultation (see Figure 9 and Figure 10 of the second consultation²²).
- 6.16 It is worth recapping the main estimates used by Ofcom in arriving at its revised estimate. These are provided in Figure 6.1 below, which is a reproduction of Figure 4 from the second consultation. All of these figures were calculated using data up to the end of April 2005.

Figure 6.1 Beta estimates quoted in the second consultation

Estimated by/ description	Data Frequency	Index	Period	Estimate (middle of range))
The Brattle Group	Daily	UK	2004-05	1.0
The Brattle Group	Daily (+Dimson adjustment)	UK	2004-05	0.6
LBS RMS	Monthly	UK	2000-2005	1.4
The Brattle Group	Daily	World	2004-05	c. 0.5

- 6.17 In its report *Beta Analysis of British Telecommunications: Update June 2005* (included by Ofcom as an annex to the second consultation), The Brattle Group argued that recent market data pointed towards an equity beta estimate value of 1.0. This estimate was calculated using two years of daily data up to end April 2005. The Brattle Group's preference for a two-year estimate over the one-year estimate advocated in previous reports was based on the stability of the two-year estimate in recent years. As of April 2005, one-year and two-year estimates both produced estimates of about 1.0. For this reason, Ofcom had quoted the one-year figure in order to facilitate comparison with the estimates it had previously set out in the PPC statement. More recent data suggests a degree of divergence between one-year and two-year estimates, as will be discussed later in this section.

²² Note that the group estimate was not explicitly used in Ofcom's two WACC calculations, which were based on a disaggregated approach, as set out in Section 4 of the second consultation.

6.18 Ofcom received a number of responses in relation to the analysis set out in the second consultation. Broadly speaking:

- customers and competitors of BT argued in favour of values towards the lower end of the range identified by Ofcom in Question 9 (i.e. a value of 1.0 rather than Ofcom's central estimate of 1.1, or a higher value of 1.2); and
- BT and Telewest argued that Ofcom's downward revision of its estimate of BT's beta was either inappropriate or excessive.

6.19 A more detailed summary of these responses, together with Ofcom's view on each and conclusion, is set out in the remainder of this section.

Stakeholder responses

Responses from competitors

6.20 Ofcom received responses from a number of the companies that rely on BT for wholesale inputs. The key points that were made in these responses are briefly outlined in the paragraphs below.

6.21 C&W was broadly in agreement with the approach proposed by Ofcom in the second consultation. It did, however, note that a one-year beta calculated using daily data, which had previously been used by The Brattle Group as a central basis for its recommendation to Ofcom, had fallen to about 1.0 at the end of April 2005, and had been below 1 for about a year prior to that. Based on this, C&W argued that the use of a central value of 1.0 would be appropriate.

6.22 Easynet was also broadly in agreement with the approach proposed in the second consultation, i.e. one in favour of a beta estimate that was lower than 1.3. Easynet did, however, argue that the use of a value that was a little below the lower end of the range by suggested by Ofcom in Question 9 of the second consultation, namely figure of 0.97, was appropriate. This was based on, *inter alia*:

- a proposal that, given the statistical problems associated with monthly estimates that had previously identified by Ofcom, Ofcom should put relatively little weight on the LBS RMS estimates; and
- an observation that Ofcom appeared to put relatively little weight on betas estimated relative to an international index.

6.23 Energis argued that the use of an estimate of 1.0 would be appropriate, on the basis that weight should be given to:

- the Brattle Group's one-year daily estimates (both unadjusted and Dimson-adjusted), which implied a beta value below 1; and
- regulatory stability.

6.24 UKCTA argued that Ofcom had been overly cautious in its approach, i.e. that it had erred too much on the side of estimates that were above the values implied by recent market data. UKCTA argued that updating the four estimates presented in the PPC statement and applying the same weights to each

estimate would imply a lower beta estimate than 1.1. Based on this, UKCTA advocated the use of an estimate of 1.0.

BT's response

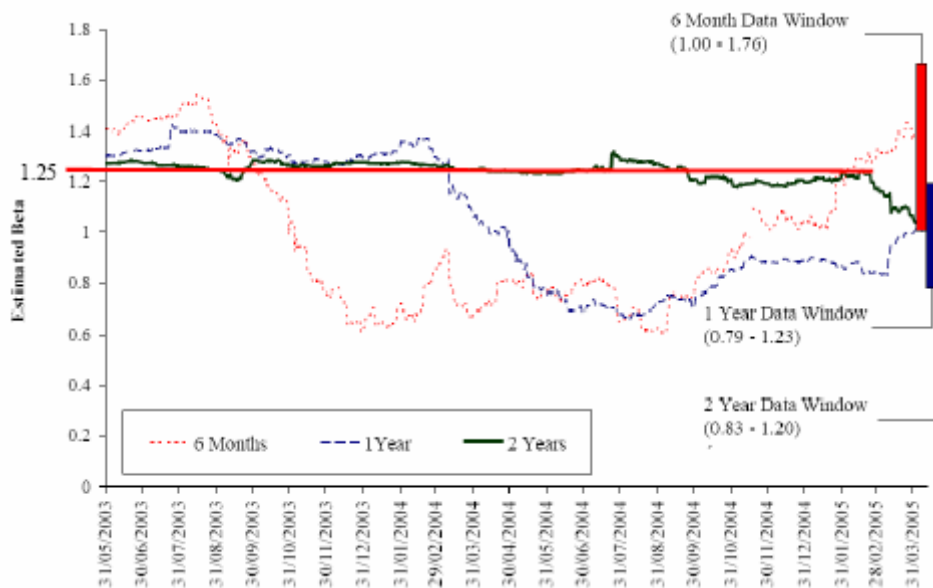
BT's main response

6.25 BT was opposed to Ofcom's proposal to reduce its estimate of BT's beta. In the main part of its response, BT outlined its views on the analysis set out in the second consultation, and also submitted a paper written on its behalf by Professor Ian Cooper of London Business School, *Comments on the document: Beta analysis of British Telecommunications: Update*.

6.26 The arguments made by BT in its main response were mainly based on the points raised in Professor Cooper's paper, which criticised specific aspects of the Brattle Group's June 2005 paper. In addition to recapping the points made by Professor Cooper, BT argued that, in particular:

- any changes to estimates of BT's equity beta should be based on identifiable changes to BT group's risk profile; and
- that a "reasonable" estimate of BT's equity beta might be around 1.25, based on a visual inspection of the data in Figure 6.2 below, which is a reproduction of Figure 2 on page 8 of BT's response.

Figure 6.2 BT's suggested group beta estimate of 1.25



Source BT

6.27 BT argued that an estimate of 1.25 would be an appropriate estimate, given that the two-year beta had been stable around this level for most of the time period analysed by BT.

BT's response - annex by Professor Cooper

- 6.28 As noted above Professor Ian Cooper ("Cooper") wrote a paper on behalf of BT, commenting on The Brattle Group's June 2005 analysis. Cooper's paper made a number of criticisms of The Brattle Group's analysis. These are briefly outlined below (further references in this paragraph refer to "BT" rather than "Professor Cooper").
- 6.29 BT argued that, "there is no strong evidence on which to base a significant revision of the earlier estimate of 1.3". This was based on a number of factors, principally:
- a criticism that Ofcom had not been able to provide an explanation as to why the riskiness of BT has changed over the past year; and
 - some specific criticisms relating to the statistical analysis upon which Ofcom had based its revised view, e.g.:
 - BT argued against The Brattle Group's recommendation of figures based on a two-year beta estimate. Cooper noted that this figure been roughly constant at a level of around 1.25 for all but the most recent few months, and argued that recent instability means that less weight should be placed on these recent values; and
 - BT argued that relying on data from the most recent few months may lead to unreliable results, because of a number of statistical problems associated with recent data, e.g. heteroscedasticity, outliers, non-normality, and low recent volatility.
- 6.30 BT argued that, "the very recent very rapid change in Brattle's estimate does not reflect a change in the fundamental risk of BT", and that recent changes to The Brattle Group's beta estimates were instead, "a statistical artefact caused by outlier observations and heteroscedasticity".
- 6.31 BT also listed a number of factors which, taken together, meant that there were "no theoretical or empirical grounds" for putting weight on estimates calculated using Dimson adjustments (these were one of the four alternative estimates presented by Ofcom in the second consultation – see Figure 6.1 for details).
- 6.32 Finally, BT re-calculated The Brattle Group's world beta estimate, based on a different data set that excluded some of the effects of currency variation, obtaining a range of values of 0.9 to 1.2, i.e. values that were some way higher than the world beta quoted by Ofcom in the second consultation.

Telewest's response

- 6.33 Telewest was opposed to Ofcom's proposal to reduce its estimate of BT's beta. Telewest stated that it had,
- "significant concerns regarding the evidence that Ofcom has presented in order to justify the shift from its estimate of the appropriate equity beta of BT Group from 1.3 to 1.1".
- 6.34 Telewest's chief concern derived from the fact that Ofcom had not provided a "compelling economic explanation for the decline in BT's equity beta", but, rather, had appeared to base its proposals on a purely statistical analysis. In arguing that this approach was flawed, Telewest drew a parallel with the

arguments used in Ofwat's 2004 publication, *Future Water and Sewerage Charges 2005–10: Final Determinations*. Telewest argued that, if Ofcom were to adopt an approach that was consistent with the precedent established by Ofwat, it would not revise its beta estimate downwards based on recent market data. Telewest argued:

"...a strict interpretation of the evidence on the WASCs (Water and Sewage Companies) suggested a fall from 0.7–0.8, as used by Ofwat in the 1999 review, to between 0.3–0.4 ... In other words, Ofwat appears to have considered that, absent a compelling economic explanation for the fall in the water companies' beta, there was no justification for reducing their equity beta".

- 6.35 Telewest also argued that the most recent available data, i.e. information that had become available after the end of the data set used in The Brattle Group's June 2005 report, which finished at the end of April 2005, pointed towards an upward trend in BT's equity beta (e.g. one-year betas had increased from about 1.0 to about 1.1). Telewest argued that the increasing importance of BT's ICT activities would mean that it would expect BT's group beta to increase, as suggested by the work carried out by PwC on beta disaggregation. Telewest also noted that the standard errors associated with the relatively recent data set used to support Ofcom's proposals were high.
- 6.36 Telewest also argued that, given the instability exhibited by the single-factor CAPM betas calculated by Ofcom, it would be appropriate for Ofcom to use forward-looking estimates (specifically, estimates calculated using the DGM) as a "sense-check" of estimates calculated using the CAPM.

Ofcom's view of stakeholder responses

- 6.37 This section sets out Ofcom's view of the stakeholder arguments outlined above.

Ofcom's view of competitors' responses

- 6.38 As outlined above, a number of the companies that rely on BT for wholesale inputs tended to argue that 1.0 would be an appropriate figure for Ofcom to use as its estimate of BT's equity beta. Most of these arguments related to the amount of weight that Ofcom should apply to each of its alternative estimates of BT's equity beta, and what values were implied by recent trends in market data. Ofcom's view on these issues is set out in Ofcom's conclusions at this end of this section, which takes into account all of the available evidence and stakeholder response.

Ofcom's view of BT's response

- 6.39 As outlined above, BT's response encompassed a discussion of both:
- the statistical analysis carried out on Ofcom's behalf by The Brattle Group in its June 2005 paper; and
 - other issues, for example:
 - how the relatively wide range of available estimates might be weighted;

- whether, setting aside the most recent statistical evidence, Ofcom should revise its beta estimates downwards in the absence of any *a priori* reason to think that the underlying level of risk faced by BT had changed; and
- what, if anything, the last two or three months' worth of data (May – July 2005) should imply for Ofcom's analysis.

6.40 The second set of issues, i.e. ones that require decisions that extend beyond the scope of statistical tests, is discussed at some length in the concluding part of this section. The remainder of this subsection therefore focuses on the detailed statistical comments made by Cooper on BT in relation to The Brattle Group's June 2005 paper.

6.41 At Ofcom's request The Brattle Group has produced a short paper discussing the issues raised by the respondents, *Discussion Of Responses To "Beta Analysis Of British Telecommunications: Update June 2005"*, August 2005. In this paper, The Brattle Group argues that:

- BT argues that Ofcom should identify a fundamental change in BT's business risk before reducing the beta below 1.3. However, BT's business risk is not the only ingredient that determines BT's beta. Beta measures the relationship between the risk of investing in BT and the risk of investing in the market. BT's beta can change if the risk of the market changes or if investor preferences change, even if the business risks faced by BT remain constant. Elsewhere in the Cooper report, BT acknowledges that shifts in market volatility can change BT's beta independently of BT's business risk.
- It is reasonable to check for specific changes in the business environment that can explain large changes in statistical results. However, the business environment is inevitably complex, and betas can change within reasonable limits without the emergence of a clear dominating business factor to explain the change. BT has not placed the perceived change in beta within context. The beta of 1.29 was a previous best estimate of BT's beta in 2003, but a standard statistical technique called a "Blume" adjustment (see, for example, paragraph 6.77 below for details) would recognize that betas tend to converge toward 1.0. At the time that The Brattle Group measured a beta of 1.29, a Blume adjustment would have predicted a beta going forward of 1.19. In the experience of The Brattle Group, the gap between a predicted 1.19 and 1.0 is not something that would signal the presence of some large external shock capable of clear identification.
- BT argues that Ofcom should ignore beta estimates that are based on data that exhibit outliers or that have heteroscedastic residuals. However, the data in April 2005 that supported a beta of 1.0 did not contain as many outliers as the earlier data that produced the estimate of 1.29. Recent, lower estimates of beta also display less heteroscedasticity.
- BT suggests that a recent but transient period of low market volatility may have contaminated the lower beta estimates of 1.0. However, if the volatility of BT's stock was also quite low recently, The Brattle Group would have no reason to suspect that reduced market volatility was introducing a net bias to the estimates. The Brattle Group shows that the volatility of BT's stock has indeed dropped, and also that the level of volatility is roughly constant throughout all the data-windows on which it based its June 2005 estimates.

- BT also cautions against using the 2-year beta estimate, which, it argues, has recently become unstable. BT's response focuses on stability in the most recent three months, but the choice of the last three months lacks any support. Significantly different results could flow from a rule of choosing the beta that seemed most stable over some arbitrary time period such as the last one year or over the last one day. Moreover, applying this methodology would mean The Brattle Group's estimates of beta could oscillate significantly – something that BT claims to be trying to avoid. A common statistical measure of volatility shows that the 2-year beta estimate is the most stable.
- BT makes additional observations regarding the validity of some of the statistical tests performed by The Brattle Group, and the specification of its All World regression.

6.42 In conclusion, The Brattle Group argues that BT's comments do not affect its conclusion: an estimate of about 1.0 would not understate the true BT beta.

6.43 In regards to Telewest's submission, The Brattle Group notes that Telewest misquoted it in a way that obscured the original intention of the quote. Ofcom concurs with this view, and does not believe that a compelling economic justification needs to be given for a decrease in Beta from 1.3 to about 1.1 or 1.0 over an 18 month period (see the end of this section for a further discussion).

6.44 The Brattle Group has also updated its beta estimates to use the most recent data, extending to the 21st July 2005. It presents a range of estimates from 0.84 to 1.07 and recommends adopting a value at the top of the range.

6.45 Ofcom concurs with the technical points raised by The Brattle Group. There are however a number of less technical issues involving a level of judgement that it is more appropriate for Ofcom to address. These are discussed in the concluding section of this section.

6.46 The text above provides an explanation of why Ofcom considers that The Brattle Group's June 2005 estimates were a valid basis upon which to base its proposals. There are however a number of other, mostly non-“technical”, issues that need to be discussed in assessing an appropriate equity beta estimate for BT given the ambiguity of recent market evidence. These are discussed in the concluding section of this section.

Ofcom's view of Telewest's responses

6.47 Telewest's chief concern regarding to Ofcom's approach to estimating BT's group beta related to Ofcom's proposal to change its estimate without having, “a compelling economic explanation for the decline in BT's equity beta”. This issue is discussed in more detail at the end of this section, as are the recent trends associated with various estimates of BT's beta as discussed by Telewest in its response.

6.48 It is worth briefly commenting though on the quote from Ofwat supplied by Telewest. The relevant section of the Ofwat document is provided below, with the text quoted by Telewest in its response highlighted in **bold** text;

*Time series data shows that equity betas of the listed water companies have been on a downward trend since their initial flotation in 1989. In the early 1990s average betas for the water sector were about 0.9 but they fell steadily to about 0.5 in 1999. They have continued to decline to a low of about 0.3 in 2002-03 although the most recent data suggests they are on an upward trend. Since July 2004 equity betas have averaged just under 0.4. Since our draft determinations, average equity betas have been relatively stable. **Taken at face value this would imply that the equity market regards investment in water stocks since the 1999 review as considerably less risky relative to the market than prior to it. Although we have taken steps to reduce regulatory uncertainty, the low beta factors are unlikely to reflect a real decrease in the riskiness of the water sector but are more likely a statistical product of the increase in market volatility. Work undertaken by Smithers & Co Ltd (2004) for Ofgem suggests that, when betas are unstable, regulators may want to give more weight to an expectation of a beta of 1 in their cost of capital assessments. We have used a value of 1 for the geared equity beta. This is a pragmatic approach, but is consistent with that taken by other regulators and the Competition Commission.***

- 6.49 Telewest's quote omits the key text, "Work undertaken by Smithers & Co Ltd (2004) for Ofgem suggests that, when betas are unstable, regulators may want to give more weight to an expectation of a beta of 1 in their cost of capital assessments". Taken at face value, this part of the Smithers report implies that, faced with unstable estimates of BT's equity beta, Ofcom should put more weight on an estimate of 1, and therefore less weight on its previously used value of 1.3. This issue is discussed in more detail in the concluding section of this section.
- 6.50 Telewest also proposed an alternative approach to estimating beta based on forward-looking dividend growth models, arguing that doing so implied an equity beta for BT of about 1.4. Ofcom notes that the range of estimates of dividend growth employed by Telewest is very wide, ranging from 2.6% to 9.55%. Telewest offers no rationale as to why these four approaches should be averaged (as opposed to, for example, weighting them according to the robustness of each estimate). As described at paragraph 4.17 of the first consultation, obtaining an assumption for the future dividend growth rate is the key issue for such estimates. Estimating a growth factor is a generic difficulty associated with forward-looking models, and is particularly problematic when applied to a single stock rather than entire market.
- 6.51 Ofcom's view is that its current approach to estimating beta (i.e. one that is based on estimates calculated using historic data) better reflects the consensus of approach followed by practitioners and other regulators.
- 6.52 As described in Section 4 of this statement, in recent years, many estimates of the ERP that are based on a DGM approach imply ERP values that are lower than Ofcom's proposed value of 4.5%. Ofcom puts a limited amount of weight on such methods in arriving at a final estimate of the ERP, and considers that putting significant weight on these estimates in the case of beta estimation would risk introducing an element of inconsistency in its analysis. If, as Telewest has argued, DGM-based beta estimates imply high beta values, whereas in the case of the ERP they imply low values, then putting more weight on DGM-based estimates in the former case than in the latter would risk biasing Ofcom's overall WACC estimates upwards.

Interpreting the evidence

6.53 As explained above, in Ofcom's view the June 2005 analysis carried out by The Brattle Group represents the best use of the data available at the time of the work being carried out. In arriving at a final group beta estimate, however, it is important to consider a number of the other issues discussed raised in both the second consultation and stakeholder responses. These issues include:

- choosing between estimates that lead to widely differing results (e.g. because of the use of different data windows) where an appraisal based on statistical measures may not be conclusive;
- arriving at a final beta estimate when estimates based on recent market data appear to be unstable over time; and
- how much weight to place on previous regulatory decisions.

6.54 Each of these issues is considered in turn in the subsections below.

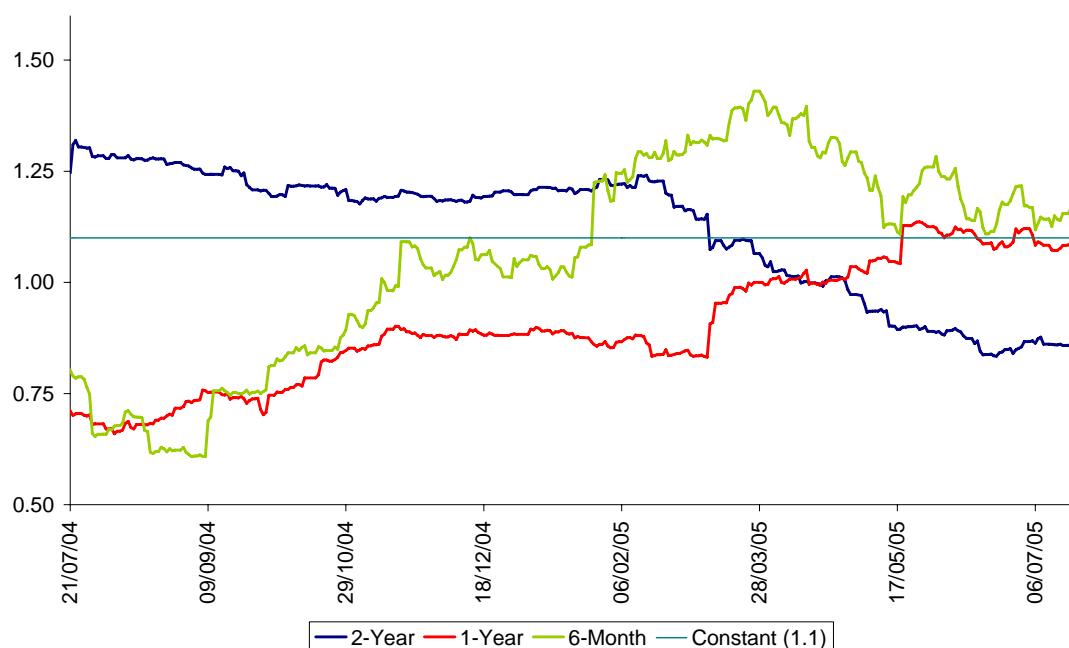
Data window

6.55 As highlighted by both BT and Telewest in their responses to the second consultation, many of the standard statistical estimates of BT's beta have exhibited significant variation over the past year or more. This is shown in the chart below, which tracks BT's beta measured using daily observations against the UK's FTSE all-share index up to mid July 2005, based on the following data windows:

- six months;
- one year; and
- two years.

6.56 This figure also features a horizontal line which enables a comparison of each of these three estimates with the central beta value of 1.1 proposed by Ofcom in the second consultation.

Figure 6.3 Daily beta estimates vs. FTSE All-Share index, July 2004 to 2005



Source: The Brattle Group

6.57 The Figure above shows that estimates calculated using three different data windows have varied significantly over the last year, e.g. (figures rounded to the nearest 0.1):

- the six month beta has ranged from a low of 0.6 in September 2004 to a high of 1.4 in March 2005;
- the one-year beta has ranged from a low of 0.7 in August 2004 to a high of just over 1.1 in May 2005; and
- the two-year beta has ranged from a low of 0.8 in June 2005 to a high of 1.3 in July 2004.

6.58 Of the three measures, the 6-month beta is by some distance the most volatile, and has the highest standard error. On this basis, The Brattle Group has recommended that Ofcom does not use this measure as a basis for estimating BT's beta.

6.59 Such striking differences between beta values estimated using different beta values had not been apparent in the analysis previously carried out on behalf of Ofcom relating to both BT and the UK mobile networks in 2003 and 2004. It had, for example, been noted that, at the end of 2003, three-year betas were somewhat higher than one-year ones, since the former included data from the TMT bubble period, during which the returns of TMT stocks were very strongly correlated with those of the market. But the scale and seemingly unpredictable nature of these differences is not an issue previously considered by Ofcom.

6.60 As previously suggested by The Brattle Group, and as argued by BT in its response, a significant factor in the fall in the two-year estimate is a "dropping out of the data" of higher correlation from the bear-market period leading up to early 2003.

6.61 Ofcom's preferred approach to beta estimation is to put weight on a number of different estimation techniques, rather than relying exclusively on any single source. But, as explained in the second consultation and the PPC statement, Ofcom views regressions estimated using daily data and a UK market index as a key measure.

6.62 The table below summarises. In tabular form, the widespread differences between estimates calculated using the three different data windows (data up to 21 July 2005).

Figure 6.4 Daily beta estimates vs. FTSE All-Share index, July 2004 to 2005

Data window	Estimate as of 21 July 2005	Standard Error
6 months	1.16	0.19
1 yr	1.10	0.12
2 yrs	0.86	0.08

6.63 It is difficult to assess which of these widely differing estimates will provide the most useful basis for estimating a forward-looking equity beta for BT. Two key (conflicting) factors to be taken into considerations are that:

- longer data windows will, by including more observations, provide statistically more precise estimates, i.e. will have lower standard errors (and will produce estimates that are less volatile); and
- shorter data windows might arguably, by placing most weight on more recent data, provide a better guide to the future movements in estimates based on longer data windows.

6.64 The Brattle Group recommended data windows starting in early to mid 2003 in both their 2004 and 2005 reports for Ofcom. This meant recommending a 1-year beta in 2004, and a 2-year beta in 2005. The Brattle Group recommended these data windows because they each exhibited the highest level of statistical stability without being potentially "contaminated" by data corresponding to the tail end of the TMT bubble.

6.65 The significant variation in the above estimates clearly provides cause for concern in using these figures in a regulatory context when the objective is to predict the level of risk that BT will face over the course of the next few years. In Ofcom's view, very little weight should be placed on the six-month estimate in itself, due to its volatility and the high standard errors associated with it. However, as argued by BT, the six-month figures may provide some information as to future movements in the other beta estimates, and as such should be taken into account when weighing up the available evidence on one-year and two-year betas, i.e. when these differ, perhaps putting more weight on whichever of the two estimation methods that produces values that are closer to the six-month beta.

Stability of estimates

- 6.66 In its response to the second consultation, BT argued that a range of statistical considerations meant that Ofcom should put less weight on estimates calculated using recent data. In particular, BT argued that the recent fall in the two-year betas used by Ofcom was not meaningful for the purpose of assessing risk on a forward-looking basis, and that, as a result, relatively little weight should be placed on these newer values. The Brattle Group's response to BT's submission, briefly summarised above under the heading *Ofcom's view of BT's response*, explains why, in the view of The Brattle Group, estimates based on recent data are robust. Ofcom concurs with this view.
- 6.67 Ofcom does not accept the argument that historic stability cannot be used as the basis for employing an estimate that has recently changed. One of the key reasons for interest in the volatility of a parameter estimate is that if its volatility is low, then a significant change in that parameter estimate is more likely to reflect some true change in the underlying parameter itself (a change in the underlying variable) rather than arising from measurement uncertainty.
- 6.68 The two-year estimate of beta was, as BT acknowledges, relatively stable at around 1.25 for two years, until it recently fell to about 0.8. This historic stability provides reason to suppose that its recent fall is not due to mere statistical "volatility" or "instability", as BT's submission suggests, but is instead reflective of some underlying change in risk.
- 6.69 The main cause of this change in this measure of underlying risk appears to be the "dropping out" of data from the "high beta" period during the bear market leading up to early 2003. Because the data of this period involved more significant movement in the stock market as a whole, it did contain useful information about the relationship between the movement of BT versus that of the market, and it was appropriate to include this information, at least for the period after the worst distortions arising from the TMT bubble had passed.
- 6.70 Ofcom also considers it important to emphasize that although it believes that the correct approach is to take the fall in the two-year beta as an indicator that BT's beta has indeed fallen, it does not consider that it would be appropriate simply to use the latest two-year estimate. This is particularly true given the signals provided by the one-year and six-month trends, which both point to values that are higher than those implied by recent estimates of the two-year beta. The judgement needed is over how far the two-year beta has fallen.
- 6.71 A further argument made by Telewest was that it would expect BT's beta to be increasing over time because of (as described in PwC's report) the increasing proportion of BT's activities accounted for by ICT. Whilst Ofcom agrees that the proportion of ICT is relevant to predicting future market data-based values of BT's beta, in its view this trend should be interpreted with caution. Current expectations regarding the role of ICT activities should already be built into investors' expectations, and hence beta estimates, and these should not change rapidly over a relatively short space of time. It is additionally important to note that normally, if a long-run forward-looking basis were to be used to estimate BT's group beta, a similar method should be used to estimate value weights for different parts of BT's business. Other things being equal this would tend to reduce the equity beta estimates applied to BT's regulated access activities.

The role of market data and “prior belief”

- 6.72 In their responses to the second consultation, both Telewest and BT argued that, effectively, Ofcom should not revise its beta estimate downwards without an understanding of the change in fundamentals that might lead to a fall in BT's equity beta. In its response Telewest cited an approach previously taken by Ofwat in interpreting the evidence provided by unstable beta estimates. As explained above, a direct interpretation of the approach followed by Ofwat is that, in the absence of reliable statistical evidence, more weight should be placed on a beta estimate of one. An alternative interpretation might be that, where parameter estimates exhibit significant variation, given the nature of the trade-off between returns that are too high and returns that are too low, more weight should be put on estimates that are towards the top of a plausible range. A third interpretation might just be to that more weight should be put on previous regulatory decisions, i.e. the status quo. The remainder of this subsection considers these issues in more detail.
- 6.73 As explained earlier in this section, Ofcom's preferred approach to beta estimation is to put weight on a number of estimation methods. But, as explained above, Ofcom considers beta estimates calculated using recent UK stock market data to be a key source of evidence. The remainder of this subsection therefore discusses some of the factors that Ofcom might take into account when the appropriate estimate calculated based on market data is potentially ambiguous.
- 6.74 BT's response argued that Ofcom's previously used estimate of 1.3 represented a “prior belief” that should be taken into account when assessing market data. A significant focus of BT's response was to test whether recent market data justified a departure from this belief. Cooper's report concluded by stating his opinion that, “there is no strong evidence on which to base a significant revision of the earlier beta estimate of 1.3”.
- 6.75 Ofcom disagrees with the approach advocated by BT. Ofcom does not agree that a value of 1.3 should be considered to represent a prior belief of the level of systematic risk that applies to an incumbent telecoms company. The value of 1.3 previously used by Ofcom was based primarily (as noted above, weight was given to a number of different sources) on analysis of market data up to the end of December 2003.
- 6.76 Forming a “belief” about the underlying level of risk faced by BT is necessarily a subjective exercise. Ofcom considers, however, that there might be reasons to think that, if not supported by market data, a figure of 1.3 might be an overestimate. For example, in their responses to the first consultation, stakeholders highlighted examples of companies with similar activity profiles to BT with lower equity beta estimates, e.g.:
- in its response to the first consultation C&W presented a sample of Bloomberg raw betas estimated for a sample of the 14 biggest European incumbents other than BT, which suggested an average equity beta of just over 0.9 at 35% gearing; and
 - the French telecoms regulator, the ART, recently assumed a beta of 1.0 for all of France Telecom's fixed telephony activities in estimating France Telecom's regulated cost of capital at a target gearing level close to that of BT. (Decision 03-1094 - 7th October 2003).

6.77 It is also worth considering the role of adjusted beta estimates. It is widely accepted (e.g. see page 54 of Ogier et al for a description) that there is reason to believe that very large or very small beta estimates, or estimates of beta with high standard errors, are biased away from their expected value. Accurate beta estimation adjusts for this bias. There are two reasons for this adjustment:

- a. We know that the mean of all betas in a market is one, and that sampling error gives inaccurate beta estimates. Therefore, for sampling reasons, estimates of beta in excess of unity are likely to overstate beta, and estimates well under unity are likely to understate beta (Vasicek, 1973; Litzenberger et. al. 1979; Wright et. al. 2003)
- b. Estimates of beta used in forward looking cost of capital calculations are necessarily derived from historical data. There is some evidence that beta tends to unity over time. Therefore, to increase forward accuracy, initial estimates of beta should be adjusted towards unity (Blume, 1971);

6.78 Ofcom is not aware of any consensus as to which of the two methods described above should be regarded as preferable. When using 60 monthly data points, this lack of consensus has little practical effect since the different adjustment methodologies produce very similar results. Most commercial risk management or market information services apply either a Blume or Bayesian adjustment.

6.79 The relatively low standard errors on the one-year and two-year betas listed above may imply that an adjustment based on statistical imprecision would have a minimal impact on beta estimates. But the relatively high recent estimated values and standard errors of the six month measure might suggest that a weighted adjustment similar to these should be applied to this value. The "Blume" estimate is potentially relevant in all cases.

6.80 In describing its "adjusted"²³ beta" estimates, Bloomberg's guidelines state that:

The Beta of a stock can be presented as either adjusted Beta or as Raw Beta. Raw Beta (Historical Beta) is based on observed relationship between the security's return & the returns on an index. The adjusted Beta is an estimate of a security's future Beta. Adjusted Beta is initially derived from historical data but modified by the assumption that a security's true Beta will move towards the market average of one, over time. The formula used to adjust Beta is: Adjusted Beta = 0.67(Raw Beta) + 0.33*(1).*

6.81 Ofcom's preferred approach is not to carry out such an adjustment as a matter of course, but considers that, where market data appears to point towards an estimate that is close to 1.0 but exhibits some variations, such adjustments are worth taking into account.

Summing up

6.82 Based on the factors outlined in the previous section, Ofcom's view is that, where current market data produces ambiguous conclusions, an at least equally valid approach to beta estimate is to, rather than asking whether there is strong evidence to suggest that BT's beta has declined from previous estimates, ask whether or not there is strong evidence to suggest that BT's beta is not equal to one. Ofcom therefore considers that the main advantage of

²³ "adjusted" refers to the Blume adjustment

putting weight on the previous estimate of 1.3 would be an objective of regulatory stability.

6.83 The text above discusses a wide range of different estimates and in arriving at an estimate of BT's equity beta. The most important of these are summarised in the table below (figures correct as of 21 July 2005). Following the recommendation made by The Brattle Group in its June 2005, Ofcom has placed little weight on Dimson adjusted estimates, and these are therefore not reported in Figure 6.5 below (whereas they were reported in the second consultation in order to provide a basis for comparison with the figures outlined in the PPC statement).

Figure 6.5 Evidence on beta estimation

Estimated by	Details, e.g. data frequency	Index	Period	Estimate
The Brattle Group	Daily (6 months)	UK	2005	1.16
The Brattle Group	Daily (1 year)	UK	2004-05	1.10
The Brattle Group	Daily (2 years)	UK	2003-05	0.86
The Brattle Group	Daily (1 year)	World	2004-05	0.92 ²⁴
LBS RMS	Monthly (5 years), Bayesian adjusted	UK	2000-05	1.43

6.84 As discussed above, and argued by a number of stakeholders, given the ambiguity of the figures quoted above, it is worth taking a number of other relevant figures and factors to take into account in order to attempt an assessment of what sort of values Ofcom might expect in the absence of any new statistical information, e.g.:

- Ofcom's previous value of 1.3, which was based primarily on one year's worth of daily data for the period up to the end of December 2003;
- the Bloomberg "European incumbent" benchmarks supplied by C&W, suggesting an average value of just over 0.9 at BT's current gearing; and
- an expectation of a value of 1.0

Conclusion on BT's group equity beta

6.85 Section 2 of this document provides a brief overview of some of Ofcom's key duties under Sections 3 and 4 of the Communications Act. In proposing the most appropriate values from within this range, Ofcom has, amongst other things, had regard to Section 3(4)(d) of the Communications Act 2003; i.e. to have regard to the desirability of encouraging investment and innovation in

²⁴ Dimson adjustments were not statistically significant based on this data set.

relevant markets when exercising its duties. Ofcom's duty to promote competition under Section 4 of The Act is also an important factor to consider. Where infrastructure-based competition is feasible, then, other things being equal, higher beta estimates will tend to encourage this type of competition, but, in markets where downstream competitors are obliged to rely on BT for wholesale inputs, lower beta estimates will promote competition downstream.

- 6.86 In determining a value for BT's group equity beta, Ofcom's aim is to ensure that companies are provided with incentives to invest, and to engage in infrastructure-based competition where this is feasible. However, too high a value could lead to inefficient entry, and to consumers paying prices that are too high. In proposing its range of estimates for BT's group equity beta, Ofcom has also had regard to its Section 3(5) requirement in performing its duty to have regard to the interests of consumers in respect of choice, price, quality of service and value for money, and to its Section 4 duties, since setting regulated access charges at a reasonable level will encourage competition at a downstream level.
- 6.87 In the light of the factors outlined earlier in this section, Ofcom remains of the view that the appropriate estimate of BT's group equity beta is 1.1. The key steps in reasoning and evidence leading to this conclusion are set out below.
- 6.88 In the absence of any statistical data or qualitative reasoning to form a different view, Ofcom disagrees with the view that an appropriate "prior" assumption for beta is 1.3. Faced with no data or qualitative reasoning about a company to suggest that it was more or less risky than the market average or that its risk tended to be pro- or counter-cyclical with that of the market, the correct assumption would be that its risk is typical of that in the market.
- 6.89 Furthermore, statistical evidence offers some (limited) evidence that there is some tendency for equity betas to revert towards 1 over time (e.g. see the description of Blume's adjustment above).
- 6.90 There are good qualitative reasons to suppose that some parts of BT's business may be subject to more non-diversifiable risk than is the average for the market. Most importantly, significant parts of BT's business involve innovative high technology products for which the nature of future demand is subject to significant uncertainty.
- 6.91 On the other hand, there is also reason to suppose that significant parts of BT's business are subject to less non-diversifiable risk than is the average for the market. In particular, Ofcom's view is that the nature of the access portion of BT's business will be subject to less non-diversifiable uncertainty than the market as a whole, and is likely to have a beta of less than 1.
- 6.92 In short, Ofcom's view is that the available qualitative indicators do not point towards an estimate as high as the previous estimate of 1.3.
- 6.93 Ofcom considers that this conclusion provides the context for a proper interpretation of the statistical data.
- 6.94 The statistical evidence used to support Oftel and Ofcom's WACC calculations in the 2001 and 2004 reviews was consistent with a BT group equity beta greater than 1. This statistical evidence was a key driver of the previous judgements by Oftel and Ofcom that BT's group equity beta was above 1, with

the most recent figure, used in the 2004 review, being 1.3 (there having been a degree of stability around this figure in the period leading up to publication of the PPC statement).

- 6.95 The statistical evidence supporting an equity group beta of above 1 has weakened since the time of these previous decisions. As discussed above, the statistical basis for the previous ruling of 1.3, especially based on The Brattle Group's preferred two-year daily beta estimate, has significantly weakened. The most recent data arguably suggests a two-year beta of about 0.8 (based on The Brattle Group's preferred two-year measure). However, despite theoretical arguments that the two-year beta is the most reliable forward estimate, significant deviation between the two-year beta of about 0.8 and the one-year beta of about 1.1, combined with the view that the proper prior is for a beta of 1, leads the Brattle Group to recommend a beta at the top of this range.
- 6.96 As noted above, the two-year estimate is the most stable, and one option would be to put a significant amount of weight on recent estimates of this parameter, and therefore setting the group equity beta below 1.0. However, as outlined by some stakeholders, there is no established economic explanation for why the group beta should have fallen so far. In the absence of such an economic explanation, in an analogous situation, as outlined above Ofwat concluded that the correct approach would be to adopt a beta of 1. Ofcom's view is that the correct approach, in the case of BT, is to maintain the prior belief that BT's group equity beta is fairly close to 1.
- 6.97 Shorter-term measures of beta offer some (limited) basis to believe that some of the fall in the two-year beta may be transitory. In particular, the one-year beta is currently at a level of about 1.1 and the six-month beta has been at, or, more commonly, above this level for a period of some months. Although the theoretical arguments do not support using these shorter-term measures (particularly the six-month beta) as the basis for an estimate of a forward-looking beta, Ofcom believes that it is reasonable to take them into account when interpreting unexplained movements in the (statistically more precise) two-year measure.
- 6.98 A reasonable conclusion from the statistical data would be that BT's group equity beta is not far from 1.
- 6.99 It would, however, be undesirable, from a perspective of maintaining regulatory consistency, to reduce BT's group equity beta, only to raise it again soon afterwards. The previous decision was for a beta of 1.3. Ofcom continues to believe that BT's group equity beta is above 1, despite the weakened statistical basis for this.
- 6.100 Since analytical reasoning suggests that BT's group equity beta should be around 1; statistical evidence suggests that it is difficult to find a basis for a BT group equity beta far from 1; and arguments from regulatory precedent and practice suggest that it would be undesirable to reduce BT's group equity beta too far, Ofcom concludes that the appropriate approach is a BT group equity beta of 1.1.

Section 7

Disaggregation and BT's copper access beta

Introduction

Background and outline of previous analysis

- 7.1 The previous section of this statement provided an overview of Ofcom's preferred approach to estimating an equity beta for BT. This figure reflects the level of systematic risk faced by BT across all of its activities. But companies commonly make investment decisions at a project or activity level, with the analysis used to support these decisions often reflecting variations in systematic risk between different activities.
- 7.2 The first consultation argued that BT's business currently encompasses a wide range of different activities, and proposed that Ofcom should reflect some of the most important of these variations in systematic risk in its financial analysis. In particular, Ofcom proposed disaggregating its estimate of BT's equity beta in order to reflect its view of the differing levels of systematic risk faced by different parts of BT's business
- 7.3 In the first consultation, Ofcom undertook an analysis intended to provide a preliminary assessment of whether the available empirical evidence supported its view regarding the relative riskiness of different parts of BT's business. This analysis focused on the following areas:
- benchmarking the equity betas of the UK's largest utility companies, and drawing a parallel between the level of risk faced by these companies with that faced by BT's copper access business;
 - benchmarking the equity betas of US telecoms companies; and
 - using previously conducted studies to compare estimates of the income elasticity of demand for retail access services (e.g. line rental) with that of other telecoms services (calls).
- 7.4 In response to the first consultation, a number of stakeholders agreed with Ofcom's proposals. Even those responses that disagreed with Ofcom's proposals tended not to provide detailed evidence or arguments in support of a proposition that BT's copper access business faces as much risk as the group as a whole.
- 7.5 The focus of most of the negative responses received from stakeholders, particularly BT, focussed on the standard of evidence needed to adopt such a disaggregated approach. In some cases, a detailed appraisal of the evidence used by Ofcom in the first consultation was provided. Recognising the need for its decision-making to be informed by a high standard of evidence, Ofcom commissioned extra research in this area in order to investigate this issue further. The key new evidence gathered by Ofcom was outlined in a report written on Ofcom's behalf by PwC and included as an annex to the second consultation. As explained below, Ofcom's second consultation asked for the views of stakeholders on this new evidence.

7.6 PwC's research focused on the following areas:

- a "first principles" analysis of the degree of risk faced by BT's copper access business;
- an analysis of the regulatory precedents for the use of a disaggregated approach to quantifying risk at a project-specific level; and
- two types of quantitative regression analysis, namely:
 - a cross-sectional analysis of telecoms companies across the world, examining the relationship between companies' equity beta estimates and the proportion of their business that is accounted for by different types of activities, e.g. "information and communications technology" (ICT), and traditional fixed lines activities; and
 - a time series analysis of BT's equity beta, examining the relationship over time between its equity beta and the proportion of its business accounted for by different types of activity.

7.7 Based on these findings, PwC said that:

We conclude that there is sufficient directional evidence for serious consideration to be given to applying disaggregated betas, with the strongest evidence suggesting that a distinction could be made between BT's information and communications technology (ICT) activities and the rest of BT's business.

7.8 These findings provide support for Ofcom's proposal to disaggregate BT's beta. As explained in PwC's report, some of PwC's findings point directly towards access having a lower beta than BT Group as a whole, whilst some others are consistent with it, i.e. they point towards access being one of a number of products that have lower beta than BT Group as a whole. Taking this further evidence together with the initial analysis set out in the first consultation, Ofcom believes that this evidence supports a moderate degree of disaggregation of BT's equity beta, as set out in the final subsections of this document.

The second consultation – questions and responses

7.9 Questions 10 and 11 of the second consultation asked for stakeholder comments with regard to Ofcom's proposed approach to disaggregating BT's equity beta.

Question 10: What is the view of respondents of the standard of evidence used by Ofcom in this second consultation, when added to that outlined in the first consultation?

Question 11: Based on the available evidence, what do respondents think would be an appropriate level of disaggregation for the equity beta of BT's copper access network? Which of the following levels would be most appropriate: (a) 0.3 points below the group average; (b) 0.2 points below the group average; (c) 0.1 points below the group average; (d) 0 points below the group average?

7.10 The WACC estimates presented by Ofcom at the end of Section 4 of the second consultation were based on option (b) of the alternatives listed in

Question 11, i.e. an assumption that the equity beta of BT's copper access business was 0.2 points below the group average.

7.11 Ofcom received a number of responses in relation to the evidence and analysis set out in the second consultation. Broadly speaking:

- customers and competitors of BT argued in favour of Ofcom's proposed approach, and in some cases argued in favour of a greater degree of disaggregation than was proposed in the second consultation, i.e. one in which Ofcom's estimate of the equity beta of BT's copper access business was set some way below its central estimate of the beta for BT Group, e.g. option (a) of the options set out in Question 11; and
- suppliers of access services, (particularly BT), and also the cable companies, argued that Ofcom should either:
 - not disaggregate between copper access and the rest of BT, i.e. option (d) in question 11 of the second consultation; or
 - carry out a minimal level of disaggregation, i.e. option (c) in question 11 of the second consultation.

7.12 A more detailed summary of these responses, together with Ofcom's view in the light of these, are discussed in the remainder of this section.

Stakeholder responses

Responses from competitors

7.13 Following publication of the second consultation, Ofcom received responses from a number of the companies that rely on BT for wholesale inputs. The key points that were made in these responses are briefly outlined in the paragraphs below.

7.14 C&W was broadly in agreement with the approach proposed by Ofcom in the second consultation. It argued, based on the equity betas of various utility companies and, drawing a parallel between the level of risk faced by these companies and BT's copper access business, that Ofcom should carry out a significant level of disaggregation of BT's equity beta (e.g. assuming an equity beta 0.4 points below the group average).

7.15 Easynet was also broadly in agreement with the approach proposed in the second consultation. Easynet argued, based on the analysis set out by Ofcom in the first consultation relating to the differences between the betas of US long-distance and local exchange carriers, that a significant level of disaggregation (about 0.4 points) would be appropriate.

7.16 Energis was broadly in agreement with Ofcom's proposed approach, although, as explained in the previous section, it disagreed with Ofcom's proposed group equity beta estimate, arguing that a value of 1.0 was appropriate. Energis argued that this meant that a value below 0.9 for the beta of BT's copper access network would be appropriate.

7.17 UKCTA agreed with Ofcom's proposed approach. It did, however, add a caveat, namely that:

“given Ofcom's tendency to continuously adopt conservative levels for CAPM components and coupled with Ofcom's reluctance to adopt disaggregated project gearing, we would not support any lower level of disaggregation”

7.18 A number of BT's competitors expressed a concern that some copper access-based products, specifically those PPCs delivered over copper, would not be included in Ofcom's definition of BT's “copper access network”. A number of arguments were advanced to suggest that PPCs should be included in this product group, for example:

- private circuits are mature, essential services from the perspective of certain types of business customer; and
- where PPCs are delivered over copper, they use much of the same underlying asset base that is used to supply standard telephony and Internet products.

Responses from incumbents and cable companies

7.19 Crown Castle argued that, given the “limited evidence available” (i.e. the analysis set out by Ofcom in the first and second consultations), Ofcom should adopt a conservative approach to beta disaggregation, e.g. to assume that an asset beta for BT's copper access business was no more than 0.1 points below the BT group average.

7.20 NTL stated that it thought that the proposed WACC figures (and therefore, implicitly, the equity betas) estimated by Ofcom for, BT's copper access business and the rest of BT, seemed reasonable. NTL did, however, express a concern at Ofcom's lack of a “robust theoretical justification” for its proposals. NTL also reiterated the concerns it set out in its response to the first consultation about the impact of Ofcom's proposals on incentives to invest in next generation access networks.

7.21 Land Securities did not address specific questions raised by the consultation directly but focused its response on the general principle of the effect that Ofcom's estimate of BT's cost of capital for copper access will have on new investments and the dangers in assessing BT's access beta. As a potential investor in fibre, its concern was that the cost of capital for BT's copper access network would be set artificially low to encourage greater competition in current generation access network markets. This would, they felt, reduce the profits available for next generation access networks, thereby reducing or even eliminating the incentives for new investment in access technologies. Land Securities emphasised their belief that copper and fibre access belonged in the same market. They argued that the importance of dynamic efficiency gains through increased investment meant that the costs of setting BT's beta too low were significantly greater than the costs associated with setting BT's beta too high.

7.22 The most detailed (and critical) responses that Ofcom received in response to the second consultation were submitted by Telewest and BT. These are discussed in separate subsections below

Telewest's response

7.23 Telewest was opposed to Ofcom's proposal to carry out a disaggregated analysis. Telewest stated that it:

...still has serious reservations concerning the robustness of the evidence that Ofcom has presented to justify its current proposals.

7.24 Telewest agreed that there might be reasons to suppose that some parts of BT's business faced a higher degree of systematic risk than its copper access business. It expressed concern, however, that none of the evidence supplied by Ofcom enabled it to provide a robust quantification of the level of risk associated with BT's copper access business. On this basis it proposed that Ofcom should either:

- adopt a "cautious" approach to disaggregation (i.e. not assuming a substantial difference in risk between BT access and the rest of BT); or
- carry out a disaggregation based on a split where reasonably close pure play comparators for divisions within BT were available – specifically, it argued that there was a more robust case for splitting out BT's ICT activities from the rest of BT.

7.25 Based on a sample of frequently traded companies classified under "computer services" in the FTSE actuaries' classification, Telewest calculated an average equity beta for UK ICT companies of 1.8 at 35% gearing (figures estimated using both daily and monthly data produced similar average results). Telewest argued that Ofcom should use a value of 1.21 as its estimate of the equity beta of BT's non-ICT activities, based on:

- its estimate of the beta for BT's ICT activities;
- Telewest's preferred estimate of BT's group equity beta of 1.3; and
- an assumption that ICT accounted for about 15% of the value of BT's business.

7.26 Telewest argued that the key advantages of this approach were:

- the availability of pure play comparators for ICT companies; and
- a relatively clear regulatory precedent for a not dissimilar similar approach, e.g. the CAA has in the past discussed stripping out the impact of (some of) BAA's unregulated activities in its financial analysis.

7.27 Telewest also expressed a concern that Ofcom's proposals might increase investors' perception of the regulatory risk facing BT, since, "investors may not be convinced that Ofcom will allow for such an upward revision in these contexts even though it may be necessary for consistency with the beta applied to the copper access business—noting, in particular, that there is no way in which the future discretion of Ofcom can be fettered".

7.28 Telewest also criticised the utility beta benchmarks set out by Ofcom in the second consultation. Telewest argued that Ofcom provided a "partial reporting

of the Smithers and Co paper²⁵, since Ofgem's final proposals put a significant amount of weight on alternative methods. These included an aggregate return on equity approach, and Smithers argued in its paper written for Ofgem that, "all other things being equal, parameter instability might make beta estimates more uncertain into the future and hence more weight might be given to the unconditional expectation of unity (beta = 1)" in addition to the beta estimates calculated using market data.

- 7.29 Telewest also argued that Ofcom's comparison between LECs and long-distance carriers was flawed because it did not take into account the impact of different regulatory regimes.
- 7.30 In its response to the first consultation, Telewest had argued that Ofcom's comparison of the respective income elasticities of demand of lines and calls was flawed since it did not take into account the impact of second lines. It cited studies carried out on that pointed towards higher income elasticities of demand for second lines. In the second consultation, Ofcom acknowledged that this is a relevant factor, although noted that its impact on its proposals was likely to be limited, given the relatively small (and declining) number of second lines, and the fact that, according to most estimates, the income elasticity of demand for second lines remains well below most that of the equivalent figure for telephone calls. In its response to the second consultation, Telewest argued that, despite it acknowledging that second lines would have an impact on the average income elasticity for lines, and that Ofcom's revised proposals did not obviously appear to take this issue into account.
- 7.31 Telewest also commented on the consequences associated with incorrectly carrying out, or incorrectly failing to carry out, a disaggregated analysis, and hence the approach that Ofcom should take in cases where the available evidence did not point to specific beta values. This issue is discussed in more detail in the concluding section of this section.

BT's response

BT's main response

- 7.32 BT recognised that there might be some justification for carrying out a disaggregated analysis. In particular, BT acknowledged that:
- there are *a priori* grounds for suggesting that copper access has lower risk than the riskiest parts of BT; and
 - the work carried out by PwC provided some evidence to support the idea that BT's ICT activities have a higher risk than the rest of BT.
- 7.33 BT was, however, opposed to the extent of the beta disaggregation proposed by Ofcom. BT argued that, since Ofcom's analysis only provided "directional" support for different parts of BT having different levels of risk, Ofcom should take a very conservative approach to disaggregation. BT suggested that, based on its preferred estimate of BT's group beta of 1.25, Ofcom should take an alternative approach, this being based on:

²⁵ This quote refers to work carried out by Smithers and Co on behalf of Ofgem (referred to as WM&M in Section 4)

- assuming that the risk of BT's copper access business was roughly equal to that of the average firm in the market, and hence use an equity beta of 1.0 at a market average gearing of around 30%²⁶, which equates to an equity beta of 1.08 at BT's current gearing ratio of about 35%; and
 - inferring a beta for the rest of BT based on this estimate.
- 7.34 BT's calculations suggested that this approach implied an equity beta of 1.08 for its copper access business and 1.36 for the rest of BT at a gearing level of 35%.
- 7.35 BT also argued that Ofcom had mistakenly understated the importance of the fact that its copper access business faces significant fixed costs, and that this factor would tend to increase the level of systematic risk faced by this part of BT's business.
- 7.36 BT also argued that the income elasticity of demand for access might increase in future since telecoms services might become a discretionary item, since low income elasticities were a factor initially cited by Ofcom as indicating that BT's copper access business faced a relatively low level of risk. This factor, if correct, would weaken the case for disaggregating on a forward-looking basis.
- 7.37 BT also commented on the consequences associated with making errors in analysis of this type. This issue is discussed in more detail in the concluding section of this section.
- 7.38 The remainder of BT's main response was dedicated to a summary of the comments on PwC's work carried out on its behalf by Professor Cooper. A summary of Professor Cooper's work is provided in the next subsection of this section (as with Sections 4 and 6, references are to "BT" rather than "Professor Cooper").

BT's response - annex by Professor Cooper

- 7.39 BT submitted a paper written on its behalf by Professor Ian Cooper, *Comments on the document: Disaggregating BT's beta by PwC*. This paper commented on the June 2005 analysis carried on Ofcom's behalf by PwC, making a number of specific criticisms of the extent to which PwC's findings were supportive of Ofcom's proposed approach.
- 7.40 Professor Cooper's report written for BT argued that, "In my opinion, there is only one robust piece of evidence in the econometric analysis provided by PwC. It is that the sample of ICT businesses chosen by PwC has a higher average asset beta than the BT group". BT argued that even this result was of limited use in reliably quantifying the differences in risk between different parts of BT, since, for example:
- it was unclear how close a proxy for BT's ICT activities, or how representative of the ICT market as a whole, PwC's sample of ICT comparators was;

²⁶ BT supplied an estimate of the market average gearing ratio based primarily on some data from a 2005 Morgan Stanley report.

- the differences between PwC's different ICT betas (e.g. see Table 1 on page 15 of PwC's report) meant that it was difficult to accurately estimate an average ICT beta; and
- the proportion of BT Group's market value represented by ICT was unclear.

7.41 BT argued that PwC's analysis of historical changes in BT's beta did not produce reliable results. BT noted some specific statistical problems with PwC's analysis, and argued that these factors strengthened its key objection, namely that, "PwC itself concludes that it is not possible to draw any firm conclusions from the historical changes analysis".

7.42 BT noted that PwC's time series approach was not a "standard" approach to divisional cost of capital estimation. BT also identified a number of statistical problems associated with PwC's time series analysis, including:

- inappropriately putting weight on unstable beta estimates calculated using weekly data;
- an inability to reflect variations in the market value of BT's access beta, which in PwC's analysis was proxied using book values;
- serial correlation;
- omitted variables (e.g. changes in the variability of the stock market);
- heteroscedasticity;
- mis-specification (firstly, inability to separate access and core activities, and, secondly, assuming that BT's activity mix at the end of the sample period could be applied throughout the modelled period); and
- non-normality of errors.

7.43 BT concluded that, based on the objections listed above, any conclusions drawn from PwC's evidence, "must be extremely limited".

Ofcom's view of stakeholder responses

Ofcom's view of competitors' responses

7.44 As outlined above, the competitors and wholesale customers of BT were broadly in favour of Ofcom's proposed approach to beta disaggregation. In a number of cases these companies argued that, of its range of proposed options, Ofcom should carry out a more widespread disaggregation, i.e. set a lower value for the equity beta of BT's copper access business.

7.45 Ofcom recognises that these arguments may have some merit, but, given the difficulties associated with obtaining robust evidence in this area, believes that a more "conservative" approach, i.e. one that errs on the side of the status quo, i.e. the use of a single beta estimate, is appropriate. As mentioned by some stakeholders, the availability of more extensive accounting data on BT's new Access Services Division may mean that a more detailed analysis will be possible in future years, enabling a further level of disaggregation.

- 7.46 Ofcom remains of the view that copper-based PPC tail segments should not be classified within BT's copper access business for the purposes of an assessment of risk levels. Ofcom agrees that SDH-based private circuits are mature services, but, since these services are mostly bought by SME and corporate customers of BT, future demand for these services, particularly in the case of the demand for new circuits, is likely to be more closely correlated with the economy-wide level of economic activity than other access services.
- 7.47 It is also important to note that much of the evidence that Ofcom has used to test its view regarding the relative risks of copper access and other services either does not apply at all, or does not apply to the same extent, to private circuits. For example, Ofcom's analysis of income elasticities focuses on the demand for exchange lines only, i.e. not private circuits.
- 7.48 Ofcom considers that its lower "copper access" WACC estimate should only be applied, at a wholesale level, to the building blocks for BT's WLR and LLU products. These are the products to which Ofcom's *a priori* reasoning, evidence, and estimates of relative market values are most applicable.

Ofcom's view of responses from incumbents and cable companies

- 7.49 Crown Castle's response focused on general, rather than specific, concerns at the quality of Ofcom's evidence, which, in Ofcom's view, are best addressed by means of its comments on the specific criticisms made by BT and Telewest, which are provided in the subsections below.
- 7.50 With regard to NTL's argument that Ofcom's analysis would benefit from a more "robust theoretical justification", Ofcom considers that the arguments provided in the first consultation, together with the economic reasoning-based arguments included in the PwC report, provide a sufficient conceptual explanation of why it would expect copper access to face less systematic risk than BT's average activities. Ofcom's view is that, as argued by BT and Telewest, obtaining reliable data represents the key difficulty associated with carrying out a beta disaggregation analysis for BT.

Ofcom's view of Telewest's response

Telewest's comments on Ofcom's evidence

- 7.51 As outlined above, Telewest suggested that, rather than Ofcom's "access vs. rest" split, there was a more robust case for splitting out BT's ICT activities from the rest of BT. Ofcom's views on this suggestion are provided in the next subsection. Initially, Ofcom considers Telewest's specific criticisms of Ofcom's evidence and proposed approach.
- 7.52 Ofcom disagrees with Telewest's suggestion that Ofcom's proposals might increase investors' perception of the regulatory risk facing BT. Applying a "below average" rate of return to BT's copper access business and an above average one to the rest of BT's activities is a key feature of Ofcom's preferred approach, and is integral to achieving an appropriate balance between consumer protection and encouraging investment and, where feasible, infrastructure-based competition. Ofcom considers that deviating from this methodology would run the risk of weakening the validity of its approach (See Section 2 for a discussion of Ofcom's duties).

- 7.53 Ofcom disagrees with Telewest's suggestion that the approach to group beta estimation taken by Ofgem in its regulatory decisions (briefly referred to in the previous section) invalidates Ofcom's finding that utility companies have lower equity betas than BT Group. Given parameters that are unstable over time, the Smithers/Ofgem reports advocated putting weight on a beta estimate of one/using an aggregate equity returns approach. Following this approach might, at one extreme, make it impossible to identify any differences in risk between any companies based on CAPM beta estimates, since, in an extreme case, estimates of the betas of any and all firms will be 1. Ofcom therefore considers that the most sensible way to compare the betas of different companies is to compare beta estimates calculated using market data over time. Whilst parameter instability may make a precise quantification of these differences at any point in time difficult, it seems clear to Ofcom from comparing, for example, the utility beta time series in the Smithers report with the BT estimates calculated for Ofcom by The Brattle Group, that its view that the UK utility companies have lower equity betas than BT is reasonable.
- 7.54 Ofcom disagrees with Telewest's suggestion that differences in regulation invalidate its analysis of the betas of US telecoms companies.
- 7.55 As explained in the second consultation, Ofcom's view is that the impact of price cap regulation on systematic risk is ambiguous. This suggests that it is not clear that comparisons between the betas of price regulated firms and unregulated firms should be biased in any particular direction by the impact of regulation. The remaining issue, as highlighted by Telewest in its response, is therefore to consider the impact of rate of return regulation on comparisons between the betas of companies subject to rate of return regulation and price capped firms.
- 7.56 The US and UK regulatory pictures have converged significantly since the 1996 paper by Alexander et al, which used beta estimates based on 5 years of data from the early 1990s. Broadly speaking, the FCC, which regulates the LECs' interstate services, now uses price caps for large incumbent LECs, with rate of return regulation restricted to the smaller companies. Individual state regulators use a variety of regulatory tools, including price caps, rate of return, and other forms of incentive regulation. Price cap, rather than rate of return, regulation is now the dominant mechanism though, for example:
- in 2002, only 8 out of 50 US states used rate-of-return regulation (see David Sappington, *Pricing of Regulated Retail Services in The Telecommunications Industry*, <http://www.treasury.gov/offices/domestic-finance/usps/testimony-docs/Sappington.pdf> for details); and
 - table 7.2 of the FCC's *Trends in Telephone Service* update, published in June 2005 (http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/trend605.pdf), shows that the "non-price cap" LECs had well below 10% of all telephone loops.
- 7.57 Additionally, some of the LECs services have now been deregulated. Ofcom agrees that it seems reasonable to assume that rate-of-return regulation might, other things being equal, be expected to reduce equity beta estimates. But, given the extent to which its importance has diminished over the past decade, Ofcom's view is that it is unlikely that this factor is a key determinant of the low

equity betas of the US LECs as described in the first consultation, given that other factors such as income elasticities point in the same direction.

- 7.58 Ofcom notes Telewest's concerns regarding the impact of second lines on income elasticities, but considers that it is not possible to translate this relatively minor effect into differences in equity betas with any reliability. This led to Ofcom arguing in the second consultation that, "that this factor may have some, albeit limited, implications for its analysis, but considers that this factor is not sufficiently important to change the finding that the income elasticity of demand for lines is lower than that for calls" In its response to the second consultation, Telewest argued that, "by keeping its central estimate of the copper access beta at 0.9, this supposedly 'limited implication' appears in fact to have been a negligible implication,". Ofcom disagrees with this view, and notes that, based on the sum of comments on the evidence set out in the first consultation taken as a whole, it did propose a somewhat more conservative level of disaggregation in the second consultation, i.e. the use of two risk categories rather than three, and proposing that BT's copper access business had an equity beta 0-0.3 points below the group average, rather than 0-0.4 points as proposed in the first consultation.

Telewest's alternative disaggregation ("ICT vs. rest")

- 7.59 Ofcom agrees that the alternative disaggregation approach described by Telewest has some merits. In particular, as highlighted by Telewest, it is somewhat easier to find pure play comparators for ICT companies than it is to find a pure play copper access operator (since none exist). In theory, this should make it possible to estimate a beta for BT's ICT activities, and hence, using an estimate of BT's group beta and a proxy for market value weights, estimate a beta for the rest of BT.
- 7.60 Telewest's approach does not, however, remove all of the difficulties associated with obtaining reliable evidence. For example, the rest beta directly calculated by Telewest relies crucially on using the correct weights for BT's ICT and rest activities. ICT is likely to be the area of BT in which it is most difficult to estimate weights that act as a reliable proxy for market value. Cooper's response written on behalf of BT identifies one shortcoming with the revenue weights mentioned in Telewest's response and PwC's report, namely that the higher risk associated with ICT means that, other things being equal, the present value of future ICT cash flows will be a smaller multiple of current revenue than that of other BT activities. This would tend to mean that revenue weights would overstate the contribution of ICT to BT's market value.
- 7.61 Another factor that, in Ofcom's view, is more obviously likely to be significant, is that the scale of BT's ICT activities is currently increasing, e.g. see page 28 of BT's 2004/05 annual report (subtitled *Growth through transformation*), which states that, "The pace of our transformation was demonstrated by the 32% growth of new wave turnover to £4,471 million, compared to an increase of 30% in the 2004 financial year. New wave turnover represented 24% of group turnover in the 2005 financial year compared to 18% and 14% in the 2004 and 2003 financial years, respectively. New wave turnover is mainly generated from ICT solutions, broadband, mobility and managed services". Other things being equal, this would tend to mean that revenue weights would understate the contribution of ICT to BT's market value. Without weights that can provide a reliable proxy for market value, Ofcom's view is that Telewest's description of the evidential merits of an "ICT vs. rest" split is likely to be overstated.

- 7.62 A key disadvantage of Telewest's proposed approach is that it assumes that all of BT's non-ICT figures have a similar level of risk. This would strongly contradict Ofcom's economic reasoning-based expectations. In particular, BT's key Ethernet- and SDH-based wholesale private circuit products are used as inputs into high-speed data services with a strong focus on the SME and corporate sectors, meaning that it seems unlikely that they face less systematic risk than BT group as a whole (and similarly unlikely that they face the same amount of risk as copper access). Putting all of BT's non-access services in a "rest" category, and permitting BT to earn higher than average returns on these, enables the higher risk of these services to be rewarded. It also encourages competition in the provision of these services, and in the provision of core networks, where there is a prospect of relatively widespread competition to BT developing.
- 7.63 It is also worth pointing out that, even accepting Telewest's proposed ICT beta estimate and weighting factors without further scrutiny, if Ofcom's preferred BT group beta estimate of 1.1 is used (see Section 6 of this document for details), Telewest's disaggregation produces a not dissimilar copper access beta to Ofcom's own approach. This is shown in the table below.

Figure 7.1 Ofcom and Telewest's approaches compared, based on an equity beta of 1

BT product group	Equity beta – Ofcom's approach	Equity beta – Telewest's approach
Copper access	0.9	1.0
Other activities	1.23	
ICT		

- 7.64 As explained above, Ofcom does not consider that the approach outlined by Telewest necessarily runs a lower risk of making costly errors (i.e. under- and/or over-rewarding products in a manner that is detrimental to consumers) than the methodology proposed by Ofcom in the second consultation. Ofcom agrees that ICT activities are very likely to be riskier than the BT average, but considers that reliably quantifying this difference is almost as difficult as in the copper access case. On this basis, given (see the end of this section for details) the benefits to consumers associated with: (1) lower access prices, subject to a fair return being earned, where there are enduring economic bottlenecks; and (2) encouraging competition and investment with regard to BT's other regulated products, Ofcom believes that its proposed approach is preferable to that of Telewest.
- 7.65 Ofcom acknowledges that the limitations of its evidence are important, and on this basis proposes a conservative approach to disaggregation (using a single group gearing figure and a limited beta disaggregation). It seems very unlikely that the risk faced by BT's copper access network is as high as the average market risk. In this context Ofcom has proposed a conservative level of

disaggregation, estimating an equity beta only 0.1 points below the market average of 1.

- 7.66 In summary, Ofcom does not accept that Telewest's proposed approach to disaggregation should be preferred to the one proposed by Ofcom in the first and second consultations.

Ofcom's view of BT's response

BT's main response

- 7.67 Ofcom disagrees with BT's proposal that the returns on its copper access business should be set based on the market average of a beta of one. Whilst, as discussed at length elsewhere, it is not possible to obtain a single overriding estimate of an equity beta for BT's copper access business, Ofcom's view is that a number of factors point towards copper access facing a level of risk that is below that of the average stock in the market, e.g.:

- the economic reasoning-based assessment set out by both Ofcom and PwC (revenue stability);
- the low income elasticities associated with access; and
- the fact that utility companies and the US LECs have equity betas that are less than one at BT's gearing level.

- 7.68 Ofcom also has concerns regarding the validity of the "average gearing level" adjustment suggested by BT in its response to the second consultation. Ofcom is not aware of any widely accepted view of what an average gearing level may be, and notes that, for example, utility companies tend to have equity betas well below 1.0 despite commonly having gearing ratios in the region of 50% (e.g. Ofgem based its March 2004 cost of capital calculations on a range for gearing of 50-60%). Additionally, BT's method assumes that debt betas for both BT and the market as a whole are zero, which will not be true for many firms in the market.

- 7.69 Ofcom does not consider it very likely that copper-based access to BT's network is likely to become more discretionary, and hence have a higher income elasticity of demand, within the next charge-setting periods for the wholesale products that use copper access as an input. To the extent that the changes described by BT (e.g. widespread substitution with mobile) are going to occur in the future, they will only happen slowly over time, and expectations of these changes are already built into estimates of BT's group equity beta. It is not clear to Ofcom that maturity and the availability of substitutes necessarily translate into higher income elasticities. Ofcom considers that arguably a better known trend in income elasticities during a product's life cycle is one where income elasticities *decline* over time, e.g. new innovations may move from being a "luxury" good to being a necessity, i.e. towards having a lower income elasticity. With increased consumer take-up of DSL, mobile and fixed access services will continue to offer significantly different functionality. Ofcom does not see why, for example, faster GDP growth (leading to increased market demand) should lead to a slowdown in fixed to mobile substitution, as it would have to do for this factor to lead to an increase in the income elasticity of demand for copper access.

7.70 Ofcom agrees that operational leverage can play an important part in determining systematic risk, but remains of the view that it is not obvious that copper access faces higher operational leverage than other BT wholesale products.

7.71 Setting aside for a moment the issues discussed in Cooper's paper, which is discussed in the next subsection, Ofcom does not consider that the arguments raised in BT's main response raise any significant new issues that had not been taken into account by Ofcom in the first and second consultations. However, all of the key points made by BT and other stakeholders are taken into account in the final part of this section, which attempts to weigh up the validity of all of the available evidence, and provide a discussion of the consequences of errors in this type of analysis.

BT's response - annex by Professor Cooper

7.72 At Ofcom's request, PwC has produced a paper discussing the technical issues raised in Professor Cooper's response, *Responses to the Consultation: "Ofcom's approach to risk in the assessment of the cost of capital" - PwC Response*. In this paper, PwC discusses the issues raised in the Cooper response, responding to each point in one of the following ways:

- noting that the issues raised in BT's response had already been taken account of in PwC's analysis, or were considered in PwC's conclusions;
- disagreeing with the views provided by BT; and
- carrying out further analysis or making further arguments based on criticisms raised in BT's report.

7.73 For those areas where PwC did carry out additional empirical tests, these provided results that were consistent with the original findings and typically improved the reliability of the analysis. There remain significant econometric difficulties with the analysis so PwC remains of the view that, whilst not enabling Ofcom to reliably quantify the difference in the level of risk between BT's copper access business and the rest of BT, all of the analysis set out in its initial report is of value to Ofcom in informing its approach to disaggregation.

Final view on disaggregation

Summary of the evidence

7.74 As described earlier in this section, Ofcom has assembled a wide range of evidence in support of its proposals, including:

- In the first consultation:
 - benchmarking the equity betas of the UK's largest utility companies, and drawing a parallel between the level of risk faced by these companies with that faced by BT's copper access business;
 - benchmarking the equity betas of US telecoms companies; and

- using previously conducted studies to compare estimates of the income elasticity of demand for retail access services (e.g. line rental) with that of other telecoms services (calls).
- In the second consultation:
 - an intuitive "first principles" analysis of the degree of risk faced by BT's copper access business;
 - an analysis of the regulatory precedents for the use of a disaggregated approach to quantifying risk at a project-specific level; and
 - two types of quantitative regression analysis, namely:
 - a cross-sectional analysis of telecoms companies across the world, examining the relationship between companies' equity beta estimates and the proportion of their business that is accounted for by different types of activities, e.g. "information and communications technology" (ICT), and traditional fixed lines activities; and
 - a time series analysis of BT's equity beta, examining the relationship over time between its equity beta and the proportion of its business accounted for by different types of activity

7.75 All of these individual sources of evidence have been criticised by various stakeholders. But, as explained earlier in this section, very few arguments have been made to support a view that a distinct copper access business would face as much systematic risk as BT group as a whole. Some of the specific criticisms of individual pieces of evidence that have been made by stakeholders may have some relevance, but, as described in both the second consultation and this statement, and PwC's response to stakeholder comments on their analysis, Ofcom's view is that the sources of evidence it has presented are appropriate, despite having reservations about the particular values that it implies for the betas of different parts of BT.

Interpreting the evidence

7.76 Recognising that none of the individual sources of evidence enable a reliable quantification of an equity beta for BT's access business, Ofcom favours a conservative approach to beta disaggregation. A copper access equity beta estimate of 0.9, as proposed in the second consultation, is only marginally below the market average beta of 1.0, and is at a similar level to recent point estimates of BT's group equity beta calculated using two years of daily data against a UK index (see Section 6 of this statement for details).

7.77 A further respect in which Ofcom's approach could be viewed as being conservative is its proposal not to use project-specific gearing ratios, because, as outlined in the second consultation, limits on the available data on which to base a disaggregated approach. It is a well-accepted fact that firms with lower risk, i.e. lower asset betas, tend to have a greater capacity for taking on debt. For example, utility companies routinely have gearing ratios in the region of about 50% (see above), and the evidence provided by Telewest in its response to the second consultation showed that the ICT companies in its sample tended to be of higher risk and hence have gearing ratios of about 10%.

- 7.78 A further point to note is that, in calculating weights to use for beta disaggregation, Ofcom has erred on the side of conservatism, i.e. higher beta estimates. Based on BT's CCA accounts for 2003/04, on a mean capital employed basis, the access:rest split is 40%:60%, but based on other measures access could be argued to represent a smaller proportion of the market value of BT, e.g. on a revenue or opex basis access accounts for less than 15% of BT. This is equally true of weights calculated using simple estimates of profitability (e.g. revenues less opex or revenues less the sum of opex, depreciation, and a return on capital employed).
- 7.79 An equity beta of 0.9 is also at the upper end of the range of beta estimates for US LECs presented by Ofcom in the first consultation, and close to the value quoted in C&W's response to the first consultation, which presented a sample of Bloomberg raw betas estimated for a sample of the 14 biggest European incumbents other than BT, which suggested an average equity beta of just over 0.9 at 35% gearing.
- 7.80 The methodology proposed by Telewest, i.e. a disaggregation between ICT and the rest of BT, would point to a copper access equity beta of 1.0 at Ofcom's preferred group beta estimate of 1.1.
- 7.81 In the light of these factors, Ofcom remains of the view that a figure of 0.9 represents an appropriate estimate of the equity beta of BT's copper access business at its current gearing level. Ofcom's estimate of the corresponding value for the rest of BT is, as set out in the second consultation, 1.23, based on group and access betas of 1.1 and 0.9 respectively, together with a 40:60 access:rest weighting.

The impact of Ofcom's proposals

- 7.82 Section 2 of this document provides a brief overview of some of Ofcom's key duties under Sections 3 and 4 of the Communications Act. The discussion of BT's group equity beta outlined in Section 3 of this document outlined the importance of Ofcom's Section 3(1), Section 3 (4), Section 3 (5), and Section 4 duties in, where Ofcom's judgement must be used, balancing the short term interests of consumers (via lower parameter estimates) against the need to avoid discouraging efficient investment (via higher parameter estimates).
- 7.83 A similar set of considerations applies when deciding whether to reward projects with different systematic risks differently, since an element of judgement is required on Ofcom's part. Departing from the use of a single beta estimate for BT would, by preventing excessive returns being earned with regard to low-risk products, improve consumer welfare with regard to such products, by promoting downstream competition. It will also reduce the incentives for inefficient investment caused by excessive regulatory returns.
- 7.84 Another key consideration to consider in this context is whether, as is set out in Section 3(3) of The Act, rewarding projects with different levels of systematic risk differently is consistent with regulatory best practice. Ofcom's proposed view, based on the arguments outlined earlier in this Section, is that its approach is consistent with this duty, being in line with widely used financial theory and the approach taken by firms in a commercial context. Additionally, as outlined in the further research carried out on Ofcom's behalf by PwC, there are some regulatory precedents supporting the use of a similar approach.

7.85 As outlined in the first and second consultations, there are two types of error that could potentially be made by Ofcom in this exercise. This means that, given the uncertainty involved, Ofcom is faced with two possible risks, namely:

- making a Type I error, i.e. incorrectly using a single group beta figure in its analysis:
 - allowing excessive returns on BT's copper access network; &
 - allowing insufficient returns on the rest of BT's activities; and
- making a Type II error, i.e. i.e. incorrectly using a disaggregated approach to assessing risk:
 - allowing insufficient returns on BT's copper access network; &
 - allowing excessive returns on the rest of BT's activities.

7.86 As argued above, Ofcom's view is that the weight of the available evidence, whilst not pointing to a particular value, means that it is unlikely that an "average" risk profile will correctly reflect the risks associated with BT's copper access products. This suggests that the likelihood of making a Type I error if the disaggregated approach is followed is much lower than that of making a Type II error if a "single group beta" approach is followed.

7.87 The consequences of each type of error are more difficult to weigh up. In the second consultation, Ofcom expressed the view that a Type I error would be the most harmful to consumers, since an error of this sort would allow excessive returns on the part of BT where there are enduring bottlenecks to competition. It would also, by allowing BT excessive returns in other markets, risk undermining competition in markets where there may be a prospect of competition by setting BT's returns at a level that is too low.

7.88 In its response to the second consultation, Telewest discussed the dynamic advantages of competition associated with setting beta estimates at too high or too low a level²⁷. Similar issues were also discussed by Land Securities PLC in its response to the second consultation. Telewest argued that:

The risks of choosing (or implying) a beta for regulated activities that is too low are:

- *increases inefficiency in the access network because it discourages new investment (or investment for displacement);*
- *distorts competition in the provision of competing infrastructure;*
- *shareholders get lower returns.*

By contrast, the advantage of a regulatory beta that is too low is that:

- *customers get current technology at lower prices.*

²⁷ This discussion was worded in terms of an "ICT vs. rest" approach to disaggregation, but an analogous argument applies to a "copper access vs. rest" split.

By contrast, if the beta for regulated activities is too high:

- *this encourages new investment, particularly from competitors;*
- *shareholders returns are too high;*
- *prices for existing services are too high (but this is a price-inelastic product—one reason why this activity has a lower beta).*

Given the dynamic advantage of competition, and consistent with Ofcom's previous statements, this suggests that erring on the high side when setting the beta for regulated activities better meets consumer welfare goals.

7.89 Ofcom considers that its general approach to cost of capital estimation is indeed one of choosing from the upper end of reasonable estimates of factors determining the regulated cost of capital. This was an important factor in, for example, Ofcom's assessments of the equity risk premium and of BT's group equity beta.

7.90 However, in Ofcom's view Telewest's discussion does not draw sufficient attention to the negative competition consequences of setting beta too high for regulated activities. If the beta for regulated activities is too high that will lead to higher prices for customers for two reasons:

- higher wholesale access charges will be passed through by retail providers and translated into higher retail prices; and
- some providers of wholesale access may no longer find it profitable to operate, and might exit the market, thereby reducing the level of competition in the market.

Thus, other things being equal, setting too high a beta has a negative impact on consumer welfare in both a static and a dynamic sense. Ofcom recognises the potential for setting returns that are too low to have a negative impact on consumer welfare, and is of the view that its proposed approach strikes an appropriate balance between setting returns that are too high versus returns that are too low.

Section 8

BT's cost of capital

Introduction

8.1 Section 7 set out Ofcom's conclusions on its approach to disaggregating the equity beta of BT's overall business. In order to reflect the variations in risk across BT Ofcom has reached the conclusion that BT's business and hence its cost of capital can be disaggregated into two constituent parts:

- BT's copper access business; and
- the rest of BT

8.2 In this section we present our estimates of the cost of capital for these two parts of BT. In the second consultation similar estimates were presented at the end of Section 4 and stakeholders were asked to consider the following question:

Question 12: What is the view of respondents on Ofcom's proposed estimates of the WACC for BT's copper access business and the rest of BT?

8.3 The analysis in this section relies on the conclusions concerning BT's beta (in Section 6), the disaggregated betas of its constituent parts (in Section 7) and Ofcom's conclusions on the ERP (in Section 4). In addition, this section also presents Ofcom's estimates of the other parameters that are required to estimate the cost of capital for BT, e.g.

- the risk-free rate; and
- BT's debt premium.

The risk-free rate

8.4 The risk-free rate of interest is an input into the calculation of both the cost of debt and the cost of equity (as explained in Section 3). For an investment to be truly free of risk, the risk of default needs to be zero, and additionally there must be no reinvestment risk. The first condition can be approximately satisfied by using the yields on UK government debt, where the risk of default can be taken to be negligible²⁸.

8.5 In the UK, the nominal risk free rate is usually proxied by the yield to maturity on gilts, whilst the real risk free rate is proxied by the yield to maturity on index linked gilts of appropriate maturity. The difference between the two provides an estimate of the rate of inflation²⁹.

8.6 There is a range of maturities on government debt that could be used as the basis for an estimate of the risk free rate. These maturities range from less than 1 year to over 30 years.

²⁸ Strictly speaking, to satisfy the second condition, risk free rates should be estimated based on a series of short run risk free investments.

²⁹ Ofcom prefers to use the geometric difference between the two rates as opposed to the simple arithmetic difference.

- 8.7 There are arguments in favour of both short and long-term gilts as the best estimate of the risk free rate for the purposes of the proposed charge control. For example:
- a maturity relevant to the duration of a particular charge control may be appropriate (e.g. if a review relates to a 3-year charge control, a 3-year gilt may be appropriate); and
 - BT is required to make investments (for example regarding network infrastructure) that will have economic lifetimes in excess of a typical charge control period, and hence a longer-term gilt may be appropriate.
- 8.8 Ofcom's preferred approach is to give weight to both of the above considerations. In calculating a risk-free rate to be applied to BT, its view is that the use of 5-year gilts strike a reasonable balance between the above two arguments (although, for example, it may adopt a different approach in estimating a cost of capital for other stakeholders in cases where a longer or shorter duration is more relevant).
- 8.9 It is worth noting that the yield curve is not currently upward-sloping, meaning that using the yield on longer term gilts would not, as has often been the case historically, lead to higher estimates.
- 8.10 UK spot gilt yields are volatile and therefore using the current yield or an average of historic yields over a certain averaging period can have an impact on the final estimate. Ofcom's preferred approach is to base estimates on current market yields of bonds of an appropriate maturity, but analysing yields over a sufficiently long period of time to avoid allowing very short run fluctuations to have an impact on its regulatory estimates. The figure below plots the time series of 5 year rates in nominal and real terms, and the implied inflation rate over time.

Figure 8.1 Nominal, Real and Inflation 5 year rates over time (2000 to 2005)



Source: Bank of England and Ofcom

8.11 As described in previous Ofcom publications (see, for example, the WACC calculation set out in the second consultation), Ofcom bases future estimates of the risk free rate on prevailing market rates at the time of publication (using a number of months' data in order to avoid very short-term fluctuations), but taking other factors into account if it considers that current rates may not be a reliable proxy for future rates. In the figure below, historic averages of the Nominal, Real and Inflation rates are presented which show the impact of taking different averaging periods.

Figure 8.2 Historic averages of the Nominal, Real and Inflation 5 year rates

Averaging period	Nominal	Real	Inflation
4 August 2005	4.3	1.8	2.4
1 week	4.2	1.8	2.4
1 month	4.2	1.7	2.4
3 month	4.2	1.8	2.4
6 month	4.4	1.8	2.6
1 year	4.5	1.9	2.6
2 year	4.6	1.8	2.8
3 year	4.5	1.8	2.6
4 year	4.6	2.0	2.5
5 year	4.7	2.1	2.5

Source: Bank of England and Ofcom

8.12 In the PPC statement, Ofcom used a value of 5% for the nominal risk free rate which reflected a 3 month average of the then most recently available data for 5-year gilts, and at the same time was reasonably aligned with a view of the longer term rate for 5-year gilts.

8.13 As Figure 8.1 above shows, the nominal rate for 5-year gilts has fallen over the last year and mechanistically applying a 3 month average of the most recent data (as done in, for example, the PPC statement) would lead to a risk free rate of approximately 4.2% (See Figure 8.2 above). Such an estimate would, however, be low by historic standards, and Ofcom believes that some weight should be given to a longer-term perspective, suggesting that the use of a slightly higher risk free rate would be more appropriate. For example the 1 to 5 year historic average rates imply a nominal rate of between 4.5% and 4.7%. This is consistent with the view expressed by some respondents that other regulators tend to use a risk free rate above the market level. Whilst in some cases this may be related to their choice of ERP (see Section 4) Ofcom believes that there is merit in considering long term views of inflation and the risk free rate where the evidence suggests that current estimates may be below the long term average.

8.14 Another way to consider the nominal risk free rate is via estimating the rate of inflation and the real risk free rate separately. The Bank of England's inflation target is 2.0% for CPI. However, in order to compare with the inflation rates in Figure 8.2 above (implied by the difference between gilts and index linked gilts which are indexed to RPI) the "equivalent" rate is 2.5% for RPI inflation³⁰. If a rate of 2.5% for RPI inflation is assumed for the long term (i.e. over the next five years) then it becomes necessary to consider an appropriate estimate for the

³⁰ See <http://www.bankofengland.co.uk/publications/speeches/2004/speech211.pdf> for an explanation of the change in inflation targets in 2004 from CPI measure to RPI.

real risk free rate. Averages taken over the last few months suggest the real risk free rate is about 1.8%, implying a nominal rate of about 4.4%. However, recent "historical" averages of the real risk free rate are higher, of the order of 2.0% to 2.1%. These imply a nominal risk free rate of 4.5% to 4.7%. We note other recent precedents for an assumption of 2.0% - see, for example, PwC's report, *Rates of return for FSA prescribed projections*, June 2003. Also, as highlighted by Telewest in its response to the second consultation, that some recent UK regulatory decisions have assumed a real rate of 2.5% or more. We consider that the use of a value this high compared to current and historic averages would not be appropriate, since, as shown in figure 8.1, this is some way above recent historical averages, and we are not aware of any consensus to suggest that rates are more likely to increase than decrease. We also note that many of the precedents highlighted by Telewest were part of decisions that used an ERP estimate below Ofcom's preferred estimate of 4.5%. In the light of these factors, we consider that 2.0% is an appropriate value for the real risk-free rate.

- 8.15 Taking account of both current and recent historical evidence, Ofcom's view is that it is appropriate to use a value of 4.6% for the nominal risk free rate. This is somewhat higher than the current rate of about 4.2% to 4.3% (which are lower than historic averages), but consistent with a longer term averages and a real risk free rate of 2.0% and a rate of inflation of 2.5%.

BT's debt premium

- 8.16 In relation to BT's debt premium, Ofcom notes that the yield on some corporate bonds has declined in recent years (although, particularly for lower-rated investment grade bonds, corporate bond spreads have increased somewhat since the first months of 2005). BT's credit rating is currently A-. Based on data obtained from Bloomberg the benchmark yield for A- corporate debt was:

- 1.03% at the end of June 2003;
- 0.74% at the end of June 2004; and
- 0.64% in mid June 2005.

- 8.17 Ofcom's view is that a debt premium of 1.0%, as used in the PPC statement, represents a reasonable value for BT's debt premium. All of the equity beta, risk free rate, and promised yields on corporate debt are currently low relative to recent historical values. Ofcom's view is that this means that it would not be appropriate for Ofcom to exclusively base its estimates of each parameter on (low) current market values.

Cost of capital estimates

- 8.18 The tables below set out the WACC estimates for BT's copper access business and the rest of BT based on the conclusions set in this statement in relation to BT's disaggregated beta (Section 7) and the ERP (Section 4). Ofcom considers two gearing scenarios for BT to be appropriate (35% and 30%), with the final estimate of the WACC in each case being the simple average of the two gearing scenarios.

- 8.19 In summary Ofcom has calculated the following **pre-tax nominal** WACC estimates for BT's different activities:

- copper access - 10.0%; and
- the rest of BT - 11.4%.

8.20 These estimates are set out in Figure 8.3 and Figure 8.4 below.

Figure 8.3 Estimates of pre-tax nominal WACC for BT's copper access business

	High gearing	Low gearing
	35%	30%
Risk-free rate	4.6%	4.6%
ERP	4.5%	4.5%
Equity beta	0.9	0.8
Cost of equity (post tax)	8.7%	8.4%
Debt premium	1.0%	1.0%
Cost of debt (pre tax)	5.6%	5.6%
Corporate tax rate	30%	30%
Cost of debt (post tax)	3.9%	3.9%
Gearing	35%	30%
WACC (post tax)	7.0%	7.0%
WACC (pre tax)	9.99%	10.04%
Average WACC (pre tax)	10.0%	

Figure 8.4 Estimates of pre-tax nominal WACC for rest of BT

	High gearing	Low gearing
	35%	30%
Risk-free rate	4.6%	4.6%
ERP	4.5%	4.5%
Equity beta	1.23	1.14
Cost of equity (post tax)	10.1%	9.7%
Debt premium	1.0%	1.0%
Cost of debt (pre tax)	5.6%	5.6%
Corporate tax rate	30%	30%
Cost of debt (post tax)	3.9%	3.9%
Gearing	35%	30%
WACC (post tax)	8.0%	8.0%
WACC (pre tax)	11.37%	11.42%
Average WACC (pre tax)	11.4%	

Section 9

Taking account of real options

Introduction

- 9.1 As described in the first consultation, in financial economics, “real option” is the term given to a possibility to modify a project.³¹ This concept is relevant to investment decisions made under uncertainty, which may either create or destroy real options. A key example is that, in making an investment, a firm foregoes the option to defer the investment and wait and see how demand for the products it will support will evolve (this option will be referred to as a “wait and see option” during the remainder of this section).
- 9.2 The application of real options theory to regulation remains an area that has hitherto received relatively little attention from regulators. For some time though, BT lobbied Oftel and, more recently, Ofcom on this subject, arguing that the value of such real options should be taken into account during regulatory decision-making and charge-setting. BT has argued that regulatory incentives to build infrastructure would better reflect the costs of BT's obligation to make its network available to other communications providers under such a framework.
- 9.3 In the first consultation, Ofcom set out a number of key considerations that might be taken into account when considering the relevance of wait and see options. Section 6 of the first consultation concluded by proposing that Ofcom should begin to develop a framework by which regulatory policy might reflect the value of these options. Ofcom argued, based on a consideration of Figure 12 of the first consultation, that the value of such options is likely to vary significantly across BT's full portfolio of retail and wholesale products. A key area identified by Ofcom as being one in which the value of wait and see options might be significant was that of next generation access networks.
- 9.4 In the first consultation, Ofcom asked two questions in relation to the relevance of real options.
- Question 7: Do respondents agree with Ofcom's suggested assessment of the likely circumstances under which real option theory will be applicable in the context of regulation?*
- Question 8: Do respondents have any views on how the value of real options might be taken into account in practice in a regulatory context?*
- 9.5 The sections that follow summarise and discuss stakeholder responses to both of these questions, and provide an illustration of the applicability of real options to competitive environments, and set out Ofcom's preferred approach in the light of stakeholder responses.

³¹ For example, see Chapter 22 of Brealey & Myers for an introductory level discussion. A more advanced treatment appears in Dixit, A. K. & Pindyck, R. S. “Investment under uncertainty”, Princeton University Press, Princeton, New Jersey.

Summary of responses

9.6 Ofcom received responses from a number of stakeholders on the subject of real options. Many stakeholders expressed strong views in relation to this issue. These views covered both of the questions asked in the first consultation, and as such discussed both:

- the “theoretical” case for the use of a real options framework, and
- whether, and how, real options might be used as a policy tool in practice.

9.7 Because of the similarities in the responses of different stakeholder types, stakeholder responses are grouped together according to type in the subsections that follow.

The cable companies

9.8 NTL argued that use of real options theory in regulation was not, as things stand, appropriate. It argued that:

“Real options theory is probably always inappropriate in the context of regulation due to the practical difficulties associated with its application. The most obvious problem lies in deciding which real options are relevant, since the answers to this question cannot be tested objectively”

9.9 NTL argued that, even in the case of next generation access networks, the area identified by Ofcom as the one where real options theory was likely to be most relevant, there were good arguments to suggest that real options might not be relevant, since, crucially:

- Ofcom had potentially exaggerated the significance of the “demand uncertainty” behind the demand for services over next generation access networks – demand in the future would follow predictable patterns, being based on the same drivers as demand today (bandwidth/capacity), with uncertainty being restricted to precise bandwidth requirements;
- Ofcom had understated the extent to which uncertainty could be eliminated through staging and/or piloting of investment; and
- some aspects of investment in next generation access (notably electronics) would be reversible

9.10 NTL also argued that it would not be appropriate to reward BT for demand or cost risks that related specifically to particular services, since investors holding a diversified portfolio of stocks would not require compensation for bearing such risks. NTL additionally cited a number of practical difficulties inherent in attempting to take into account the value of real options.

9.11 Telewest was supportive of the list of criteria outlined by Ofcom in question 7, although it argued that Ofcom's assessment of the case for using real options in the case of next generation access might be overstated, since it might be the case that many future high-bandwidth services would be able to be served over current-generation access networks, meaning that other investment strategies would be available to a would-be next generation access network provider.

9.12 In response to question 8, Telewest outlined some high level principles that might be used in order to value real options. It suggested that Ofcom could base an approach to valuing real options on the following parameters:

- a single “state” variable, that varies randomly over time;
- an assumption as to how the uncertainty/volatility of that ‘state variable’ can be expected to evolve over time; and
- an expiry date for the option.

Other stakeholders (other than BT)

9.13 The responses received from the fixed-line communications providers other than BT were generally opposed to the use of real options theory in a regulatory context. These responses tended to focus on practical estimation difficulties, and the lack of precedent or consensus amongst regulators or practitioners regarding the use of a real options framework.

9.14 Easynet and the other fixed communications providers argued that the value of wait and see options would be negligible in cases where an incumbent had SMP, since, in such cases, first mover advantages would tend to be of considerable value.

9.15 Easynet also quoted analysis by Nicolas Economides in *Real options and the costs of the local telecommunications network*³², which, it argued, demonstrated that many of the conditions under which real options will have a significant value do not apply in telecoms markets. Based on this paper, Easynet argued that many of the costs of investing in telecoms networks, such as electronics, are not sunk. Easynet also argued that incumbents tend to face relatively little demand uncertainty in many markets such as that for local loops.

9.16 A number of the fixed communications providers argued that a detailed analysis of the arguments in relation to the applicability of a real options framework to next generation access networks was premature, since such networks as yet remain unplanned.

9.17 C&W argued that the resource requirements inherent in assessing the value of real options, together with the informational asymmetries between regulators and incumbents, meant that there was a risk that, “real options would skew the measurement of risk in favour of the regulated firm”. On this basis, C&W argued that the use of a real options analysis should be restricted to cases where there was, “real uncertainty in investment and measurable significant danger of stranding of assets”.

9.18 The mobile network and terrestrial broadcast transmission network providers were in favour of the use of a real options framework in regulation. In some cases they argued that it was important that Ofcom was committed to applying the principle equally across all the sectors that it regulates, i.e. not just in relation to BT, and that Ofcom should provide more certainty in this area.

³² Alleman, J. & Noam, E., (eds) *The New Investment Theory of Real Options and its Implications for the Cost Models in Telecommunications* Kluwer (2000)

- 9.19 Vodafone highlighted the possible relevance of real options theory to the purchase of 3G spectrum, and the use of mobile networks by virtual operators.
- 9.20 In (confidential) responses, NTL Broadcast and Crown Castle outlined their views on the applicability of real options theory to broadcast transmission services.
- 9.21 The Analysis Group submitted a working paper written by Professor Robert Pindyck, titled, *Pricing Capital Under Mandatory Unbundling And Facilities Sharing*. This paper resulted in part from a study commissioned by Verizon, one of the incumbent LECs in the US, and suggested a methodology by means of which the cost of capital figure used to calculate access prices might be marked up to reflect, "the transfer of option value from incumbents to entrants". This paper explained that different assumptions regarding the volatility of demand growth might lead to widely differing real option values, and, whilst it did not conclude with a single final estimate, it argued that,

"In state proceedings, for example, inordinate time and resources have been spent on the question of whether an ILEC's historic average cost of capital is 12.9 versus 13.1 percent. We have seen that the correct cost of capital input for TELRIC should be significantly larger than either of these numbers; at issue is whether it should be larger by about 1 percentage point or 4 to 5 percentage points."

BT

- 9.22 BT was strongly in favour of the use of a real options approach in regulation. BT stressed that, whilst first mover advantages are valuable in some cases, it should not be assumed that their value was sufficient to compensate incumbents for all real options that had been given up in making an investment.
- 9.23 In response to question 7, BT appeared to agree with Ofcom's suggested assessment of the likely circumstances under which real option theory will be applicable in the context of regulation. BT suggested a number of products to which a real options framework might be relevant in future, as shown in the following direct quote:
- *BT's proposed investment in Multi-Service Access Nodes (MSANs) as part of its 21CN programme;*
 - *IP-based core networks (possibly including BT's proposed Metro Nodes and IP/Voice soft gateways);*
 - *Fibre-to-the-kerb or fibre-to-the-premise investments; and*
 - *Wireless local access, including wireless end-user broadband e.g. using Wi-Max or other emerging standards.*
- 9.24 In response to question 8, BT acknowledged the practical difficulties inherent in attempting to take the value of real options into account in practice. In the light of these difficulties, BT's response to this question did not focus, for example, on a particular model that might be used to assess the value of real options, but rather suggested some first steps that might be taken by Ofcom towards a better understanding of the precise implications of real options theory for particular parts of BT's business, including:

- undertaking, possibly in conjunction with BT, work in this area in order to further develop its thinking with regard to the practical application of real options theory;
- considering whether regulatory forbearance might be an appropriate approach in cases where the value of wait and see options was significant; and
- consider using non-price factors such as the length of contractual terms to reflect the value of real options

Principles for the application of real options to regulation (Question 7)

9.25 In the first consultation, Ofcom identified a list of circumstances under which wait and see options might have a potentially significant value. As outlined above, all stakeholders who responded to question 7 agreed with this list. The key comments made by stakeholders in relation to this question can, broadly speaking, be divided into the following two groups:

- companies with access obligations arguing that the circumstances identified by Ofcom in the first consultation applied to various products not specifically mentioned in the first consultation. Comments of this type were made by Vodafone, BT, Crown Castle, and NTL Broadcast; and
- customers of the above firms arguing that Ofcom had exaggerated the applicability of real options theory to BT wholesale products, including next generation access, or to telecommunications services in general. Comments of this type were made by NTL, Telewest, and Easynet.

9.26 Many of these comments go beyond the intended scope of this consultation, which was not intended to reach a definitive list of products to which a real options approach would be applied. Rather, it was to establish a set of criteria in order to inform Ofcom's future regulatory approach.

9.27 Therefore, whilst this statement is focused on a set of criteria for informing Ofcom's view on the applicability of real options, Ofcom expects to engage further with stakeholders on specific product issues in relation to future access pricing reviews.

Conditions under which real options adjustments might be relevant

9.28 In the first consultation (see paragraph 6.12), it was suggested that an adjustment to the standard regulatory approach of discounting expected net cash-flows to obtain a net present value might, in principle, be considered when (this list of issues will be referred to as, "conditions 1 to 3" in the remainder of this section):

- (1) there is an option to wait and see – i.e. investments are not now-or-never;
- (2) net returns are uncertain; and
- (3) investments are irreversible.

9.29 The first consultation suggested a set of more specific criteria, relevant particularly to certain BT access products, whereby conditions 1 to 3 could be assessed (Figure 12, pp46-47). These were:

- the presence of a significant amount of demand uncertainty (e.g. return on investment is dependent on demand growth);
- investment cannot be staged, reversed, or piloted;
- significant technology risk;
- risk of stranding due to investment being competitor specific;
- the availability of other investment strategies (e.g. new demand can be served using existing network); and
- no chance that loss of wait and see will be mitigated by gaining a first mover advantage.

9.30 The first consultation (e.g. at paragraph 6.44) proposed that the value of wait and see options is likely to be:

- significant in the case of next generation access networks;
- relevant to a degree in the case of next generation core networks; and
- small in other cases.

9.31 The remainder of this section outlines and comments on stakeholder comments on the three conditions set out above, and provides a further discussion of Ofcom's more specific criteria and their possible application to various BT wholesale products.

9.32 Before this more detailed discussion, however, following a number of stakeholder responses to the first consultation that touched on this issue, it is first useful to consider the relevance of the degree of competition to the discussion of real options.

The relevance of competition

9.33 In the first consultation, the examples given and the surrounding discussion were expressed in terms of options facing a single firm. Some stakeholders (Cable and Wireless, Easynet, NTL) raised questions about the applicability of real options in the presence or the absence of competition.

9.34 Ofcom seeks to promote competition, and to promote investment decisions that, as far as is practicable, mimic those that would be made in competitive or contestable markets, recognising that in doing so it is important to offer a fair reward for risk. In any adjustments to its approach that were made to take account of real options, Ofcom would be seeking to reflect the conditions that would prevail under competition, not to underpin the investment decisions and returns of a dominant firm. Single-firm examples were used in the first consultation because real options can be explained more simply in "non-technical" terms when only one firm is involved.

- 9.35 To provide an outline of the importance of competition, we expand below on the discussion of the conditions 1 to 3 from the first consultation, focusing particularly on competition, at the same time as acknowledging stakeholder responses.
- 9.36 The Annex at the end of this chapter (this annex can be omitted without loss of continuity), sets out an illustrative example of the effects of real options in a competitive environment. The key points that the example illustrates are:
- the impact of real options is not the same under competitive conditions compared to monopoly conditions (the key differences being derived from the potential for entry);
 - real options do have an effect under competitive conditions, though this effect appears in the form of changes to prices, rather than changes to firm's profits; and
 - the effect on prices is that, when options-to-wait are important, short-term prices are higher but long-term prices lower than would be the case if there were no option to wait.
- 9.37 This example is more complicated than those given in the first consultation because it seeks to demonstrate the impact of competition on the value of a real option.
- 9.38 The remainder of this subsection considers the three conditions referred to at paragraph 9.28 above, expanding on the significance of competition for them and acknowledging stakeholder responses.

Condition 1: There is an option to wait and see - Investments must not be now-or-never

- 9.39 Wait-and-see options are only likely to arise when an investment opportunity will still be available later. There are a number of reasons why, even though it may appear that there is an option to wait, condition 1 is not fulfilled and investments are in fact "now or never". Such reasons are particularly associated with competition, with the consequence that there may be more genuine options to wait for dominant firms than for competitive firms. A well-known example is where there is a first-mover advantage and a risk that a competitor may pre-empt. The possibility of pre-emption may erode or eliminate the effect of wait-and-see options.

Condition 2: Net returns must be uncertain

- 9.40 Options only have value when there is uncertainty. As discussed in the first consultation, Ofcom considers that the degree of uncertainty varies significantly across different communications markets.
- 9.41 Ofcom does not, in general, accept the view offered by NTL that it is not appropriate to reward companies for giving up wait and see options in cases where uncertainty is caused by specific risk. The degree of irreversibility of investment is likely to be less when there is firm-specific uncertainty than when uncertainty is industry-wide, because there may be a possibility of selling plant, equipment and other products of investment to other firms (who may attach a value to the plant, equipment or other product-of-investment that is unaffected

by the adverse firm-specific event). However, recovery through resale is unlikely to represent full reversibility and some products of investment will simply not be resalable. Ofcom agrees that, in portfolio theory based models, equity holders do not require compensation for specific risk. However, investors will be interested in specific risk under a real options framework since they will take account of value associated with the timing of investment, to which company-specific risks may be relevant.

- 9.42 Ofcom agrees with one of the other points made in NTL's submission - if the specific risk profile of one company is less favourable than that of other companies, Ofcom would not seek to compensate shareholders for having taken on "inefficient" risks. For example, if an incumbent was considered to have a cost risk profile that created greater dangers of (non-diversifiable) downside risk, relative to upside risk, than would be the "norm" in a competitive market, Ofcom would be likely not to consider it appropriate to make any adjustment to compensate shareholders for this.
- 9.43 Furthermore, only those sources of uncertainty that are relevant to a competitive environment should feature in any adjustments made to take account of real options. For example, if the source of uncertainty were uncertainty on the part of an incumbent as to how rapidly a dominant position would be eroded by competition (a scenario raised by the NTL submission), Ofcom would not consider it appropriate to make adjustments associated with options-to-wait before investing.
- 9.44 Ofcom also acknowledges the argument of Easynet that in the telecommunications industry many aspects of demand are not uncertain. However, Ofcom remains of the view that there is currently significant uncertainty regarding the future demand for some, although not all, of the services in communications markets.

Condition 3: Investments must be irreversible

- 9.45 When investments are irreversible, an asymmetry might arise between positive shocks and negative shocks in a competitive environment. Positive shocks would stimulate entry, bidding away high profits, while negative shocks would not lead to exit, because irreversible investments cannot be undone (leading to losses).³³ Consequently, when an option to wait existed, short-term prices that stimulated investment (so-called "investment triggers") would be raised above prices delivering a zero NPV, because waiting allows avoidance of the downside of the asymmetry.
- 9.46 Because of this, short-term prices would be higher than if investments were reversible, meaning that the path of prices over time would be affected by the presence of an option to wait. This limited entry or new investment would leave early investors with positive profits in early periods, before the uncertainty was resolved or before later entrants could bid away profits. Under appropriate market structures and modes of competition these profits would exactly offset the value of waiting – under competitive equilibrium conditions the option value of waiting might be zero.³⁴ This is an important point to recognise in calculating

³³ More strictly, negative shocks would lead only to (at most) sufficient exit to cause prices to rise up to cover variable costs. (Where there are further options to invest later there may not even be this much exit – See Dixit & Pindyck, op. cit., especially Chapter 8.3.)

³⁴ This point is illustrated in the annex to this chapter, titled "An illustrative example".

any adjustments. It is the rise in short-term price triggers for investment associated with the option to wait that is important, not the option value of waiting *per se*. As a regulator Ofcom would aim to stimulate the competitive path of prices, but it is not its aim to preserve option-value-related rents that would accrue to a monopolist.

- 9.47 Ofcom has taken account of the submission of Easynet, as outlined above, to the effect that real options are not applicable to the telecommunications industry because many costs are not sunk. However, as outlined in the first consultation, Ofcom does accept that some, though not all, investments in communications (particularly the costs of investment in network infrastructure) are irreversible in the sense relevant – especially when the impact of irreversibility cannot be mitigated through staging or piloting. The first consultation marked out next generation core and next generation access products as being examples. The possibility of selling industry-specific capital to other firms will not, in general, allow for full reversal of investment in the case of industry-wide unfavourable outcomes (e.g. demand for a new product being less than expected) because other firms will not be prepared to pay as much for an investment under these circumstances as its expected value at the time of investing. The difference (which might be a substantial proportion of the whole) will be lost.

Further issues

Creation of option value

- 9.48 It is also worth commenting on two further issues in the remainder of this section. Firstly, as discussed in the first consultation (paragraph 6.33ff), Ofcom believes that there are other relevant real options in addition to the option to wait. In particular, investment can create options as well as using them up - by investing in a Mark I project an option may be created to produce a Mark II product; e.g. by investing in a platform a company creates an option to sell add-on products facilitated by the platform³⁵; etc. In general, Ofcom does not consider it clear that the value of options destroyed by investment will be greater than the value of options created, and hence that a full consideration of real options ought to lead to higher threshold returns rather than lower ones in all cases. In making any adjustments to its approach in order to take account of options, Ofcom would listen carefully to the views of stakeholders about offsetting options created by investment, as well as options to wait foregone.

Real options and the cost of capital

- 9.49 It is also worth noting that discussions of the need to add to the standard NPV hurdle rate are based on the standard assumption that the cost of capital involved is the project cost of capital. However, as discussed in previous sections, Ofcom's preferred approach to estimating a company's WACC typically involves choosing parameter values that are towards the upper end of the plausible range. An important motivation for this is uncertainty over the appropriate cost of capital and the belief that under-investment would be worse than over-investment. Ofcom's approach to WACC estimation therefore already makes some allowance for uncertainty. This does not imply that Ofcom's

³⁵ An example of this might be digital interactive services sold on a digital TV platform.

existing approach precisely compensates for real options effects³⁶, but it might be argued that the use of real option adjustments to costs of capital for specific projects would be accompanied by a reduction in the need for Ofcom to select from the upper end of the range in more general estimates.

Ofcom's approach

- 9.50 Based on the conclusions of the consultation, Ofcom proposes to analyse the case for the application of real options to individual wholesale products on a case-by-case basis, by means of more detailed dialogue with the relevant stakeholders.
- 9.51 As highlighted by a number of stakeholders, real options theory is only likely to be applicable to a fairly narrow set of circumstances, meaning that, based on the criteria established in this consultation, the onus will in most cases be on stakeholders to persuade Ofcom of the relevance of real options theory to particular wholesale products. Ofcom envisages that a more detailed assessment of, *inter alia*, the value to incumbents of waiting and seeing, and of any first mover advantage, would be undertaken in each case.
- 9.52 Ofcom would only envisage "taking the lead" in carrying out such an analysis in the case of very large investment projects that clearly involve an strong element of specific risk, such as BT's next generation access network.
- 9.53 Before using a real options approach to regulation, Ofcom would need to be fully persuaded of the extent of the applicability of the criteria it outlined in the first consultation, e.g. demand uncertainty, inability to pilot/trial, absence of first mover advantage, and, crucially, the genuine value associated with waiting and seeing, before concluding that wait and see options have a significant net value. Ofcom envisages that all stakeholders will be given an opportunity to comment on its approach in relation to specific regulatory decisions at the appropriate time.
- 9.54 Ofcom also wishes to note once again that any adjustments made would aim to reflect the increase in hurdle rate that would prevail in a competitive or contestable market – Ofcom would not want option value adjustments to deliver a reward for dominance. This means that, if and when Ofcom did accept submissions that option values should be taken into account, it would need to determine that the appropriate adjustment that was relevant in a competitive or contestable environment, and would be particularly interested in submissions from other stakeholders concerning the impact of competition.

Details of application of real options to regulation (Question 8)

- 9.55 In the first consultation, Ofcom asked stakeholders for their views on how the value of real options might be taken into account in practice in a regulatory context.

³⁶ Indeed, in the case of the numerical example above it is not a higher cost of capital, per se, that is required to compensate for the effect of the option to wait (total returns are £2m in the high state in both the no-option-to-wait equilibrium and in the option-to-wait equilibrium). Rather, it is the balance of returns over time that is affected – when there is an option to wait net returns per period are higher in the short term but lower in the long term.

- 9.56 Stakeholder responses to question 8 were more varied than response to question 7. The key comments made by stakeholders in relation to question can be divided into the following three groups:
- fixed line providers arguing that the practical difficulties associated with attempting to take the value of real options into account are so significant that any attempt to do so would not be appropriate. Comments of this type were made by NTL and the fixed line communications providers; and
 - suggestions (either detailed or at a high level) suggesting an actual model by means of which the value of weight and see options might be quantified. Comments of this type were made by Telewest and Analysis group; and
 - incumbents arguing that a range of practical methods (such as scenario analysis, or, in extreme cases, regulatory forbearance) should be used to ensure that the value of real options should be taken into account,
- 9.57 Ofcom does not agree that practical difficulties are a reason for not attempting to *understand* the relevance of real options. It does, however, agree that the problems associated with a detailed modelling exercise to quantify the value of real options would be prohibitive. Ofcom's view is therefore that, for the foreseeable future, it will not be appropriate for it to attempt to develop a model with which to value real options, such as the one developed by Robert Pindyck and included in the Analysis Group response. Some stakeholders have argued that a simple approach such as decision tree modelling might yield potentially powerful insights, a view that may be closer to the most appropriate means by which to take this analysis forward.
- 9.58 Ofcom's preferred option is to commit, as the need arises, to investigating the value of real options on a case-by-case basis, without setting out detailed proposals for implementation at this stage.

Cost-based versus benefits-based approaches

- 9.59 In the first consultation, Ofcom drew a distinction between the costs and risks incurred by regulated companies and the benefits that the availability of regulation products confers on competitors. This was highlighted in paragraph 6.38 of the first consultation: "The second of the two types of real option in the bullet points above relates to the benefits flowing to altnets and their consequent willingness to pay, rather than the incumbent's costs. Basing access prices on the benefits to altnets, rather than the costs of the incumbent, is an alternative approach that has some merits. Ofcom does not believe, however, that it is consistent with the promotion of competition".
- 9.60 Submissions from Pindyck, DotEcon, BT and the Analysis Group suggested either that, firstly, access prices should be set based on the benefits that the availability of cost-based access confers on competitors, or, secondly, that in certain circumstances the value of regulation to competitors might be exactly equal-and-opposite to the impact on incumbents.
- 9.61 Ofcom's view is that cost-based regulation promotes competition more effectively than would value-based regulation. Insofar as effects on entrants provide a means to calculate the effects on incumbents' costs, and from there to calculate the effects on investment decisions in a competitive environment, such effects may be useful inputs into a cost-based regulatory approach.

However, subject to upstream incumbents being able to recover their costs, Ofcom believes that it is appropriate for remaining rents to be exposed to competition in the downstream market. Provided that regulation is successful in delivering normal rates of return to incumbent investment decisions, there will be no biasing of incentives towards access-seeking.

Conclusion on real options

- 9.62 As outlined above, in their responses to the first consultation, stakeholders typically agreed with Ofcom's assessment of the circumstances under which real option theory will be applicable in the context of regulation. The extent to which these circumstances apply to various products in the industry is, however, a more subjective, and possibly controversial, area. is because of this that there currently seems to be no consensus amongst stakeholders regarding the way in which an appropriate mechanism for taking account of the value of real options might be identified.
- 9.63 Ofcom's proposed approach is therefore to encourage stakeholders to engage with Ofcom in order to discuss the value of real options in specific access pricing contexts.

Annex to Section 9 - an illustrative example regarding real options in a competitive environment

9.64 This example follows on from the summary outline at paragraph 9.36 above.

9.65 The example is based on a case where there are many firms, in a competitive environment, each considering supplying one unit per period of a product for which sales will continue forever. Firms face a choice between investing either at the start of today or the start of tomorrow. Investing means that a firm pays a fee (£1m) to buy a licence to sell the product. Firms cannot sell on their licences, so that the fee is sunk, and the investment expenditure is irreversible.

9.66 First consider a scenario in which there is no uncertainty. Any firm investing receives a constant net return (R) in every period. In a competitive market just a sufficient number of firms would invest such that the level of supply would push prices to a level that would give the marginal investing firm an NPV of zero from investing. In other words, net returns would be just sufficient to cover the sunk cost of entry, whilst delivering a normal rate of return (given by the cost of capital, assumed to be 10% in this example). Figure 9.1 below illustrates this first scenario, "Certainty over future returns".

Figure 9.1 An illustrative example - I

Scenario		Net returns, today	Net returns, tomorrow onwards
Certainty over future returns	Returns	R	$R / 0.1^{37}$
	NPV	11R - £1m	
No firm has an option to wait	High	X_H	$X_H / 0.1 = 10X_H$
	Low	0	0
	Expected as of today	$0.5X_H$	$0.5(10X_H) = 5X_H$
	NPV	$5.5X_H - £1m$	
One firm can wait and see, and invests tomorrow only if demand high	High	-	$10X_H$
	Low	-	-
	Expected as of today	-	$5X_H$
	Expected return from waiting (discounted value at start of today)	$0.5(10X_H - £1m / 1.1)$	

Notes:

Investors are assumed risk-neutral;

The discount rate is 10% = 0.1;

The probability of high demand is assumed to be 50% = 0.5;

Net returns are net of production costs; and

The (sunk) investment cost is £1m.

9.67 In competitive equilibrium this suggests that R must be £0.09m³⁸ per period, receiving a constant payment of £0.09m per period, starting from today, is financially equivalent to receiving £1m today given an interest rate of 10% p.a.

³⁷ $R / 0.1$ is the value of the series of returns: $R / (1 + 0.1) + R / (1.1)^2 + R / (1.1)^3 + \dots$

- 9.68 In the “certainty” scenario, firms are indifferent between investing today and investing tomorrow i.e. there is no real option value. This is because firms have no incentive to wait to invest, since waiting until tomorrow to purchase a licence just means missing one day of sales, but also delaying the payment of the £1m investment cost.
- 9.69 The second and third scenarios in Figure 9.1 consider situations in which there is uncertainty over how much demand there will be. Demand could be “high” or “low”, with probability $p (=0.5)$ in each case. For simplicity, “low” demand means zero demand in this example.
- 9.70 Assume that firms find out today how much demand there will be in each period for the rest of time (and therefore what the net returns each period will be in the high demand scenario, denoted X_H). Importantly they do not know this at the start of today.
- 9.71 Since there is uncertainty firms have to make their decisions on the basis of expected outcomes. If there were no option to wait i.e. if today were the only day on which a licence could be bought, then (as in the certainty case) firms would purchase licences if the net present value of the expected stream of profits from the investment were zero. This is the second scenario in Figure 9.1 “No firm has an option to wait”.
- 9.72 In competitive equilibrium, exactly a sufficient number of firms would purchase licences such that, given the supply of product from those firms, the expected NPV of the marginal investing firm would be zero. In Figure 9.1 this means supply is sufficient that prices deliver returns net of production costs of $X_H = £0.18m^{39}$ per unit. If demand turned out to be low, then on average firms with licences would make losses (or less-than-normal profits), while if demand turned out high, then on average firms with licences would make (greater-than-normal) profits. But expected profits, at the time of the investment decision (i.e. at the start of today), would be just normal profits for a competitive industry⁴⁰.
- 9.73 Now consider the third scenario, titled, “One firm can wait and see, and invests tomorrow only if demand is high”. Suppose that there is just one firm with a genuine option to wait (e.g. only one firm could buy a licence tomorrow), and that once all other firms have made their investment decisions the NPV to this firm from investing today (given the prices that are implied by the supply from all other firms) is £0. Alternatively, it could be imagined that this firm, with the option to wait, is a regulated monopoly, with the regulator having set prices

³⁸ $11R - £1m = 0 \Rightarrow R \Rightarrow £0.09m$

³⁹ $5.5X_H - £1m = £0 \Rightarrow X_H \approx £0.18m$. To understand this another way, note that $£0.18m + £0.18m/1.1 + £0.18m/1.1^2 + \dots \approx £2m$. A 50% chance of getting £2m is worth £1m, so £0.18m is the annual net return when demand is “high” that is just enough to be worth paying £1m to have a 50% chance of getting it.) When there is one firm that can wait, since $X_H \approx £0.18m$,

⁴⁰ Note that the net returns of £0.18m per unit in the high demand state for this case (the case of uncertainty) are higher than the competitive prices in the certainty case (£0.09m). This is necessary in order that firms invest at all. If, when they took a risk and were fortunate, they received only the same returns as would prevail under competition if success were certain (“normal” returns), firms and investors would not receive a “fair reward” for risk. The “fair bet” price, delivering returns of £0.18m per unit, allows them to make higher-than-certainty returns in high demand cases so as to compensate them for losses (or below-normal profits) in low-demand cases.

constant in each period (i.e. at $X_H = £0.18m$ above production costs), at a level at which the NPV from investing today is £0.

- 9.74 Should such a firm invest today? The answer is no: waiting leads to greater-than-normal profits if demand is high whilst avoiding the losses if demand is low. So the expected profits from waiting are strictly higher than those from investing today. There is an expected return from investing today of £0, while investing later delivers $0.5(10X_H - £1m / 1.1) \approx £0.45m > £0$. The option to wait leaves such a firm with above-normal expected profits.
- 9.75 Next consider Table 9.2. In a competitive scenario, if all firms had an option to wait, then some would choose to wait. Because some firms wait before investing, today's supply will be lower and hence today's prices (delivering net returns of Y_H) higher than in the absence of options to wait. Higher prices today make investing early more attractive, so while some firms wait, others invest. To understand the point being made, note that if no firms chose to wait, then any one firm waiting would be in the position of the firm in third scenario in Figure 9.1 i.e. waiting would be better than investing for this firm.
- 9.76 However, if demand turns out to be high, sufficient firms will enter tomorrow to compete down prices (delivering net returns of Z_H per period from tomorrow onwards) at a level that will eliminate later excess profits. They invest under conditions of certainty, so the prices in later periods of high demand are the same as those in the certainty scenario (therefore $Z_H = £0.09m$)⁴¹. Just sufficient firms will wait that today's supply will be low enough (and so the prices paid to early investors today high enough) to make waiting and not waiting equally attractive – so some firms invest early and others will wait. This means that in equilibrium, under the competitive conditions in this example, the real option value of waiting is zero.
- 9.77 However, the option to wait, whilst not affecting the total return of firms, has had an effect on the path of prices – relative to a counterfactual under which there had been no option to wait, they are higher in the short-term than if there had been no option to wait, but lower in positive long-term futures. In the example in Figure 9.2, short-term prices (over and above production costs) rise from the £0.18m per unit of Table 9.1 to £1.09m per unit in the short-term, but fall to £0.09m per unit in the longer-term if demand is high.

Figure 9.2 An illustrative example - II

⁴¹ Of course, if demand turns out to be low, firms investing early will still be unable to recover their license fee payments and so will lose £1m. Firms that wait will not enter if demand turns out low.

Scenario		Net returns, today	Net returns, tomorrow onwards
Many firms can wait – returns to those investing today	High	Y_H	$Z_H / 0.1 = 10Z_H$
	Low	0	-
	Expected as of today	$0.5Y_H$	$0.5(10Z_H) = 5Z_H$
	Expected return from investing today (discounted value at start of today)	$0.5Y_H + 5Z_H - £1m$	
Many firms can wait – returns to those investing tomorrow if demand high	High	-	$10Z_H$
	Low	-	-
	Expected as of today	-	$5Z_H$
	Expected return from waiting (discounted value at start of today)	$0.5(10Z_H - £1m / 1.1)$	

Notes

In competitive equilibrium when all firms have an option to wait,

$$0.5Y_H + 5Z_H - £1m = £0 = 0.5(10Z_H - £1m / 1.1)$$

$$\Rightarrow Y_H \approx £1.09m > X_H \approx £0.18m \text{ and } Z_H \approx £0.09m < X_H \approx £0.18m$$

(Note that $£1.09m + £0.09m/1.1 + £0.09m/1.12 + \dots = £2m$. So once again it is worth £1m to have a 50% chance of getting the stream of payments when demand is "high".)

9.78 The implication of this is that, under uncertainty, short-term prices are high enough for the successful outcomes to be sufficiently profitable for them to compensate the early investor for the unsuccessful outcomes, whilst investors that wait until uncertainty is resolved still make only normal profits – prices fall as uncertainty is eliminated (even when, as is assumed in this example investors are risk-neutral)⁴².

9.79 If the purchase of the licence were not irreversible (e.g. if it could be sold back to the licensing authority for £1m) then even if there were an option to wait, firms would invest up to the point at which the marginal investor had an NPV of zero. In this scenario, if demand turned out to be low some investors would "exit" by selling back their licences.

9.80 There are four points of interest that are emphasized in this example, namely:

- when market conditions are such that both early and late investment occur, under competitive conditions there may be no option value of waiting arising from market-wide uncertainty. (option value adjustments are not about delivering extra returns to some market players.);
- real options can, however, affect the path of prices under competition;
- a regulator seeking to mimic the price path when there is an option to wait would permit prices in the short-term that were higher than permitted if there is no option to wait; and

⁴² Note that in this case the "fair bet" requirement (higher-than-"normal" returns in high demand cases to compensate for lower-than-"normal" returns in low demand cases) is still achieved, but this time is done via front-loading of the higher returns.

- a regulator seeking to mimic the price path when there is an option to wait would permit prices in the long-term that were lower, in favourable circumstances from the firm's point of view, than permitted if there is no option to wait.

Annex 1

Previous consultation questions

Question 1: Do you agree that 2% to 5% represents a reasonable range of values for the ERP? Within this range, do you agree that Ofcom should revise its central estimate downwards from 5% to 4.0% or 4.5%? Which of these is the most appropriate?

Question 2: Do respondents think that if projects with different risk profiles are to be rewarded differently, this should be through the cost of capital or the cash flows or should it depend on the types of risks involved? How would such extra (or reduced) rewards be treated in future financial analysis (e.g. at future charge control reviews)?

Question 3: Do respondents think that projects or business units with different systematic risks should be rewarded differently? If so, is it possible to establish a robust methodology by means of which the systematic risk of these projects could be assessed and the adjustment to the reward determined?

Question 4: Do respondents agree that it is appropriate for Ofcom to disaggregate its estimate of BT's equity beta, and in particular to estimate a distinct equity beta for BT's copper access network?

Question 5: Do respondents agree with Ofcom's approach to assessing possible values for the equity beta of BT's copper access network, and its suggested range of values?

Question 6: Do respondents agree that initial appraisals of projects with high specific risk tend to underestimate the true expected costs of the project? If so, how should the true expected cost of the project be assessed and any adjustment to the required reward determined.

Question 7: Do respondents agree with Ofcom's suggested assessment of the likely circumstances under which real option theory will be applicable in the context of regulation?

Question 8: Do respondents have any views on how the value of real options might be taken into account in practice in a regulatory context?

Question 9 – Do stakeholders agree that Ofcom should revise its central estimate of BT's equity beta downwards from 1.3 to 1.0, 1.1, or 1.2? Which of these figures is the most appropriate?

Question 10: What is the view of respondents of the standard of evidence used by Ofcom in this second consultation, when added to that outlined in the first consultation?

Question 11: Based on the available evidence, what do respondents think would be an appropriate level of disaggregation for the equity beta of BT's copper access network? Which of the following levels would be most appropriate: (a) 0.3 points below the group average; (b) 0.2 points below the group average; (c) 0.1 points below the group average; (d) 0 points below the group average?

Question 12: What is the view of respondents on Ofcom's proposed estimates of the WACC for BT's copper access business and the rest of BT?

Annex 2

Glossary

This document contains a number of terms that may be unfamiliar to non-specialists. In most cases, a short definition is provided at the first instance of each term within the main body of the document, but for reference purposes a short glossary of specialist terms is provided below.

Asset beta: A company's asset beta reflects the operational risk associated with a firm's underlying assets. Unlike a firm's equity beta, it does not take account of financial leverage. Asset betas are genuinely unobservable, and have to be calculated by taking an equity beta estimate for a particular company and adjusting for its gearing.

Bayesian adjustment: When equity betas are calculated based on historic data, estimates are subject to a degree of error, since regressions will be based on a limited number of observations. A Bayesian adjustment attempts to offset this inherent problem by weighting betas towards an estimate of 1, i.e. in the absence of a fully reliable estimate, assuming that the company faces the same amount of systematic risk as the average firm in the market.

Capital Asset Pricing Model (CAPM): The CAPM is a model that is widely used to estimate the level of systematic risk faced by a company. It models systematic risk as a function of the correlation between the returns to the firm and the returns to the stock market. Although it remains the most widely used of the asset pricing models, empirical tests of the CAPM carried out in recent years have in some cases called its robustness into question.

Cost of capital: See WACC.

Debt Premium: A company's debt premium measures the company specific risk premium for corporate debt above the risk free rate.

Dimson adjustment: Equity beta estimates are typically calculated by regressing a company's past returns against those of the market in order to measure the historical covariance between two. When high frequency (e.g. daily) historical data is used, regression analysis may be distorted by various factors, including the institutional micro-structures of high frequency stock trading. A Dimson adjustment is an adjustment procedure that can be used to mitigate such distortions.

Diversification: Diversification is the means by which investors can reduce the level of risk that they are exposed to by distributing investment assets among a variety of different securities.

Equity beta: Under the CAPM, a company's equity beta reflects the systematic risk that it faces relative to the average company in the market as a whole. Equity betas reflect the uncertainty faced by equity investors due to the effects of both operational risk and financial leverage, i.e. commitments to make fixed payments to the company's debtholders.

Equity Risk Premium (ERP): The ERP is a parameter that, under the CAPM, reflects the extra return that investors require in return for investing in equities rather than a risk free asset. It is a market, rather than company-specific, factor.

Gearing: The gearing level of an investment reflects the proportion of its total financing that is made up by debt, rather than equity.

Real options: A “real option” is the term given to a possibility to modify a project at a future point. The first consultation included a detailed discussion of the option for a firm that faces significant demand uncertainty to “wait and see” how the demand or technology for a new product will evolve before making an investment.

Risk free rate: The risk free rate is the expected rate of return on a risk free investment.

Specific risk: Risk that is specific to a given company or project, and that can be diversified away by an investor holding a balanced portfolio of stocks.

Systematic risk: Risk that which cannot be diversified away by investors, e.g. the risk associated with fluctuations in GDP growth (such as a recession or boom), oil prices, and interest rates.

Weighted Average Cost of Capital (WACC): A company's WACC measures the rate of return that a firm needs to earn in order to reward its investors. It is an average representing the expected return on all of its securities, including both equity and debt.

Yield Curve: Risk free rates vary with maturity (e.g. the annual return on a 10-year government bond might be higher than the annual return on a 5-year government bond, because of the extra uncertainty associated with years 6 to 10, which are further in the future. A yield curve is a plotted graph that shows the relationship between yield and maturity. If a yield curve slopes upwards (downwards), this means that the return associated with longer-term debt is greater (less) than that associated with shorter-term debt.