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Abstract
Starting in 1998, the electricity market in England and Wales will be opened up to full competition, and all consumers will be allowed to choose their electricity supplier. This promises to result in lower prices, but there will be additional transactions costs exceeding £100 million a year for the first five years. Relative to a counterfactual without competition, there are likely to be large transfers from electricity companies (and the coal industry) to consumers, but the companies lose more than consumers gain. This conclusion might be reversed if competitive pressure leads to significant additional cost savings in the future.

1.Introduction

Restructuring of the electricity industry in the United Kingdom has been in progress since the introduction of the 1989 Electricity Act. Since then the industry has been privatised and much of it opened up to competition. Competition in electricity supply, the retailing activity of selling electricity to consumers, has evolved in stages. It began in 1990 when the largest 5,000 customers with a maximum demand in excess of 1 MW were allowed to choose their supplier. In 1994, competition was made available to an additional 50,000 customers with a maximum demand of between 100 kW and 1 MW. The 23 million domestic and small business consumers in the "franchise market," who are currently

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supplied by local monopolies, will be given the opportunity to choose their power supplier beginning in late 1998.

Original plans for the domestic market called for competition to begin in April 1998; however, plans were postponed in order to give suppliers more time to develop and test their data management services.[1] The market is now scheduled to open in September 1998 with competition being phased in over several months. In addition to delays in preparing the market, there are fears that the cost of making competition possible may exceed the benefits that will flow from it. The Trade and Industry Select Committee has twice called for an independent cost-benefit analysis of the changes. The Committee is concerned both at the overall cost of the project, and also at the likely distribution of any gains from competition. There is a fear that consumers who do not leave their present supplier will not receive any benefits from the presence of competition, and in particular, that low-income consumers (who are relatively unattractive to suppliers) may have little to gain from changing their supplier. In this case, the incumbents will then have a *de facto* monopoly and little incentive to investigate savings for their customers [Henney, 1997].

This paper discusses some of the expected costs and benefits from opening up the franchise market to competition. Our aim is to produce an account of what the expected balance is likely to be and how different groups might fare. We discuss two counter-factual alternatives to competition and compare the welfare of our groups of consumers and companies. The next section of the paper provides a summary of the industry's recent history and describes how prices are determined. Section 3 discusses competition in the industry and some of the results which have occurred to date. We outline our model in section 4, and our predictions in section 5. We offer our conclusions in section 6.

[1] Data management services include: registration systems necessary to track customer movement among suppliers, metering, data collection, and provision of prepayment meters.

2. Industry Players and Electricity Prices

The principal players in the current industry framework came onto the scene on Vesting Day, 31 March 1990. At that time the body previously responsible for almost all the electricity generated in England and Wales, the Central Electricity Generating Board (CEGB), was broken up to form four separate companies: three generators, National Power, PowerGen, and Nuclear Electric; and a transmission company, the National Grid Company (NGC). The 12 Area Boards became Regional Electricity Companies (RECs), with a monopoly over distribution in their area, but facing competition in supply to larger customers.

The restructuring separated the four principal components of electricity service, generation, transmission, distribution, and supply, and made it possible for different rules to be applied to each component. For instance, competition in generation was made possible by separating the potentially competitive generation element from the natural monopoly of transmission. Initially, the two largest generators, National Power and PowerGen, controlled most of the generation market owning 30GW and 18GW of capacity, respectively (approximately 82% of total capacity at the time). Over time, however, Independent Power Producers (IPPs) were able to sign profitable long-term contracts with local RECs making the prospect of market entry less risky. These prospects were made even more attractive by advancements in generation technology, namely, Combined Cycle Gas Turbines (CCGTs). Many new IPPs signed 15 year contracts with local RECs which were backed by low cost CCGT plants that took little time to build (approximately 3 years), and were cheaper to run than typical coal-fired plants. While National Power and PowerGen are still the two largest generators, their shared capacity has fallen significantly over the past seven years.

The wholesale market price for electricity is determined via a process by which generators submit bids to the electricity Pool. Bids consist of prices for each generating unit (set) as well as information on the availability of each. The Pool operates as a ‘day ahead’ market in the sense that a generator’s bid represents the price at which he would be willing to supply electricity for any half hour of the following day. The bids are arrayed from lowest to highest to determine the efficient order for dispatching plant and the marginal operating set. It is the bid of the marginal set which determines the system

marginal price; this price together with an incentive payment to encourage availability determines the Pool Purchase Price which is paid to all generating plants that are dispatched. Other costs are recovered through an Uplift charge; the sum of the Pool Purchase Price and Uplift gives the Pool Selling Price paid by all suppliers. Contracts for differences (CfDs), used by suppliers and generators to hedge against Pool price fluctuations, cover between 80% and 90% of output. Under the conditions of CfDs, the supplier reimburses the generator when the contract strike price exceeds the Pool price, and the generator reimburses the supplier when the reverse is true. Many CfDs are simply hedges based on the expected Pool price, but some have been used to redistribute revenues around the industry. In particular, the RECs and the two biggest generators signed "coal-related" CfDs in 1990 and 1993 with high prices which allowed them to finance take-or-pay contracts with the British coal industry, buying almost all of their coal needs at prices significantly above world market levels. The CfDs between the RECs and the IPPs have also turned out to be significantly above out-turn Pool prices to date.

The natural monopolies in transmission and distribution are treated as common carriers which must allow any licensed company to use their networks, paying regulated prices. Distribution prices were allowed to rise slightly following the privatisation, but were sharply reduced by the regulator in 1995 and again in 1996. Transmission prices remained constant for three years, then faced a "RPI - 3%" price control for four years, and were reduced by 20% in 1997. The retail (or supply) price faced by smaller consumers is also regulated with a formula consisting mainly of pass-throughs - RECs have been able to pass on the (regulated) cost of transmission and distribution, and the actual cost of buying from generators in the wholesale market. This feature allowed the RECs to pass on the cost of their expensive coal-related and IPP CfDs. Customers have also had to pay a fossil fuel levy, introduced in 1990 to raise funds for decommissioning nuclear power stations (when the rate was around 10% of the value of "leviable" electricity) but now used only to support renewable generation sources, at the lower rate of 0.9%.

Prices have fallen for all consumer groups since Vesting day, although some groups experienced price rises at first. The greatest falls have been experienced by large industrial customers (excluding the largest), whose prices fell by around 10% in 1990,

once they no longer had to share the cost of buying British coal at above-market prices. Medium-sized consumers experienced a similar reduction in 1994, when they left the RECs' franchise. The very largest consumers faced rising prices in 1991 (there was a one-year transition period), because they had effectively been receiving a subsidy under the old system. Prices for domestic customers did not start to fall until 1993, but reductions in the cost of generation, in regulated transmission and distribution charges, and in the fossil fuel levy have all now been passed on to them. Excluding Value Added Tax, prices have fallen by 20 percent in real terms since 1990 for domestic customers and 22-29 percent for industrial customers. The biggest single cause of this has been a reduction in the industry's fuel costs, but the industry's own costs have also been falling. At first, this was reflected in higher profits, but it is now being seen in lower prices [Green, 1998].

3. Competition

The British experiment in electricity restructuring and liberalisation has been very thorough and ambitious. Though restructuring of utilities is occurring world-wide, there is little evidence so far to evaluate the results [Pollitt, 1997]. Therefore, it is no surprise that the path to full competition has not been without problems, but many positive changes have occurred in the industry since Vesting. In the competitive portion of the market, many consumers (60 per cent in the over 1MW market and 40 per cent in the 100kW market) have chosen to switch suppliers; both those who have switched and those who have remained have experienced lower energy bills. Likewise, more efficient fuel combinations in generation have resulted in improved environmental conditions. Newbery and Pollitt [1997] provide a cost benefit analysis of the restructuring and privatisation of the CEGB. They show that, from 1990-96, emissions of carbon dioxide, sulphur dioxide, and nitrogen oxide have fallen by 31%, 45% and 43%, respectively. Overall, Newbery and Pollitt value the changes which they observe as a saving of 5% of the CEGB's costs (excluding environmental gains).

One cannot directly apply the experience in the current competitive market to the franchise market, however. Experience so far in the competitive market has shown that larger customers are more likely to switch suppliers. The large absolute savings available to large companies give them an incentive to 'shop around' for good deals and some even

hire consultants for this task. Smaller customers, on the other hand, may not find it advantageous to invest time or money to seek out the best bargains. If small customers attach a high cost to switching suppliers, they may choose to forego small savings on their annual bill. While it is not a necessity that a consumer switch from his current supplier in order to reap the benefits from the competitive process, the degree of market contestability will depend partly on customers' propensity to switch, and this propensity will in turn be a function of the discounts that are promised by competitors.

Costs of extending the competitive market

The Trade and Industry Select Committee has investigated the preparations for introducing competition in 1998. In 1995 the committee made three general observations:

> ...we found that there was no-one to take overall responsibility for what will be a massive change in the industry; a reliance on a system of bill settlement which had not been thought through or costed; and no analysis of expected costs and benefits to consumers. [Trade and Industry Committee 1997, p. vii].

The Committee repeated its call for an independent cost-benefit analysis in its second report on the subject. The regulator had submitted estimates of the benefits of competition, which we discuss below, but the Committee was concerned at the distribution of those benefits, and the cost of opening the market to competition.

The problem is that the systems which have worked (after some initial problems) for 50,000 customers in the 100 kW market could not be extended to the 23 million customers in the present franchise market. Large customers need a meter which records their consumption in every half-hour, so that their supplier can be billed for the correct amount of electricity, but their metering charges exceed the average domestic customer's bill. A new system is needed for small consumers, based on infrequent meter readings, with consumption allocated to individual half-hours according to standardised load profiles. The Pool is responsible for organising this profiling system, while the RECs are responsible for "data management services"; i.e., keeping track of consumers as they

switch suppliers, so that meter readings can be correctly sent on to the Pool. Offer has now determined that the RECs can charge customers £276 million for their set-up costs (spread over five years), together with annual operating charges of £36 million. These figures, based on the cost estimates provided by the lowest-cost companies, are well below the sums initially suggested by the industry. The Pool's initial cost estimates were also well above the level which Offer believed appropriate, and have also been reduced. The Pool's settlement charges for the present franchise market are now expected to be around £40 million a year, and "are expected to fall once the capital cost of the new system has been met" [Offer, 1997c, p 32]. (It should be noted that franchise suppliers already pay settlement charges of 0.01 p/kWh to the Pool, and so the increase in charges is about £30 million a year).

These figures may overstate the true resource cost of introducing competition if the RECs have inflated their projected costs (in the hope that the regulator would allow them more revenue) or if the companies providing the new systems were pricing above cost and earning profits. The regulator recognized that the cost of information technology (IT) decisions previously made by suppliers which were not related to “1998” costs should not be passed on to consumers and excluded these costs from the estimates submitted by the supply companies when setting the post-1998 price restraints [Offer, 1997b, p 7]. Many RECs have outsourced their data management service requirements to computer service companies on the basis of competitive bidding,[2] and we assume that these companies face enough competition to make them bid close to their costs.

Benefits of Competition

We can identify three main benefits from extending competition to the domestic market. First, there may be reductions in the industry’s costs. This is most likely to affect the supply businesses’ own costs, where the additional competitive pressure will be greatest, but it may extend into generation if the RECs are forced to seek better deals and put more

pressure on generators. Second, there may be reductions in the industry's profit margins, where these are presently above the competitive level, which would produce "normal profits". A simple reduction in the margin might just be seen as a transfer from a company to its consumers, and while this might be justified on distributional grounds (if the company had been making supernormal profits), it would not add to the unweighted sum of economic welfare. If lower profit margins meant lower prices and greater consumption, however, this would lead to an increase in welfare through the additional consumer surplus on the extra consumption. We could expect lower profit margins in retail prices, and perhaps also in wholesale (generation) prices. Third, companies may provide improved services, such as more convenient payment methods, or better advice on the efficient use of electricity. One advantage of competition is that a company may spot a gap in the market that no-one else had identified, and fill it profitably, with benefits to consumers that could not have been anticipated.

In the case of electricity, there are also important interactions with the gas market, which has just been opened to full competition. Most of the RECs have gas supply businesses, and British Gas wants to sell electricity. The cost of dealing with consumers (meter-reading, billing, and other communications) should be reduced if one company sells both gas and electricity, and the savings may be passed on to consumers if competition is strong enough: British Gas is offering an additional discount of £10 per year to customers who buy both gas and electricity from that company. A referee has suggested that some of the gains from competition in the gas market may be conditional on having a competitive electricity market, so that firms can make "dual fuel" offers of this type, for instance. Even if we did not have to open a second market to get effective competition in the first, to have competition for one fuel but not the other could cause significant distortions (as British Gas, exposed to competition from the RECs, but not yet able to sell electricity to domestic customers, has repeatedly pointed out). Following these arguments, it could be worth opening the electricity market, even if it was costly to do so, in order to achieve the benefits of a fully competitive gas market. To test this argument, we would need to model both markets together. That would be a very worthwhile

[2] Several RECs have contracts with the IT company, CapGemini who will also be responsible for running the Pool's settlement system.

project, but is beyond the scope of the present paper, which looks at the electricity market alone.

Offer produced an estimate of the benefits of competition as part of its evidence to the Trade and Industry Select Committee [Offer, 1997e]. In 1995/96, purchases for the franchise market cost about £600 million more than the same amount of electricity would have cost at Pool prices. Offer suggested that competition in supply might halve this premium, and also lead to more competition in generation. That might produce cost savings of between two and four per cent, worth between £200 and £400 million a year. Lower prices would increase consumption and hence consumer surplus, although this effect is hardly significant. (Offer's estimate valued this at £100 million a year, but related it to the percentage change in price (which was about five per cent), rather than the percentage change squared). Offer's text also suggested that new services might be worth £100 million a year (if 10% of customers gained an additional 10% in value), but this was not included in the summary table. Overall, Offer expected benefits of £600 to £800

Benefits:	Offer figures	Correct formula
More efficient purchasing	£300 million p.a.	£300 million p.a.
Lower generation costs - franchise	£1-200 million p.a.	£1-200 million p.a.
non-franchise	£1-200 million p.a.	£1-200 million p.a.
Additional consumer surplus	£100 million p.a.	£5 million p.a.
New services	?	?
Total Benefits:	£6-800 million p.a.	£5-700 million p.a.
Costs:	Low estimate	High estimate
Set-up costs	£150 million	£517 million
Operating costs	£22.5 million p.a.	£83.1 million p.a.

Table 1 - Offer's estimates of the Benefits and Costs of 1998.

million a year, expressed as £6 to £8 billion over ten years. These were compared to additional operating costs of between £20 and £80 million a year, and set-up costs of between £150 and £520 million. (The high figures were company estimates, the lower

[http:\www.twoten.press.net/stroies/97/09/12/headlines/business_cap_gemini.html

figures reflected Offer's initial adjustments, and Offer's latest figures are intermediate.) Offer's ten-year comparison made no attempt to take present values for these costs and benefits, but the figures for the benefits were so much greater than the costs that this would not have affected the favourable conclusion.

Since these estimates were produced, the regulator has published more information on prices after 1998. He has determined that the RECs will be subject to a fixed maximum price for at least two years from April 1998, designed to protect small consumers if competition is not strong enough to keep prices down. Previous price controls have allowed companies to pass through the actual cost of generation, with correction factors to take account of previous years' over- or under-recoveries, but such correction factors could well distort a competitive market. Instead, the regulator has estimated the companies' future costs, and set a price control (in p/kWh) at this level.

Figure 1 and table 2 show how this has been done. The weighted average cost of the coal contracts, the IPP contracts, and the other contracts assigned to the franchise market was 3.85 p/kWh in 1996/97, shown by the dotted line in figure 1. For 1998/99, the regulator has reduced the cost of the coal contracts (by 9%) to take account of the likely reduction in the price of the generators' coal purchases. The prices of the other contracts are assumed to be unchanged, but the IPP contracts are now spread across all of the RECs' purchases, including those for the present non-franchise market, while some of the former non-franchise contracts (by far the cheapest) are allocated to the ex-franchise market. The net effect is to reduce the average cost of generation from 3.85 p/kWh in 1996/97 to 3.53 p/kWh in 1998/99. Companies with above-average purchase costs in 1996/97 have been required to make larger reductions, but we concentrate on the average figures. When combined with forecast reductions in transmission and distribution costs (and the costs of organising competition), these figures justify a price reduction of about 6% (in real terms) between 1997/98 and 1998/99. The regulator has also imposed a further real cut of 3% for the following year, so that prices should not rise in nominal terms. Since franchise customers will pay about £8.5 billion for their electricity in 1997/98, these reductions are worth more than £500 million in the first year, and £750 million in the second year. That does not mean that welfare will rise by this amount, however. First, much of the price reduction is a transfer to consumers from electricity

companies (and the coal industry). Second, some of these reductions might have come about in any case, and are not strictly due to competition. In the next section of the paper, we describe the model which we use to identify the welfare changes which are due to the introduction of competition to the franchise market.

	1996/97		1998/99	
	Price (p/kWh)	Volume (TWh)	Price (p/kWh)	Volume (TWh) (for weighting only)
Coal contracts	3.92	71.7	3.57	71.7
Other franchise	3.71	34.3	3.71	34.3
IPP	3.84	28.9	3.84	7.6
Other			3.00	21.3
Average	3.85	134.9	3.53	134.9

Table 2: The RECs' generation costs. Source: Offer [1997d]

4. Our Model

We wish to model the changes in welfare arising from the introduction of competition in the franchise market. For the companies in the industry (including fuel suppliers), this means calculating the change in profits, while for consumer groups, we must measure the change in consumer surplus. With a linear demand curve, this is equal to the change in price multiplied by the average of the quantities consumed with and without the introduction of competition. To add the changes across consumer groups and companies, we need to attach weights to each group's welfare.

The simplest approach is to assign each group the same weight, and just calculate the sum of the changes, but many people would disagree with the valuations implicit in this approach. Electricity companies earned high profits for most of the 1990s and many commentators would now place a relatively low weight on their profits. Most people would place a higher weight on the welfare of low-income consumers than on high-income households. Unfortunately, we do not have figures for electricity consumption by income,

but we know that consumption and income tend to be positively correlated. This implies that we might place the highest weight on the welfare of small domestic consumers, followed by large domestic consumers, business consumers, and finally the electricity companies. To simplify the discussion, we will sometimes give the unweighted sums of the changes in consumers' welfare and of the electricity companies' profits, but we are aware that some readers might wish to apply more detailed weighting schemes.

The model was calibrated to fit the data for 1996/97 provided in Offer [1997c,d]. The regulator uses a "bottom-up" approach to calculate price controls for the ex-franchise market, adding the predicted costs of generation, transmission, distribution, and supply, together with a profit margin and the fossil fuel levy. We follow this approach to calculate the cost of serving six customer groups: small domestic, large domestic, small business, other ex-franchise consumers, 100 kW consumers, and 1 MW consumers. Small domestic customers are those with annual consumption of less than 4,000 kWh. We defined small business customers to be those taking less than 20,000 kWh per year: there will be a price control for business customers taking less than 12,000 kWh, but the lower limit would have implied a very small group. The numbers of customers in each group, and their consumption, is shown in table 3. The figures are scaled down from those provided (for Great Britain) in Offer [1997a].[3]

We define the "competitive price" for each customer group to equal the cost of serving that group, including the profit margin on supply. Customers who are presently non-franchise and large business franchise customers will pay their respective competitive price. The average price which the RECs are allowed to charge their domestic and small business customers has been set by the regulator, and implies a 12.2% reduction on the prices in 1996/97. We allow for some rebalancing between the two groups of domestic customers, as long as the average constraint is met. (The regulator's price will be less than the profit-maximising price, given the low number of customers who are likely to switch to cheaper suppliers). Other suppliers selling to domestic customers will offer the competitive price, given their costs. The proportion of customers (in each group) who switch suppliers is given by the equation:

[3]Consumption in England and Wales is approximately 91 percent of the Great Britain total.

$$\text{proportion}_i = s_i \left[(p_i^r - p_i^c) / p_i^r \right]$$

where p_i^r is the regulated price for group i, p_i^c is the competitive price for group i, and s_i is the "switching propensity" for that group. Our base value for s_i is 1.25, which is consistent with the observation that approximately 25% of gas customers have changed their supplier in response to a price reduction of roughly 20%.

The predicted charges for transmission and distribution are taken from Offer (1997d); these items are the subject of existing price controls. The consumer price includes the fossil fuel levy at the April 1998 rate of 0.9% of the pre-levy price. The costs of generation and supply, and the suppliers' profit margin, are choice variables for the model. Our base value for the profit margin is the 1.5% of turnover which is allowed in the new supply price controls. The cost of supply depends on the class of customer, ranging from 0.6 p/kWh for small domestic customers in 1996/97, to 0.05 p/kWh in the 1MW market.

We use the demand-weighted Pool Selling Price as the starting point to estimate the cost of generation, but most purchases are hedged with contracts for differences. In 1996/97, the RECs paid a premium of around 5% to obtain cover for their purchases for the non-franchise market. Wholesale electricity prices are normally expressed per kWh generated, but we require the cost per kWh delivered, scaling up the wholesale price to take account of losses in transmission and distribution. We also need to take account of load factor effects: standard domestic customers take an above-average proportion of their demand at peak times, and their consumption therefore costs more than the demand-weighted price, while large customers generally have high load factors, and pay less than the demand-weighted price. This gives us:

$$\text{Delivered price}_i = \text{base wholesale price} * (1 + \text{loss factor}_i) * \text{load factor}$$

where i references customer groups, and the base wholesale price is equal to the demand-weighted Pool Selling Price, multiplied by the premium paid to hedge purchases with contracts for differences. The higher premia in the RECs' coal-related and IPP contracts

are treated as lump sums, to be deducted from their revenues when their profits are calculated, but not affecting the price that they would charge in the competitive parts of the market.

We do not model generation in detail. Competition in the franchise market might make generation more competitive (as purchasers drive harder bargains) or less (if entry becomes harder if purchasers become less willing to sign long-term contracts). We assume a small reduction in the Pool Selling Price compared to 1996/97 (suggested in Offer [1997d]) and treat the premium in the coal-related contracts as a choice variable. To calculate changes in the generators' profits, we subtract the cost of coal purchases, and an estimate of the long-run marginal cost of increases in output. We assume that competition may affect the price which the generators are willing to pay for British coal, but will not lead to an accelerated decline in the amount of coal that they buy, which depends on plant mix. If the volume of coal (and hence its production cost) is unchanged, then the change in the coal industry's welfare equals the change in the amount spent.[4] Transmission and distribution costs are assumed independent of volume (an assumption which will tend to overstate the welfare from additional consumption). The fossil fuel levy is used to recover a set amount of money, and so changes in the amount raised will eventually be passed on to consumers.

Offer [1997d] gives a break-down of costs for the franchise market as a whole. We differentiate among our four franchise customer groups, and have chosen values (shown in table 3) which have the correct average, and are consistent with the tariffs provided in CRI [1997]. This allows us to explore the view that large consumers may get a better deal than smaller customers after the market is opened to competition. Hancock and Waddams Price [1997] show that the RECs have already changed their tariffs in ways which favour their larger customers. On average, customers who are poor, elderly, or disabled tend to consume below-average amounts of electricity, and have therefore lost out from these changes.

[4] If competition led to an even greater reduction in the amount of British coal burnt, we might perceive either a welcome saving in costs, or an unwelcome cause of pit closures.

	Small domestic	Large domestic	Small business	other
Generation	4.05	3.75	3.90	3.83
Transmission	0.35	0.22	0.26	0.25
Distribution	2.43	1.70	2.00	1.90
Supply cost	0.60	0.30	0.30	0.19
Supply margin	0.15	0.20	0.17	0.18
Levy	0.53	0.43	0.46	0.44
Total	8.11	6.60	7.09	6.79
Consumption (Twh)	31.2	59.7	8.3	35.8
Customers (million)	13.1	8.2	1.4	0.6
Total bill (1996) (£ million)	2530	3937	586	2427

Table 3: Our breakdown of franchise supply costs (p/kwh in 1996/97 prices)

Table 4 shows the cost per kWh in the franchise market as a whole, for three scenarios. The first column shows the costs that actually occurred in 1996/97. The second column gives the costs that might have occurred in 1998/9, if competition had not been introduced. The cost of generation is the same as that predicted by Offer for 1997/98 (very slightly lower than in the previous year), while transmission and distribution charges are reduced in line with their price controls. The cost of supply has hardly fallen, but the profit margin is reduced to 0.5%, a level appropriate for a monopoly.[5] The fossil fuel levy has been reduced from 7% to 0.9%. The third column gives the costs that Offer has allowed for in setting its price controls for 1998/99. The cost of generation has been reduced by 8% as described above, but the costs of distribution and supply are higher, taking account of increased settlement costs and the new charge for data administration. The profit margin on supply has increased to 1.5%. The figures

[5] Offer [1997c, p.30].

are not identical to those in Offer [1997d], since the regulator's figures are in 1998/99 prices (6% above the 1996/97 prices that we use), and we classify the 0.1 p/kWh of costs which are recovered through the transmission services scheme as generation costs (they were recovered through the Pool in 1996/97), while Offer has reclassified them as part of transmission.

	1996/97	1998/99	
		no competition	with competition
Generation	3.85	3.83	3.53
Transmission	0.26	0.19	0.19
Distribution	1.94	1.78	1.87
Supply cost	0.34	0.35	0.37
Supply margin	0.18	0.03	0.09
Levy	0.46	0.14	0.13
Total	7.03	6.31	6.17

Table 4: Our breakdown of franchise supply costs (p/kwh in 1996/97 prices)

5.0 Results

The Benchmark

Our benchmark model compares the two '1998' scenarios described above. Table 4 gives the level and composition of the average franchise prices, with Offer's assumption of reductions in the coal contract premia (9%) and the price of coal (14%) included in the "competition" scenario. Given our assumptions, changes in the price of coal (which might happen even without competition) simply transfer welfare between the generators and the coal industry. Lower generation prices would transfer welfare to the RECs (if their prices stayed high) or consumers (if regulation or competition forced electricity price reductions).

Table 5 shows the gain to consumer groups, suppliers, generators, and the coal industry for the benchmark model. The second and third columns are welfare changes relative to 1996/97, while the final column shows the amount of gain from introducing

competition. We first note that customers are more than £1 billion better off in both cases relative to 1996/97. As can be seen in Table 6 consumption is higher and prices lower for all consumer groups in the two scenarios. Consumers gain over £300 million with competition than without: equal to roughly 3.7% of the amount franchise customers paid for electricity in 1996/97. On the other hand, RECs and generators fare worse because of lower consumer prices and a lower Pool price, respectively.

	The Benchmark		
	no competition (change from 96/97)	competition (change from 96/97)	difference
Small domestic	259.4	301.3	41.9
Large domestic	403.6	507.5	103.9
Small business	60.1	73.5	13.4
Other ex-franchise	248.8	437.3	188.5
100 kW	183.7	183.7	0
1 MW	216.5	216.5	0
Consumer total	1372.1	1719.8	347.7
Suppliers	-18	-254	-236
Generators	-96	-173.5	-77.5
Coal	0	-167	-167
Levy	-815	-817	-2
Use of System	-373	-363	10
'Company' total	-1302	-1774.5	-472.5

Table 5: Welfare estimates (£ million relative to 96/97)

Table 6 shows that many consumers remain with their local REC even in the face of price reductions, due to switching costs. We have assumed that the RECs give a slightly greater price reduction to large consumers than to small, but have kept the differential

down to 1%. The regulator has required that the median bill should fall by 6% in real terms, and that standing charges may not increase in nominal terms, which limits the amount by which the RECs can favour larger customers. Given our switching equation and the profit margins in the two market segments, the RECs can increase their profits by giving larger consumers as much of the price reductions as the regulator will allow. As more of the reductions are given to large customers, we could reach a scenario in which many of the small customers who do not switch would have been better off with the smaller, but evenly distributed, price reduction which we predict under "no competition". We note that British Gas cut its price for direct debit customers by 9% in January 1998 (largely passing on price reductions from Transco, the pipeline operator[6]),

	1996		No Competition		Competition	
	quantity Twh	price p/kWh	quantity Twh	price p/kWh	quantity Twh	price p/kW
Small domestic: don't switch	31.2	8.11	31.5	7.28	29.7	
Small domestic: switch supplier					1.8	
Large domestic: don't switch	59.7	6.60	60.3	5.93	55.8	
Large domestic: switch supplier					4.6	
Small business: don't switch	8.3	7.09	8.3	6.37	7.8	
Small business: switch supplier					0.6	
Other ex-franchise	35.8	6.78	36.2	6.09	36.4	
100kW	45	4.50	45.4	4.09	45.4	
1MW	77	3.50	77.6	3.25	77.6	
Total	256.9		259.3		259.8	

Table 6: Consumption and prices by group

but that customers who pay their bill in arrears (and have been less likely to switch supplier) got only a 1% reduction. In any case, the customers who switch supplier receive

[6] Trade and Industry Select Committee [1998, para. 42].

much lower prices than those who stay with the RECs, and the welfare gains are concentrated on this minority.

The regulator's price reductions assume that the RECs can pass on part of the excess cost of their IPP contracts to non-franchise customers. We assume that they cannot, and although entrants make small gains from competition, suppliers as a group lose heavily. Likewise, lower contract premia outweigh the gains from lower coal prices, leading to losses of £78 million for generators. In the benchmark model, the volume of coal delivered remains the same, thus coal industry revenues fall by exactly the amount of the coal price reduction, 14%. Levy and Use of System receipts vary with prices and quantities. Comparing the two main scenarios, levy receipts fall under competition since the decline in average price (2.7%) outweighs the increase in consumption (0.19%). Conversely, the small increase in consumption increases Use of System revenues under competition.

Sensitivity

Table 7 summarises the expected changes in welfare resulting from variations in parameters which might be affected by competition. We use the results from the competition scenario in Table 5 as our basis of comparison. Our first departure from the benchmark concerns customers' willingness to change suppliers. The benchmark value assumes that 25% of customers would switch in response to a 20% reduction in price; here we assume that half would choose to switch. Compared to competition in the benchmark, consumer welfare improves by approximately £24 million though RECs lose £30 million (entrants gain £6 million). Total consumption remains unchanged, but there is a reallocation of consumers from relatively higher priced REC suppliers to lower priced competitive suppliers. The greater switching might put more pressure on RECs to improve services and cut costs, however. With equal weighting of consumer and company benefits, increased switching improves social welfare by just under £2 million.

There are some benefits that competition may bring which we find it difficult to anticipate *a priori*. Suppliers may find market niches that they can satisfy at lower costs than existing competitors or may discover previously unfulfilled needs in the industry.

Innovations resulting from these possibilities may be manifest in the form of lower supply charges. So far we have not assumed that the price reduction given to the REC customers changes in response to supply cost reductions. Presumably, this would occur in a competitive market, and the result would be increased gains for consumers. The effect on RECs would depend on the magnitude of cost savings derived from innovations. Similarly, if suppliers choose to compete on service without offering price reductions, our model would not reveal this benefit.[7]

With case 2, we address the question of expected benefits in the event that, instead of competition, suppliers' pricing behaviour were guided by a type of yardstick regulation. We assume that each REC would be allowed to pass on a weighted average of its own generation costs, and the average of all RECs' costs; this would provide a stronger incentive to cut costs than the present system, but the incentive would not be as strong as with full competition. We assume a premium on the coal contracts (and a coal price) half-way between the levels in our two base scenarios, while the yardstick scenario involves no "1998" costs. If this type of regulation were effective at passing on cost savings to consumers, then they might be at least as well off as in the case of competition. Higher generation costs improve the status of generators while higher coal prices benefit the coal industry. Though social welfare appears higher in this scenario compared to competition, cost savings or service improvements from competition might reverse this result.

As discussed in Section 3, the cost of preparing the industry for full supply competition can be divided into a one time set-up cost and an ongoing annual operating cost. RECs will be able to recover costs for a period of five years, thus our model includes one-fifth of Offer's estimated set-up cost. Once this portion of cost has been recovered (approximately one-half the annual cost for the first five years) and only the operating costs are passed through to customers, the case for competition is made more appealing. We look at this 'steady state' scenario in case 3, which passes the saving on to consumers, together with the further 3% reduction in prices imposed by Offer for the second year of competition [Offer, 1997d]. Relative to 1996/97, the welfare gain is approximately £11

[7] We could model this by treating a higher standard of service (and an unchanged price) as equivalent to the same standard of service at a lower price (see the comment after case 3).

million with equal weighting (and thus still below the "no competition" scenario). Welfare will improve still further if competition results in supply cost reductions which are passed through to final customers. Our estimates suggest that a supply cost reduction of 10% (with the savings passed on to customers) would bring the steady state welfare gains to the level of the 'no competition' gains in the benchmark; e.g., just over £70 million relative to 1996/97.

	competition change from 96/7	case 1: increased switching	case 2: yardstick regulation	case 3: steady state
Small domestic	301.3	307.3	310.6	376
Large domestic	507.5	523.8	483.2	676
Small business	73.5	75.6	71.9	95.9
Other ex-franchise	437.3	437.3	461.6	447.3
100 kW	183.7	183.7	183.7	183.7
1 MW	216.5	216.5	216.5	216.5
Consumer Total	1719.8	1744.3	1727.5	1995.4
Suppliers	-254	-278	-233	-469
Generators	-173.5	-173.1	-148.9	-172.2
Coal	-167	-167	-80	-167
Levy	-817	-818	-818	-820
Use of System	-363	-362	-363	-355
'Company' Total	-1774.5	-1798.1	-1642.9	-1983.2

Table 7: Parameter variations (£million relative to 96/97)

In his cost-benefit analysis to the Trade and Industry Select Committee, the DGES estimated demand elasticity to be -0.1 in the short run and -0.4 in the long run. Our analysis so far has assumed the short run value, but the higher long-run value implies that lower prices will lead to a greater increase in consumption, and higher welfare. As we

increase elasticity towards the long run value the gap between social welfare in the competition/no competition scenarios becomes smaller. With a value of -0.2, consumers are better off by £352 million with competition than without while companies lose £464 million (compare to the 'difference' column of Table 5). If we increase the value to -0.4, the corresponding values are £361 million for consumers and £-446 million for companies. While such a change does not influence prices, consumption in the competitive scenario increases by 2% and 4.5% for elasticities -0.2 and -0.4, respectively.

6.0 Conclusions

It is clear from our analysis that the transfers between companies and consumers resulting from competition are much greater than the net changes in welfare. Consumers are due to gain from lower charges for transmission and distribution (at the expense of NGC and the RECs) and from the reduction in the fossil fuel levy (at the expense of the nuclear industry, and ultimately the government) in any case. Extending competition to the franchise market is likely to create additional transfers to consumers from the RECs, (who may no longer be able to pass on all the cost of their IPP contracts) and the coal industry. The unweighted sum of welfare will only increase if costs are reduced, or if prices fall towards marginal cost and encourage additional consumption. In our benchmark case, cost reductions are outweighed by the cost of introducing competition to the franchise market, and the increase in consumption is not sufficient to offset this.

The Trade and Industry Select Committee asked for a cost-benefit analysis which looked at the gains and losses for particular consumer groups. We have divided domestic consumers into two groups, and predict that large consumers will gain more than the small. Hancock and Waddams Price [1997] show that the RECs have been rebalancing their tariffs in ways that reduce prices to large consumers, who may well have been paying more than the cost of serving them in the past. In our model, the RECs can increase their profits by ensuring that the price reductions required by the regulator are concentrated on larger customers (within the constraints that the bill of a 3,300 kWh consumer must fall by a specified amount, and the standing charge may not rise in nominal terms). We have seen that customers who switch supplier can obtain much lower prices than those who remain

with their local REC. Together with the rebalancing, this implies that the gains from competition in the franchise market are likely to be concentrated on those consumers who take above-average amounts of electricity, and those who are better informed.

We have discussed transfers between consumers and companies, but should remember that companies will sometimes pass any losses on to their workers. For instance, competition will have effects on industries such as coal as is evidenced by the demand for coal contracts in 1998. While RJB, the largest UK coal provider supplied 25 million tonnes of coal to the industry in 1996/97, contracts for 1998/99 may cover little more than half of that amount.[8] We should point out that the generators are likely to have wanted to reduce their coal purchases in any case, and the decline of the coal industry was sealed when work started on the latest gas stations, two or more years ago. The end of the RECs' franchise means that there is no guaranteed market that could absorb the cost of measures to protect the miners' jobs.

We have not assigned weights to the welfare of consumers and companies, but repeat that this does not mean that we should be indifferent to the transfers between them. The transfers involved in the regulator's reductions in transmission and distribution prices are much greater than the welfare gains that will result from prices which are closer to marginal costs, but there is a strong case in equity that if the industry is earning supernormal profits, prices to consumers should come down. Since extending competition is likely to erode supernormal profits, it will create transfers which might be desirable from an equity viewpoint, even if the unweighted sum of welfare declines. What we cannot tell is whether subjecting the RECs to a system of yardstick regulation on their purchase costs would provide the same incentive to keep costs down, and succeed in passing the benefits on to consumers, without incurring the transactions costs of the 1998 process. Similarly, the impact of the end of the franchise market on competition in generation is a subject we are continuing to research.

Our analysis suggests that the transactions costs of introducing competition could reduce welfare, at least initially (though consumers are indeed likely to benefit). If competition encourages the companies to make further cost savings, these could easily

[8] *Financial Times*, 16 December 1997 "Deal with generators looks to have saved RJB jobs."

outweigh the transactions costs involved. There is also the Austrian view of competition as a process of discovery - no one can predict the new services which a new entrant might profitably provide. An optimistic view might be that it is worth incurring the transactions costs and short-term losses in order to create these opportunities.

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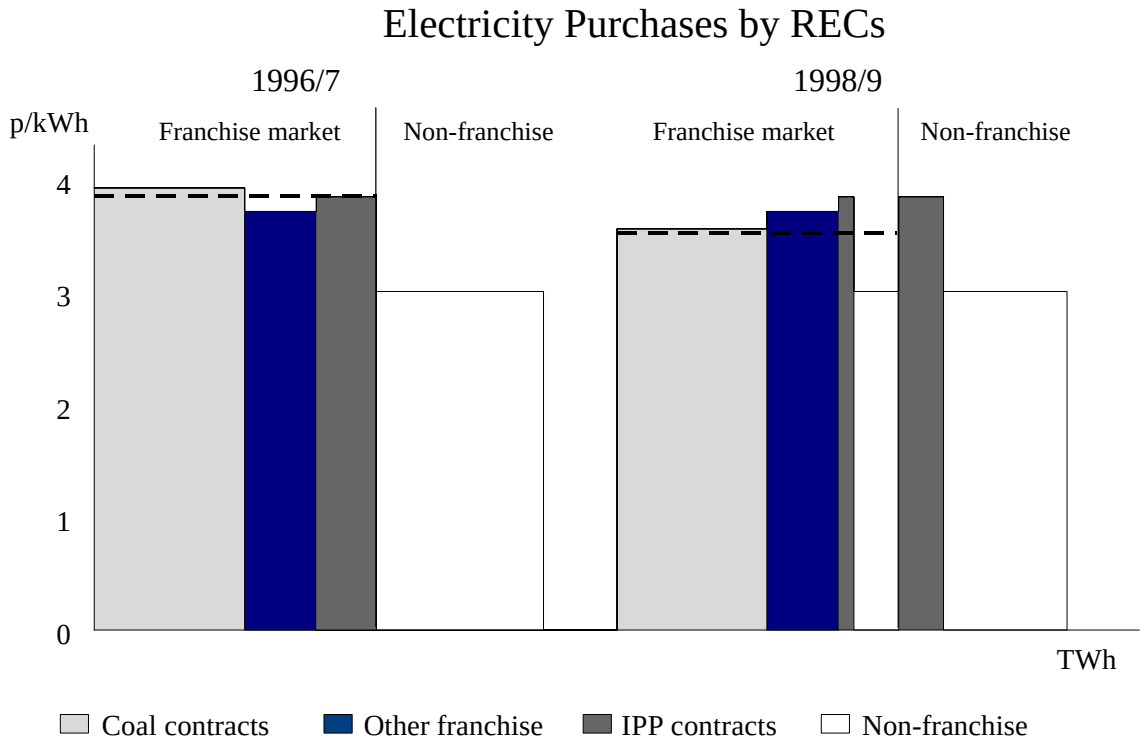

Figure 1

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