Reforming Household Energy Markets: Some Welfare Effects in the United Kingdom

by

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Abstract

This paper summarises some early effects of deregulating the UK energy sector, focusing on the effects on consumers of changes in prices, quality and opportunities for switching supplier. Changes in the sector include privatisation and restructuring of the supply industry; and more recently deregulation of all final energy prices (though those of monopoly inputs such as transmission and distribution remain controlled). The (measured) quality of service has increased, savings have been available from switching supplier and final consumer prices have fallen. But the exercise has been costly, and consumers have not reaped all the potential financial gains available from switching, and there is evidence of remaining incumbent and oligopoly power in the residential supply markets, and low income consumers in particular may remain vulnerable. The implications of these findings for the future of energy markets both in the UK and elsewhere are discussed, as prices rise to reflect shortages in wholesale markets and carbon reduction programmes.

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1. Introduction

Privatisation and reregulation have transformed the various parts of the British[1] energy supply industry in different ways. The residential electricity and gas supply industries consist of four vertical stages: generation/supply; national high voltage/pressure transmission; more regional and local low voltage/pressure distribution; and the retail function of sales and billing to final consumers The industries were privatised in the last two decades of the twentieth century (gas in 1986, electricity in 1990/91); electricity was restructured by separating generation from transmission at privatisation, but full operating separation of distribution from supply was not enabled until 2001 by license separation. At the time of writing the company which is the incumbent in each of the 14 regions also owns the (still monopolised) distribution system for that area in eight of the fourteen areas, although they are operated and accounted for separately. The gas supply industry was originally privatised with transmission, distribution and retail integrated ("from beachhead to meter"), but regulatory pressure resulted in the separation of transmission and distribution from supply by 1997.

Final residential markets were subject to price caps immediately after privatisation and choice has gradually been introduced. In electricity, choice for householders was planned in the privatisation legislation, and was completed in 1999 within six months of schedule. At privatisation of gas the incumbent was granted an indefinite monopoly for the household market, but this was changed by legislation in 1994, and all consumers had a choice of supplier by 1998. As consumers started to switch supplier, regulation was gradually withdrawn, and the final markets were fully deregulated in April 2002. At the same time reform of the wholesale electricity markets in 2000 replaced a spot market system where suppliers were paid the marginal price, with one based on bilateral contracts, and where generators were paid the price which they bid.

More recently, UK energy policy has focused less on market reform and more on other concerns which are common to many other industrialised countries. The Energy White Paper (2003) emphasised the importance of the residential sector in reducing emissions of greenhouse gases (it contributes one third of the total). Meanwhile the government has developed a programme to eliminate fuel poverty[2], and the energy regulator has instigated a Social Action Plan. These are important aspects in assessing the likely future effects of deregulating the energy market.

This paper does not directly consider the wholesale market changes, which are described and analysed in Evans and Green (2003) and elsewhere, but focuses on some effects on consumers of the reforms in the transmission, distribution and retail markets. In particular it assesses the change in final prices, which are of course affected by all upstream markets, the changes in quality of supply as measured by the regulators, consumer gains from switching, evidence of remaining power in the energy markets, and the likely effects on low income consumers, and the determinants of consumption among low income consumers. These studies are primarily based on quantitative analyses of markets undertaken by the author in collaboration with others, but include qualitative analysis of discussions with regulators, companies and consumers. These findings have been reported in other papers, and are brought together here for the first time as an overview of past energy reforms and possible directions for future policy both in the UK and elsewhere. The next section summarises the various findings under the headings of quality, price, market power, gains from switching, determinants of consumption and distributive effects. Section 3 discusses them in the light of likely future energy policy and draws some preliminary conclusions for energy policy.

[1] This discussion excludes discussion of Northern Ireland, where reforms have been much later. While most of the changes apply to England, Wales and Scotland, some electricity reforms have applied differently to Scotland; this does not affect the overall conclusions.

[2] A household is in fuel poverty if it spends, or needs to spend, more than 10% of its income on household energy requirements.

2. Results of Energy Reform

2.1 Quality

One concern when industries were privatised was that the incentives to reduce costs provided by price cap regulation might, in some sense, be too strong. An obvious way of reducing costs would be to lower quality, for example by taking greater risks that a wire or pipeline might not withstand adverse weather or other conditions. How far companies would respond to such incentives depended partly on their own time horizon. In the very short term, within a given price cap period, the company could gain from cost cutting quality reductions because it retained any cost savings not foreseen when the price cap had been set. But when the cap came to be reset, any increase in asset base, including that provided by improvements to raise quality, might be included by the regulator in determining the appropriate return for the next price cap. This element of the price cap setting process is effectively intermittent rate of return regulation, and would include similar incentives for gold plating or excess quality (Sherman, 1989). There is some irony in the fact that the element of service which consumers value most is continuity of service, which is most likely to be interrupted because of faults in the delivery system (distribution or transmission) rather than from the company which is providing retail services, with whom the consumer has direct contact.

Poor quality usually results from failure to cope adequately with uncertain aspects of demand or supply, for example unusually cold (or hot) weather which puts heavy demands on the supply and distribution systems or adverse weather which affects the supply network (high winds bringing down overhead power cables); similarly difficulty in answering consumer queries often results from unexpectedly high demand for information resulting from system failure.

It was not clear which incentives would dominate the companies' behaviour, nor indeed what the incentives had been before privatisation under public ownership. There were suspicions that public ownership might have resulted in quality that was too high relative to the cost of providing it and consumer preferences, though a model of public ownership like that in Rees (1984) might suggest otherwise, especially since minimum revenue targets were based on the level of assets, providing a *disincentive* for raising the capital base. However other evidence points to an "engineering based" attitude to quality which sought technical robustness independent of consumer preferences for quality and price (see eg Mulholland, 1998)

Although the incentives on the privatised companies were unclear, public expectations and awareness of quality issues increased markedly across the utility industries as a result of the privatisation process and its attendant publicity, and regulators were increasingly involved in setting standards for the delivery of services. These were primarily related to regulated monopoly provision, i.e. transmission and distribution in energy, but were also applied to supply services before deregulation. A study of the process in gas and electricity (Waddams Price, Brigham and Fitzgerald, 2002) showed that neither regulators nor regulated companies reacted only to the direct economic incentives.

In distribution systems, customers necessarily share some standards with their immediate neighbours: the robustness of a pipeline or distribution wire is common for all those served by it. Therefore there is limited scope for consumers to choose a higher standard of service and pay more for it on an individual basis. This is possible in some areas, eg frequency of meter reading, but not where networks are shared with other customers. Regulators, while recognising that they should be balancing the average consumer's preference for higher quality against their willingness to pay for it, found it extremely difficult to ascertain consumer preferences (Baldwin and Cave, 1999). In effect they were subject to pressure to constantly raise standards, and this is clear in the areas which were subject to target, the

standards that firms were expected to achieve and the penalties for non achievement. There were three dimensions to the penalties which regulators imposed on companies. Two lay in compensation payable to consumers, namely the amount that needed to be paid to each affected consumer and whether such payment was automatic in the event of breach of standards, or had to be activated by consumers themselves. The energy regulators increased both of these elements over time. They also imposed increasingly high fines for failure to achieve (rising) overall performance standards, and eventually included performance directly in the price cap under the Information and Incentives Project for electricity distribution companies.

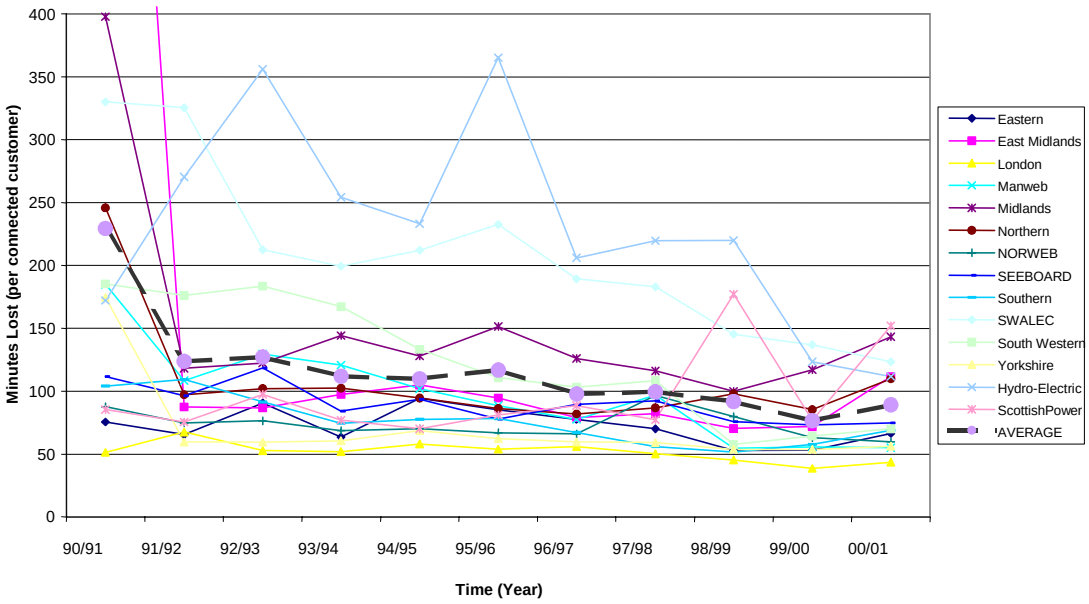
Regulators naturally choose to measure and reward dimensions of quality which are easy to measure and verify, rather than necessarily those most valued by consumers, and inevitably induces some 'game playing'; a commonly used measure is how quickly companies respond to telephone calls, which encourages speed of response but not necessarily a solution to the customer's query or complaint. More recently the energy regulator has included as a target the requirement to notify consumers of their rights to compensation and ensuring they receive it.

In energy the unification of two independent regulators, Ofgas and OFFER, into a single body, Ofgem in 1999, enables comparison of service standards for similar industries which evolved from different bases. The regulators had chosen to measure broadly the same areas of service, and some discrepancies between the standards are explicable because of the different nature of the industries (for example the target time period for restoring electricity supplies is shorter than for gas). However some differences are less easy to explain, like the difference in the time expected to notify consumers about the targets and compensation if they are breached (10 working days for electricity and 20 for gas) which suggests at least some element of randomness in the choice of the target levels (Waddams Price, Brigham and Fitzgerald, 2002).

For their part, rational firms would be expected to balance the cost of improving robustness against the expected penalties if the system were to fail. Some 'optimal breach' of quality standards might occur, particularly given the stochastic nature of demand and supply conditions. In interviews, some firms indicated that they would indeed be prepared to breach the targets, particularly in an area which they did not see as central to their own corporate objectives and image. But in practice standards rose throughout the energy sector (Chau, 2002), at least for those measures which the regulator was measuring and rewarding (see figure 1 as an example of one measure of electricity quality, minutes lost). Standards here are typical of several measures in showing convergence, with the poorer performing companies improving their delivery, rather than an improvement by the best performing companies.

Of course we cannot know what was happening to other unmeasured dimensions of quality. There is some concern about the accuracy of data for two very different reasons. In the early days, lack of experience in measurement may have led to errors; it is a common experience in developing countries that as factors such as informal supplies, standards first appear to fall as measurement improves. Conversely, experience with the process, reinforced by financial incentives to perform well may lead to some 'gaming' in later years. But we do know from interviews with the firms that they viewed quality and the regulator's endorsement of their own achievements as important indicators of reputation which were important to them in marketing in unregulated markets, both at home and overseas. This suggests that companies may be providing more quality than the regulator indicates to regulated consumers, in order to make more profits in regulated markets. Regulated consumers may therefore be paying for a higher level of quality than they would choose to (if the regulator has set the targets accurately according to this criterion) so that the firms can score well in a marketing tool to be used in other markets. We return to this in the discussion of distributive aspects below.

Figure 1: Electricity distribution AVAILABILITY: Minutes Lost



2.2 Retail Prices

Household energy markets were opened up to competition between 1996 and 1999. In gas, competition had become well established for large consumers in the immediately preceding years; theoretically it had been possible in these markets to buy from other suppliers since the early 'eighties, but competition did not really get underway until after a report by the Monopolies and Mergers Commission (MMC, 1988) and a follow up investigation by the Office of Fair Trading in 1991. Primary legislation was required to enable competition to be introduced to the residential market, and this was announced in 1994 (until the last moment it was not clear whether scarce parliamentary time would be devoted to this or to privatising the Post Office) and enacted in 1995 (Gas Act, 1995). Because the concept of supply competition while the transmission and distribution pipelines remained monopolised was so novel, competition was introduced very gradually in the residential market: first for about a million consumers in the south west in 1996, gradually extending to the south and north east, and not completed across the UK until two years later. Electricity competition was introduced in phases, and had been foreshadowed in the residential market in the privatisation legislation. It was completed between August 1998 and May 1999. Gas competition was helped by the spot gas market, where during the initial period prices were lower than those to which the incumbent supplier was committed through long term contracts, giving entrants a cost advantage. The prices of the incumbent remained regulated as competition began, but entrants' prices were not regulated. Since the product itself was homogeneous, competition soon focused on price rather than other dimensions, and this competition was widely seen as determining which of the many entrants would survive in the medium term, when the market wasn expected to be supplied by 'a handful' of companies.

Residential consumers pay for energy in one of three ways. The traditional method is to await a quarterly meter reading, from which a bill is generated, and pay in arrears - so called 'standard credit'. Because of the poor state of British housing and the potentially large bills generated by such infrequent billing, especially after a winter quarter, a prepayment method was introduced, requiring customers to charge a card or key at a local payment outlet and insert it into the meter to release a flow of energy. Because this method is often used for those in debt to the supply company or with poor credit ratings, it is predominantly used by low income households, particularly for gas. By 2004 around 12% of gas consumers and 20% of electricity consumers used prepayment. Some poverty campaigners are

concerned about the possibility of 'self disconnection' when consumers cannot afford to charge the cards and so are deprived of energy. Research among the consumers themselves indicates that an overwhelming majority welcome the control over energy spending which this method provides (Cooke et al., 2001). As competition was introduced supply companies have introduced discounts for those paying by monthly direct charges to their bank accounts, known as direct debit, and. Of the three methods of payment, the last is cheapest for the companies (since it is largely automated) and prepayment is the most expensive because it involves the cost of handling frequent cash payments.

When competition was first introduced, the incumbent national gas company and most of the incumbent suppliers in the fourteen electricity regions, charged a fixed rate per consumer for being attached to the distribution system (a standing charge) and a single per unit rate for energy consumed. There were other structures - no standing charge and two per unit rates, the one for low consumption very much higher than that for later units consumed, and sometimes a combination of a two part tariff such as this and a standing charge. When the companies were monopolies it was generally agreed that the standing charge did not cover all the consumer related costs, and that the differences between the tariffs did not reflect the differences in the costs of supplying those using different payment methods. Indeed, as part of its argument to retain its monopoly, the incumbent had argued that the standing charge would rise dramatically with competition (MMC, 1993). It is ironic that this same incumbent abolished its standing charge in the face of competition only seven years later.

Of course other aspects of tariffs did not reflect costs fully either, for example the higher costs of rural distribution networks were generally smeared across all consumers. However these cross subsidies are unlikely to be eroded as long as distribution remains a monopoly. It became an issue in supply precisely because competition was expected to attract entrants to compete most vigorously where profitability was greatest. This raised concerns for low income consumers, who were more likely to use prepayment meters and use small amounts of energy (although proportionately energy took a higher proportion than average of their income) where tariffs were thought to have been low relative to costs before competition was introduced.

The main entrants into both the gas and electricity markets have been incumbents in similar markets, so for gas all 14 of the regional electricity suppliers entered in at least some areas, and in electricity the national gas incumbent and the other thirteen incumbents entered, though in the latter case not necessarily on a national level. Some other companies entered in the early stages, mostly from other parts of the energy industry such as Calor gas, oil and coal supply companies, but by 2004 the big players who have emerged in both the gas and electricity markets had roots as the gas incumbent, two Scottish and three English electricity companies. In nine of the fourteen distribution areas, the supplier is owned by the French Government or a German public company; in the other five supply is by one of four publicly owned UK companies. From the initial 20 or so suppliers, there are now 6 large energy suppliers left, with a few small niche companies remaining.

Predictions about the development of competition in different markets proved broadly accurate. Entrants were much keener to target the direct debit market, and prepayment consumers had few attractive alternatives to the incumbent supplier in the early days. This pattern was reflected in deregulation, where price caps were removed first from direct debit markets, around 2000, and lastly from prepayment markets in April 2002.

Cross-subsidies were also eroded, in part at least. Analysis of prices in 1999 (Otero and Waddams Price, 2001a) showed that at this stage, before competition was well enough established to warrant deregulation, electricity suppliers charged varying differentials between payment methods; in particular they offered much deeper discounts to direct debit consumers, as compared with prepayment, out of area, where they were not constrained by regulation, than in their own incumbent area where they were

subject to regulatory price cap. This difference are shown in table 1, which suggests discrimination in favour of prepayment consumers and against direct debit payers by incumbents in their home area, compared with their own unconstrained behaviour out of area. It is particularly ironic that this was encouraged by the regulatory constraints, since the privatisation Acts required that companies should not discriminate unduly against any customer or group of customers. This was rarely tested, though there was one case, following a referral from the Gas Consumer Council, relating to the relative charges made for different payment methods in gas, where a similar trend was emerging, see figure 2 below (Otero and Waddams Price, 2001b).

Given that they were free to choose relative prices out of area, these could be construed as reflecting the company's perception of profitability in each market; if this were the case it suggested that the regulator's continued constraints on prepayment prices in area were depressing prices for these consumers below that which companies would regard as profitable. Any entrant had to offer supplies for all three payment methods, but since so few companies undercut the incumbent's offers in the prepayment market this confirmed that these consumers were not seen as very profitable. Thus in the early days the best competitive offers were for direct debit customers.

Table 1. Test statistics for the Direct Debit to Prepayment ratios charged by each company

Company	*Direct Debit to Prepayment ratio in:*		
	Own region	*Other regions*	*t statistic* [1/]
Eastern	0.93	0.73	-20.578 ***
East Midlands	0.88	0.87	-0.582
London	0.96	0.78	-9.775 ***
MEB	0.96	0.85	-17.853 ***
Northern	0.94	0.89	-8.313 ***
Norweb	0.91	0.85	-7.208 ***
Seeboard	0.96	0.89	-7.179 ***
Scottish Hydro	0.98	0.90	-12.696 ***
Scottish Power	0.95	0.88	-8.581 ***
Southern	0.92	0.90	-3.868 ***
Sweb	0.96	0.85	-15.081 ***
Swalec	0.89	0.90	0.496
Yorkshire	0.91	0.89	-10.621 ***

[1/] The tests are 2-sided *t* tests. They investigate the significance of the difference between the average of the direct debit to prepayment ratios of each company in other regions and the ratio in its own region. A negative (positive) value indicates that the average ratio in other regions is below (above) the incumbents' ratio in its own region.

*** denotes significance at the 1 per cent level.

Source: Otero and Waddams Price, 2001a

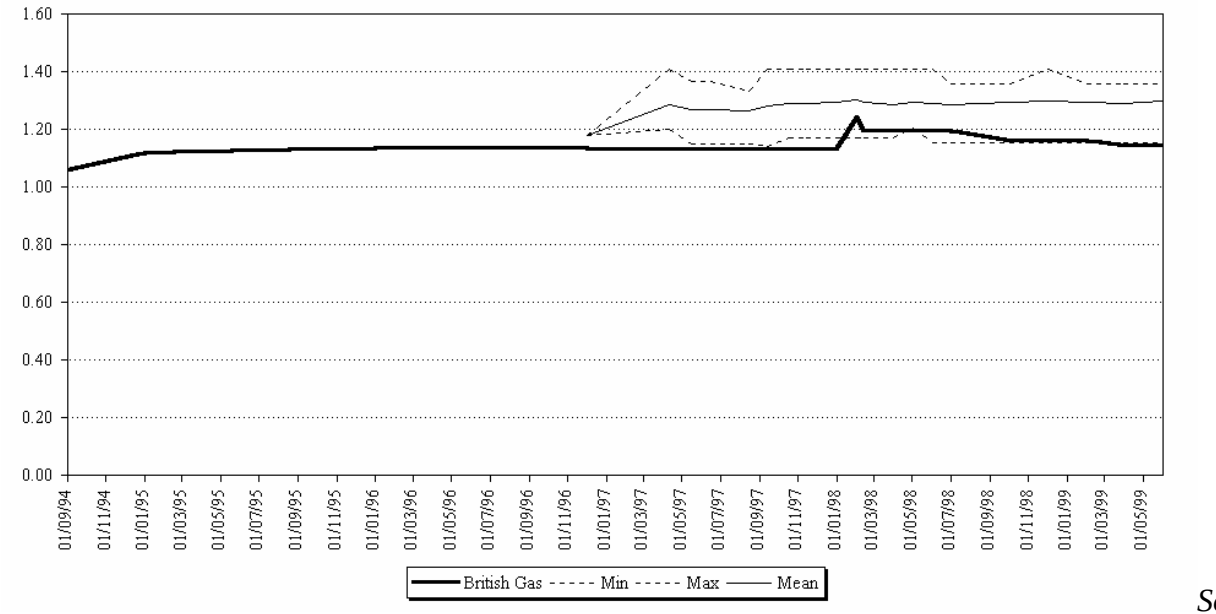
Table 2: Comparison of in area price ratio direct debit: prepayment (before and after regulation) (*from Sharratt and Waddams Price 2003)*

	1999	2003	
Eastern	0.93	0.93	Powergen
East	0.88	0.93	Powergen
London	0.96	0.93	London/SWEB
MEB	0.96	0.9	npower
Northern	0.94	0.88	npower
Norweb	0.91	0.91	powergen
Seeboard	0.96	0.93	London/SWEB
Scottish	0.98	0.95	Scottish and Southern
Scottish	0.95	0.94	Scot Power/SWALEC
Southern	0.92	0.9	Scottish and Southern
Sweb	0.96	0.94	London/SWEB
Swalec	0.89	0.9	Scot Power/SWALEC
Yorkshire	0.91	0.86	npower
average	**0.94**	**0.92**	**Significantly lower at 3%**

Table 3 Comparison of out of area (unregulated) price ratio direct debit: prepayment (*from Sharratt and Waddams Price 2003)*

	1999	2003	
Eastern	0.73	0.87	Powergen
East	0.87	0.92	Powergen
London	0.78	0.86	London/SWEB
MEB	0.85	0.8	npower
Northern	0.89	0.8	npower
Norweb	0.85	0.87	powergen
Seeboard	0.89	0.84	London/SWEB
Scottish	0.90	0.84	Scottish and Southern
Scottish	0.88	0.84	Scot Power/SWALEC
Southern	0.90	0.84	Scottish and Southern
Sweb	0.85	0.85	London/SWEB
Swalec	0.90	0.84	Scot Power/SWALEC
Yorkshire	0.89	0.8	npower
average	**0.86**	**0.84**	**Not significantly different at 5%**

Figure 1. Ratio of Prepayment tariff to Direct Debit for British Gas and range of variation of this ratio for new entrants



Source: Otero and Waddams Price, 2001

Concern therefore arose that once the prepayment market was freed from price caps, prices would rise, to the detriment of low income consumers. Analysis of prices at the time of deregulation (2002) showed that prices in these markets had indeed risen relative to other payment methods. But the process was obviously slow, with considerable discrepancies still obvious between relative charges by incumbents and entrants (Sharratt and Waddams Price, 2004, tables 2 and 3 above).

A more detailed analysis of how annual bills depended on cost and demand factors at the time the markets were fully deregulated in 2002 throws interesting light on what seemed to be influencing prices (Salies and Waddams Price, 2004). The market was developing rather differently for credit and prepayment consumers. In the credit markets there seemed to be quite vigorous competition, with a spread of prices representing a disequilibrium situation as entrants undercut incumbents; incumbents seemed able to maintain a price rather above that of entrants, a policy which is presumably profitable because there are some consumers who will not switch even for quite large gains (see section 2.5 below). However once some incumbent power had been accounted for, prices for these payment methods seemed to be largely related to costs, indicating a market with strong competitive elements. In contrast the prepayment tariffs seemed little related to costs, and the incumbent's prices were little higher than those of entrants, suggesting somewhat lackadaisical competition, but with incumbents not charging much more than entrants. This is shown in table 4 which shows the factors which explain the electricity bills for households with average consumption for each of the three payment methods.

Table 4: Parsimonious SURE results for medium consumer (3300 kWh per year)
Dependent variable: annual bill

annual consumption	Standard credit	Direct debit	prepayment
Constant	16808.90*** (454.18)	15838.97*** (450.27)	26564.48*** (724.55)
Virtual Standing Charge dummy	532.81*** (109.87)	484.18*** (110.16)	
Distribution charge	.971*** (.053)	.971*** (.053)	.326*** (.07)
Transmission Charge	.275*** (.028)	.269*** (.028)	
Distribution area	.016*** (.004)	.018*** (.004)	
Distribution customers	-.423*** (.091)	-.410*** (.090)	-1.160*** (.162)
Incumbent	1883.64*** (153.24)	2166.86*** (153.56)	
Suppliers			
Atlantic	461.10*** (85.02)	-1015.65*** (84.67)	3458.31*** (338.84)
Basic Power		927.05*** (89.37)	-1427.37*** (362.72)
London		-153.34* (86.22)	
Manweb		820.59*** (275.09)	1225.58*** (362.44)
Northern	1464.23*** (556.00)	2153.23*** (551.00)	-1865.18*** (338.84)
Npower			-1602.18*** (338.84)
SEEBOARD	932.74*** (149.43)		.687
Powergen	1254.82*** (387.16)	792.96*** (149.00)	1721.65*** (239.91)
Scottish Hydro		1138.98*** (383.53)	1413.46*** (623.36)
Scottish Power	541.86*** (86.54)		
TXU	721.58*** (164.24)	513.51*** (162.57)	796.44*** (244.40)
Adj. R^2	.917	.923	.904

standard errors in parentheses. *. Sig at 10%. **. Sig at 5%. *** Sig at 1%.
Source: Salies and Waddams Price, 2004

One question which arises is why incumbents did not immediately rebalance charges and raise prepayment prices when regulation was removed. Qualitative research with the companies indicates that they feel considerable informal pressure from the regulator, and from the consumer watchdog and

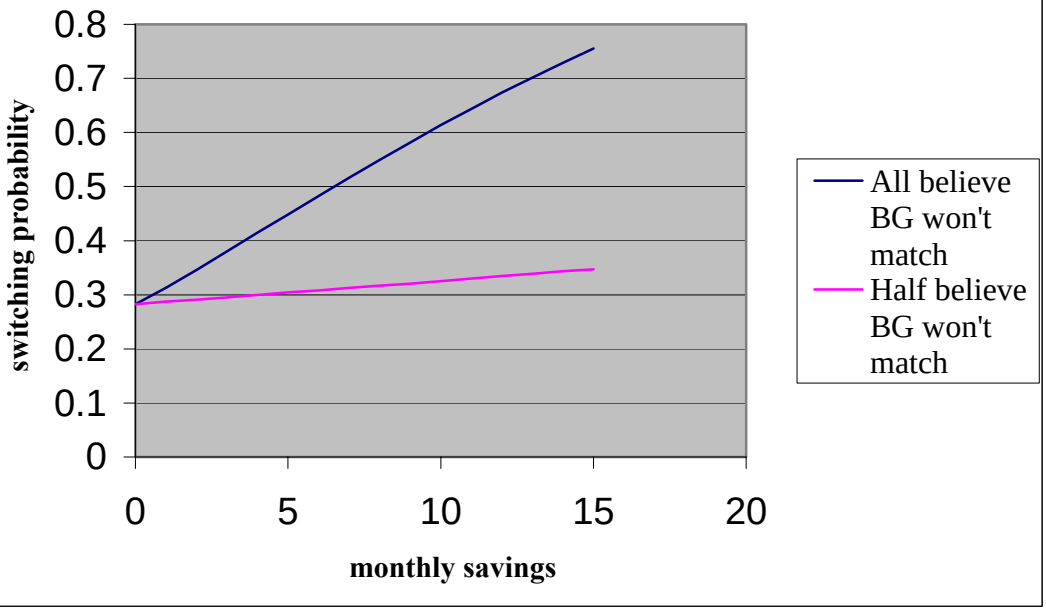
the public and media more generally, not to make changes which operate against the interests of what are perceived as a vulnerable group (Sharratt, 2003). The consumer watchdog, energywatch, have been quick to publicise such changes, and since they also publish complaints data. companies may feel vulnerable to their criticism. Moreover although the regulator no longer controls prices, it does still issue supply licenses and had responsibility for implementing the government's social and environmental programmes, and so companies are clearly conscious of its influence.

It may well be that consumers behave differently in the prepayment market. The need to recharge a card, and the relatively low income of most of these consumers, mean they are likely to be much more knowledgeable about their energy use and prices. There is some evidence that they have higher price elasticity of demand (Mathieu and Waddams Price, 2004) and that they make better decisions when switching supplier (Waddams Price, Waterson and Wilson, 2004). The cross subsidies which they used to receive when supplied by nationalised, and later regulated privatised monopolies, mean that there is, as predicted, less scope for them to gain from the competitive process.

2.3 Market Power

The question of supplier power identified in Salies and Waddams Price (2004) in the energy market is unusual, because the industry was so recently opened to competition and so much depends on consumer attitudes to the newly available choice. Consumers confer market power on the incumbent by tolerating higher prices from the incumbent (these higher prices were identified in the table 4 above). Giulietti, Waddams Price and Waterson (2003) explored this by viewing the switching decision as an investment by the consumer. Switching has a cost (psychic and in time and effort expended rather than financial), and in the questionnaire used for this analysis, consumers were asked whether they thought switching would be very time consuming and how difficult they thought it would be. To explore how great a price premium they would tolerate from the incumbent, consumers were asked what savings they would require to switch. This information determines the shape of the incumbent's downward sloping demand curve. At any particular mark up above competitors he can choose to retain more customers by narrowing the gap, but making less profit on consumers who are retained; or to maintain or raise the premium, making more profit on retained consumers, but losing the profit on those who switch away. Assuming that entrants are charging marginal costs (or the competitive price) the information provided by consumers about the margins they would tolerate enabled us to calculate the profit maximising mark up for the incumbent. At the time of the survey in 1998, it appeared that it was profitable for the gas incumbent to maintain a price around 33% above that of his competitors, which would result in losing about 45% of the market. In 2004, around that proportion of residential gas consumers have indeed switched, and the maximum savings available to a typical consumer on standard credit tariff by switching from the incumbent (at the same payment method and consumption level) are 38%, suggesting that the model derived from consumer reaction in the very early days of competition remain robust.

Figure 4: Switching probability under different assumptions



source: Giulietti et al., 2003

The investment model of consumer switching was supported by the statistical significance of the interaction between the maximum bill savings available and whether consumers expected the incumbent to match the entrants' offers (i.e. a measure of how long the expected gains from switching would last). Much of the incumbent's market power arises from consumers not bothering to switch because they incorrectly expect the incumbent to match. Figure 4 shows how many more consumers would switch if they believed that the incumbent would not match the entrants' prices. Over time we might expect consumers to become wise to the fact that matching was not occurring, but in fact we find that eighteen months later, a higher proportion of the group of consumers who had not switched by that time believed that the incumbent would match, perhaps justifying their continued inactivity in the market (Waddams Price, 2004). Awareness of choice in the market had also declined. Both of these trends suggest that the market power of the incumbents is increasing over time. This continuing market power raises concerns for the future which are discussed further in section 3 below.

Another potential measure of the market's competitiveness, the convergence of prices, was examined using the same data set of prices in Giulietti, Otero and Waterson (2004). Preliminary results suggest that differences in trend values of electricity prices have not shrunk as the market has matured. This persistence in price differences, and the falling number of competitors, confirms that the market is not exhibiting the characteristics which would be expected of an increasingly competitive market, and especially not after the period when price caps were removed.

2.4 Gains from switching

The extent of market power affects the gains available both to consumers who switch and to those who remain loyal to the incumbent. Have those who have switched gained from the process? The process of opening residential energy markets to competition has been costly, and commentators questioned beforehand whether the benefits would outweigh the costs (see for example Green and MacDaniel, 1998). Given the novel element of being able to choose supplier in this market, the inevitable inertia of many consumers, and some concerns about whether the marketing methods of incumbents were over zealous, research into early switching behaviour suggests that the gains to consumers are small on aggregate, and are unlikely to outweigh the costs of establishing the scheme and companies' marketing expenditure. This research was undertaken on data collected soon after the markets opened, but more recent data collected by Ofgem (Ofgem, 2003) do not suggest that the market has matured very far in this respect.

Two sets of data were used in assessing switching behaviour and benefits and, indirectly, market power. The first is a series of questions asked to a panel of householders in late 1998 and early 1999. This was the second stage in a three part panel survey, and the respondents formed a representative sample of UK households. The second data set was from a survey of low income householders conducted in 2000. At the time of the first survey all consumers could choose their gas supplier, and a few could choose their electricity supplier. By the time of the second survey, households had been able to choose gas supplier for between two and four years, and electricity supplier for between a year and twenty one months, depending on location.

Consumer benefits for those who had switched gas supplier were calculated only in financial terms; we were not able to calculate whether consumers increased consumption as a result of switching to a lower tariff, but since short term elasticities are comparatively small (see section below) errors will also be small. The first set of data were analysed first to identify the characteristics of consumers who switched gas supplier, using a two stage model in which switching was dependent on awareness of the potential for doing so. This gave a much better fit to the data than other attempts, by ourselves and others, to model switching as a one stage process. Older people and those using prepayment were less likely to be aware of switching possibilities. The former is not surprising given the long period for which older people have had no choice, and the latter can be explained by less enthusiastic marketing by entrants to this group, for reasons explained above. In this early stage of the competitive market, awareness increased with the time that the market had been opened, but levelled off, and eventually fell after about 22 months. This was longer than applied to any household in this survey, but reduced awareness was observed, consistent with these estimates, when this panel of consumers was approached again about eighteen months later (Waddams Price, 2004); the regulator has also reported falling awareness (Ofgem, 2003). Other factors such as education, income, size of bill or size of potential savings do not seem to influence awareness (see table 5).

Table 5: Double hurdle model of considering switching *(source Giulietti, Waddams Price and Waterson, 2003)*

AWARENESS AND CONSIDERING SWITCHING EQUATION				
RESULTS FOR BIVARIATE PROBIT MODEL				
AWARENESS EQUATION				
variable	marg effect	coefficient	p>z	mean
Constant	-	0.395	0.122	1.000
OAP households	-0.091	-0.368	0.032	0.090
Non-BT telephone customer	0.049	0.247	0.098	0.263
Prepayment meter customer	-0.169	-0.622	0.000	0.082
Elapsed time	0.022	0.114	0.006	10.307
Elapsed time squared	-0.009	-0.003	0.017	148.536
PROPORTION WHO ARE AWARE				0.865
PROBABILITY OF BEING AWARE				0.871
CONSIDERING SWITCHING EQUATION				
variable	marg effect	coefficient	p>z	mean
Constant	-	-0.767	0.001	1.000
Bill Savings	-0.010	-0.026	0.082	4.006
Reluctance of BG*bill savings	0.045	0.113	0.000	0.340
Missing bill value dummy	-0.1	-0.274	0.070	0.12
Importance of savings	0.155	0.408	0.000	0.525
Importance of supplier reputation	-0.135	-0.359	0.001	0.382
Income	0.002	0.452	0.033	1.399
Income squared	-0.001	-0.091	0.065	3.971
Low income dummy	0.108	0.280	0.084	0.247
Population density	0.001	0.005	0.708	4.857
Changed car insurance	0.084	0.244	0.100	0.179
Changed house insurance	0.048	0.215	0.075	0.117
Non-BT telephone customer	0.179	0.337	0.003	0.263
Expected time to switch	0.105	0.268	0.032	0.189
Ease of switching	0.129	0.327	0.049	0.246
RHO (1,2)	-0.890		0.000	
LR test p-value			0.945	
LRI measure of goodness of fit			0.114	
PROPORTION CONSIDERING SWITCHING				0.324
PROBABILITY OF CONSIDERING SWITCHING				0.256
UNCONDITIONAL PROBABILITY OF CONSIDERING SWITCHING				0.294

We considered both those who said they had switched, and those who were considering switching. Because the data were from an early stage of market opening the latter conformed better to our economic model, showing that once aware, consumers were more likely to consider switching if they had high potential bill savings and believed that the incumbent was reluctant to match the prices of entrants (ie they expected such savings to persist), if savings were important to them and reputation of the firm was not, if they thought that it would take little time to switch and that switching would be easy, if they had higher income (though at a declining rate), and if they had switched car or house insurance or telecom provider.

We then calculated what the gains from switching would be if consumers switched to the best available offer for their level of consumption and payment method (table 6). Calculations of the overall effect of competition both on switchers and non switchers depended on our assumptions about suppliers' behaviour in equilibrium. In our most optimistic scenario we assume that entrants set a competitive price level which the incumbent matches, resulting in consumer gains of around a thousand million pounds a year, just about equal to the estimated costs of companies in persuading the relevant number of consumers in this model to switch. In more pessimistic scenarios, in which incumbents raised their prices above those which had prevailed under regulation, consumers lost up to a hundred million pounds per year, which accounted for a welfare loss of similar levels. Only in the most optimistic scenario, with consumer surplus weighted more heavily than producer surplus, would there be any gain from the introduction of competition.

Table 6: Welfare gains and losses compared with regulated monopoly, £ million
(gains positive, losses negative) *source: Giulietti et al., 2003*

Scenario	**Interim**	**Optimistic equilibrium**	**Pessimistic equilibrium**	**2003 optimist**	**2003 pessimist**
% market switched	20%	20%	45%	36%	36%
% paying competitive price	20%	100%	45%	36%	0
Costs incurred by producers					
Entrants, cost of switching pa	-48	-48	-107	-86	-86
incumbent to switchers	-182	-182	-410	-328	-328
incumbent to non switchers		-730	523	-158	
incumbent to entrants					-89
Oligopoly rent to entrants					89
Total producer benefit	***-230***	***-960***	***+4***	***-572***	***-414***
Consumer benefits					
incumbent to switchers	182	182	410	328	328
incumbent to non switchers		730	-523	158	
Transfer to consumers	**182**	**912**	**-112**	**486**	**328**
Welfare gain: switchers	4	4	10	7	4
Welfare gain: non switchers		17	-12	1	
Total consumer gain	***186***	***933***	***-114***	***495***	***332***
Welfare change = weights	**-44**	**-27**	**-110**	**-77**	**-82**
Ratio CS:PS for welf change>0	>1.23	>1.03	<0.04	>1.16	>1.24

In the next analysis of low income households, interviewed in 2000, we modelled awareness and switching in a similar way, but examined the gains which consumers had made in practice by switching (we knew their current supplier, and the tariffs concerned, and could calculate the difference in bills between the supplier to whom they had changed and the incumbent). The initial analysis here was for electricity, rather than gas as in the previous study. Because the sample was representative of prepayment households, the average income was much lower than the UK average, and two thirds of

the households used prepayment, by sample design (the national average was around 15% at that time). Preliminary analysis showed that only about half the households had switched to a lower cost supplier at their current consumption level and payment method (Waddams Price, 2004). As noted above, the entrants' prices offered little reduction on the incumbent's charges; even so this apparently random nature of whether gains are made seems surprising. However both gains and losses were generally small, with 78% of switchers altering their bills by less than 10% by changing suppliers.

This relationship was explored further through a two stage choice model similar to that used in Giulietti, Waddams Price and Waterson, and extending the analysis to identify what determined whether a consumer had chosen 'well' in terms of available offers, this time for electricity switching (Waddams Price, Waterson and Wilson, 2004). This was conducted for switchers only, as a two stage model, adjusting the estimate of determinants of the amount gained or lost for the characteristics which predisposed households to switch in the first place. In the switching and awareness equation the median gain from switching was used, while in the gain/loss equation the actual benefit was the dependent variable. We therefore separate the decision to switch, by looking at the expected gain with a random choice of entrant, from the decision of which supplier, once the household has decided to switch in principle.

Preliminary results indicate that the coefficient of the median gain is close to 1, confirming that on average the actual gains which consumers made increased alongside the gains they would have made by switching randomly. The more firms were active in the market the lower the likely gain, though at a declining rate, with the turning point around 15 firms; the actual range varied from 12 to 18 firms in each region. This suggests that too much choice may confuse consumers. Households with more adults and/or children were more likely to make a good choice of supplier; this may be acting as a proxy for household income adjusted for size, since neither bill size nor income per se seemed to affect how good a choice was made. Those aged around mid forties were less likely to choose well than their younger or older counterparts, perhaps a function of lifestyle and responsibilities at that age, though households with only members over 75 tended to choose less well. Not surprisingly, households switching away from the incumbent for the first time made more gains than those making second or subsequent switches.

Direct debit payers seem to choose less well, though this may partly reflect data limitations. Entrants encourage new customers to sign up to direct debit, even if they were not using this payment method previously, but we do not know consumers' previous payment methods. By (wrongly) assuming that someone currently using direct debit was doing so previously, we understate their actual gains, since they will have gained both from switching supplier and changing to a cheaper payment method. Some of this effect is picked up in the equation which explains switching, where we see that switchers are less likely to report that they are on prepayment after the event. But there may remain some bias according to payment method from our assumption, in explaining the gains which households have made. Among all the switchers, the estimated average gain was around £12 per year, around 5% of an average bill.

2.5 Determinants of consumption

In the analysis described above, short run elasticity of demand was assumed to be insignificant in calculating consumer gains. The same data set of questions to low income households was used to identify the determinants of energy consumption, factors which are increasingly important as the Government seeks to limit household energy demand as part of its carbon reduction programme, while protecting low income consumers from rising prices and reducing the number of households in fuel poverty through the regulator's Social Action Plan. The data set was unique in including both company and individual estimates of consumption - the former from company estimates and the latter from individuals' reports of expenditure. The individual estimates were much higher than the companies'. It is possible that this was because the householders were approached in Spring, at a time when they were paying their winter fuel bills, and there is a seasonal effect. However to our surprise we found that it was much easier to obtain economically sensible explanations for the household estimates than for the company estimates. In both sets of equations the value of R squared was unusually high for cross section data (Mathieu and Waddams Price), with a slightly higher value using company estimates. We continue to investigate the phenomenon of differences in customer and company estimates, and to extend our analysis from electricity to gas, so that there will be some explanation of household energy demand as a whole.

Because we knew the tariffs of the supplying companies we were able to test whether (either measure of) consumption seemed more responsive to average or marginal price. Our prior expectation was that average price was more important, since most consumers do not have detailed knowledge of their tariffs. This was indeed the case, with marginal price providing very poor explanation of consumption. One set of equations for each payment method using consumer demand estimates and average price is shown in table 7.

Table 7. Coefficients for parsimonious equations identifying determinants of annual energy consumption *(source: Mathieu and Waddams Price, 2004)*

Payment method → Independent variable ↓	Prepayment	Direct Debit	Credit
Constant	13.852*** (0.125)	14.860*** (0.511)	13.730*** (0.175)
APRICEI [a]	-2.555*** (0.059)	-3.268*** (0.178)	-2.558*** (0.081)
INCOME[a]	.	0.133*** (0.027)	.
HSIZE[a]	0.205*** (0.018)	.	0.220*** (0.037)
KIDS	-5.230E-02* (0.022)	.	.
HADULT	-5.158E-02** (0.019)	.	.
MORTAGE	9.354E-02*** (0.023)	.	.
OWNED	8.615E-02* (0.045)	.	.
SOUTH	-5.400E-02** (0.018)	-0.159*** (0.044)	.
EFFICIENCY	.	-0.676** (0.204)	.
GAS	-0.312*** (0.025)	-0.656*** (0.078)	-0.450*** (0.057)
OTHER	-0.188*** (0.047)	.	-0.379*** (0.108)
R Squared	0.620	0.716	0.663
ANOVA sig.	0.000	0.000	0.000
Number of observations	1593	205	643

Dependent variable: consumer estimates of consumption. Standard errors of the coefficients are given in parenthesis.

[a] Variables in natural logarithm.

*** coefficient is significant at the 0.001 level; ** coefficient is significant at the 0.01 level; * coefficient is significant at the 0.05 level.

Table 8. Expected change in use of electricity with changes in price *(source Mathieu and Waddams Price, 2004)*

Payment method → Variable ↓	Prepayment	Direct Debit	Credit
APRICEI	-2.754***	-3.379***	-2.673***
INCOME	5.973E-02**	0.172***	0.142**

**** significant at 1%; ** significant at 5%*

When we focused on the effect of price and income alone, we found low positive income elasticities (between 6 and 17%) and very high price elasticities (between -2.7 and -3.4), see table 8. We interpret these as long term elasticities. The cross section data reflected regional as well as company differences in price, often resulting from upstream cost differences which had persisted for many years. Our interpretation that these elasticities apply to the long term are confirmed by answers to qualitative questions designed to elicit whether individual consumers were constrained by price and income in their energy consumption indicated. The question was 'If the cost of electricity went down (up) by £15 a week, would you use more (less) electricity or use the same electricity and use the saving for something else (see questionnaire in Cooke et al., 2001)?' and the answers are summarised in Table 9. These showed that in the short term the great majority of respondents did not believe that they would change demand in response to changes in price. The high elasticities are therefore likely to be long term characteristics of energy demand rather than rapid responses to changes in price.

Table 9: Expected change in use of electricity with changes in price *(source: Mathieu and Waddams Price, 2004)*

Price increases↓ decreases →	**More electricity**	**Same electricity**
Less electricity	238 (group B1)	605 (group C1)
Same electricity	356 (group D1)	1928 (group A1)

2.6 Distributive effects

The cross subsidies which had been inherited from the energy suppliers' nationalised predecessors raised concern that the competitive market would be detrimental to vulnerable groups who had previously benefited from them. In some senses, the failure of vigorous competition to develop, identified in section 2.3, would allay some of the worst fears on these grounds, but only at the expense of more general efficiency losses. The impact of early moves towards competition in these markets was analysed by examining the effects of changing price structures on different household groups through the Family Expenditure Survey (FES). In energy, the main effects were through rebalancing between the standing charge and the running rate, and a relative increase in charges for prepayment and quarterly credit consumers relative to those using direct debit. This provided a net disadvantage for pensioner households and those on disability benefit, but had a surprisingly small net effect on average gains within each income quintile (Waddams Price and Hancock, 1998). Unfortunately it is difficult to replicate this analysis for more recent years because the FES does not contain information on supplier, and it is not possible to identify the tariff (and hence the consumption level) of respondents. However the FES from an earlier period was used in a more recent piece of work analysing the distributional effect of two new tariffs in energy (Bennett, Cooke and Waddams Price, 2002). This examined the impact of abolishing the standing charge in gas (the incumbent did so in 2000) and of an innovative tariff which fixed energy charges according to the size of house and number of occupants rather than the energy actually used for households receiving certain income related benefits and pensioner households. The removal of the standing charge benefited prepayment consumers and those using fuel direct tariffs with direct deductions from benefits. While the *proportion* of gainers was highest for low income deciles, more than three quarters of the poorest decile lost from removal of standing charges. However it did not benefit the fuel poor, one of the main targets of the government's and regulator's social action plan, because such households usually consume large amounts of fuel in absolute terms, as well as relative to their income.

TXU's Social Action tariff, however, did benefit the fuel poor, and particularly households in the three lowest income deciles when it was originally introduced. Since the version analysed in Bennett and Waddams Price, the scheme has been restricted, and now applies only to customers over 60, who live

in houses with 3 or fewer bedrooms and in households of 4 or fewer people; this will obviously restrict the benefits much more than the original, where qualification was based on receipt of income related benefits. The revisions almost certainly reflect the high benefits which the analysis showed were available under the original scheme, and which would have required substantial subsidies from other consumers, threatening the parent company's competitiveness in the general market place. (The original company offering these tariffs, TXU, has since been taken over by Powergen, though its financial difficulties were not primarily due to the Staywarm scheme itself).

Improvements in quality of service, discussed in section 2.1 above, also showed some distributive bias. Households in regulated (uncompetitive) markets might receive higher quality service, at higher cost than they would choose, because suppliers wanted to use their favourable position in comparative league tables compiled by the regulator to gain market share in other, unregulated, markets, usually overseas. This phenomenon in energy transmission and distribution markets would impose a cost on the whole of the UK residential market, with no obvious distinction between income levels.

3. Future trends

The privatisation and deregulation of the energy industries has undoubtedly delivered benefits, and costs fell in the early years after privatisation (Newbery and Pollitt, 1997); consumers of large quantities of energy have benefited from lower prices, which they have been able to pass on to final consumers of their products, but it is not clear that residential energy consumers have shared directly in the benefits, partly because falling upstream costs make the counterfactual difficult to identify. But quality (at least of those aspects measured by the regulator) has risen – though since expectations have also increased with privatisation this is not always apparent to the general public. Vulnerable households have not benefited as much as others from opening markets to competition because they had benefited from cross subsidies. More worryingly, there is evidence of continuing market power amongst suppliers which, together with substantial consolidation in the industry, raises concerns about whether a cosy oligopoly, or an agreement not to encroach on each other's markets, may mean that prices will rise more than necessary to reflect the environmental agenda in the future.

The slow development of competition means that neither the worst fears (in terms of disadvantaging the poor) nor the best hopes (in terms of a convincingly competitive market) have emerged from the change in ownership and deregulation of the UK residential energy markets so far. This may be disguised good news, given that the emphasis is moving from these concerns to those of an environmental nature. In particular, the government is committed to a 60% reduction in carbon emissions by 2050, a substantial part of which will have to be delivered by the residential market. Initial exploration of consumer attitudes undertaken for Powergen (Diaz-Rainey et al., 2003) suggest that the main driver for households to reduce energy consumption is cost. About a third of the consumers interviewed for this survey in 2003 had tried to reduce their energy use, but only one in ten of these mentioned environmental concerns as a motivation. Ironically the inefficiencies of the nationalised and monopolised market may inadvertently have reflected the efficient (private) cost of supply plus an allowance to reflect the negative externality of the greenhouse emissions involved. Of course it is unlikely that this combination of events would have provided exactly the correct cost signal, but at least prices were in the appropriate relation to (efficient) prices given the pollutants. Whatever other policies are pursued, the trend of falling energy prices over the last twenty years or so is likely to be reversed over the next decade, and this is already apparent. This will pose real challenges for the government's policy to end fuel poverty; where the major success in the programme so far is attributable to falling energy prices.

A similar optimistic interpretation might be applied to the evidence of both incumbent and oligopoly power in the energy supply market. Moreover such power is likely to be enhanced by common programmes across the industry. The transparency of prices encouraged by energywatch and the Social Action programme are both opportunities for companies to practise implicit co-ordination, and the environmental programmes will add a third such vehicle.

One piece of good news on the price rise front is that long run elasticities among low income consumers seem to be quite high, so a 10% increase in price would result in a 30% decrease in demand. This is problematic if households are not using enough energy to meet their basic needs, and the fact that few consumers feel constrained in the short run suggests that it might take some time for the changes to work their way through the system. However with long term planning and appropriate protection for low income households in hard to heat property, modest price rises should result in substantial energy savings, at least among this group where demand is likely to be most price responsive.

One alternative to rising energy prices is to change consumer attitudes. Few respondents to the 2003 Powergen survey considered energy efficiency when purchasing appliances, and many called for more stringent standards to reduce the choice available to them. This is ironic in a market where governments have stressed the benefit of opening the markets and giving consumers choice. It is unclear how far consumers really welcome such choice, and the responsibilities which it brings, and our evidence shows that consumers often fail to exercise it in their own best interests. Of course those who wanted greater regulation had not been directly confronted with the likely cost in terms of higher prices; and it is likely that more stringent standards would be distributionally regressive, since lower income households often purchase cheaper second hand appliances, which might become unavailable because they did not conform to modern standards. But overall the message of the survey was that while respondents welcomed more information, they also wanted to be guided, and even constrained in their choices. Moreover there was a call for the government to lead by example, for example showing energy savings in public buildings.

Consumers showed an unsurprising resistance to higher energy prices, favouring instead incentives to purchase ‘green’ energy. Given the current level of energy prices, and likely movements in the wholesale markets in the immediate future, it seems likely that such subsidies could only be provided against a background of generally higher energy prices. The information gathered from the various research projects reported in this paper may be helpful in enabling the UK government to move forward into a very different energy era; and for other countries and industries considering similar reforms to those in the UK to consider the experience of one ‘pioneer’ in this area, and the effects on consumers in the short and the longer term.

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