

The Restructuring and Privatisation of Electricity Distribution and Supply Businesses in England and Wales: A Social Cost–Benefit Analysis

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Abstract

In December 1990, the 12 regional electricity companies — responsible for the distribution and supply of electricity in England and Wales — were privatised. For the first few years following privatisation, real prices, profits and costs in the industry rose. Following two Price Control Reviews, prices have now fallen sharply and there have been substantial reductions in costs and more recently in profits. This paper attempts to conduct a social cost–benefit analysis of the privatisation by examining actual and predicted falls in costs over the period to 2005. We conclude that the privatisation did yield significant net benefits but that these were unevenly distributed across time and groups in society. Relative to our preferred counterfactual, consumers experience slightly lower prices and the government gains £5 billion in sale proceeds and net taxes. However, consumers begin to gain only from 2000.

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I. INTRODUCTION¹

There have been major changes in the electricity supply industry since it was radically restructured in 1990. These changes have included the growth of competition in supply and generation, substantial improvements in efficiency and reductions in prices, improvements in customer service standards and changes in the ownership of many licensed electricity companies.

The White Paper that announced privatisation (Secretary of State for Energy, 1988) stated clearly that the main beneficiaries would be the consumers. Competition would 'create downward pressures on costs and prices, and ensure that the customer comes first' (cited in MacKerron and Watson (1996, p. 186)). Our main objective is to find out whether consumers benefited from the restructuring and privatisation of the regional electricity companies (RECs) in England and Wales.

We use the technique of social cost–benefit analysis (SCBA) as used in Jones, Tandon and Vogelsang (1990) to study this question. Our study complements previous social cost–benefit analyses of the effect of restructuring and privatisation of the Scottish electricity supply industry (Pollitt, 1999), the electricity supply industry in England and Wales (Green and McDaniel, 1998), Northern Ireland Electricity (Pollitt, 1997b) and the Central Electricity Generating Board (Newbery and Pollitt, 1997). It is also in line with other SCBA studies such as Galal et al. (1994).

This paper seeks to review the performance of the regulated supply and distribution businesses of the RECs in the England and Wales electricity supply industry since privatisation and evaluates the gains (or losses) from restructuring and privatisation. It also assesses the distribution of these gains (or losses) to consumers, producers and the government. A SCBA approach is used to achieve these objectives. The paper is in six sections. Section II briefly sets out the historical background. Section III details the theoretical arguments for liberalisation (restructuring and privatisation) and the social cost–benefit methodology used. Section IV explains the data, Section V contains the results and Section VI concludes.

II. HISTORICAL BACKGROUND

The electricity supply industry was in public ownership from 1948 to 1990. In England and Wales, the Central Electricity Generating Board (CEGB) was responsible for generation and transmission; it sold electricity to 12 area boards under the terms of the bulk supply tariff, based upon its marginal costs. The area boards were responsible for the distribution and supply to electricity consumers.

¹A glossary of terms is provided at the end of the paper.

During the course of 1982, the government's ultimate intention to introduce legislation to allow private companies to set up to provide electricity to consumers became clear (Electricity Consumers' Council, 1982). The White Paper *Privatising Electricity*, in which the government laid out its plans for the industry, was published in February 1988 (Secretary of State for Energy, 1988).

Shortly prior to privatisation in 1990, 12 regional electricity companies replaced the 12 area boards. Transmission became the responsibility of the National Grid Company (NGC), a company fully owned by the RECs. Distribution and supply were uncoupled to some extent, as a REC can supply electricity outside its franchise area on the payment of a charge for distribution over another REC's network.

Each REC owns and operates the electricity distribution network in its authorised area. The distribution systems consist of overhead lines, cables, switchgear, transformers, control systems and meters to enable the transfer of electricity from the transmission system to customers' premises. Supply businesses are engaged in the bulk purchase of electricity and its sale to customers. Compared with the supply business of, basically, metering, billing and contract management, the distribution business is highly capital-intensive.

The distribution of electricity is the most important business activity of the RECs and typically contributes the majority of their operating cash flow and profits. In 1998, distribution and supply charges accounted for approximately 32 per cent and 13 per cent respectively of a domestic customer's bill, and distribution has a significant influence on the overall quality of supply to customers. Analysing the impact of changes in ownership and the regulatory framework makes economic sense owing to the potentially large influence that electricity distribution may have on final prices, and the distribution of gains or losses from these changes.

Electricity prices are regulated at different levels and stages.² The initial *distribution price controls* on the RECs were put in place by the government and executed by the Department of Energy at the time of restructuring, and permitted price increases ranged up to 2.5 percentage points above the inflation rate (OFFER, 1994). Responsibility for future price controls was placed under an independent regulatory body, initially called OFFER and latterly known as Ofgem.³ The pattern of price falls in transmission, supply and generation is such that the share of distribution costs in final prices has risen since privatisation. In the earlier years, there had been public concern about profits and prices; later, more concerns were expressed with regard to increased dividends and the ability

²The price controls since privatisation are summarised in Appendix A.

³OFFER (the Office of Electricity Regulation) started operation on 1 September 1989, five months after the first price controls on the RECs came into force. In response to changes, especially due to the fact that several companies increasingly sold both gas and electricity to homes and businesses, Ofgem (the Office of Gas and Electricity Markets) was formed in 1999 by the merger of Ofgas (the former gas regulator) and OFFER.

of distribution companies to finance share buy-backs⁴ and about the high prices that bidders have been willing to pay to acquire RECs.

The initial price caps that were set by the Department of Energy were considered by many to be somewhat 'too' generous to the companies. The most important review was in August 1994, when OFFER announced reductions averaging 14 per cent in final electricity prices to take effect in April 1995, requiring cuts in real terms of 11–17 per cent in distribution charges in 1995–96 and further reductions in real terms of between 10 and 13 per cent in 1996–97. Distribution charges were, thereafter, required to fall by 3 per cent per year in real terms for the duration of the price control (until March 2000). These price controls were then modified in 1998 to allow RECs to make certain additional charges for services to facilitate competition in supply. These distribution price controls have been revised from 1 April 2000. Based on Ofgem's predictions of costs and revenues, the RECs will be faced with price controls on distribution businesses averaging 3 per cent for the next five years, with an initial cut in RECs' distribution revenue by about 23.4 per cent and an overall revenue cut of £503 million at 1995 prices (see Ofgem (1999a)). Controllable costs⁵ for the RECs are projected to fall by 2.3 per cent per annum over the period 1998 to 2005.

Price controls on the RECs' supply businesses limited average prices to rise by no more than inflation during the period 1990–91 to 1994–95, and then regulation was tightened to RPI–2 for the supply business of all the RECs until March 1998. In April 1998, further revised controls set real reductions in prices between 3 and 12 per cent, followed by a real reduction of 3 per cent in 1999. Price restraints proposals for 1998 and 1999 were set in 1997, stating an average reduction in tariffs in 1998 by 6 per cent and a further average reduction of 3 per cent in 1999 (OFFER, 1997). Price controls to apply in 2000–02 have been set on standard domestic and Economy-7 customers, with price reductions of 5.7 per cent and 2.1 per cent respectively per annum on the final prices. It is expected that controls will no longer be necessary after this period, following the expected degree of competition in supply (although a review is planned after these two years).

According to Henney (1994), by 1994, the majority of customers had seen no price benefit from the privatisation of the electricity supply industry. Small domestic and commercial customers effectively financed the privatisation, while the largest customers lost the benefit of their special agreements. Only the medium-sized (1–5MW) maximum demand customers benefited. This was because they were able to purchase cheaper electricity from the generators.

⁴Henney (1997) gives a clear indication on this concern relating to the RECs. He also explains the other regulatory problems surrounding the electricity sector during the early years of restructuring and privatisation, especially relating to the distribution businesses.

⁵These consist mainly of operating charges net of NGC exit charges, rent and rates, depreciation, etc.

Additionally, domestic prices of electricity initially increased, relative to industrial prices, by about 5 per cent more than expected, with the increase being concentrated in the early years of privatisation and restructuring (Yarrow, 1992).

Henney (1997) explains the rise in prices and profits after privatisation as a regulatory failure, in terms of the lax setting of the initial price control for wires. Also, the government could not substantiate the claims for potential productivity gains at the time of restructuring, although we calculate a unit labour productivity growth of 2 per cent p.a. from 1970 to 1987. We also note that, during the period 1981–82 to 1988–89, final electricity prices in England and Wales rose at less than the rate of inflation.

The period 1990 to 1995 saw large increases in the profitability of the RECs, leading to large rises in their share prices. Such windfall gains to shareholders of privatised utilities attracted the express attention of the UK government, which announced the imposition of a tax on utility companies' profits. The tax on RECs amounted to £1.25 billion.⁶ The Electricity Association, on behalf of the industry, welcomed the Chancellor's confirmation that the windfall tax 'will be a one-off' levy and that provision could be made to 'pay in two instalments'.⁷ Table 7 later summarises the amount of windfall tax paid by the electric utilities.

After the demerger of the NGC from the RECs in 1995, many changes occurred within the electricity supply industry, changing the nature of business of the RECs. The lifting of the 'Golden Share' meant that mergers and acquisitions could take place after 1995. By March 1996, four RECs had been taken over and three others were the subject of take-over bids, including bids from the leading fossil-fuel generating companies, PowerGen and National Power (Green, 1996). A summary of some selected take-over activities that involve the RECs is provided in Appendix B. RECs are a more diverse group today than was the case five years ago. There have also been significant changes in the way that many of the RECs structure their business and the range of activities in which they are involved. For example, following successive rounds of liberalisation, several RECs have developed very active second-tier supply⁸ businesses. Eastern Electricity now has substantial generation interests; it is, in fact, one of the largest generators in England and Wales. Most RECs are now active in the supply of gas as well as electricity. This provides opportunities for joint marketing of the two fuels.

The role and scope of regulation for the electricity market have also changed. Ofgem is planning to lay tighter restrictions to ensure that each regional monopoly electricity distribution business is held in a separate corporate entity,

⁶Extracted from 'The lucky few escape Brown's windfall net', *Inside Energy*, vol. 8, no. 3, 11 July 1997. It should be noted that the NGC and British Energy did not have to pay any windfall tax, because the former was demerged from the RECs (as opposed to being floated in its own right) and the latter realised no windfall profit since it was privatised.

⁷'Brown's first budget — windfall tax: two tranche tax is welcomed', *Financial Times*, 3 July 1997.

⁸The supply of electricity outside the REC's authorised area.

ring-fenced from all other activities carried on within the licensee's group. It is expected that this ring-fencing arrangement will protect capital providers as well as consumers. It is also expected that savings from mergers and acquisitions will eventually have to pass over to consumers (Ofgem, 1999b).

III. METHODOLOGY

1. Theoretical Issues and Empirical Work

The ideological beliefs underlying restructuring of the electricity supply industry in England and Wales were that private ownership and the profit motive gave far better incentives than the most benevolent kind of state control (let alone the state interference that seemed to be the best that British governments could achieve) and that competitive private industries gave better results than monopolies (Green, 1998). Efficiency gains following cost reductions, depending on the severity of competition and the quality of the regulatory framework in place, are assumed to benefit consumers through price reductions and improvements in the quality of service.

The privatisation of utilities is a complex affair, often involving three separate and not necessarily connected elements. The first is clearly a shift in ownership from the state to private hands. The second is a corporate restructuring, leading to the creation of new or radically reshaped companies. The third is a change in procedures by which the sector operates, usually involving an injection of competitive procedures (Thomas, 1996). New regulatory policies, standards and practices often accompany these changes. Depending on the combination of these factors, liberalisation will tend to cause significant changes in the way businesses are conducted. Pollitt (1997a) identifies five theoretical arguments relating to the likely efficiency effects of liberalisation. First, liberalisation can improve incentives by reallocating property rights from the public to the private sector (Alchian, 1965). Second, liberalisation may change the objective functions of managers being faced with private sector incentives (following Niskanen (1968)). Third, there may be incentives for distortionary resource allocation caused by some types of regulation (such as the rate of return regulation) leading to inefficiency (following Averch and Johnson (1962)). Fourth, liberalisation may cause influence activities within the industry (such as empire building), which may cause a divergence from efficiency (Milgrom and Roberts, 1990). Fifth, theories of policy commitment suggest that the government can effectively reduce interventions and the costs that accompany these interventions by liberalisation (such as in Willig (1994)).

The UK is a developed market economy, with an electricity sector that has developed strong linkages with the rest of the economy. This means that the theoretical predictions weakly argue for restructuring and privatisation in the

case of property rights, bureaucracy and commitment theories, but are uncertain about the sign and magnitude of changes when it comes to incentives under regulation and influence activities. Poorly constructed incentive regulation could negate all the positive effects from liberalisation. The results of any individual restructuring and privatisation process in a given industry and in a given country have the potential to be highly variable (Pollitt, 1999).

There are two broad methods to analyse the impact of liberalisation (Pollitt, 1997a). One deals with assessing the impact from actual occurrences. The other tries to predict or simulate the potential impact based on some historic trends. Any overall evaluation of the efficiency effects of privatisation and restructuring will need to take into account a wide range of impacts. The methodologies used to assess the impact of liberalisation based on price or cost comparisons, such as Yarrow (1992) and Bishop and Thompson (1992), or using simulation or frontier methodologies, such as Burns and Weyman-Jones (1994), have been subjected to a uniform and strong criticism: they do not attempt to address directly the issue of whether liberalisation is likely to be socially beneficial. None considers the distributional consequences of liberalisation and most neglect the environmental costs of liberalisation. A more comprehensive approach would be a computational general equilibrium approach (CGE) such as the one used by Chisari, Estache and Romero (1999), where the macroeconomic and distributional impacts of privatisation and regulation are assessed. Nevertheless, the above studies do not possess the power of an overall social cost–benefit analysis that we discuss below, and are themselves based on numerous assumptions as to specification of objectives and constraints.

SCBA studies, such as Galal et al. (1994) and others (Pollitt, 1999; Green and McDaniel, 1998; Newbery and Pollitt, 1997; Pollitt, 1997b), have addressed the failures of the other methodologies. In this study, we use a SCBA framework to analyse the effect of liberalising the RECs' regulated supply⁹ and distribution businesses in England and Wales.

2. The Social Cost–Benefit Methodology

Jones, Tandon and Vogelsang (1990) identify three main groups in society — namely, consumers, private producers and government. A full SCBA should, in theory, be able to address the impact on economic efficiency and equity. Our first objective is to answer the question, 'Does the (expected) fall in costs resulting from restructuring and privatisation warrant the cost of restructuring and privatisation?'. Then we shall address the distributional aspect of the problem: 'Who gained and who lost (if anyone) in the process of restructuring and privatisation?'. The first question considers the productive efficiency impact

⁹Reported data cover first-tier and most second-tier supply. Excluded second-tier supply is assumed to be negligible.

of restructuring and privatisation, while the latter issue relates to equity. We are ignoring the allocative efficiency aspect, for simplicity.¹⁰

Jones et al.'s method looks at costs, prices, profits, taxes and consumer surplus. For simplicity, we shall follow Newbery and Pollitt (1997), such that

$$\Delta W = V_{sp} - V_{sg} + (\lambda_g - \lambda_p)Z,$$

where W is social welfare, V_{sp} is the social value under private operation, V_{sg} the social value under continued government operation, λ_g the shadow multiplier on government revenue, λ_p the shadow multiplier on private funds and Z the actual price at which the sale is executed.

Privatisation will be socially worth while if $\Delta W > 0$ (a value less than zero would imply a net loss to society). Assuming that, in a developed market economy, we would expect no big difference in shadow multipliers such that the shadow value of public funds is equivalent to the shadow value of private funds, we set $\lambda_g = \lambda_p = 1$. Therefore all we are left with is the change in social value of the enterprise following the ownership change.

The calculation of ΔW involves the calculation of the difference in (actual and predicted) costs under private and public ownership plus an estimate of investment cost savings. The only problem is to ascertain what would have happened had the enterprise been left under public ownership. In order to address this issue, we need to build a set of counterfactuals based on historic cost figures and other economic data. Although we can never know what would have really happened to the industry or sector under public ownership, this is a necessary condition for the SCBA.

We evaluate efficiency gains due to cost reductions and investment savings by deducting the costs under private ownership from the counterfactual costs calculated for the public sector. The restructuring and privatisation costs are then deducted from the efficiency gains to arrive at the value of ΔW . The final exercise will be to analyse the distributional efficiency. ΔW will be allocated to our three groups — consumers, producers and the government — in order to find out who gained, who lost and by how much.

¹⁰The rationale for doing this follows Newbery and Pollitt (1997, p. 280). Dead-weight losses are calculated according to the following formula: Dead-weight loss = $0.5 \times \epsilon \times \tau^2$ as a proportion of total revenue (where ϵ is the electricity demand elasticity and τ is the proportional difference between actual and counterfactual per-unit revenue of dead-weight losses). In the year during which we calculate that prices diverged most from the counterfactual value, the retail price of electricity would be increased by around 7.5 per cent. Given a total retail sales revenue of around £16 billion and an electricity demand elasticity of 0.3, the maximum dead-weight loss is £13 million p.a. In the context of what follows, these values can be ignored.

TABLE 1
Accounts for the England and Wales Area Boards and RECs at Current Prices

	<i>£ million</i>												
	1985– 86	1986– 87	1987– 88	1988– 89	1989– 90	1990– 91	1991– 92	1992– 93	1993– 94	1994– 95	1995– 96	1996– 97	1997– 98
Turnover	2,004	2,142	2,152	2,463	2,754	3,752	4,230	4,436	4,666	4,882	4,531	4,400	4,419
<i>Less</i> NGC exit charges						205	228	252	270	288	278	271	221
Turnover <i>net</i> of NGC charges	2,004	2,142	2,152	2,463	2,754	3,547	4,001	4,184	4,396	4,594	4,253	4,129	4,198
Total costs	1,699	1,794	1,903	2,071	2,326	2,960	3,135	3,167	3,229	3,265	3,049	2,945	2,947
<i>of which:</i>													
Distribution costs						1,865	1,910	1,900	1,956	1,962	1,768	1,609	1,555
<i>Less</i> NGC exit charges						205	228	252	270	288	278	271	221
<i>Equals</i> Distribution controllable costs						1,660	1,682	1,649	1,686	1,674	1,490	1,338	1,334
Supply controllable costs						419	449	477	467	485	439	442	486
Total controllable costs	1,207	1,287	1,375	1,499	1,721	2,079	2,131	2,125	2,153	2,159	1,929	1,780	1,820
Depreciation (CCA)	492	507	528	572	605	676	776	791	806	818	842	894	906
Operating profit (CCA)	305	349	249	392	427	792	1,094	1,268	1,437	1,617	1,482	1,456	1,471
Gross value of assets	24,041	24,578	25,696	27,284	28,452	30,383	37,336	38,207	39,108	41,421	42,483	43,960	45,585
Tax	194	194	170	216	265	217	299	347	393	442	405	398	403
Units distributed (TWh)	209	215	221	226	230	236	239	238	242	245	253	257	259
Labour, RECs	83,469	82,512	82,165	83,196	82,500	82,288	81,135	77,329	71,149	65,062	57,317	50,364	47,473
<i>Labour productivity index</i>													
RECs	90	94	97	98	100	103	106	110	122	135	159	183	196
UK production industries	84	91	95	98	100	102	109	118	124	130	128	129	129
RPI, September	95	98	102	108	117	129	135	139	142	145	151	154	159

In order to achieve the above objectives, we construct consolidated accounts of the 12 RECs for the period 1986–87 to 1997–98 (Table 1). For a detailed account of the numbers used and adjustments made for the pre- and post-privatisation periods, refer to Appendix C. Appendix D sets out the privatisation scenario (panel 1) and the preferred public ownership counterfactual (panel 2) costs, revenues and taxes that we use to calculate efficiency gains and their distribution. The differences between the figures for controllable costs in panels 1 and 2 measure the operating efficiency gains. The differences in revenue give the value of the change in customer benefits. The differences in tax measure the effect on government flow revenues, while the differences in profit (less differences in tax) give a measure of the gains to the producer.

(a) Comparing Costs with and without Privatisation

We use four possible scenarios¹¹ — 0, 1, 2 and 3 per cent counterfactual controllable cost decline. We could have used other counterfactuals, such as a counterfactual cost increase, or privatisation accompanied by a different regulatory framework (a stricter regime versus a more lax regime, etc.). For simplicity, and comparability with previous studies (such as Newbery and Pollitt (1997)), the latter is not performed in the present paper.

To arrive at the counterfactual controllable costs, we calculate a base pre-privatisation figure using three-year averages of the unit controllable costs (equal to total controllable costs divided by total units distributed) centring on 1987–88. We do not just use the immediate pre-privatisation year, given that it may not be representative of the business-as-usual operation of the industry under public ownership. We project costs from the base year assuming various counterfactual cost declines. For example, the 1 per cent counterfactual cost decline per annum will yield a series that takes the three-year average centring on 1987–88 as the first value and then generates a series at the common multiplying factor of 0.99 on a successive yearly basis.

Once the counterfactual cost declines are calculated, it is easy to find the difference between C_p and C_g (costs under private and public sectors¹² respectively). These differences define controllable cost savings potential following privatisation. The differences are taken from Appendix D. Beyond 2005, we lock the per-unit efficiency gains at the 2004–05 level and assume

¹¹It would be rational at this stage to consider a 2 per cent p.a. counterfactual cost fall to be the most likely counterfactual, given productivity growth from 1970 to 1987 averaging 2 per cent p.a. We provide more support for a 2 per cent counterfactual cost fall p.a. in Section V(3a). We also perform the SCBA using a 4 per cent and a 5 per cent counterfactual cost fall and the results are only presented in Table 2. A 0 per cent counterfactual implies *status quo* within the public sector.

¹²Note that the costs under the private sector (RECs) have incorporated Ofgem's projections of future cost declines from 1998–99 to 2004–05 (see Appendix D for details).

continuing demand growth of 1.3 per cent.¹³ These values are aggregated on a present-value basis using some discount rates. It is useful to experiment with different discount rates, both to account for the sensitivity of the results and to judge the robustness of the net welfare effects. We used discount rates varying from as low as 5 per cent to as high as 12 per cent. We note that a discount rate of 6 per cent was the Treasury's preferred discount rate in the 1980s, 8 per cent is the current rate and 10 per cent is a typical private sector discount rate (Newbery and Pollitt, 1997). Panel 2 in Appendix D gives the counterfactual costs for a 2 per cent p.a. counterfactual cost decline.

(b) The Investment Savings

Investment savings originate from the difference between companies' forecasts of capital expenditure and their actual expenditure (and if the latter is regulated, as it is for the RECs, then it represents the 'allowed' capital expenditure. Although capital expenditure needs are a function of the load factor and can be sensitive to changes in the load, we calculate investment savings for the RECs as the difference between updated forecasts by the RECs and the allowed expenditure by OFFER. In 1993, RECs' forecasts of total capital expenditure for the period 1995–96 to 1999–2000 totalled £1.29 billion p.a. (OFFER, 1998c). However, following significant efficiency improvements, OFFER's (1999a)¹⁴ updated forecast for 1999 and 2000 is £1.10 billion p.a.

We incorporate these estimates of the investment savings (the difference between the expected £1.29 billion and actual £1.10 billion) into our SCBA. This is achieved by considering that these additional investments of £190 million p.a. would have been undertaken under the public sector, and hence inflating the capital expenditure needs of the sector for 1995–96 to 2004–05. We project changes in assets, operating profit and depreciation, and build the counterfactual per-unit cost and revenue to incorporate these changes. This is done by inflating the assets under public ownership by £190 million per year from 1995–96, depreciating these assets by 2.5 per cent p.a. and assuming a required 4.75 per cent rate of return on these assets. The average revenue figures presented in panel 2 in Appendix D, and efficiency savings referred to in Tables 2 and 4–6, are inclusive of the investment savings.

(c) The Efficiency Gains from Restructuring and Privatisation

The most expected result from restructuring and privatisation is the potential competitive pressure from the product and capital markets and the greater incentives to cut costs. Unfortunately, for the distribution businesses in England and Wales, product competition is not much of an issue. Benefits from

¹³Taken from NGC (1999).

¹⁴Figures presented here are at 1997–98 prices.

restructuring and privatisation should accrue mostly from productive efficiency gains.

The value of efficiency gains from restructuring and privatisation is the present value of $C_g - C_p$ plus the present value of investment savings realised over the relevant time period. In other words,

$$\Delta W = \Delta C + \Delta I - R \& P,$$

where ΔC represents savings in controllable costs, ΔI is the investment savings and $R \& P$ represents the restructuring and privatisation costs aggregated on a present-value basis. All restructuring and privatisation costs are assumed to be zero under the public sector counterfactual (and after 1998 for the RECs). Table 3 later illustrates the magnitude of these costs.

(d) Distribution of the Net Efficiency Gains

Once the present value of the net efficiency gains is obtained, the next aim is to analyse its distribution among the relevant groups (namely, consumers, producers and the government). Let us define the benefits to consumers, producers and the government as $\Delta Cust$, $\Delta Prod$ and ΔGov respectively. The distribution of welfare gains, ΔW , follows the identity

$$\Delta W \equiv \Delta Cust + \Delta Prod + \Delta Gov.$$

$\Delta Cust$ is calculated as the difference between actual and projected counterfactual average revenue of the RECs. Since revenue is made up of (or equivalent to) profit plus costs, projecting the counterfactual per-unit revenue involves computing the sum of counterfactual profit, counterfactual controllable cost and counterfactual 'other costs'. These 'other costs' are the depreciation charges. We therefore derive counterfactual per-unit revenues for all counterfactual cost declines (see panel 2 in Appendix D).

Counterfactual operating profit (pre-tax) is calculated using a rate of return on the gross value of tangible fixed assets¹⁵ and projected at the rate of return in 1989–90 (see Appendix D). Although the rate of return was politically fixed during the period before privatisation, it was stable until 1988–89. There is reason to believe that the net rate of return on net assets in 1989–90 (equal to 4.75 per cent) was far above what would have occurred under normal conditions and 'had the design to make the sector more attractive to investors' (Electricity Consumers' Council, 1988).

Taxes and counterfactual taxes are calculated by projecting a tax rate. The tax rate is estimated using information on actual taxes paid. Projecting the tax for the

¹⁵Gross value of tangible fixed assets is used rather than net assets, given its relative stability compared with the latter.

public sector would involve using the tax rates and applying them to our calculated counterfactual operating profit (see Appendix D). The change in tax (actual less counterfactual) is summed on a present-value basis to arrive at ΔGov .

Following Newbery and Pollitt (1997), we calculate gains to the producers,¹⁶ $\Delta Prod$, as a residual, such that $\Delta Prod = \Delta W - \Delta Cust - \Delta Gov$.

3. Assumptions

We make five important assumptions to generate the data on costs, average revenue, profit and tax presented in Appendix D:

1. The demand growth rate is 1.3 per cent from 1997–98.
2. Projected revenue per kWh under private ownership falls as per regulatory changes from 1997–98, which we take to be 3 per cent in distribution revenue and 6 per cent in supply revenue for 1998–99, and 3 per cent p.a. thereafter until 2005. Projected controllable costs change according to distribution and supply price controls; from 1997–98 to 2004–05, we assume a 2.3 per cent p.a. decline in total controllable costs.
3. The rate of fall in controllable costs is constant under each possible scenario, such that a 1 per cent p.a. counterfactual fall in controllable costs implies that controllable costs will fall at 1 per cent p.a. until the end period (2005). Thereafter, any divergences between actual and counterfactual costs are locked.
4. Private sector assets grow at 1.3 per cent, equivalent to the demand growth rate, from 1997–98, and depreciation grows at the same rate from 1997–98.
5. Counterfactual operating profit is calculated using the 1989–90 rate of return under public ownership.

We make some further assumptions for the RECs with respect to the distributional consequences of the restructuring and privatisation. While there are many similarities between the distribution systems that RECs operate, there are also some differences. For example, companies vary in size (in terms of area or the number of customers or the quantity of electricity distributed), in the degree to which their customers are scattered in rural areas or concentrated in urban areas and in the extent to which they have larger customers who may take supply at higher voltages rather than requiring to be transformed to a lower voltage, as well as in other ways (OFFER, 1998a). We shall assume that these differences between RECs are not of major significance. These are simplifying assumptions that we need to make for the SCBA, otherwise weights on physical

¹⁶Green and McDaniel (1998) use a top-down approach. They calculate electricity price changes and then calculate the benefits (or losses) to consumers. We use a bottom-up approach, identifying the cost-driver to the price change and then explaining why prices have not fallen as much as costs.

characteristics expressing these differences would have been required to assess the final distribution of gains in efficiency from restructuring and privatisation. A detailed REC-by-REC study would be needed to assess the locational implications of divergences in physical and other characteristics between RECs.

Equal social weights are also assumed. That is, the value of one unit of currency to consumers is equal to the value placed on it by either the government or the producer.

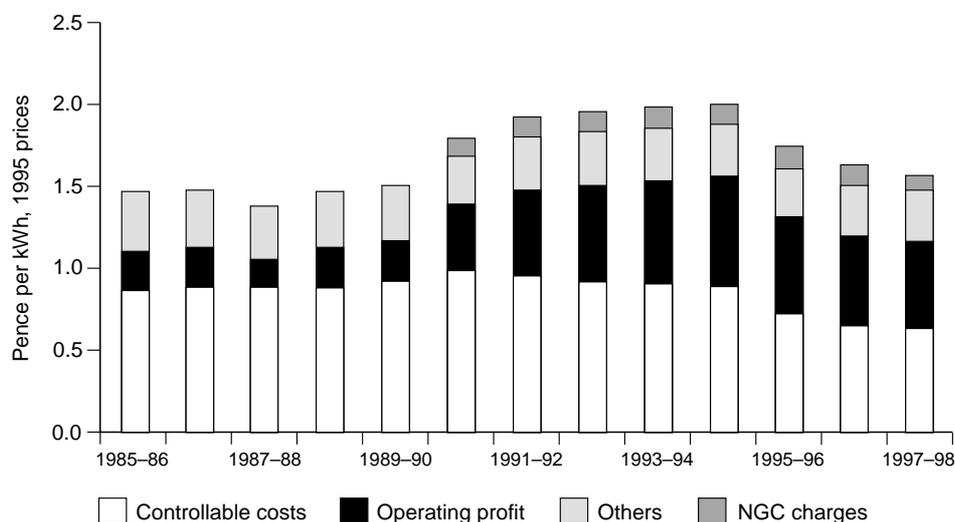
IV. DATA

To undertake the SCBA, data on turnover, operating costs, controllable operating costs, taxation, operating profit, dividends, costs of restructuring and privatisation, employment, output and retail price indices (among others) are required for the whole period 1985–86 to 1997–98. A list of the items used is given in Appendix C. Table 1 earlier shows the data used. The composition of turnover is depicted in Figure 1. Using the actual data on controllable costs, ‘other’ costs, tax and operating profit, we are able to compute counterfactual values for the public sector. Appendix D gives a summary of the data on controllable costs, average revenue, depreciation, profit and taxes, under both private and public sectors.

Operating costs cover the day-to-day costs of running the network, such as repairs and maintenance, planning and control, overhead costs, NGC exit

FIGURE 1

The Composition of Turnover in RECs and Area Boards



charges and distribution system business rents and rates. Around one-third of operating costs can be considered to be largely outside the control of the companies (including the NGC exit charges and depreciation). Price controls will have a tendency to reduce the proportion of controllable to total costs. Our objective is to evaluate, for the area boards and RECs, the present value associated with the change in controllable costs.

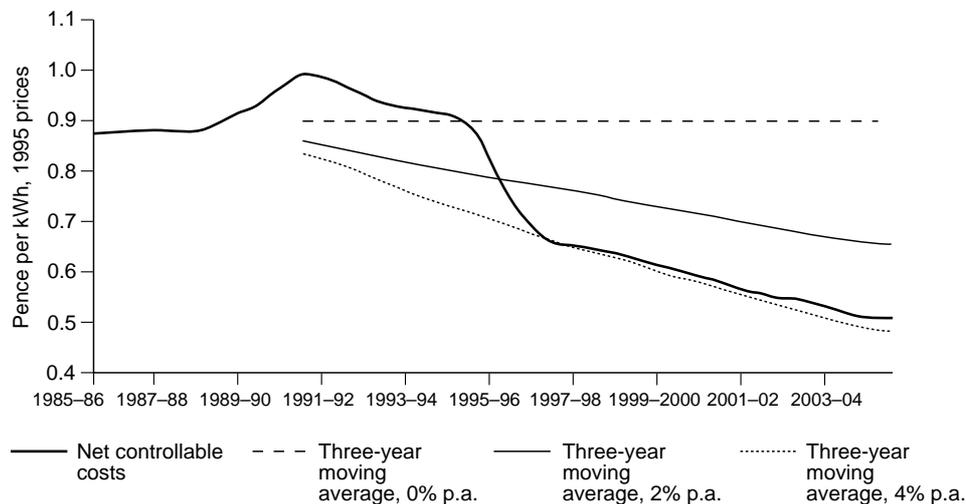
V. THE RESULTS

1. Cost Changes

We note that there was a rise in real unit distribution and supply controllable costs by about 15 per cent immediately after privatisation in 1990. The cost remained at a high level until 1994–95, after which there was a dramatic fall. The rise in controllable cost of £358 million (in nominal terms) between 1989–90 and 1990–91 represents a 21 per cent increase in nominal terms or a 7 per cent rise in real controllable costs per unit distributed. Between 1994–95 and 1997–98, the real controllable cost declined by about 23 per cent, which represents a 28 per cent fall in controllable costs per unit distributed. Figure 2 demonstrates the trend in controllable costs over the entire period of study. This diagram incorporates the predicted decline in costs after 1998, based on OFFER's and Ofgem's forecasts. We note that the results of our SCBA are not driven by the initial rise in controllable costs, given that the level was maintained

FIGURE 2

Actual and Counterfactual Controllable Costs of RECs



until 1994–95. We observe a clear relationship between the cost changes and changes in the regulatory ‘environment’.

2. Efficiency Gains

Table 2 provides estimates of the discounted efficiency gains of the RECs. We use a 1.3 per cent demand growth rate.¹⁷ All other assumptions made in Section III(3) are maintained.

With a discount rate of 6 per cent, efficiency gains through cost reduction (£5.8 billion) and investment savings (£1.3 billion) amount to £7.1 billion with a counterfactual cost fall of 2 per cent p.a. and a future controllable cost fall of 2.3 per cent p.a. This efficiency gain is partly offset by restructuring and

TABLE 2
Operating Cost and Investment Savings

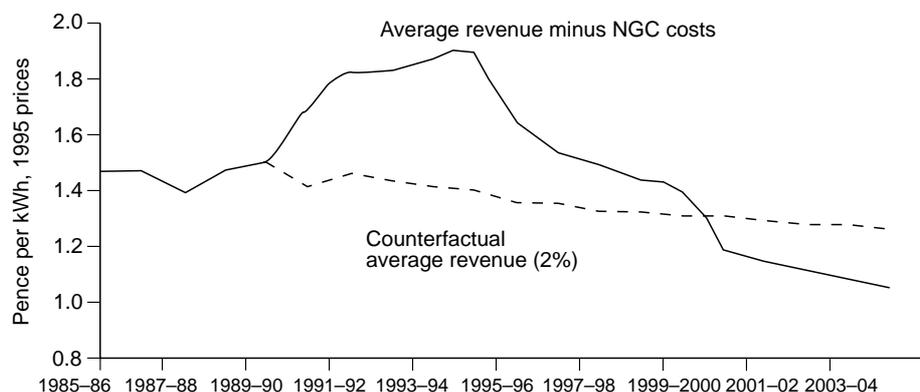
Counterfactual cost fall	Discount rate				
	5%	6%	8%	10%	12%
	£ billion, 1995 prices				
0%	25.0	19.4	13.1	9.7	7.6
1%	16.4	12.6	8.4	6.1	4.6
2%	9.4	7.1	4.6	3.2	2.2
3%	3.3	2.3	1.2	0.5	0.1
4%	-2.1	-1.9	-1.8	-1.8	-1.9
5%	-6.9	-5.7	-4.5	-3.9	-3.6
	Levelised p/kWh starting in 1994–95				
0%	0.36	0.35	0.33	0.31	0.30
1%	0.24	0.23	0.21	0.20	0.18
2%	0.14	0.13	0.12	0.10	0.09
3%	0.05	0.04	0.03	0.02	0.00
4%	-0.03	-0.04	-0.05	-0.06	-0.07
5%	-0.10	-0.10	-0.11	-0.13	-0.14
	Percentage cost/kWh				
0%	27%	26%	25%	24%	22%
1%	18%	17%	16%	15%	13%
2%	10%	10%	9%	8%	6%
3%	4%	3%	2%	1%	0%
4%	-2%	-3%	-3%	-4%	-5%
5%	-7%	-8%	-9%	-9%	-11%

¹⁷Note that cost savings are sensitive to changes in the demand growth rate. For instance, at a 2 per cent counterfactual cost fall and using a 6 per cent discount rate, cost and investment savings amount to £6.3 billion at a 1 per cent demand growth rate, £7.1 billion at 1.3 per cent and £7.8 billion at 1.5 per cent demand growth.

TABLE 3
Restructuring and Privatisation Costs of the RECs

	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
Actual (£ million)	4.3	57.8	83.6	35.7	79.1	161.8	161.5	238.1	104.4	103.7
1995 prices (£ million)	6	72	94	38	82	165	162	229	98	94
Pence per kWh	0.003	0.031	0.040	0.016	0.035	0.068	0.066	0.091	0.038	0.036
Discount rate										
	5%	6%	8%	10%	12%					
Total 1995 prices (£ million)	1,073	1,081	1,098	1,118	1,140					

FIGURE 3
Labour Productivity in the England and Wales Electricity Supply Industry and in UK Industries



privatisation costs (of £1.1 billion), yielding efficiency gains net of restructuring and privatisation costs of £6.1 billion. Table 3 describes the restructuring and privatisation costs discounted at the different rates. The totals in Tables 4a–4d are the efficiency gains net of restructuring and privatisation costs at the different discount rates. These efficiency gains are driven by increasing labour productivity (see Figure 3).

3. Efficiency Gains for Each Scenario

(a) Background to the Choice of the Central-Case Scenario

We select a central-case counterfactual cost fall of 2 per cent as what might have happened in the public sector, on the grounds of previous experience of RECs and experiences of other publicly owned electricity companies around the time the RECs were privatised. At 1985–86 prices, total costs per unit sold for the RECs rose by only 2.3 per cent over the whole period 1980 to 1986. Added costs (p/kWh) over the same period declined by 3.4 per cent p.a. and distribution costs (p/kWh) declined by 1.5 per cent p.a.¹⁸ The number of staff employed per GWh was on a continuous decline from 0.39 in 1979–80 to 0.33 in 1985–86, and labour productivity growth has been about 2 per cent p.a. between 1970 and 1987. RECs’ costs declined over the period 1985–86 to 1988–89 by an average

¹⁸Added cost equals total electricity supply costs less electricity purchase costs less non-CEGB fuel costs less profit from non-electric business. Distribution cost is net of income arising from statutory and other non-profit-earning rechargeable work (refer to Electricity Council’s Annual Reports and ‘Indicators of Performance’ for more details on the definitions and on the figures used here).

of 0.8 per cent p.a., and net controllable costs declined at a rate of 0.3 per cent p.a.

On the electricity prices front, by April 1987, prices had fallen by 15 per cent in real terms over the previous five years as a result of increased electricity sales, improved efficiency and, most importantly, significant falls in world fuel prices culminating in a £300 million cut in the CEGB's coal bill in 1986–87 (Electricity Council, 1988).

If the RECs had continued in public ownership, it is very likely that they would have been subjected to unit cost reduction targets of around 2 per cent p.a. This was the experience of the Scottish (Pollitt, 1999) and Northern Ireland (Pollitt, 1997b) electricity supply industries during the years preceding their privatisation. The public sector Nuclear Electric experienced a reduction in

TABLE 4
Net Efficiency Gains from Restructuring and Privatisation and their Distribution at Various Discount Rates

£ billion, 1995 prices

	Discount rate				
	5%	6%	8%	10%	12%
(a) Strong pro-privatisation scenario (counterfactual cost fall 0% p.a.)					
$\Delta Prod$	10.3	9.5	8.6	8.1	7.7
ΔGov	-6.0	-4.5	-3.0	-2.1	-1.6
$\Delta Cust$	19.6	13.3	6.4	2.7	0.4
ΔW	23.9	18.3	12.0	8.6	6.4
(b) Pro-privatisation scenario (counterfactual cost fall 1% p.a.)					
$\Delta Prod$	10.3	9.5	8.6	8.1	7.7
ΔGov	-6.0	-4.5	-3.0	-2.1	-1.6
$\Delta Cust$	11.0	6.5	1.7	-1.0	-2.6
ΔW	15.3	11.5	7.3	5.0	3.4
(c) Central-case scenario (counterfactual cost fall 2% p.a.)					
$\Delta Prod$	10.3	9.5	8.6	8.1	7.7
ΔGov	-6.0	-4.5	-3.0	-2.1	-1.6
$\Delta Cust$	4.0	1.1	-2.1	-3.9	-5.0
ΔW	8.3	6.1	3.5	2.0	1.1
(d) Pro-public scenario (counterfactual cost fall 3% p.a.)					
$\Delta Prod$	10.3	9.5	8.6	8.1	7.7
ΔGov	-6.0	-4.5	-3.0	-2.1	-1.6
$\Delta Cust$	-2.1	-3.7	-5.5	-6.5	-7.1
ΔW	2.2	1.2	0.1	-0.6	-1.1

operating costs (net of fuel costs and provisions) of 3.2 per cent p.a. over the period 1989–90 to 1994–95.

(b) Central-Case Efficiency Gains

We present our central case in Table 4c. Using a counterfactual cost fall of 2 per cent p.a. in the public sector, as discussed in Section V(3a) above, and discounting at a rate of 6 per cent (and incorporating the forecast 2.3 per cent p.a. reduction in controllable costs), efficiency gains net of restructuring and privatisation amount to £6.1 billion at 1995 prices. These gains are sensitive to the discount rate used. At a discount rate of 10 per cent, the efficiency gains amount to £2.0 billion at 1995 prices. The sensitivity in the present values at different discount rates is explained by the skewness of the distribution of costs and benefits. Given that most benefits from restructuring and privatisation start accruing after 1994–95, using high discount rates to calculate the present value at 1995 prices will reduce the significance of these benefits.

(c) Pro-Privatisation Scenario

A pro-privatisation scenario may become more likely if there is any reason to believe that the performance in the public sector would have worsened after 1989–90. There are some debates as to whether the labour productivity improvement that we noted earlier under state ownership would have been sustainable at all.

Using a counterfactual cost decline in the public sector of 0 per cent (i.e. assuming that there would have been no cost change under public ownership) yields a net benefit of restructuring and privatisation of £18.3 billion using a discount rate of 6 per cent. Table 4b shows that, at a 1 per cent p.a. counterfactual cost fall and a discount rate of 6 per cent, the net gain is £11.5 billion at 1995 prices.

Tables 4a and 4b also show that consumers benefit by £13.3 billion at a 6 per cent discount rate and a counterfactual cost fall of 0 per cent p.a. and by £6.5 billion at a counterfactual cost decline of 1 per cent p.a. This positive benefit owes itself partly to the drastic cost and price falls with price controls after 1995 and the most recently announced set of price controls. Producers gain £9.5 billion (relative to the counterfactual) at 0 per cent counterfactual cost fall (unadjusted for windfall tax).

(d) Pro-Public Scenario

Table 4d details the pro-public ownership scenario. This scenario is one with a high expected rate of cost decline in the public sector that also saves on the costs of restructuring and privatisation. With a counterfactual cost decline of 3 per

cent p.a., public sector ownership is a more desirable option at a discount rate of 10 per cent or more.

4. The Distribution of Benefits Based on the Central-Case Scenario

We have found that, if $\Delta W > 0$ and assuming equal social weights, then restructuring and privatisation are successful in raising social value. This is the case for the privatisation and central-case scenarios described above. An investigation into the distribution of the gains will indicate whether that allocation achieved ‘fairness’.

Figure 4 illustrates the trend in distribution and supply prices, actual and counterfactual. We can observe that there was a significant hike in prices in the initial five years after privatisation. It was only with the Price Control Reviews that prices fell drastically. Figure 5 illustrates the distribution of gains from restructuring and privatisation on an annual basis. It is only after 1999–2000 that benefits started accruing to customers (relative to the central-case counterfactual). The jumps in the distribution of benefits to consumers correspond to the Price Control Reviews after 1995.

Table 4c gives the distribution of the gains (or losses) from restructuring and privatisation under the central case (a 2 per cent counterfactual cost fall, a 2.3 per cent p.a. future controllable cost reduction). We note that consumers gained a modest £1.1 billion (at a 6 per cent discount rate) under private ownership. The producers gained about £9.5 billion and the government received £4.5 billion less in taxes (or gained £5.0 billion after accounting for windfall tax revenues and sale proceeds from privatisation). Higher counterfactual cost falls or higher discount rates would mean that consumers suffer from the restructuring and

FIGURE 4
Actual and Counterfactual Average Prices

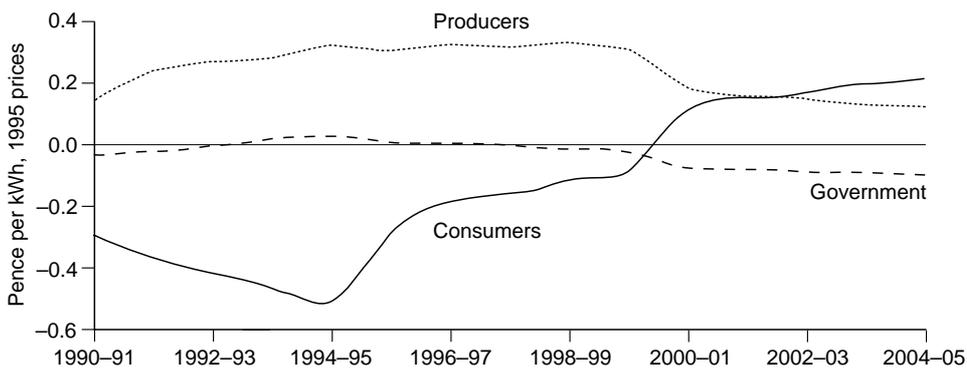
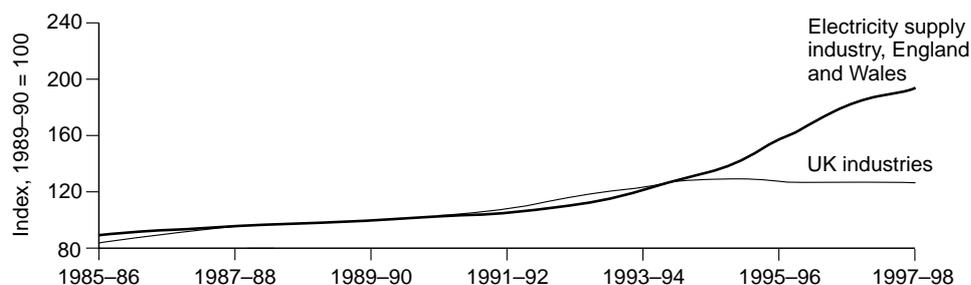


FIGURE 5
(Annual) Distribution of Efficiency Gains from Restructuring and Privatising the RECs in England and Wales



privatisation. Consumers only benefit in the privatisation and central-case scenarios, and only at discount rates not exceeding 6 per cent under the central-case scenario.

We note an additional benefit to consumers not yet accounted for in the above results. The flotation of the NGC allowed the RECs to offer exceptional rebates of about £50 per customer, for the period 1996–97. This one-off rebate on consumers’ bills also led companies to benefit from rebates on their fossil-fuel levies. The net benefit that was finally transferred to consumers amounts to £890 million (at 1995 prices and discounted at 6 per cent). At a 10 per cent discount rate, it amounts to £857 million.

There may be a potential danger to producers’ profits, which may have an adverse impact on future levels of investment and quality of supply. The tough regulation, which brought about significant reductions in prices, leads to sharp falls in profits by 2005 (to pre-tax profit rates below those in 1989–90). Nevertheless, these may have the effect of inducing further efficiency gains.

We analyse the sensitivity of our results further, by varying the rate of the (projected) future fall in controllable costs to 2005, for the central-case scenario in Table 5. This shows that faster falls in controllable costs than the rate that Ofgem predicts (if ever achievable), and assuming that prices fall at 3 per cent p.a. in line with Ofgem predictions, leave the basic patterns of the results unchanged. However, competition in supply from 1998, by allowing customers to switch suppliers and by encouraging competitive price reductions, may mean that the supply component of REC revenue will fall faster than 3 per cent p.a. from 1999 to 2005.

TABLE 5
The Central-Case Scenario under Different Levels of Future Cost Reductions

£ billion, 1995 prices

	Discount rate				
	5%	6%	8%	10%	12%
	(a) Central case with 2% p.a. future cost fall (counterfactual cost fall 2% p.a.)				
$\Delta Prod$	9.9	9.2	8.4	7.9	7.6
ΔGov	-6.1	-4.7	-3.0	-2.2	-1.7
$\Delta Cust$	4.0	1.1	-2.1	-3.9	-5.0
ΔW	7.7	5.6	3.2	1.8	0.9
	(b) Central case with 2.3% p.a. future cost fall (counterfactual cost fall 2% p.a.)				
$\Delta Prod$	10.3	9.5	8.6	8.1	7.7
ΔGov	-6.0	-4.5	-3.0	-2.1	-1.6
$\Delta Cust$	4.0	1.1	-2.1	-3.9	-5.0
ΔW	8.3	6.1	3.5	2.0	1.1
	(c) Central case with 3% p.a. future cost fall (counterfactual cost fall 2% p.a.)				
$\Delta Prod$	11.3	10.3	9.1	8.4	7.9
ΔGov	-5.6	-4.3	-2.8	-2.0	-1.6
$\Delta Cust$	4.0	1.1	-2.1	-3.9	-5.0
ΔW	9.7	7.1	4.1	2.5	1.4
	(d) Central case with 3.3% p.a. future cost fall (counterfactual cost fall 2% p.a.)				
$\Delta Prod$	11.7	10.6	9.3	8.5	8.0
ΔGov	-5.5	-4.1	-2.7	-2.0	-1.5
$\Delta Cust$	4.0	1.1	-2.1	-3.9	-5.0
ΔW	10.3	7.5	4.4	2.7	1.5
	(e) Central case with 4% p.a. future cost fall (counterfactual cost fall 2% p.a.)				
$\Delta Prod$	12.6	11.3	9.7	8.8	8.3
ΔGov	-5.1	-3.9	-2.5	-1.8	-1.4
$\Delta Cust$	4.0	1.1	-2.1	-3.9	-5.0
ΔW	11.5	8.5	5.0	3.1	1.9

5. Results of SCBA of Other Parts of the Industry

Our results are in line with previous studies, such as Newbery and Pollitt (1997), who performed a SCBA on the restructuring and privatisation of the CEGB. Rising profitability and government revenues have meant that consumers did not benefit during the first five years after privatisation.

Table 6 summarises the results of the preferred counterfactual from SCBA studies on the electricity supply industry in the UK. The results cannot be strictly

compared as the analyses use different time periods of real data and anticipated regulatory action. However, the available results show significant overall gains in three out of four privatisations.

Consumers lose in the CEGB and Scottish (SESI) cases (and in the RECs case at higher discount rates) but gain in the case of Northern Ireland Electricity (NIE). It should be noted that this result follows from tough regulation, which is included in the analyses of the RECs and NIE but not in the analyses of the CEGB and SESI. However, the pattern of initial losses is similar in all cases. The

TABLE 6
A Comparative Analysis of the Distribution of Net Benefits^a from Restructuring and Privatisation in the UK

		<i>£ billion</i>	
		Discount rate	
		6%	10%
<i>CEGB</i>	<i>Pro-private case</i>		
(Newbery and Pollitt, 1997)	$\Delta Cust$	-1.3	-2.2
Turnover = £9.2 bn (1995 prices)	ΔGov	-8.5	-4.1
	$\Delta Prod$	19.4	11.5
	ΔW	9.6	5.2
<i>NIE</i>	<i>Central case</i>		
(Pollitt, 1997b and 1999)	$\Delta Cust$	1.0	0.5
Turnover = £0.5 bn (1995 prices)	ΔGov	-0.1	-0.1
	$\Delta Prod$	-0.4	-0.2
	ΔW	0.5	0.2
<i>SESI</i>	<i>Preferred case</i>		
(Pollitt, 1999)	$\Delta Cust$	-1.5	-0.8
Turnover = £1.9 bn (1995 prices)	ΔGov	-5.2	-3.1
	$\Delta Prod$	6.7	3.6
	ΔW	0.0	-0.3
<i>RECs</i>	<i>Central case</i>		
(This paper)	$\Delta Cust$	1.1	-3.9
Turnover = £4.9 bn (1995 prices)	ΔGov	-4.5	-2.1
	$\Delta Prod$	9.5	8.1
	ΔW	6.1	2.0

^aUnadjusted for windfall taxation and sale proceeds.
 Source: Adapted from Pollitt (1999).

TABLE 7
Government Sale Proceeds and Windfall Tax Revenues

£ billion, 1995 prices

	Discount rate	
	6%	10%
<i>Government sale proceeds</i>		
CEGB	9.7	9.7
NIE	0.9	1.0
SESI	3.6	3.9
RECs	8.2	9.8
Total UK	22.5	24.5
<i>Windfall taxes</i>		
RECs	1.3	1.2
SESI	0.2	0.2
Others ^a	0.4	0.4
Total UK	2.0	1.8

^aMostly successor companies to CEGB, with a negligible contribution from NIE.

government loses flow revenues (taxes and dividends) but this is more than offset by the proceeds of £22.5 billion (at 1995 prices and discounted at 6 per cent) (Table 7). From the RECs alone, restructuring and privatisation benefits the government via sale proceeds and windfall taxes of £9.5 billion (Table 7), which more than offsets the loss of flow tax revenue and yields a net benefit of £5.0 billion.

Comparing the different privatisations, CEGB and the RECs were the most beneficial to society (as reflected by the proportion of net gains to total turnover). Overall, consumers seem to have lost. It may be that reforms in the electricity generation market, where market power has been reduced, and supply competition will eventually deliver net benefits to consumers. The government has gained least from SESI, but it gains most from the RECs after adjusting for sale proceeds and windfall taxes. Producers see large increases in after-tax profits in all but the NIE case, which includes a sharp reduction in real prices in 1997. Some of the rise in profits was, nevertheless, offset by the windfall tax.

6. The Quality of Supply: A Note

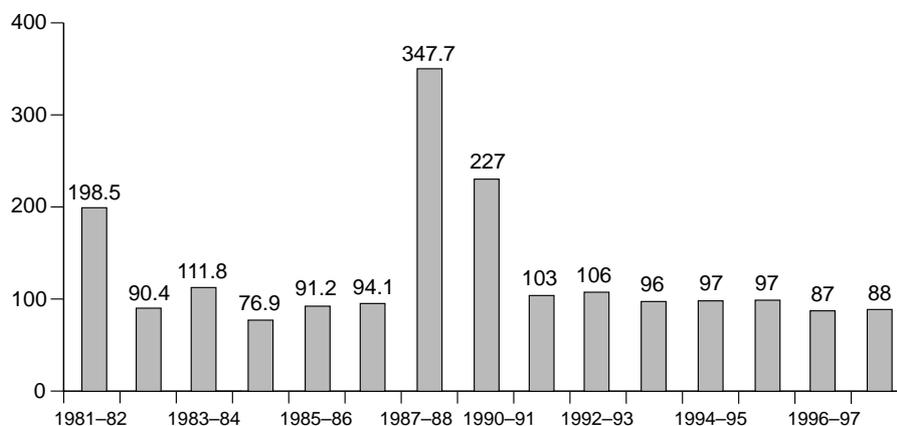
One might ask what the effect of restructuring and privatisation has been on the quality of supply. If liberalisation has altered this (relative to the counterfactual), then such changes should be included in the analysis, as quality of supply is a potentially valuable dimension of the output of the RECs. There are various

ways to judge what happened to the quality of supply following the liberalisation of the RECs. However, this is not a simple issue to handle. Incorporating it in the full SCBA would require the measurement¹⁹ and valuation of the quality of supply and the identification of a counterfactual of what might have happened in the absence of liberalisation of the RECs.

Two main measures of quality of supply are security and availability. Security is defined as the number of interruptions per 100 customers. The average of 89 interruptions per 100 customers in 1996–97 improved to 88 in 1997–98 and was better than the 10-year average of 93 interruptions per 100 customers. But we observe no definite trend in security over the period 1990 to 1998. OFFER documents note that there have not been major changes in the security of supply for any company since privatisation (for example, OFFER (1998b)). Figure 6 depicts what has happened to quality of supply, based on the average number of minutes lost per customer, since 1981. We observe that the low experienced in the 1980s has not been realised after privatisation, but, on average, private ownership has managed to maintain quality of supply.

Availability is defined as the average number of minutes of off-supply experienced by customers. Although most companies record an average better performance than their 10-year average in 1997–98, variation between them is high. There have also been unplanned power cuts throughout the period 1986 to

FIGURE 6
Minutes of Supply Lost per Customer



Notes: Figure for 1987–88 includes the effect of the hurricane in 1987. Data for 1988–89 and 1989–90 are missing.

¹⁹Measurement difficulties centre around valuing the cost of a supply interruption, given that this depends on the time of day at which it occurs, whether it is planned or unplanned, its length, the type of customer involved and the number of interruptions.

1998. No major change in availability trends is noted by OFFER (1998b) for the pre- and post-privatisation periods.

Based on a MORI poll conducted on behalf of OFFER in 1999, two in five domestic customers suffered unplanned power cuts in the previous two years. As with the other types of power cut, rural residents are notably more likely to have done so (62 per cent compared with 35 per cent living in urban locations). More than half of domestic customers in some regions have experienced recent unplanned power cuts, compared with figures as low as 12 per cent elsewhere (OFFER, 1999b). Thus the quality of supply is still an issue.

To conclude, over the last 12 years, the picture on quality of supply is mixed. We observe a slight overall improvement in quality of supply, but the benefits have not accrued to all customers equally. There are reasons to believe that rural customers have not done too well relative to urban customers. It is difficult to develop a counterfactual for quality of supply. It may be that quality of supply would have improved over the period if the RECs had continued in public ownership. We therefore assume that quality of supply has been maintained and, for the purpose of our analyses, can be ignored.

7. A Discussion of the Results

Setting out the factual record of the winners and losers for the first eight years of privatisation is fairly straightforward. What is more difficult is to interpret the record. There are inevitably problems of assessing the results that have occurred against what might have happened if the old public sector regime had continued. Another effect of the simultaneous changes in ownership, structure and regulation is that, even where it is possible to determine outcomes, it is difficult to know how to interpret their causes (MacKerron and Watson, 1996).

Per-unit net controllable costs rose by about 12 per cent during the two years between 1988–89 and 1990–91. It was only after 1994–95 that per-unit net controllable costs fell to reach their pre-privatisation low. The reduction was more drastic after 1996–97, when actual cost reductions beat counterfactual cost reductions of even 3 per cent p.a. It might be difficult, at the outset, to marry the results of this paper with those of other studies, such as Green (1998), who found that final electricity prices for many customers had fallen by 30 per cent in real terms since 1990, or Burns and Weyman-Jones (1994), who found that there were improvements in the technical efficiency of the RECs after privatisation. However, Yarrow (1992) found rapid price increases following the early years of privatisation and is in line with some of our findings in this paper. Green (1998) also pointed out that, although there is an observed fall in price, it does not necessarily mean that costs and prices have been minimised or that distribution and supply prices have also fallen. Indeed, Green (1998) suggested that there was a rise in non-fuel costs in the initial period. Similarly, Burns and Weyman-Jones (1994) investigated technical efficiency changes after privatisation using

data envelopment analysis (with physical inputs and outputs), and their results allow us to think that there is a divergence between technical and economic efficiency, providing a further rationale for undertaking this SCBA (as pointed out by Pollitt (1997a)).

Burns and Weyman-Jones (1996) found distribution costs to have fallen in the years immediately following privatisation. Surprisingly, they estimated distribution costs for the pre-privatisation years by using the ratio of distribution costs to total electricity supply activity post-privatisation and applying this ratio to the pre-privatisation costs. This assumes that privatisation did not change the ratio. There is good reason to believe that this may not be correct. Newbery and Pollitt (1997) found that generation and transmission costs fell by around 10 per cent per unit over the period 1989 to 1993, meaning that the ratio of distribution costs to total revenue would have been lower before privatisation by a significant margin and the ratio may have risen if costs went up (which is what we find). Thus, applying the same ratio significantly overestimates costs in the old public sector.

It would seem that the large number of structural changes that occurred after 1995 explain some of the rapid reduction in costs. Regulatory reviews have helped greatly after 1994–95. But the natural question that comes to mind is, ‘How much of the cost decline is explained by the regulatory Price Control Reviews and how much is explained by the structural changes that started taking place after 1995?’. Answering this question would take us beyond the objective of the present work.

Possible explanations for the initial cost increases include: a rise in materials and services costs due to subcontracting to subsidiaries to shift costs out of regulated businesses; wage costs inflated by privatisation; discontinuities between the area boards and the RECs; lax regulatory controls; a rise in institutional costs caused by the creation of new businesses and markets; and/or possibly some other restructuring costs not explicitly included in the exceptional and extraordinary items. The eventual cost reductions and efficiency improvements could be explained by the regulatory success of the Price Control Reviews after 1994–95 and by the significant restructuring that took place after 1995 with the sale of NGC and the lifting of the ‘Golden Share’, leading to major acquisitions and merger activities. If price reviews after 1994–95 contributed to most of the fall in costs, then the initial cost increases were largely due to regulatory failure.

Figure 5 earlier depicts the distribution of net efficiency gains to consumers, producers and the government. It was only after 1999–2000 that positive material benefits (relative to the central-case counterfactual) started to accrue to consumers. This would suggest that our choice of discount rate in computing the

net present values of costs and benefits is crucial to yielding the kind of results that we expect.²⁰

‘The regulator’s proposals [from 2000] for deep cost cutting in electricity distribution businesses represent a tough challenge for the industry. In addition, businesses are being faced with new and very demanding performance targets’.²¹ The future costs to producers, the gains to consumers and the large gains to the government from restructuring and privatisation (at Ofgem’s projected 2.3 per cent p.a. fall in costs) imply that the tougher regulation imposed on the RECs may possibly constitute another serious regulatory failure, failing to judge the incentive effects on the RECs and the long-term viability of the industry as a whole.

VI. CONCLUSIONS

Our aim has been to assess the costs and benefits of the process of restructuring and privatisation of the RECs in the UK electricity supply industry. We do this by including the regulator’s price reviews for the years until 2004–05. A social cost–benefit analysis is used to achieve our aim.

1. We find a rapid increase in revenue of the distribution and supply businesses, leaving per-unit revenue at an average of 22 per cent above the pre-privatisation-period level during the first price control period.
2. We infer a restructuring and privatisation cost (at 1995 prices) equal to £1.1 billion at a 6 per cent discount rate. This cost reduces the benefits of restructuring and privatising the distribution and supply businesses of the RECs.
3. From the experience of electricity supply industries in Northern Ireland and Scotland and of Nuclear Electric, and from the performance of the area boards during the period 1979 to 1989, a 2 per cent p.a. counterfactual cost fall is considered reasonable.
4. Net efficiency gains from restructuring and privatisation (relative to our central case), which started accruing to consumers after 1999, amount to about £6.1 billion. We note that the net efficiency gains of the RECs are very

²⁰An exercise into the analysis of efficiency gains and the net benefits to consumers, by locking the data at 1997–98 (assuming that there is no further change in regulation and excluding the forecasts of cost and price declines of Ofgem), reveals that, at a 2 per cent counterfactual cost decline and using a 6 per cent discount rate, the net efficiency gains (net of restructuring and privatisation costs) amount to £3.3 billion, and the net effect on consumers is a loss of £14.3 billion. These results suggest that all the benefits that are expected to accrue to consumers are entirely based on the expected future cost and price decline and the redistribution of revenue that has been proposed by Ofgem. This sort of analysis raises the serious issue of whether restructuring and privatisation of the RECs gave rise to the sort of benefits that were initially expected.

²¹‘Regulator’s price controls: Electricity Association response’, Press Release PR/55/99, Electricity Association, London, 2 December 1999.

sensitive to the discount rate used, mainly due to the skewness in the distribution of these gains.

5. Labour productivity nearly doubled in 1997–98 over its 1990–91 level. Productivity growth during the period 1970 to 1987, of 2 per cent p.a., does not match the growth experienced after 1994–95.
6. The regulatory structure (set before the creation of OFFER) that defined the initial price controls during the early years of privatisation did not contribute to cost decline. We find that the benefits of restructuring and privatisation came about mostly from institutional changes after 1995 and from distribution and supply Price Control Reviews of OFFER and Ofgem. The unit costs of the RECs fell an unprecedented 20 per cent between 1994 and 1998.
7. As a base case, we find that consumers are expected to gain £1.1 billion (at 2 per cent counterfactual cost fall and 6 per cent discount rate) relative to continued public ownership of the RECs. With the NGC rebates they were offered in 1995–96, total benefits to consumers would be about £2 billion; however, consumers lose at a 10 per cent discount rate. It is noted that, by 1998, consumers have lost considerably from the restructuring and privatisation of the RECs, and the net benefits we derive from the SCBA are based on discounted (expected) future benefits.
8. The government would have gained about £5.0 billion (sale proceeds plus change in taxes) from the restructuring and privatisation of the RECs.
9. We observe that these results have happened at a time when there have been no significant changes in the overall quality of supply.

We find rapid increases in profits during the first few years after privatisation. The tough regulatory structures put in place have tried to erode these profits, and this intention was confirmed by the imposition of windfall taxes in 1997. With the more stringent regulation, we wait to see more benefits accruing to consumers to cover the loss in the initial periods after privatisation. But tougher regulation designed to achieve greater levels of ‘efficiency’ can also significantly alter the distribution of those gains away from producers, inducing perverse effects on long-run efficiency, incentives, quality of supply and service reliability.

**APPENDIX A
SUMMARY OF DISTRIBUTION AND SUPPLY PRICE CONTROLS
FOR RECs IN ENGLAND AND WALES**

<i>Period</i>	<i>Rate of price (cost) decrease</i>
<i>Distribution businesses</i>	
1990–91 to 1994–95	Variable up to 2.5% above the inflation rate
1995 to 1995–96	11–17% (average of 14%)
1996 to 1996–97	10–13%
1997 to April 2000	Average of 3% p.a.
2000 to 2004–05	One-off cut in distribution revenue by 23.4% in 2000–01; then a 3% p.a. fall in unit revenue until 2005
<i>Supply businesses</i>	
1990–91 to 1994–95	0% in final prices
1995 to 1997–98	2% p.a. fall in supply business net revenue
1998 to 1999	6% reduction in tariffs in 1998–99; further 3% reduction in 1999–2000
2000 to 2002	Overall price reductions of 5.7% p.a. for standard domestic customers and 2.1% for Economy-7 customers. These price controls are accompanied by the reallocation of costs from distribution to supply, and hence subject to another set regulatory control.

APPENDIX B overleaf

**APPENDIX B
TAKE-OVER ACTIVITY IN THE UK ELECTRICITY SUPPLY
INDUSTRY**

<i>Target company</i>	<i>Bidder</i>	<i>Date of completion</i>
SWEB plc	Southern Group (US)	18.09.95
Eastern Group plc	Hanson plc	18.09.95
Manweb plc	Scottish Power plc	12.10.95
NORWEB plc	North West Water plc	08.11.95
SEEBOARD plc	Central & South West Corporation (US)	11.01.96
SWALEC	Welsh Water plc	29.01.96
Midlands Electricity	Avon Energy	07.06.96
Northern Electric plc	CE Electric UK plc	24.12.96
East Midlands Electricity plc	DR Investments (UK) plc	10.01.97
London Electricity plc	Entergy Power (UK) plc	07.02.97
Yorkshire Electricity plc	Yorkshire Holdings	01.04.97
The Energy Group plc (Eastern)	Texas Utilities Company	19.05.98
East Midlands Electricity plc	PowerGen	27.07.98
Southern Electric	Scottish Hydro-Electric	14.12.98
London Electricity plc	Electricité de France	27.01.99
Midlands Electricity supply business	National Power	19.04.99
SWEB supply business	London Electricity (EDF)	12.06.99
SWALEC	British Energy	13.09.99

Note: This table is adapted from CRI (1998, Table A, p. xviii) and CRI (1999, Table B, p. xxi). We provide only those take-overs that have been completed and we have excluded those that were rejected or withdrawn.

**APPENDIX C
CONSTRUCTING ACCOUNTS FOR RECs IN ENGLAND AND WALES,
1985–86 TO 1997–98: SOURCES AND METHODS**

The pre-privatisation information for the 12 RECs (i.e. the area boards) is drawn from their respective Annual Reports and Accounts and from the Main Prospectus (Kleinwort Benson, 1990). For the post-privatisation era, both Annual Reports and Accounts of the RECs and their published Regulatory Accounts have been used. The physical data of the RECs are also drawn largely from their Annual Reports. However, reporting between companies differs and some data are not published. We resorted to company reports sent to us direct from the companies. In the period 1994 to 1998, a lot of these data have been extracted from OFFER's 'Reviews of Supply Businesses', 'Price Control Reviews' and 'Draft Papers on Competition', which are published on Ofgem's website. Every effort has been made to correct for discrepancies.

Electricity Distribution and Supply

Below is a brief description of the items, the variations between the company spreadsheets and the adjustments made.

<i>Item^a</i>	<i>Source and details</i>
Electricity turnover ^b	For the years 1986 to 1990, these items have been taken from the Main Prospectus and area boards' Annual Reports and Accounts. For distribution and supply businesses, turnover for 1986 to 1990 is net of purchases of electricity. For the period 1990–91 to 1997–98, total turnover is calculated by adding distribution turnover (net of exceptional and extraordinary items) to the value-added in the supply business (equals operating profit plus implied operating costs). Post-privatisation data have been obtained from the RECs' Annual Reports and Accounts.
Operating costs	For the years 1986 to 1990, the information has been taken from Annual Reports and Accounts. For the years after 1991, the item is a sum of the distribution and supply businesses' operating costs. The item has been adjusted for depreciation following current cost accounting and for exceptional and extraordinary items. Adjustments for NGC exit charges were made once the data for each company were aggregated. Totals of NGC exit charges were obtained from OFFER documents. Supply operating costs are made up of distribution costs and administrative expenses. Costs are before monetary working capital adjustment. Depreciation has been adjusted to account for common costs.
Units distributed (TWh)	Most data have come from Annual Reports. For 1997–98, data for some companies are missing and the figures were extracted from OFFER's 'Supply Price Control Reviews' (several volumes).
Total gross value of assets (excluding consumer contributions)	For the pre-privatisation period, this is given as the difference between the cost of tangible fixed assets at 31 March and the value of consumer contributions at 31 March. The full company figure is multiplied by 0.95 to account for non-electricity-supply assets. The post-privatisation equation is the sum of the distribution and supply tangible fixed assets. This provided the most stable basis for projecting counterfactual profit.
NGC exit charges	Figures are available for 1993–94 to 1997–98 in OFFER's 'Distribution Price Control Proposals'. For other years, they are published in OFFER documents. NGC exit charges are non-controllable costs to the RECs.
RPI, September	The RPI refers to September of the financial year. It has been taken from the Office for National Statistics website.

Fiscal Studies

<i>Item^a</i>	<i>Source and details</i>
RECs' controllable costs	These are the controllable costs of both the supply and distribution businesses aggregated (total operating costs less NGC exit charges, depreciation and exceptional costs).
Labour employed	This has been extracted from the Annual Reports and Accounts and from values sent direct by the companies. For 1998, it was calculated from CRI (1999).
Productivity index, UK production industries	This has been extracted from <i>Economic Trends Annual Supplement</i> and represents the output per employee in UK production industries.
Restructuring and privatisation costs	These have been extracted from Annual Reports and Accounts (basically, from the restructuring costs of privatisation component of exceptional items). Restructuring and privatisation costs exclude flotation costs and the costs associated with OFFER. Restructuring and privatisation costs are assumed to be zero after 1998–99.
Tax	This has been extracted from the Main Prospectus and CRI (various). Tax figures from the Main Prospectus give the tax liability based on the assumption that each area board was an independent entity for this purpose. For later years, for the RECs, tax liability is calculated on the same basis. The tax rate is calculated as tax as a proportion of operating profit before tax. Prior to privatisation, we assume 92% of total tax relates to electricity supply. Afterwards, we assume a tax rate of 27% (see panel 1 in Appendix D)

^aElectricity turnover, operating costs, etc. are net of income from or costs incurred in non-electricity businesses (such as appliance retailing). These values are also net of extraordinary and exceptional items. Turnover includes non-trading rechargeables and other income.

^bThe turnover for supply businesses includes internal turnover. This might slightly inflate the operating costs following these inter-segment sales, but we have made no adjustments for them.

APPENDIX D
ACTUAL, PROJECTED AND COUNTERFACTUAL DATA USED IN THE SCBA

Panel 1: Data for the Private Sector

	<i>£ million, 1995 prices</i>														
	1990– 91	1991– 92	1992– 93	1993– 94	1994– 95	1995– 96	1996– 97	1997– 98	1998– 99	1999– 2000	2000– 01	2001– 02	2002– 03	2003– 04	2004– 05
Controllable costs ^a	2,332	2,296	2,210	2,200	2,159	1,858	1,678	1,657	1,619	1,582	1,545	1,510	1,475	1,441	1,408
Depreciation ^b	758	836	823	824	818	811	843	825	836	847	858	869	880	892	903
Profit ^c	889	1,179	1,319	1,468	1,617	1,427	1,372	1,339	1,279	1,240	762	731	701	670	639
Revenue ^d	3,978	4,310	4,352	4,492	4,594	4,095	3,893	3,821	3,733	3,668	3,165	3,110	3,055	3,002	2,950
Tax ^e	243	323	361	402	442	390	375	366	350	339	208	200	192	183	175

^aControllable costs for the private sector are actual costs until 1997–98 and then fall by 2.3 per cent p.a. until 2004–05. This figure is taken from Ofgem forecasts.

^bThese data are the actual depreciation values as reported in the Regulatory Accounts of the RECs from 1990–91 to 1997–98. From 1998–99 to 2004–05, depreciation is estimated from a straight-line depreciation method applying the rate to the asset base (which itself is assumed to grow at the demand growth rate of 1.3 per cent).

^cData on profit for the private sector are residual values after 1998 (they are calculated as the difference between revenue and the sum of controllable costs and depreciation).

^dAfter 1997–98, the values are obtained by subjecting revenue per kWh to OFFER's and Ofgem's forecasts and policies. Revenue per kWh falls by a weighted average of 3 per cent for distribution and 6 per cent for supply (equals 3.56 per cent) in 1998–99 and by 3 per cent in 1999–2000. Total revenue then falls by £503 million in 2000–01, and thereafter revenue per kWh falls by 3 per cent p.a. until 2004–05.

^eThe tax rate is calculated as the ratio of tax to operating profits. A tax rate of 27 per cent was used. This was estimated by taking 90 per cent of the ratio of total corporate tax paid to operating profits in 1992–95 using data from CRI (1995 and 1996).

Panel 2: Data for the Public Sector Using a 2 Per Cent Counterfactual Cost Decline

	£ million, 1995 prices														
	1990–91	1991–92	1992–93	1993–94	1994–95	1995–96	1996–97	1997–98	1998–99	1999–2000	2000–01	2001–02	2002–03	2003–04	2004–05
Controllable costs ^f	2,018	2,005	1,956	1,952	1,933	1,961	1,952	1,929	1,915	1,901	1,888	1,874	1,860	1,847	1,833
Depreciation ^g	758	836	823	824	818	811	847	834	849	864	879	895	911	926	943
Profit ^h	512	604	597	600	622	619	635	643	659	675	691	706	722	738	753
Revenue ⁱ	3,287	3,444	3,376	3,376	3,373	3,390	3,433	3,406	3,423	3,440	3,457	3,475	3,493	3,511	3,529
Tax ^j	316	373	369	371	384	382	392	398	407	417	427	436	446	456	465

^fThese controllable cost figures for the public sector are derived for the central-case scenario (of a 2 per cent counterfactual fall in cost p.a.). The starting figure is based on a three-year average of controllable costs centring on 1987–88. This value is then multiplied by a factor 0.98 until 2004–05.

^gThese depreciation figures are made up of the depreciation figures under private ownership plus any addition to depreciation following additions to the asset base under the public sector due to investment savings, as discussed in Section III(2b).

^hProfit under public ownership is calculated by applying a rate of return on assets. Assets are allowed to grow at 1.3 per cent p.a. plus the value of the estimated investment savings. The rate of return that is applied to the assets is the 1989–90 one.

ⁱThis counterfactual revenue is made up of the sum of counterfactual profit, counterfactual controllable costs and counterfactual depreciation.

^jThe counterfactual tax is calculated using 92 per cent (to account for non-electricity-supply share) of the three-year average of the ratio of company tax to pre-tax electricity supply operating profits for the period 1987–88 to 1989–90. This rate is applied to the counterfactual profits to arrive at the actual tax values.

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Eastern	Annual Reports and Accounts 1985–86 to 1997–98 Regulatory Accounts from 1990–91 to 1997–98
East Midlands	Annual Reports and Accounts 1985–86 to 1997–98 Regulatory Accounts from 1990–91 to 1997–98
London	Annual Reports and Accounts 1985–86 to 1997–98 Regulatory Accounts from 1990–91 to 1997–98
Manweb	Annual Reports and Accounts 1985–86 to 1997–98 Regulatory Accounts from 1990–91 to 1997–98
Midlands	Annual Reports and Accounts 1985–86 to 1997–98 Regulatory Accounts from 1990–91 to 1997–98
Northern	Annual Reports and Accounts 1985–86 to 1997–98 Regulatory Accounts from 1990–91 to 1997–98
NORWEB	Annual Reports and Accounts 1985–86 to 1997–98 Regulatory Accounts from 1990–91 to 1997–98
SEEBOARD	Annual Reports and Accounts 1985–86 to 1997–98 Regulatory Accounts from 1990–91 to 1997–98
Southern	Annual Reports and Accounts 1985–86 to 1997–98 Regulatory Accounts from 1990–91 to 1997–98
SWALEC	Annual Reports and Accounts 1985–86 to 1997–98 Regulatory Accounts from 1990–91 to 1997–98
SWEB	Annual Reports and Accounts 1985–86 to 1997–98 Regulatory Accounts from 1990–91 to 1997–98
Yorkshire	Annual Reports and Accounts 1985–86 to 1997–98 Regulatory Accounts from 1990–91 to 1997–98

Other Accounts and Reports

Electricity Consumers' Council (London)	Annual Reports 1980 to 1988
Electricity Council (London)	Indicators of Electricity Supply Industry Performance 1985 to 1988 Annual Report and Accounts 1988–89

²²Other data have been gratefully received direct from the RECs themselves.

GLOSSARY OF TERMS

<i>Term</i>	<i>Definition</i>
CCA	current cost accounting
CEGB	Central Electricity Generating Board, formerly incorporating all the electricity businesses in the UK
first-tier supply	the supply of electricity by a regional electricity company to customers in its own area
liberalisation	restructuring and privatisation
NGC	National Grid Company, the company that owns the transmission network
NIE	Northern Ireland Electricity
OFFER	Office of Electricity Regulation, the office regulating electricity businesses in the UK
Ofgem	Office of Gas and Electricity Markets, replacing OFFER and incorporating the Office for Gas Regulation (Ofgas)
RECs	regional electricity companies, replacing the area boards after restructuring and privatisation
SCBA	social cost–benefit analysis, the method of analysis used in this study
second-tier supply	supply of electricity outside a REC’s own area
SESI	Scottish electricity supply industry