



**Critical Review of Ofgem's Consultation
Document on Mergers in the Electricity
Distribution Sector**

**Report by Europe Economics
for the Electricity Association**

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
1 INTRODUCTION	4
Issues Raised by Distribution Mergers	4
Overview of Ofgem's Document	4
Scope and Structure of this Paper	5
2 PRINCIPLES AND PRECEDENTS	6
Detriments and Benefits.....	6
Potential Remedies.....	7
Merger Control in the Water Sector	7
Previous Electricity Distribution Mergers	9
3 CRITICAL REVIEW OF OFGEM'S DOCUMENT	11
The Impact of Comparative Analysis on Prices	11
Quantification of the Detriment of a Merger.....	12
Benefits of Distribution Mergers	14
Can Detriments be Mitigated or Offset by Benefits?	15
Compensation for a Reduction in the Number of Comparators.....	15
4 DEVELOPING A ROBUST FRAMEWORK	17
APPENDIX 1: ECONOMIC PRINCIPLES	18
Economic Basis for Merger Control	18
The Scope for Market Competition in Electricity Distribution	19
The Role of Comparative Analysis.....	20
Potential Detriments of Distribution Mergers	22
Potential Benefits of Distribution Mergers.....	23
Balancing Detriments with Benefits and Remedies	24
The Role of Price Control Adjustments.....	25
APPENDIX 2: COMPARATIVE ANALYSIS METHODOLOGIES	27
Ofwat (1999).....	27
Ofgem (1999)	28
DTe (2000)	29
APPENDIX 3: IMPACT OF THE LOSS OF A COMPARATOR	30
Ordinary Least Squares Regression	30
Corrected Ordinary Least Squares Regression	30
Data Envelopment Analysis.....	31
Stochastic Frontier Analysis	32



EXECUTIVE SUMMARY

- 1 This paper provides an independent review of Ofgem's November 2001 consultation document on mergers between electricity distribution companies.¹ It was produced for the Electricity Association by Europe Economics, an independent economics consultancy specialising in economic regulation, competition policy and the application of economics to public policy and business issues.
- 2 The objective of this paper is to assess Ofgem's document and approach against the economic principles that ought to underpin the assessment of distribution mergers, and the precedents set by regulatory bodies, including the Competition Commission.

Potential benefits and detriments of distribution mergers

- 3 Mergers of electricity distribution companies are generally undertaken with a view to achieving cost savings through economies of scale and scope and the elimination of duplication between the merging enterprises. These benefits are effectively shared between investors and customers through the operation of the price control regime, and under Ofgem's methodology for past distribution mergers, the benefits to customers would amount to a total present value at least of the order of £200 million.
- 4 Mergers are also the main manifestation of competition in the market for corporate control. They provide a route for more efficient management teams to take control of a greater proportion of the industry, improving overall efficiency. The threat of mergers also contributes to efficiency incentives for the management of all companies.
- 5 Against these benefits, there may be detriments arising from the reduction of the number of independent management teams in the industry. The paper puts forward the following categorisation of potential detriments:
 - lessening of competition in the market for corporate control;
 - reduction in comparative information available for corporate governance; and
 - reduction in comparative information available for economic regulation.
- 6 A robust approach to the assessment of a distribution merger would need to consider the balance between the potential benefits and detriments of the transaction, and to assess whether remedies can be imposed to reduce the impact of any detriments that may arise.

Shortcomings of Ofgem's approach

- 7 This paper identifies a number of significant shortcomings in Ofgem's approach, both in terms of the principles that appear to have driven Ofgem's analysis, and in terms of the

¹ Ofgem, *Mergers in the electricity distribution sector: consultation document*, November 2001.



- detailed methodology outlined by Ofgem to estimate the potential detriment associated with the loss of a comparator.
- 8 Without greater clarity in the methodology to be used at future periodic reviews, it is not possible to assess the impact of the loss of a comparator on the regulatory regime. Ofgem's comparative analysis methodology for the 1999 review was defective and cannot form the basis for a robust methodology for future reviews. Ofgem needs to set out the way in which it proposes to use comparative information in the future before it can assess the extent to which the value of that information would be reduced by a merger.
 - 9 Ofgem does not appear to take account of the fact that the continued legal separation and financial ring-fencing of distribution companies under common ownership would reduce the extent of any detriments. Separation ensures that the de-merger option remains open as a form of competition in corporate control, thus reducing the impact of any detriments from a merger. Furthermore, no information is actually lost as a result of a merger, and data remain available for comparisons to be made at the level of licensed entities. Any reduction in the value of this information arising from the loss of an independent management team would therefore be less than that of an outright loss of comparator.
 - 10 Ofgem's analysis appears to disregard the benefits to customers of distribution mergers. In previous mergers, customers have benefited from merger cost savings after an initial five-year period, which amounts to a benefit with a present value at least of the order of £200 million, far in excess of Ofgem's estimate of the detriment of a merger. Furthermore, customers benefit from the greater efficiency of management promoted by competition in the market for corporate control, for which mergers are an essential mechanism. These benefits need to be set against any detriments in assessing the impact of a distribution merger.
 - 11 Ofgem's approach to the quantification of the potential detriment arising from the loss of a comparator is not a robust one. Differences between efficiency projections for electricity distribution, National Grid and Transco may be due to a range of factors other than the availability of comparative information, and the consideration of operating expenditure in isolation from capital costs and quality of service cannot provide information on total efficiency. Ofgem's assumption that any benefits of comparative analysis can be attributed equally to all comparators is also unsubstantiated, since differences in the value of a comparator would be expected to result from both the quality of the comparator being lost, and from the number of comparators left in the industry.
 - 12 Ofgem has not provided a satisfactory analysis of the remedies that might be appropriate, even if detriments could be identified from a distribution merger. It is not clear from Ofgem's paper whether Ofgem proposes that the compensation that it estimates at £30 million would be paid to customers on top of the substantial long-term reduction in charges resulting from the sharing of merger savings, and if so how any risk of double-counting would be prevented. In any event, Ofgem does not explain how compensation would be a remedy for any public interest detriments arising from the loss of a comparator.



Possible way forward

- 13 Given these shortcomings, it is not clear how Ofgem's approach could form the basis of a robust framework for the analysis of the benefits and detriments of a merger of electricity distribution companies.
- 14 Instead, this paper suggests that a more fundamental review of the potential benefits and detriments of distribution mergers, and of the remedies that may counter any detriments, should be developed before attempts are made at quantifying any detriments arising from the loss of a comparator. Such quantification would in any event be dependent upon a clear specification of the role of comparisons in the regulatory framework, and in particular the comparative analysis methodology to be used at future periodic reviews.



1 INTRODUCTION

Issues Raised by Distribution Mergers

- 1.1 The 14 electricity distribution licensees in Great Britain can be considered to be monopoly providers of electricity distribution services in their respective areas. Whilst the appropriate market definition (e.g. whether there is substitutability between electricity and other energy sources) and the importance of barriers to entry may be debatable, it is reasonable to consider that the provision of a connection to the “public” electricity network constitutes a separate relevant market for each connected customer, and that the local electricity distribution company holds a totally dominant position in that market. Thus, a merger of electricity distribution companies is unlikely to lessen competition in markets for the provision of electricity distribution services.
- 1.2 Merger control under the Fair Trading Act 1973 in the electricity distribution sectors will therefore focus on other aspects of the public interest. This might be presumed to encompass Ofgem’s duties under the Electricity Act 1989 (as amended by the Utilities Act 2000), and Ofgem’s ability to perform these duties effectively.
- 1.3 For mergers in the water sector, the Water Industry Act 1991 (as amended by the Competition and Service (Utilities) Act 1992) requires account to be taken of the ability of the regulator to make comparisons between companies. By contrast, there is no specific statutory guidance on the public interest with respect to electricity distribution mergers.
- 1.4 For mergers that have a Community dimension, as defined by the EC merger regulation, the European Commission has prime responsibility for assessing the impact of the transaction. It uses a competition test rather than a public interest test. However, the merger can be referred to the competition authorities of a member state if specific markets within that state would be affected. Furthermore, a member state can take appropriate measures to protect legitimate interests other than those taken into consideration by the EC merger regulation, and it might therefore be possible for remedies (under the Electricity Act) to be considered in connection with a merger that has a Community dimension.

Overview of Ofgem’s Document

- 1.5 The stated purpose of Ofgem’s paper is to “develop a clear and predictable framework for dealing with [distribution mergers] as a means of helping distribution companies plan for the future”.
- 1.6 Ofgem argues that mergers reduce the scope for comparative analysis to inform regulation, and should only be allowed if they generate customer benefits that would outweigh that detriment.
- 1.7 Ofgem recognises that estimating the value of the detriment can be difficult. However, it sets out a possible approach. This is in contrast to its view that “it is not possible to quantify the benefit associated with the threat of take-over” (paragraph 2.16).



- 1.8 Ofgem's proposed approach appears to rely mainly on the observation that recent Ofgem price control determinations have assumed reductions in controllable operating costs of 3 per cent a year for stand alone businesses (National Grid 2000 and the Transco 2001), and 4.3 per cent for the regional distribution companies in 1999.
- 1.9 Ofgem attributes the difference between these assumptions to the scope for comparative analysis, and calculates a corresponding 20-year present value of £350 million for what it sees as the value to consumers of comparative analysis. On that basis, Ofgem puts forward a figure of £30 million as a possibly adequate level of compensation for one merger (paragraph 1.2 of Ofgem's Appendix 1).
- 1.10 Ofgem's paper does not explain whether Ofgem proposes that this "compensation" would give rise to a one-off payment to customers, and whether it would be additional to the sustained price reduction of £12.5 million a year (between a pair of merging companies) that Ofgem has used for previous mergers as a way of transferring estimated merger benefits to customers after a five-year lag. The interaction with Ofgem's possible assumption that merged companies would be at the efficiency frontier when setting future expenditure allowances is also unclear.

Scope and Structure of this Paper

- 1.11 This paper focuses on specific factors arising from mergers of (at least two) electricity distribution companies. It does not consider issues that would be associated with all mergers that involve electricity distribution companies with other companies, for example financial ring-fencing. It also does not include an analysis of the impact of distribution mergers on markets outside electricity distribution, such as contracting, metering or the provision of connections, for which the ordinary competition test appears to provide a suitable basis for merger control.
- 1.12 The paper is organised as follows. Section 2 summarises the economic principles that ought to underpin the assessment of distribution mergers, and provides an overview of recent precedents from both the water and electricity distribution sectors. Section 3 is a detailed review of Ofgem's consultation document. Section 4 concludes the paper by outlining how a robust framework for the assessment of distribution mergers might be developed.
- 1.13 The paper also comprises three appendices. Appendix 1 provides an analysis of the economic principles that ought to underpin the assessment of distribution mergers. Appendix 2 summarises comparative analysis methodologies recently used by economic regulators in order to support a periodic review, and Appendix 3 outlines the potential impact of the loss of a comparator on these techniques.



2 PRINCIPLES AND PRECEDENTS

2.1 This section summarises the economic principles that ought to underpin the assessment of distribution mergers, based on the detailed analysis in Appendix 1, and reviews the treatment of recent mergers in the water and electricity distribution sectors.

Detriments and Benefits

2.2 Merger control regimes generally seek to protect competition, by prohibiting mergers that would lessen competition and that do not provide sufficient efficiency benefits (or sufficient sharing of these benefits with consumers) to outweigh the public interest detriment of a reduction in competition, or by allowing mergers subject to remedies designed to reduce any public interest detriments whilst allowing the benefits to be gained.

2.3 In the electricity distribution sector, it is reasonable to assume that there is no product market competition. The analysis in Appendix 1 indicates that the three main potential detriments of a distribution mergers would be:

- lessening of competition in the market for corporate control;
- reduction in comparative information available for corporate governance; and
- reduction in comparative information available for economic regulation.

2.4 In the case of the market for corporate control, further analysis would be required in order to delineate the relevant markets (e.g. do foreign management teams compete with British ones?) and identify any barriers to entry (e.g. could a financial institution make a competitive bid for an electricity distribution business?). However, even if competition were thought to be limited to GB electricity distribution companies, it seems that no more than a handful of competitors would be required to ensure effective competition.

2.5 With respect to the use of comparative information, a loss of a comparator may be considered more likely to give rise to a detriment. However, the assessment of any such detriment would need to take account of the fact that physical data reported at the licensed entity level could still be used for comparisons; and that the loss of an outlying comparator could reduce the statistical noise present in comparisons.

2.6 The potential benefits of distribution mergers are substantial. Cost savings as a direct result of the removal of duplication following a merger are assessed by Ofgem at no less than £12.5 million a year, and these savings are expected to be passed through to customers after an initial period of five years for which they are retained by the company.

2.7 Furthermore, mergers are the main expression of the market for corporate control. They enable potentially more efficient management teams to increase the proportion of the industry that they control, and the threat of future mergers provides additional performance incentives for incumbent management.



Potential Remedies

- 2.8 To the extent that any detriment is identified, continued legal separation and ring-fencing of the merging companies along the lines already implemented in electricity distribution provides a remedy that reduces the detriment. Ring-fencing can ensure that the de-merger option remains open, which protects competition in the market for corporate control. It also protects the integrity of physical data and audited accounting data for the licensed entities, thus ensuring that it retains some of its value for comparative analysis.
- 2.9 The economic analysis does not justify the imposition of a “compensatory” price cut on merging companies as a remedy for any detriment arising from the loss of a comparator. In the event that loss of a comparator is not outweighed by the benefits of the merger, the appropriate remedy would in fact be prohibition of the merger, or, should this not be available, complete operational and managerial separation of the merging entities so as to protect the comparator.
- 2.10 The analysis also identifies a risk that differences in treatment in future price controls between merger cost savings and other deviations from expenditure allowances may lead to distortions in the incentives faced by companies’ management, and highlights the importance of consistency between the treatment of merger savings and the setting of expenditure allowances, which might implicitly include expected merger savings if they are based on evidence from other companies and industries where mergers have taken place.

Merger Control in the Water Sector

- 2.11 Out of four proposed mergers of water companies referred to the Monopolies and Mergers Commission (MMC) since 1994, three were blocked outright as a result of the Monopolies and Mergers Commission’s reports. One merger was found to be against the public interest, but prime jurisdiction in that case rested with the European Commission and the merger eventually took place subject to remedies, including significant price reductions.
- 2.12 The arguments used in all four cases were quite similar. In particular, Ofwat argued that the detriments of a merger on the comparative information available for regulation would be significant, and that the benefits of comparisons were large but difficult to quantify. Some of the incumbent management teams (resisting the proposed merger, which was in all four cases a hostile take-over attempt) proposed a quantification of the impact of the loss of a comparator on the level of prices set by the regulator.
- 2.13 In all four cases, the MMC found that there would be a public interest detriment from the loss of comparative information available to the regulator. Its assessment of the potential benefits of the merger focused on the scope for the merged company to become a



leading comparator, which it thought would constitute an adequate remedy for the loss of a comparator. The Lyonnaise/Northumbrian merger was allowed on these grounds.²

- 2.14 In earlier cases, for example Three Valleys,³ the MMC had also accepted that the direct efficiency benefits of a merger could outweigh the loss of comparative information.
- 2.15 Where the MMC considered that substantial cost reductions were not achievable, so that the merged company would not be likely to be a leading comparator, and potential efficiency benefits would not outweigh the detriment of the merger, then the merger was prohibited.⁴ No remedies were found that would outweigh the detriment in these cases. For example, in the Mid Kent case the MMC argued that “large price reductions would not be sustainable in terms of long-term cost reductions and were therefore an inappropriate remedy”.⁵
- 2.16 For the mergers which were not prohibited (and hence resulted in loss of comparators), the MMC required the full integration of the merging companies under a single licence, the re-opening of the price control, and significant price reductions for the merged company.
- 2.17 However, this remedy was motivated by a wish to guarantee the delivery of the projected efficiency benefits that were considered necessary to outweigh the detriments of the merger, rather than as a form of compensation for customers. For example, in the Northumbrian case, the MMC argued that a price reduction would “compel [the merged company] to move to the forefront of efficiency in the industry”.⁶ Given that Lyonnaise had sought clearance for a take-over of Northumbrian before deciding whether to bid and at what price, it could be argued that the MMC recommended the price cut as a selection mechanism to ensure that Lyonnaise would only proceed with the merger if it was confident of its ability to achieve significant efficiency improvements, thereby becoming a leading comparator and remedying the detriment that loss of a comparator would otherwise have caused.
- 2.18 Ofwat’s approach to small water mergers (which are not automatically referred to the Competition Commission) has evolved in a manner similar to that of the MMC, i.e. allowing mergers with significant efficiency benefits and/or likely to create a strong comparator, but subject to the immediate claw-back of estimated merger benefits through adjustments to the price control for the merged entity.

² Monopolies and Mergers Commission, *Lyonnaise des Eaux SA and Northumbrian Water Group PLC*, July 1995.

³ Monopolies and Mergers Commission, *General Utilities PLC, The Colne Valley Water Company and Rickmansworth Water Company*, April 1990.

⁴ Monopolies and Mergers Commission, *Wessex Water PLC and South West Water PLC*, October 1996.

Monopolies and Mergers Commission, *Severn Trent PLC and South West Water PLC*, October 1996.

Monopolies and Mergers Commission, *Mid Kent Holdings PLC and General Utilities PLC and SAUR Water Services PLC*, January 1997.

⁵ Monopolies and Mergers Commission, *Mid Kent Holdings PLC and General Utilities PLC and SAUR Water Services PLC*, January 1997, paragraph 1.21.

⁶ Monopolies and Mergers Commission, *Lyonnaise des Eaux SA and Northumbrian Water Group PLC*, July 1995, paragraph 2.75.



- 2.19 Thus, the treatment of merger efficiency savings in the water sector is significantly different from the approach adopted to date by Ofgem, which has allowed merging electricity distribution companies to retain these benefits for five years. It could be argued that Ofwat's approach deters companies from seeking the best way of optimising their efficiency by treating merger benefits differently from any other efficiency savings.

Previous Electricity Distribution Mergers

- 2.20 Ofgem has allowed electricity distribution mergers without an immediate adjustment to prices. In contrast to water, merging companies have retained separate legal personality and licences.
- 2.21 In the cases of ScottishPower and Scottish and Southern Energy, cost savings estimated at approximately £12.5 million for a pair of companies under common ownership were passed through to customers with a five-year lag, as part of the 1999 periodic review.⁷
- 2.22 Ofgem noted in the 1999 final conclusions that there could be detriments arising out of distribution mergers as a result of the loss of comparators, and stated that "it is likely that Ofgem, subject to any special circumstances, will wish to recommend that the next proposed merger of PES distribution businesses should be referred to the Competition Commission for detailed consideration of the public interest issues involved".⁸
- 2.23 However, no referral to the Competition Commission was made in more recent cases of distribution business combinations, namely the 24seven operating joint venture between London Power Networks and TXU Europe Distribution, WPD's ownership of networks in the South West and South Wales, and the merger of Northern Electric Distribution and Yorkshire Electricity Distribution.
- 2.24 Ofgem's stated approach to these cases was that it would review the efficiency savings which have been delivered on the fifth anniversary of the venture or merger, with a view to applying a minimum rebate from these gains to customers of £12.5 million a year, and that it would expect distribution companies involved in mergers to be at the frontier on cost and quality of service at the time of the next price control review.
- 2.25 Ofgem's policy was justified as follows:

"Finally, Ofgem concluded that there should not be an additional customer rebate for the loss of a comparator. Even though the MMC water judgements both implied support for compensation for loss of comparator, the benefits of the merger, and their impact on the market as a whole have to be set against the deemed loss. Each case must be considered on its merits. In general, Ofgem believes best value for customers is to allow incentives to operate freely and not

⁷ The figure used in the 1999 final proposals was "of the order of £12 million". See Ofgem, *Reviews of Public Electricity Suppliers 1998 to 2000: Distribution Price Control Review: Final Proposals*, December 1999, paragraph 6.40.

⁸ Ofgem, *Reviews of Public Electricity Suppliers 1998 to 2000: Distribution Price Control Review: Final Proposals*, December 1999, paragraph 6.43.



to impose a levy on potential efficiency. Nonetheless, Ofgem would expect combining distribution businesses to be at the frontier on both cost and quality of service.”⁹

- 2.26 The same approach was most recently confirmed by Ofgem in August 2001 in a brief consultation document regarding the merger of Northern Electric Distribution and Yorkshire Electricity Distribution, although views were invited on “whether sufficient comparators will be maintained”.¹⁰

⁹ Ofgem, *The Proposed Takeover of Hyder Plc by Western Power Distribution Limited: A Joint Consultation Paper by the Directors General of Ofwat and Ofgem: Part Four*, June 2000, paragraph 71.

¹⁰ Ofgem, *Northern Electric plc's proposed acquisition of Innogy Holdings plc's Yorkshire electricity distribution business: A consultation paper*, August 2001, paragraph 5.3.



3 CRITICAL REVIEW OF OFGEM'S DOCUMENT

The Impact of Comparative Analysis on Prices

- 3.1 Ofgem's document focuses on the impact of the comparative information available at the time of the periodic review on the level of prices. Thus, it is appropriate to examine the way in which Ofgem might be expected to use such techniques in future reviews, and the extent to which Ofgem's claims that comparative analysis permits lower prices can be sustained.

Comparison methodology for future reviews

- 3.2 The impact of a merger on the regulatory regime can only be quantified on the basis of a clearly understood methodology for using comparative information as part of future price control reviews. The absence of such a clear methodology makes it impossible to assess the validity of Ofgem's approach.
- 3.3 Appendix 2 summarises the methodologies used by Ofgem, Ofwat and the Dutch electricity regulator DTe in their most recent price reviews and highlights some of their main potential shortcomings.

Consistency between opex, capex and quality

- 3.4 An important consideration for the future use of comparative analysis will be the consistency of treatment between operating expenditure, capital expenditure and quality of service.
- 3.5 In particular, reliance on separate comparative analyses for operating and capital expenditures might well lead to the determination of an operating expenditure "frontier" that is only consistent with high levels of capital expenditure, whilst the capital expenditure "frontier" can only be reached through high operating expenditure.
- 3.6 The use of a methodology that suffers from such a fundamental shortcoming would be expected to remove much of the benefits that can arise from properly-implemented comparative analysis. Thus, if a similar methodology were to be used at future reviews, then it is questionable whether any benefits would actually be derived from the use of comparative analysis, and therefore whether a reduction in the number of comparators could cause any detriment.
- 3.7 Similarly, the use of comparative analyses of expenditure without regard to differences in quality of service would reduce the potential benefits of comparative analysis, and therefore lead to a lower valuation of any detriment arising from the loss of a comparator.
- 3.8 The focus on operating expenditure in Ofgem's methodology for valuing the loss of a competitor could also lead to a systematic bias. It is possible that Ofgem's regulation of National Grid and Transco induces different distortions between capital and operating expenditures than its regime for electricity distribution. If this is the case, and in particular



if the use of comparative analysis on distribution companies encourages capital expenditure as a way of “scoring highly” in comparative analysis of operating expenditure, then the difference between projected rate of operating expenditure reductions between electricity distribution and National Grid/Transco may be explained, at least in part, by different levels of asset quality and capital expenditure.

- 3.9 Ofgem's analysis of possible causes of differences in the expected rates of expenditure reductions between National Grid, Transco and electricity distribution (paragraphs 2.9-2.11) cannot be considered to be comprehensive or robust. No evidence is given to support the claim that “these factors do not appear to apply to electricity distribution companies” (paragraph 2.10), and the analysis of the impact of capital expenditure is sketchy in the extreme (paragraph 2.11). Ofgem's analysis does not even purport to take account of potential differences in the quality improvements required of different companies.
- 3.10 Finally, Ofgem's reliance on the efficiency improvement assumptions made at one price review as the basis for its valuation of the loss of a comparator means that the uncertainty attached to that valuation will be significant. Since five-year projections of efficiency improvements are relatively uncertain by nature, the statistical significance of a difference of 1.3 percentage point per annum in an efficiency assumption is questionable.

Quantification of the Detriment of a Merger

- 3.11 As set out above, there are serious doubts about the validity of the methodology outlined by Ofgem to assess the overall benefits of comparative analysis. The second step of Ofgem's methodology is to estimate the reduction in these benefits that would result from a distribution merger, and we now consider the validity of the assumptions made by Ofgem in this respect.

Is a generic approach appropriate?

- 3.12 Ofgem does not seek to justify its calculations by reference to the impact that the loss of a comparator would be likely to have on the comparative analysis to be performed at future periodic reviews.
- 3.13 Appendix 3 outlines how the impact of the loss of a comparator on comparative analysis might be assessed, and highlights the extent to which this impact depends on the specific comparative analysis methodology used and on the particular comparator that is being lost. In particular, the removal of an inefficient outlier could, in fact, improve the robustness of statistical comparisons. These factors underline the shortcomings of Ofgem's generic, almost “rough and ready”, approach, and the importance of specifying the comparative analysis methodology to be used in the future before seeking to quantify the impact of the loss of a comparator.
- 3.14 Whilst there could be benefits in terms of regulatory certainty in setting out a generic approach, Ofgem does not offer any analysis of these benefits as against the detriment



that would result from effectively blocking “good” mergers or allowing “bad” mergers through a one-size-fits-all approach.

Impact of the number of comparators

- 3.15 Ofgem suggests that the total benefit of comparative analysis can be considered proportional to the number of comparators.
- 3.16 This assumption is highly questionable. As set out above and in Appendix 1, many of the benefits of diversity of ownership and management are likely to arise from competition in the market for corporate control. These benefits may be gained almost in full provided that there are at least a handful of independent companies, to provide scope for experimentation and to ensure that co-ordinated behaviour is unlikely to be sustainable. Thus, the valuation of any detriment arising from the loss of a comparator would be expected to depend on the remaining number of comparators.
- 3.17 A similar analysis is likely to apply to “anecdotal” comparisons between companies, any benefit of which are likely to be less than proportional to the number of comparators.
- 3.18 Furthermore, even with regards to statistical comparative analysis, any generic detriment arising from the loss of a comparator would be the result of an increase in statistical noise and a widening of confidence intervals. Again, the incremental benefit of an additional comparator will depend on the total number of comparators.
- 3.19 Finally, some of the value of comparative analysis is likely to derive from physical comparisons of data reported at the level of the 14 licensed entities, and would not be expected to be affected by further mergers, unless they were accompanied by a reduction in the number of licences. Indeed, Ofgem's proposal to use comparative analysis between Transco's local distribution zones indicates that it values comparisons of data corresponding to operations under common ownership.¹¹
- 3.20 Thus, it is clear that a reduction from nine to eight management teams would have a much smaller impact than a reduction from, say, three to two teams, and that some of the benefits of comparative analysis would not be reduced by a reduction in the number of independent management teams. As such, Ofgem's estimate of £30 million per transaction could not be considered robust, even if the overall figure of £350 million had been appropriately justified.
- 3.21 The logic of Ofgem's argument would also imply that a distribution company engaging in a de-merger should be allowed to raise prices by £30 million, since, according to Ofgem, the creation of a further independent comparator would generate public interest benefits of £30 million.

¹¹ See for example Ofgem, *Review of Transco's Price Control from 2002: Regulatory Instructions and Guidance for Reporting Outputs*, November 2001, paragraph 2.10.



Impact of the quality of comparators

- 3.22 Ofgem's generic approach also fails to take account of differences in the quality of comparators. In particular, a merger may produce a new comparator that is more efficient than at least one of the merging entities, especially if a particularly inefficient company is being taken over. Mergers could also help make companies more comparable by leading to greater consistency in the data reported in respect of different licensed entities.
- 3.23 In these cases, the removal of a comparator may actually reduce the statistical noise in future comparative efficiency analyses.

Timing of detriments

- 3.24 Ofgem's assessment of the timing of any detriment is unconvincing, and its proposals for the settlement of compensation are unclear. Ofgem suggests that "the timing of any payment should take place [sic] when the merger completes" (paragraph 3.15). However, the quantification of the benefits of comparative information refers exclusively to its use at periodic reviews, and thus the impact of a merger on prices would, according to Ofgem, only arise after the first periodic review that relies on post-merger data.
- 3.25 Ofgem's approach is also predicated on the assumption that differences in efficiency arise solely from differences in top management. However, many working practices may be entrenched within companies, and it is most unlikely that a merger would be able to affect the efficiency of day-to-day operations with immediate effect.
- 3.26 Another potential source of delay between the merger and the total loss of independent data could arise from the long-term impacts of previous asset management policies. For example, the underlying efficiency of a company may not be apparent from reported data until changes in the quality of the asset base have had time to be achieved.

Benefits of Distribution Mergers

Efficiency savings

- 3.27 Whilst recognising the scope for achieving efficiency savings through mergers, Ofgem does not appear to give weight to the fact that mergers are the main tool by which underperforming management can be removed and replaced by a team that has proved (to investors) its ability to improve financial performance. Clearly such efficiency improvements would be to the benefits of customers in the long run.

Stronger comparators

- 3.28 As argued above, mergers can enhance the effectiveness of comparative analysis if they replace unusual or inefficient companies with more uniform, stronger and/or more efficient comparators, leading to an overall reduction in statistical noise even though the number of comparators is reduced.



Incentives arising from the threat of take-over

- 3.29 The existence of a merger control regime may also affect competition in the market for corporate control. If incumbent managers are effectively protected from competition, then their incentive to get to and remain at the forefront of efficiency will be weakened, to the detriment of investors and customers alike. Expectations that price limits will be cut as a result of mergers could exert a strong dampening effect of this type of competition.
- 3.30 Ofgem recognises these effects, but argues that “it is not possible to quantify the benefit” (paragraph 2.16). No evidence is provided to support this claim. In fact, it could be argued that the efficiency differences between electricity distribution and Transco/National Grid identified by Ofgem arise mainly from the spur to managerial efficiency given by competition in corporate control in the electricity distribution sector, rather than from the use of comparative efficiency in regulation. In any event, Ofgem's inability to quantify an effect would not amount to a justification for ignoring it altogether.

Can Detriments be Mitigated or Offset by Benefits?

Treatment of efficiency savings

- 3.31 Ofgem does not appear to allow for efficiency savings to be set against any detriments arising from the loss of a comparator. Given that a merger would generate benefits for customers of the order of £200 million (being the net present value at a post-tax annual discount rate of 5 per cent of a stream of price reductions of £12.5 million a year starting five years hence), this seems a rather serious oversight.

Ring-fencing

- 3.32 Ofgem does not assess the scope for, and value of, mitigating the loss of a comparator through ring-fencing.
- 3.33 Mitigation can be achieved by continued use of physical data, for example on quality of service and asset serviceability, for parts of companies and groups.
- 3.34 Furthermore, ring-fencing of separate licensed entities within the ownership group protects the option of future de-merger and ensures the provision of audited accounting data at the licensed entity level.

Compensation for a Reduction in the Number of Comparators

- 3.35 Ofgem does not justify the imposition of an additional compensatory adjustment to price limits following a merger.
- 3.36 As Ofgem partially recognises (paragraph 3.14), the potential detriments of a distribution merger will affect customers of other companies rather than those of the merging companies. In fact, customers of the merging companies stand to benefit (after five



years) from the sharing of merger cost reductions. Thus, there is no rationale for compensating the customers of the merging entities through price reductions.

- 3.37 A possible alternative interpretation of the so-called compensation payment would be to consider it as a remedy to mitigate the potential detriments associated with the loss of a comparator. However, there does not seem to be a mechanism by which a price cut would reduce any detriments, and Ofgem does not provide any evidence in that direction.
- 3.38 Another possible reading of Ofgem's policy, following the Northumbrian water case, would be to consider the so-called compensation payment as, in fact, a way of setting a threshold level of efficiency benefits that the companies must be confident to achieve if they merge. However, this does not provide a logical interpretation of Ofgem's paper either, since Ofgem's established approach to the sharing of merger cost savings already establishes a threshold level of savings (net of one-off merger costs) of the order of £200 million in present value terms that merging partners must be confident of meeting if they are to benefit from a merger, whereas Ofgem's analysis only identifies detriments to a value of £30 million.



4 DEVELOPING A ROBUST FRAMEWORK

- 4.1 This review has outlined most of the issues that would need to be considered in developing a robust framework for assessing distribution mergers, and has assessed Ofgem's analysis against relevant economic principles and precedents.
- 4.2 The analysis indicates that Ofgem's suggestion that "for each future merger it may be appropriate for approximately £30 million of compensation to be passed back to customers" (paragraph 1.2 of Ofgem's Appendix 1) is not supported by the evidence presented by Ofgem.
- 4.3 In fact, Ofgem has not demonstrated that any form of compensation would be appropriate in connection with distribution mergers, let alone justified its proposals for the mode of calculation and timing of any such compensation.
- 4.4 Ofgem recognises the potential benefits to customers of consolidation in the electricity distribution sector, and has already set down a basis for passing the benefits of mergers to customers through the price control in a way that does not unduly distort the incentives of companies to undertake corporate transactions.
- 4.5 Further analysis and debate is now required in order to complement these arrangements with a robust methodology for assessing the balance between the potential benefits and detriments of further distribution mergers. This, however, is contingent upon the establishment of a clear, coherent and robust framework for the periodic review of price limits and for the use of comparative analysis within that framework.
- 4.6 This paper hopes to contribute to that debate by putting forward an analysis of the principles that ought to underpin the assessment of distribution mergers. It remains open to further consideration whether, and if so how, the potential public interest benefits and detriments of distribution mergers can be quantified.



APPENDIX 1: ECONOMIC PRINCIPLES

- A1.1 This appendix reviews the economic principles that ought to underpin an analysis of whether a particular transaction would operate against the public interest, including by impairing Ofgem's ability to regulate the sector in line with its statutory duties. It also considers the scope for remedying any detriment that might be identified.
- A1.2 In order to provide a firm basis for the analysis, we first review the economic rationale for merger control and the role of different forms of market competition and comparative analysis in the electricity distribution sector. We then outline the potential benefits and detriments of distribution mergers and the way in which any detriments might be remedied and/or balanced with benefits.

Economic Basis for Merger Control

- A1.3 Before considering the impact of mergers on comparative regulation, it is worth reviewing the economics of merger control in general.
- A1.4 Most mergers can be expected to generate cost reductions or productive efficiencies. Despite this, merger control laws give the authorities an opportunity to prohibit certain mergers. Under the Fair Trading Act, mergers are assessed against the public interest, and, in general, the main potential public interest detriment would result from a substantial lessening of competition. The EC regime is based on a competition test and aims to prevent the creation or strengthening of a dominant position (i.e. the lack of effective competitive constraints).
- A1.5 Thus, a merger can be blocked if it would reduce competition, even if it would also generate resource savings. The reasons for enshrining such a preference for competition in law include both allocative and productive benefits of competition.
- A1.6 Allocative efficiency benefits arise from the fact that, in most circumstances, prices and service levels constrained by competition enable more efficient patterns of production and consumption than monopoly prices.
- A1.7 Productive efficiency benefits can result from competition as it enables more efficient technologies and better management to grow at the expense of less efficient forms of production, thus leading to a more efficient industry overall. Further, a competitive market may also provide external benchmarks for assessing management performance (e.g. by comparing profits earned in a competitive marketplace with the market cost of capital), which may help reduce principal-agent inefficiencies in investor-owned companies.
- A1.8 In the case of electricity distribution, in the absence of direct competition for customers, the regulatory regime and especially price controls are intended to promote incentives for allocative and productive efficiency. Since comparative information is used by the regulator, a merger (if it results in the loss of such information) may be detrimental to the regulatory regime and thereby to the public interest, and that detriment needs to be balanced with any benefits of the merger.



The Scope for Market Competition in Electricity Distribution

A1.9 Whilst the provision of electricity distribution services can be considered a monopoly activity in each region (no reasonable substitute is available to customers), market competition in other markets still plays an important role in the electricity distribution sector. A robust merger assessment methodology would therefore need to take account of the impact of the merger transaction on market competition where it exists.

Upstream markets

A1.10 Most of the inputs of electricity distribution companies (e.g. labour and materials) are sourced in competitive markets, which would be little affected by a distribution merger.

A1.11 However, the recent trend towards separation of asset ownership and strategic asset management from the day-to-day operation and maintenance of the network may mean that the market for the supply of operation and maintenance on medium-term contracts needs to be considered in the analysis of a distribution merger.

Market for corporate control

A1.12 The general competition between firms in attracting capital, and between investors in supplying capital, is likely to be little affected by a merger.

A1.13 However, capital market competition also includes a different process, whereby "owners" (being management teams backed by investors) compete with each other for the corporate control of "businesses" (sets of assets and operations). This form of capital market competition takes place mainly through take-overs, whereby a presumably more efficient owner takes control over a business by purchasing it from the previous investors and ousting the previous management.

A1.14 Take-overs may be hostile or friendly, i.e. the transaction may or may not be supported by the incumbent management. Both hostile and friendly take-overs can be expressions of effective competition for corporate control. In both cases, the new owner must be confident of its greater efficiency in order to be prepared to offer a price acceptable to the incumbent investors. Furthermore, take-overs allow more efficient owners to expand the scope of their control, to the benefit of overall efficiency, in the same way that more efficient firms in competitive product markets tend to increase their market share.

A1.15 A key driver of the incumbent management's reaction to a proposed take-over (besides differences in information and opinion) will be the terms of employment of the managers. In particular, investors may find it most efficient to encourage friendly mergers through "golden parachutes" — compensation payments to managers for change of control, which can help align the incentives of managers and investors by reducing the incentives of managers to oppose beneficial take-overs solely in order to protect their positions.



The Role of Comparative Analysis

A1.16 Given the assumed absence of product market competition in electricity distribution, the closest substitute to price and service competition between electricity distribution companies will be the use of comparisons between companies. Such comparisons may include comparisons of financial performance by investors, incentive schemes based on comparative operational performance, as well as the use of comparative efficiency analysis by the regulator.

Comparative information and corporate governance

A1.17 Comparisons with other similar companies are an important aspect of corporate governance, at least for investor-owned companies. Comparative data can provide benchmarks for long-term incentive schemes for senior executives. Comparisons of performance with other companies can also inform decisions of investors and non-executive directors on the retention and remuneration of executives.

A1.18 The use of comparative benchmarks rather than fixed benchmarks to assess management effectiveness may enable a higher level of gearing to be used, without exposing managers to unacceptably large risks such as industry-wide cost shocks. Instead, incentives can focus on the differences of performance with other companies, which are likely to be a better reflection of management effort and management quality.

A1.19 Thus, comparative information can help improve the effectiveness of incentive arrangements between companies and managers, and thereby ameliorate principal-agent problems and improve the companies' efficiency.

Comparative information and economic regulation

A1.20 In a similar way, comparative information can be used as part of a price control regime in order to increase efficiency incentives (by reducing the influence that the actual expenditure of each company has on its own price limits) and/or reducing the risks borne by companies (by passing industry-wide risks through to customers, so that the profit risk for each company depends more on its relative performance).

A1.21 The availability and appropriate use of comparative information can therefore improve the allocation of risks between companies and customers, and thereby may be expected to improve the efficiency and/or reduce the cost of capital of the industry, leading to benefits to customers in the long run.

A1.22 The number and quality of comparators available will affect the confidence that can be placed on the results of comparative analysis. On average, a larger number of comparators and/or a more comparable set of comparators may be expected to reduce the noise attached to estimates of relative performance. However, the removal of a comparator through a merger will not always reduce the uncertainty attached to comparative analysis. For example, the removal of an outlier could in fact reduce statistical noise.



- A1.23 Reducing statistical noise and uncertainty allows more focused incentives to be given to companies, and lowers the uncontrollable risk borne by companies. More focused incentives should be expected to improve efficiency, whilst less uncontrollable risk would reduce the amount of profit or contingency that needs to be allowed in price controls to ensure that companies are able to finance their activities.
- A1.24 However, in order to achieve these benefits, comparative analysis must take account of all costs and of quality of service. Simple comparisons of operating expenditure that do not take account of differences in capital stock or capital expenditure may in fact increase noise and risks, rather than lead to accurate expenditure projections and incentives focused on total efficiency.
- A1.25 Similarly, comparisons of operating performance without taking account of expenditure differences (as suggested by Ofgem for telephone response under the IIP) can impose additional risks on companies without necessarily improving the incentives, and may not be beneficial.
- A1.26 Comparative information may also be used to seek to incentivise managers by “naming and shaming” poorly performing companies. If this is based on a partial measure of efficiency, such as quality of service without reference to expenditure, then such a policy would drive a wedge between the interests of managers (whose career prospects may be damaged by naming and shaming) and investors (whose proper focus is on the returns of the business). Investors may actually find it best to offer to compensate managers through higher remuneration for being named and shamed, in order to maintain their focus on overall efficiency rather than expend company resources to protect their own reputations.
- A1.27 Comparative information may be thought to reduce the information rents earned by companies. However, in the long run any such profit opportunities afforded to companies ought to be taken into account in assessing the profit allowances included in price controls.
- A1.28 Stock market listing of shares and bonds provides a valuable source of information for the regulator. However, the potential loss of that information is not specific to mergers of distribution companies and could also arise from the merger of an electricity distribution company with a group operating in other sectors.
- A1.29 In summary, comparative analysis by the regulator can be beneficial to the public interest, but only if it is used with care and focuses on measures of total efficiency, including quality as well as all categories of costs. Given the difficulties inherent in comparing performance of different companies, and especially the inherent limitations of mechanistic methodologies, it seems likely that the only significant benefits that can be gained from the availability of comparative information is through a comprehensive and reasoned analysis, as part of the periodic review, of differences in total efficiency between companies, to inform estimates of the scope for catch-up improvements in expenditure and/or quality of service.



Potential Detriments of Distribution Mergers

A1.30 The main benefits of diversity of ownership and management in the electricity distribution sector are therefore likely to arise from both market competition and comparative information. An important form of market competition is the market for corporate control, which incentivises and selects good management. Comparative information can play an important role both as part of the corporate governance of the companies and as part of the periodic review process.

A1.31 We now review how the potential detriment of a distribution mergers may be assessed.

Impact on market competition

A1.32 Upstream markets (e.g. for labour and materials) are likely to include many activities besides electricity distribution, and the risk of a reduction in buyer-side competition in these markets appears to be remote.

A1.33 Even if narrow markets could be defined (perhaps for the provision of network operation and maintenance services), a reduction in the number of buyers from, say, nine to eight, would hardly constitute a substantial lessening of competition. (The impact of a merger of suppliers of these services would need to be considered under a traditional competition-based merger control framework.)

A1.34 Furthermore, electricity distribution businesses have relatively well-defined and stable input requirements, so that their ability to effect a “monopsony restriction” on the amounts that they buy is likely to be limited. Thus, entry and exit by suppliers would almost certainly be able to ensure the continuation of a competitive market.

A1.35 The impact on the market for corporate control may be more significant. Diversity of ownership and management is beneficial as it enables experimentation and diversity in management and the replacement of ineffective management teams through take-overs, and that diversity could be reduced through mergers. Benefits might also be gained from industry benchmarking and information sharing, if it allows some companies to adopt best practice techniques developed by others.

A1.36 There is no reason to suspect that ordinary standards of competition assessment should not apply to the market for corporate control. Thus, the relevant market would need to be defined, and it might well encompass the control of power systems enterprises outside Great Britain and/or the control of other similar businesses. The ease of entry would also need to be considered — for example, whether a financial institution would be able to put together a suitable management team and a credible bid for an electricity distribution company.

A1.37 Even if a narrow market definition were shown to be appropriate, and if significant barriers to entry were found, a reduction in the number of competing management teams from, say, nine to eight, would not be expected to constitute a substantial lessening of



competition, especially as the “lumpy” nature of transactions would make co-ordinated behaviour particularly difficult to sustain.

A1.38 The situation may be different if the number of independent management teams were to go from, say, three to two. However, economic theory of oligopolies does not suggest any “magic number” at or below which tacit co-ordination becomes sustainable. Instead, assessment of the impact of a merger would require a reasoned assessment of its unilateral and co-ordinated effects, based upon an analysis of the characteristics of the market.

Impact on comparative analysis

A1.39 On average, a reduction in the number of comparators would be expected to increase the amount of statistical noise present in the results of comparative analysis, and therefore reduce its value as a tool for investors to incentivise managers, and for the regulatory regime to incentivise companies.

A1.40 However, a merger may not in fact lead to any loss of data, provided that legal separation of the licensed entities is maintained. Comparisons based on physical data would be unaffected, and the only reduction in the value of the information would arise from the removal of an independent management team. Further analysis would be required to assess the relative importance of these different kinds of comparisons to the regulatory regime.

A1.41 Furthermore, the impact of the removal of a comparator will depend on the quality of the remaining comparators as well as (and perhaps more significantly than) the number of comparators. For example, removal of an outlier, such as a particularly inefficient management team, would in fact reduce the statistical noise of the analysis. Furthermore, whilst past performance may not be a reliable indicator of future performance, there may be inherent differences between companies that mean that different comparators may be of different value to a comparative efficiency assessment. A reasoned analysis on a case-by-case basis is therefore likely to be required in order to assess accurately the impact of a merger on comparative analysis, if such an accurate assessment is required.

A1.42 Finally, the use of “anecdotal” rather than statistical comparisons by investors or by Ofgem, and the potential use of international comparisons, would not be affected in a mechanistic way by a reduction in the number of comparators within Great Britain.

Potential Benefits of Distribution Mergers

Sharing of efficiency savings with consumers

A1.43 The price control system is likely to pass through cost reductions to customers after an initial period during which they are retained by the company (as an incentive to achieve these reductions). Thus, the efficiency benefits of a merger would be shared with consumers, and would constitute a public interest benefit.



A1.44 The period for which they are retained depends on the details of the regulatory regime. To date, Ofgem has allowed companies to retain merger savings for a period of five years, after which they are transferred to customers through lower price limits.

Selection of more efficient management teams

A1.45 Mergers are a key feature of the market for corporate control. Each merger transaction may be expected to allow a better management team (in the eyes of investors which are risking capital on the basis of that belief) to increase the proportion of the electricity distribution businesses that it controls, to the benefit of the overall efficiency of the industry. This benefit would be passed through to customers of the merging companies through higher quality of service and/or the ordinary process under the price control by which cost reductions are shared with customers. Such efficiency improvements would also feed through to customers of other companies by demonstrating the available scope for efficiency improvement, which would influence comparative analysis and therefore the expenditure projections at the following price control review. (However, care would need to be taken in the comparative analysis methodology to ensure that no double-counting occurs as a result of the potential inclusion of merger savings in expenditure allowances.)

A1.46 Furthermore, a clear and rational regulatory policy with respect to distribution mergers would ensure strong incentives on management teams to maintain a good performance, since mergers provide the main competitive pressure on their survival in office. By contrast, excessive restrictions or penal “remedies” for mergers would have the effect of protecting incumbent managers from the threat of take-over, enabling them to exert low levels of effort and requiring a greater degree of control by investors. Thus, merger control must take account of its potential impact on the competitive process in the market for corporate control.

Balancing Detriments with Benefits and Remedies

A1.47 If public interest detriments of a merger are identified, the assessment must then consider whether these detriments can be remedied, and/or whether there are benefits of the transaction that would outweigh any detriments and that could not be gained without the merger (and therefore without incurring the potential detriments).

A1.48 Three main potential detriments of a distribution mergers have been identified:

- lessening of competition in the market for corporate control;
- reduction in comparative information available for corporate governance; and
- reduction in comparative information available for economic regulation.

A1.49 We now consider the likely effectiveness of potential remedies.



De-merger option

- A1.50 A possible remedy for lessening of competition in the market for corporate control would be to maintain a strong ring-fence on each of the merging licensed entities, and to require the merging companies to retain independent legal structures and resources. This would ensure that the companies are capable of de-merger at relatively low cost, which would maintain relatively low barriers to entry in the market for corporate control since individual licensees could still be bought and sold. This would be similar to the provision governing mergers of franchised train operators, where each franchise within the group must maintain sufficient resources available to it.
- A1.51 Further analysis would be required to determine whether the current licence requirements are an effective way of keeping the de-merger option open, and whether this option is a cost-effective remedy.

Separation of information

- A1.52 To date, merging electricity distribution companies have retained separate legal personalities with separate licences and ring-fencing, and are required to submit separate sets of data for regulatory purposes. (By contrast, adjacent water companies that have merged have been brought within a single legal entity and under a single licence.)
- A1.53 This means that no data is lost as result of a merger, and that many comparisons between companies are not affected. The only reduction in the value of comparative information would therefore be in respect of comparisons that seek to identify differences in management approaches. Further analysis would be required to assess the relative importance of these different kinds of comparisons to the regulatory regime.

Alternatives to merger

- A1.54 It would be beyond the scope of this initial review to assess the extent to which alternatives to a full merger can bring some of the benefits of a merger without incurring all of the detriments.

The Role of Price Control Adjustments

Compensating adversely affected groups

- A1.55 It is possible that some parties may suffer a net detriment whilst others receive benefits as a result of a merger. If so, and if the overall benefits of a merger exceed its overall detriments, then there could be merit in using the price control system to compensate those adversely affected and ensure that the transaction is of benefit to all.
- A1.56 However, in the case of distribution mergers, it is not clear that any group would suffer a net detriment from a merger. Customers of the merging companies are likely to gain substantial benefits from cost reductions, at least after a period. The losses, if any, resulting from reductions in competition and comparative information would be borne by



all customers in the long run, and the parties most likely to be adversely affected would therefore be customers of other companies.

Sharing merger benefits

- A1.57 A different issue is the sharing of merger cost savings. Whilst a number of potential methodologies may be considered, two important caveats must be borne in mind.
- A1.58 First, differences in treatment between merger benefits and other efficiency savings would inevitably distort incentives, and encourage managers to promote or avoid mergers for reasons other than their underlying efficiency. Such distortions should only be introduced in the price control regime if they can be shown to bring substantial benefits.
- A1.59 Second, consistency must be ensured between the treatment of merger savings and the setting of expenditure allowances. If the expenditure projections underpinning the price control implicitly allow for the possibility of cost savings through mergers, then transferring such cost savings to customers in the event of a merger could amount to double counting of these benefits and deprive investors of their opportunity to earn a reasonable return.



APPENDIX 2: COMPARATIVE ANALYSIS METHODOLOGIES

A2.1 This appendix provides a brief review of the comparative analysis methodologies used in some recent regulatory reviews.

Ofwat (1999)

A2.2 Ofwat's assessment of the scope for water companies to reduce their prices was built on two key elements.¹²

A2.3 First, Ofwat identified the extent to which there was scope for efficiency savings in the industry as a whole, informed by a general efficiency study identifying the efficiency improvements that had been made by comparable firms and industries in comparable circumstances.

A2.4 Second, within the water industry in England and Wales, Ofwat assessed the comparative efficiency of each firm and thereby identified companies where catch-up efficiency savings could be expected.

A2.5 Ofwat's 1999 assessment of comparative efficiency was based on the estimation of econometric relationships between costs and cost-driver variables, using ordinary least squares and corrected ordinary least squares regressions. This was done separately for operating and capital maintenance expenditures, and within each category separately on the main underlying activities.

A2.6 Each regression sought to determine the average cost function in the industry for a particular activity, and the difference between the actual and predicted cost was considered to provide a measure of each company's efficiency relative to the industry average. The robustness of the efficiency measures derived was checked by considering alternative parameterisations for the econometric model.

A2.7 By aggregating across activities the exercise eventually produced two measures of comparative efficiency, one relating to operating expenditure and the second to capital maintenance expenditure.

A2.8 The models were in essence regression models, where the performance of the "average" performer was estimated. Companies above the average performer were considered to be relatively more efficient, and companies below the average were considered relatively less efficiency. Thus, the residuals in the regression were assumed to provide a measure of the relative efficiency of each firm.

A2.9 However, the residuals will also contain measurement errors or inaccuracies in the model, for example due to omitted explanatory variables. In order to take into account such data errors, some improvements were suggested by removing the observations closest to the

¹² Ofwat (1998) Assessing the Scope of Future Improvements in Water Company Efficiency: A Technical Paper.



frontier and re-estimating the frontier with the reduced sample. However, there was inevitably a degree of arbitrariness in the selection of the observations to be deleted.

Ofgem (1999)

- A2.10 Ofgem's methodology was entirely different.¹³
- A2.11 Regression analysis was undertaken to estimate costs by using a composite variable (consisting of number of customers, network length and units distributed) that was considered to be the cost driver. However, the weights of the components were set on the basis of engineering estimates rather than estimated statistically. Furthermore, the cost data used by Ofgem were after making significant adjustments to companies' reported expenditures.
- A2.12 In addition, although regression analysis was employed, an external constraint on the intercept (£25 million per annum) was imposed on the model.¹⁴
- A2.13 This regression line was not in fact used to determine relative efficiency. Instead, Ofgem took the view that Eastern and Southern were the most efficient companies, and use the line joining the (constrained) regression intercept with data for these two companies (these three points happened to be aligned).
- A2.14 No sensitivity analysis on the robustness of the results was undertaken, and no diagnostics tests on the goodness of fit of the model were reported.
- A2.15 As Ofwat in its 1999 review, Ofgem considered separately operating and capital maintenance expenditures. The advantage of this methodology is that these categories of expenditure may have substantially different cost drivers, and therefore analysing them separately may allow more accurate cost models. The problem is that separating operating and capital expenditure gives rise to difficulties in assessing total cost efficiency. For example, differences in the capitalisation policies used in reporting accounting data, or different asset management policies, would unduly distort the assessment of relative efficiency. Neither Ofgem nor Ofwat have yet developed a robust way of combining these two separate inefficiencies.
- A2.16 In 1999, Ofgem made a rather simplistic judgement of capital efficiency and then rewarded the companies that appeared most efficient through a seemingly arbitrary uplift on revenue allowances.
- A2.17 Furthermore, differences in quality of service would also need to be taken into account in order to assess overall efficiency.

¹³ Ofgem (1999) *The Distribution Price Control Review and Separation of Businesses*, Letter to the Chief Executives of PES Distribution Businesses.

¹⁴ Ofgem (1999) *Reviews of Public Electricity Suppliers 1998-2000: Distribution Price Control Review: Draft Proposals*.



DTe (2000)

- A2.18 The Dutch Electricity Regulator DTe has recently relied on Data Envelopment Analysis (DEA) as a benchmarking method for electricity distribution companies, to the exclusion of any statistical analysis.¹⁵ DEA is based on linear programming techniques rather than statistical analysis, and does not take any account of data errors or statistical noise. Its main benefit is that it allows the shape of the frontier to be determined on the basis of the data alone, without requiring an assumed functional form for the cost function.
- A2.19 Estimates of inefficiency were based upon inputs (mainly operating expenditure) and outputs (units distributed, number of consumers, maximum demand, quality of service). A similar analysis was used for transmission companies. In that case, the model also included a number of “environmental” variables were used such as population density, area, mains length and share of underground cables.
- A2.20 DTe’s argument for choosing DEA was that it had only a limited number of observations available, which would cause serious problems in statistical techniques.
- A2.21 However, DEA is also sensitive to small sample sizes. In particular, increasing the number of explanatory variables when the number of comparator is relatively small tends to boost efficiency scores, generally making companies look more efficient. This is because the dimensions in which a particular company can be unique increase and therefore it becomes more difficult to identify its peer group. DEA can also be sensitive to measurement errors and the omission of explanatory variables, and does not offer the possibility of statistical tests of the reliability of the results.

¹⁵ DTe (2000) *Choice of model and availability of data for the efficiency analysis of Dutch network and supply businesses in the electricity sector.*



APPENDIX 3: IMPACT OF THE LOSS OF A COMPARATOR

A3.1 This appendix considers ways of estimating the impact of the loss of a comparator on different techniques for comparative efficiency analysis.

Ordinary Least Squares Regression

A3.2 Ordinary least squares (OLS) regression is a method that fits a regression line to the data in a way that minimises the sum of the squared residuals.

A3.3 A simple OLS regression model may be written as

$$y_i = \beta_0 + \sum_n \beta_n x_{ni} - u_i$$

where y represents output, x_n represents a vector of n inputs, β_n is a set of slope parameters to be estimated, β_0 is a constant, and u is attributed to relative efficiency.

A3.4 The removal of a comparator is likely to affect both the estimated mean and the variance of the regression parameters. Thus, the “frontier” will move somewhat, and the width of the confidence intervals associated with the frontier parameters will vary.

A3.5 However, there is no firm rule as to whether the frontier would shift up, down or merely tilt, as this would depend on the relative location of the comparator being removed. On average, the loss of a data point may be expected to lead to a widening of confidence intervals. However, this effect may be more than offset in particular cases by a reduction of statistical deviations, especially if the point being removed was an outlier.

Corrected Ordinary Least Squares Regression

A3.6 The corrected ordinary least squares (COLS) procedure consists of two steps. In the first step, OLS is used to obtain estimates of the slope of the frontier, thus determining the assumed returns to scale of the cost function.

A3.7 In the second step, the intercept (β_0) is shifted up to ensure that the estimated frontier bounds the data from above. Thus, the COLS intercept is defined by:

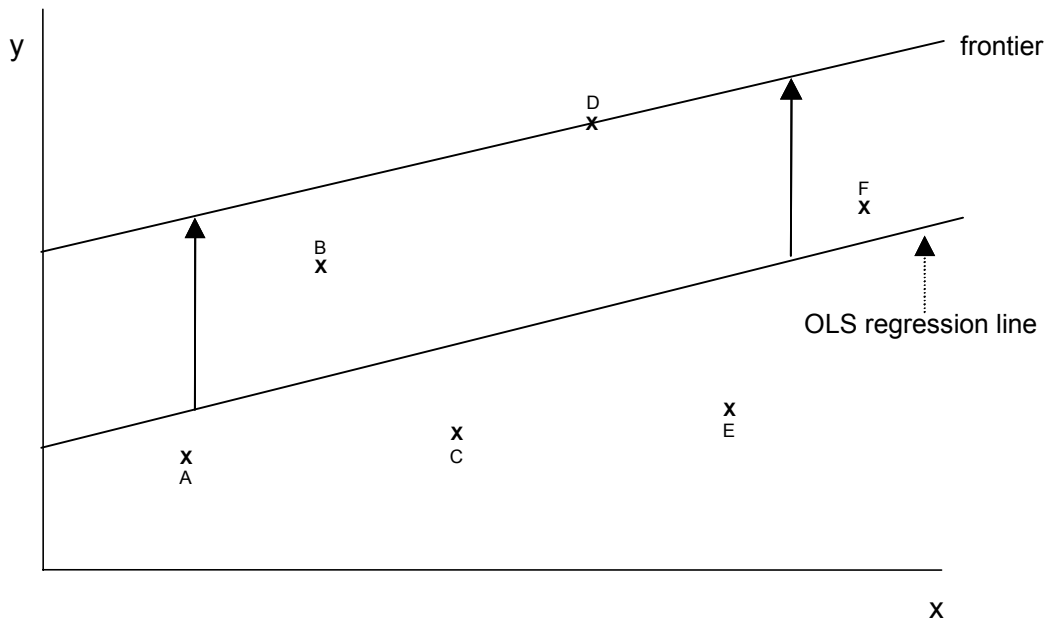
$$b_0 = \beta_0 + \max \{u_i\}.$$

A3.8 As a result of this shift, the residuals are corrected in the opposite direction, so that the COLS estimate of inefficiency is $\max\{u_i\} - u_i$.

A3.9 This is illustrated in Figure 1.



Figure 1: Corrected Ordinary Least Squares Regression



A3.10 In general, the loss of a comparator would have the same limited and ambiguous impact on COLS as on OLS regression. The exception is the case where the point being removed corresponded to the company deemed most efficient, in which case the loss of that comparator would mean that the frontier would be shifted downwards to the company deemed second most efficient.

Data Envelopment Analysis

A3.11 Data envelopment analysis (DEA) is an extension of simple ratio analysis, generalised to handle multiple outputs and inputs. In DEA, the efficiency of a firm is computed using the a measure of efficiency as a ratio of the output produced to the inputs consumed:

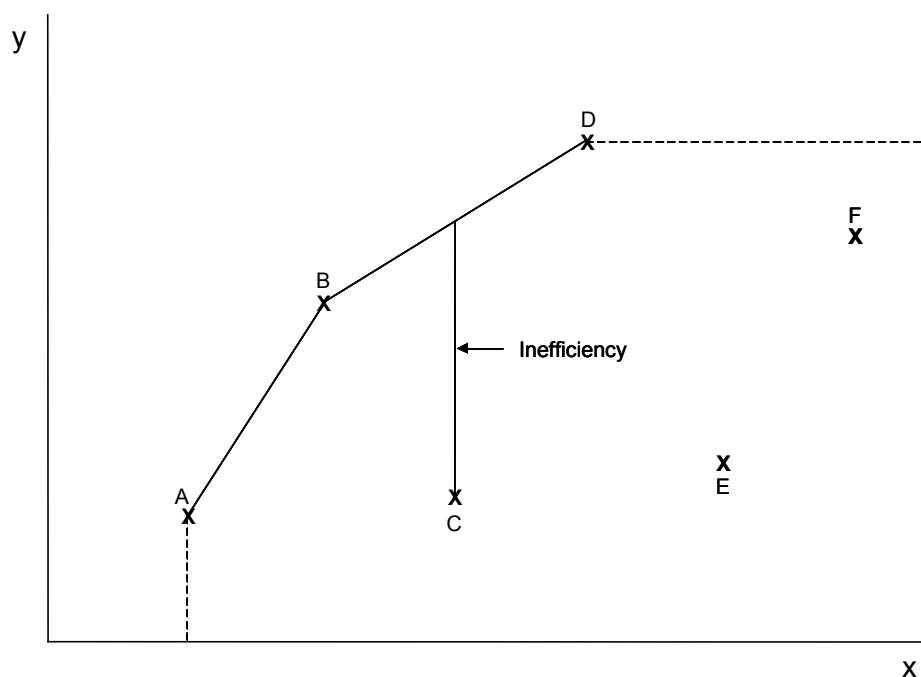
$$\text{efficiency} = (\text{sum of weighted outputs}) / (\text{sum of weighted inputs})$$

A3.12 DEA uses mathematical linear programming techniques in order to find the set of weights that maximises the efficiency score of each firm, subject to the constraint that none of them has an efficiency score greater than 100 per cent at those weights. In this way, DEA builds up an “envelope” of observations that are most efficient at each set of weights. A firm is deemed inefficient if has a worse score than another firm at the set of weights that maximises its relative efficiency. Thus, for an firm deemed inefficient, at least one other firm will be deemed efficient with the target firm’s set of weights. These “efficient” firms are known as the peer group.

A3.13 This is illustrated in Figure 2 below.



Figure 2: Data Envelopment Analysis



- A3.14 In DEA the gap between any observation and the frontier is attributed to inefficiency. Therefore, firms A, B, and D in Figure 2 would be considered as efficient. By contrast, firm C lies inside the frontier and is considered as inefficient, and its inefficiency would be measured by reference to its “peer group” of companies which define the local shape of the frontier. In the case pictured above, the peer group of C would consist of B and D, and the line joining them would be the frontier against which C is assessed.
- A3.15 The impact of the removal of a comparator on DEA is therefore totally dependent on the deemed efficiency of that comparator. Removal of a comparator deemed efficient could have a significant impact on the frontier. Removal of a comparator deemed not efficient would have no impact on the frontier.
- A3.16 DEA does not allow statistical confidence intervals to be determined, as it does not take account of the possibility of statistical noise in the data. Thus, there is no general measure of statistical robustness that could be affected in a systematic way by a reduction in the number of comparators.

Stochastic Frontier Analysis

- A3.17 Stochastic frontier analysis (SFA) combines the statistical framework of regression analysis with a recognition of the distinction between statistical noise, which can be considered symmetrically distributed, and inefficiency, which can only increase costs or decrease output compared to the “frontier”.



A3.18 SFA may be undertaken using various estimation techniques, and the following analysis is based on the method of moments. A possible model may be written as:

$$y_i = \beta_0 + \sum_n \beta_n n x_{ni} + v_i - u_i$$

where v_i represents noise and u_i represents inefficiency.

A3.19 The only observable quantity is the residual $v_i - u_i$, rather than v_i or u_i separately. Since u_i reflects inefficiency and is restricted to be positive, the overall residual does not have a mean value at zero. Thus, OLS cannot be used as an estimation technique on the above equation.

A3.20 However, that equation can be rewritten as follows:

$$y_i = [\beta_0 - E(u_i)] + \sum_n \beta_n n x_{ni} + v_i - [u_i - E(u_i)]$$

where $v_i \sim N(0, \sigma_v^2)$ if noise is assumed to be normally distributed

and $u_i \sim N^+(0, \sigma_u^2)$ if inefficiency is assumed to follow a half-normal probability distribution.

A3.21 Since the compound error $v_i - [u_i - E(u_i)]$ has zero mean and constant variance, OLS can be used to obtain estimates of β_n . This enables an estimate of β_0 to be derived as follows:

$$b_0 = [\beta_0 - E(u_i)] + (2/\pi)^{1/2} \sigma_u = \text{OLS intercept} + (2/\pi)^{1/2} \sigma_u$$

where σ_u is obtained using the third moment of the OLS residuals.

A3.22 As in OLS regression, the removal of a single observation will therefore have a limited and ambiguous impact on the OLS intercept and on σ_u , and therefore on the location of the frontier. This is because the frontier is constructed using all available observations, as opposed to COLS and DEA where the observations are enveloped around one or a set of firms deemed most efficient (ignoring the possibility of statistical noise).

A3.23 The impact on the confidence that can be attached to estimates of frontier parameters would also depend on the location of the point that is being lost. On average, as in ordinary regression, a lower number of data points may be expected to lead to wider confidence intervals. However, confidence intervals may be narrowed in particular cases, for example if the point being removed was an outlier in the original analysis.