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Consumer Choice and Industrial Policy: a study of UK Energy Markets#*

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Consumer Choice and Industrial Policy: a study of UK Energy Markets

Abstract

Consumer choice is increasingly recognised as a crucial factor in industrial policy. To illustrate the implications of such choice we present an investment model of the switching choice in the UK residential natural gas market and examine responses to a specially commissioned survey of nearly seven hundred consumers, identifying search and switching costs. Through an assessment of the savings which consumers say they require to switch supplier, together with an evaluation of consumer switching behaviour, we deduce that the incumbent retains considerable market power, suggesting that some continued regulation may be necessary.

Keywords: consumer choice, regulation, competition, energy, search costs, switching costs

JEL: L500, L950, D120, L120

1. Introduction

Markets for goods previously provided by a single supplier have been opened up to competition across the world. But how competitive do they become in practice? We believe this paper to be the first academic empirical study of this question for a major consumer industry, formerly the province of a monopoly supplier and now opened fully to competition, namely the UK domestic natural gas market[1] As such, it provides a useful example of the development of competition in a market and the importance of consumer behaviour in determining the extent to which any market may become competitive. The rôle of consumer behaviour in industrial policy is increasingly recognised (Prendergast, 2001, Waterson, 2003), and is particularly crucial in markets where choice has only recently become available. Examples range from patent expiry in pharmaceuticals to new products (e.g. internet services), and include previously regulated monopolies such as telecoms.

Our paper uses specially gathered information in the UK natural gas supply market to examine how residential consumers exercised choice as it first became available, and the implications of their decisions for industrial and regulatory policy in the light of subsequent developments. Through a rollout process starting in 1996, the UK energy markets were fully

[1] There have of course been many studies of airline deregulation, but in that industry there were commonly two or more suppliers on most routes and consumers were accustomed to making choices; the firms just did not compete very vigorously. However, consumers did not have to make a conceptual leap involved in changing supplier. Similarly there have been empirical studies of financial markets, two of which we draw on in our discussion. What is more remarkable is that there appear to have been no academic studies of consumer choice behaviour following deregulation of telephone service in the United States (Knittel, 1997, focuses on explaining firms' margins). In the area of energy, there is a paper by Goett et al (2000) but this involves experimental rather than real choices between suppliers.

opened to entrants, a precursor to similar moves in many other countries, including the United States. By mid 2002, 36% of gas and 34% of electricity consumers had switched supplier (DTI, 2003), the highest proportion in the world. Thus the UK provides an ideal test-bed for examining the impact of competition in consumer energy purchases, and its implications for other markets in which customer switching plays an important role. Given an essentially homogeneous product and an engineered process of competition, the key research questions are whether such markets will become fully competitive and at what cost? To answer this question we investigated actual switching behaviour by administering a specifically designed questionnaire to identify the characteristics of residential consumers who exercise their choice to switch gas suppliers.

We model the choice to change supplier as a consumer investment decision. Our econometric analysis treats this decision as a two-stage process (dependent on consumers' awareness of the choice). From this, we draw conclusions about the incumbent's power, the development of the market and regulatory policy. It transpires that the market is not competitive in certain significant respects, and that devising a policy to render it more so is not straightforward.

Most economic and marketing literature on consumer switching relates to markets where there is some degree of product differentiation and a history of supplier choice. Energy markets have neither, delivering a (necessarily) homogeneous product and newly open to competition[2], although switching experiences in other similar markets such as telephones, insurance and banking may influence switching decisions here. Purushottam and

[2] Suppliers may attempt to differentiate their product through service quality, though early advertising focused on price, with little attempt to differentiate the product.

Krishnamurthi's (1992) (marketing) paper models choice history as affecting every choice decision. There are two components: S for stay, describes the evolution in consumer utility of brand i, currently being consumed, whilst M for move, describes the evolution in utilities of other brands j. This suggests that consumers' perceptions about brands (particularly, in our case, perceptions about the incumbent and about the evolution of the new entrants) matter, in addition to the more direct influence of current prices.

Rothschild (1974) has modelled the consumer's decision of how long to continue searching. Klemperer (e.g. 1989, 1995) has developed a considerable amount of theoretical work in the area and considers three types of switching costs, of which transactions costs are the main category relevant to utilities. Such costs naturally make the individual firm's demand more inelastic and so reduce rivalry. Some customers, with a high reservation price, may effectively be monopolised by the incumbent, allowing the incumbent to sustain a higher price than entrants in the longer run[3]. Calem and Mester (1995) and Kiser (2002), which we discuss later, examine empirical evidence in financial market decisions. Knittel (1997) seeks to explain market power (the price-cost margin) in the US long distance telecoms market in terms of search costs (a function of the availability of market information for example on prices, advertising, etc. and the opportunity cost of time) and switching costs, which in his market largely take the form of a fee for switching. We similarly distinguish between search and switching costs. Though no monetary fee is imposed for changing energy suppliers, there is a time cost involved and anecdotal evidence indicates that some consumers do explore the potential savings but do not switch, indicating some distinction between their perception of the two costs. Green (2000) presents a theoretical model of how switching costs may hinder competition in a residential energy market.

[3] We do not here consider models dealing with several established suppliers over more than one time period.

In section 2 we describe our economic modelling framework, which treats the decision to switch gas suppliers as a consumer investment choice, where the costs are those of searching and switching and the benefits are the expected gains from lower prices. Reflecting the novelty of choice, we employ a double hurdle model distinguishing awareness of opportunity, which may itself be affected by firms' marketing behaviour, from the contingent decision to take advantage of it. Section 3 describes the data and the econometric technique involved. Section 4 presents the results of modelling switching and considering the move and our conclusions about search and switching costs and in Section 5 we use these to examine the market power of the incumbent and welfare issues. Section 6 concludes and discusses policy implications.

We focus entirely upon the gas market because we view it as significantly the more interesting of the domestic energy markets for the present research question for three reasons. First, at the time of the survey, all gas consumers were in fact able to switch, whereas this was not true for electricity. Second, as a result, only a very small proportion of electricity consumers had in fact switched by the time our sample was taken. Third, the gas incumbent was at a competitive disadvantage as a result of "take or pay" contracts struck above the then spot price, so all entrants were able to undercut its prices, on average by 11%. Thus gas provides the clearest indication of the extent to which competition may be expected to provide benefits. Comparative descriptive statistics for electricity are provided in the appendix.

2. The Economic Modelling Framework

In order to switch supplier, a consumer must be aware they can do so. Once aware, they decide whether to search and then whether to switch. Thus there is a double hurdle, with the characteristic that only if the first (awareness) hurdle is overcome, is the second (searching and switching) decision faced.

Awareness is influenced both by intrinsic consumer characteristics and external factors. Consumer characteristics such as education level, awareness of similar changes in related markets, age, unemployment and disability may affect general awareness of such market opportunities; in the gas market awareness is also likely to depend on the importance of the fuel to the consumer (i.e. the amount consumed relative to income and housing tenure), and by time elapsed since a choice became available, which varied across the sample.

Awareness of opportunities to switch supplier will also be influenced by entrant firms, who target certain customer groups because they offer profitable opportunities at relatively low marketing cost. Conceptually, the profit from customer i may be written:

$$\pi_i = R_i - C_i$$

where R_i represents the net revenue stream from that customer and C_i the cost of gaining them as a customer. We know (from our surveys of supplier companies) that one of the most targeted groups is moderately affluent consumers in neighbourhoods where they are relatively easily accessed (not, therefore, the most affluent consumers, who live in less densely populated areas). One of the least targeted groups is prepayment meter users because

they are relatively high cost to serve and price has been subject to downward regulatory pressure.

We can summarise the intrinsic and external factors affecting awareness[4] by:

Awareness = a(Bill size, household tenure, income, educational attainment, age/ OAP households, disability, unemployment, previous switching experience , elapsed time, payment method, population density, household size) (1)

where Awareness is a zero/ one variable.

Once consumers *are* aware they can switch, they proceed to search (and perhaps switch) if the expected gains exceed the anticipated costs. We cannot identify search activity completely separately from switching, so model these together as: Search and switch if:

$$\int_{1}^{\tau} [V_i(p_n, \mathbf{p}, y_i, \mathbf{T}_{in}) - V_i(p_o, \mathbf{p}, y_i, \mathbf{T}_{io})]dt \; - S_i(.) - M_i(.) > 0 \qquad (2)$$

where V_i, the indirect utility function, is a function of gas price (old, p_o or new, p_n), a vector of other prices (**p**), income (y) and tastes (**T**) for price savings and for old versus new goods (i.e. the consumer's trade-off function). We assume for simplicity that this function is separable in vector **T** and the other variables. S is *i*'s search cost and M *i*'s switching cost (of moving supplier).

We consider first the factors affecting search and switching costs. Search costs can be reduced by information provided by market players and will be affected by the some of the same factors that influence awareness, and we know that some people are targeted more

[4] All variables are defined in Table A1.

intensively than others. Thus some will "merely" evaluate information with which they are supplied by several parties, whilst others will need to gather actively all or most of the information themselves.[5] This is potentially important for our estimating equations, since some variables are likely to generate more than one effect. The most obvious example is income. Higher income increases the opportunity cost of search, but this may be counteracted by targeting based on income, which runs (at least for moderate incomes) in the opposite direction. In line with previous studies, we experiment with non-linearities in the income variable. To separate the influence of educational attainment on income, post compulsory education is included separately. In addition, more densely populated areas will be targeted more. Search cost is likely to be negatively related to experience of switching previous services, particularly telephone, because of the advantage of experience in such changes.

Once people have completed their search, they switch if the expected benefits exceed expected costs. Unlike search cost, anticipated switching cost depends only on each consumer's expectations, since the actions involved in switching from one supplier to another are essentially standard across the industry. But consumers do vary in their *expectations* of the time required to switch and the importance which they attach to ease of switching.

The expected price benefit from search and switching lasts (maybe to a diminishing extent) over the period from when switching occurs until time τ when *i* expects incumbent prices to converge to those of entrants. To relate the utility from switching to the savings, it is more

[5] Of course, it might be argued that sensible consumers will engage in their own search, rather than relying on material provided by firms. However some consumers may be provided with more promotional materials to assist in their search activities.

convenient to represent the effects of a price change in terms of *i*'s expenditure function μ_i, so that expression (2) becomes:

$$\int_1^{\tau} [\mu_i(\mathbf{q}; p_n, \mathbf{p}, y_i, \mathbf{T}_{in}) - \mu_i(\mathbf{q}; p_o, \mathbf{p}, y_i, \mathbf{T}_{io})]dt \text{ - } S_i(.) - M_i(.) > 0 \quad (3)$$

where **q** is the vector of prices at which expenditure is evaluated. This can be simplified by noting that, given the relative magnitudes of the various factors involved, an accurate approximation is obtained using the consumer surplus difference[6]:

$$\int_1^{\tau} [CS_i(p_n, \mathbf{p}, y_i, \mathbf{T}_{in}) - CS_i(p_o, \mathbf{p}, y_i, \mathbf{T}_{io})]dt \text{ - } S_i(.) - M_i(.) > 0 \quad (4)$$

Moving from theory to empirical form, we know (by calculation) *i*'s savings in the bill if consumption stays constant. Each consumer's decision to switch is to a particular supplier, and determined by the specific price advantages expected. Because of the large number of suppliers (up to 14) compared with our set of switchers, we model the decision to switch as a general one, using the average savings available[7]. Switching away from the incumbent yields the majority of savings for most consumers, making the choice of a particular entrant of second-order importance. Using estimates from Baker et al. (1989), the difference between the two is likely to be of the order of 2%. However, since the own price elasticity varies significantly with income, so too will the amount of consumer surplus, and we represent consumer surplus by combining two variables:

[6] Here we use Willig's (1976) approximation formulae, and the facts that consumers spend on average 3% of their income on gas (Office of National Statistics, 2000), consumer surplus from the price change is at most around 20% of the bill, and income elasticity of demand is at most say 0.2 (Baker et al., 1989). This suggests an inaccuracy of the order of less than one part in a thousand through using the Consumer Surplus approximation.

[7] The large entry into a homogeneous good market, including all the incumbent electricity suppliers, seems to have been a bid to survive as part of the 'handful' expected to be long term players in the market (Centrica 2001). By 2003, merger and exit had reduced the number to 6 major and 2 small players.

$$CS_i \approx \alpha \text{Bill Savings}_i + \beta(\text{Bill Savings}_i * \text{Income}_i) \quad (5)$$

where the average effect will be picked up by the Bill Savings variable, but the interaction term allows for a potential differential effect across income levels[8].

Consumer views on whether BG is or is not "reluctant to match" lower prices by entrants are known, and determine the period over which potential savings are expected to ensue. Hence we use

$$\text{TotalECS}_i \approx \gamma CS_i + \delta(CS_i * \text{Reluctance of BG}_i) \quad (6)$$

to incorporate respondents' views on how long the likely benefits are expected to last[9].

Finally, a consumer's intrinsic willingness to switch may depend on the importance they attach both to savings in general and to the reputation of a new supplier compared with BG (i.e. $\mathbf{T}_{in}$ as against $\mathbf{T}_{io}$). Attitude to alternative suppliers may also depend on levels of risk aversion. We can identify the importance of savings and reputation, and each consumer's attitude to risk, from the questionnaire.

In making the switching decision, consumers will take into account both these perceived quality benefits and the price advantage. These will differ between consumers. Since we model only the choice of whether to switch away from the incumbent, rather than the consumer's choice of a specific entrant, we represent the difference in price between British Gas and a new entrant for that consumer and bill type in constructing the bill savings

[8] We also allow in our estimates for the empirical fact that not all consumers were able to report their bill size, and the relevance of such ignorance for their switching decision.

[9] The cross term between equations (5) and (6) is dropped because it will be so small.

explanatory variable[10]. The constant term will be a measure of the average difference in unmeasured elements of quality between British Gas and a new entrant, as perceived by consumers.

In sum, the considerations above suggest that an estimating equation for choice of switching should include the following variables:

Switching propensity = b(bill savings, bill savings*income, reluctance of BG*bill savings, missing bill value dummy, importance of savings, importance of supplier reputation, risk attitude; income, income-squared, low income dummy, population density, educational attainment, previous switching experience; expected time to switch, ease of switching, payment method)[11] (7)

Calem and Mester's (1995) study of consumer search and switching behaviour and its influence on the stickiness of credit card interest rates employs a similar range of variables to those we use in equation (7). Specifically, they include: income and income squared, educational attainment, demographic variables such as age, household tenure, a range of attitudinal variables akin to ours and whether the household is credit constrained[12]. Not all consumers who would eventually change supplier had done so at the time of our survey. To

[10] More precisely, it is the difference between current monthly bill and alternative bill that would have to be paid if supplied by the cheapest supplier, based on a range (low, medium, high) of consumption levels, and current payment method.

[11] All variables are fully explained in table 1.

[12] Kiser's (2002) study of attitudes to switching at depository institutions uses similar variables, including income, education, age and household tenure.

account for those who might change in future, in section 4 below we additionally model 'considering switching' using similar specifications, to explore potential market developments.

3. Data and econometric methodology

Our consumer data come from a survey of 692 consumers interviewed in December 1998 and January 1999 when all residential customers were able to choose their gas supplier, but this choice was still comparatively novel. It had been available for different periods (between 8 and 30 months) in different areas.

We asked the interviewees about awareness[13], consumption of gas (via detailed questions about their bill), the factors which respondents considered important in changing supplier, the savings which respondents required in order to switch, the time they anticipated it would take to switch, and switching actions of other types (e.g. telephone supplier and insurance provider) they had engaged in[14]. We also obtained information on income and household characteristics of our respondents, and know whether they lived in a rural area. Tariffs of market participants were obtained from the 'Which?' (Consumers Association) website and the Ofgem website provided details on when market areas had been opened to competition.

Data definitions are given in Table A1 and corresponding descriptive statistics in Table A2. Switching decisions in our sample were broadly comparable with national figures available at

[13] Our question was: "In your area, are you able to switch gas supplier?"

[14] We also asked equivalent questions about electricity. Details on the specific questions asked are available by request from the authors.

about the same time. 86% of our sample were aware that they could switch and just over 20% of our sample had switched gas supplier, similar to the population as a whole at the time of the survey (National Audit Office, 1999). 12% of our consumers could not give us sufficient information on their bill to make savings calculations but for those that did, given their characteristics, they could have saved an average of around £4 per month by switching gas supplier.

Table A3 lists correlations between the various variables. As expected, awareness and Switched Gas Supplier are highly correlated. The main variables that are significantly linked with having switched include the interacted reluctance of BG and savings variable, the importance of savings to the consumer, the importance of BG's reputation and each of the variables representing previous changes of supplier of telecoms, car and house insurance.

The survey was the second of three waves of interviews on consumer switching behaviour. The first, in December 1997, we view as a pilot. It involved face-to-face interviews with individuals from 1865 households in the Office of National Statistics Omnibus survey[15]. As with other longitudinal studies, our survey suffers from attrition. However, as Table 1 shows, there are no statistically significant differences in the mean values of our key variables between the full and the reduced sample. Nevertheless, we addressed the issue of potential

[15] In this survey interviews are held every month with approximately 1900 individuals, aged 16 or over, in private household in Great Britain. The sample is selected to be representative of the British population and stratified by region, proportion of households renting from local authorities and proportion of households in which the head of household is in socio-economic group 1-5 or 13 (i.e. a professional, employer or manager). The results of this pilot study are reported in Parmar, Waddams Price and Waterson (2000). For more technical details see Office of National Statistics Omnibus survey, Technical report, December 1997, Weight C and information on the ONS website www.statistics.gov.uk.

selection bias by employing a probit model to analyse the probability of participation in the second wave of the survey, using demographic information about all the individuals with connection to gas mains who took part in the first round of interviews[16] (see Connolly et al, 1992). Based on this model we estimated the inverse Mills ratio which was included as a regressor in all later estimating equations for the decision to switch. In all cases the Mills ratio variable was insignificant, confirming that potential attrition bias does not seem to affect the estimated determinants of the switching decision[17].

Table 1 Demographic characteristics of the sample		
Survey	**Round 1**	**Round 2**
Number of respondents	1685	863
Finished compulsory education	1374 (82%)	749 (87%)
Own house/mortgage	1134 (67%)	644 (75%)
Households with 1 adult	611 (36%)	240 (28%)
Households with 2 adults	875 (52%)	496 (56%)
Households with no children	1162 (69%)	560 (65%)
Households with 1 or 2 children	426 (25%)	259 (30%)
Households with pensioners	355 (21%)	176 (20%)
Connected to gas mains	1354 (80%)	692 (80%)
Finished compulsory education	1178 (87%)	749 (87%)
Own house/mortgage	948 (70%)	692 (100%)
Households with 1 adult	462 (34%)	173 (25%)
Households with 2 adults	734 (54%)	415 (60%)
Households with no children	894 (66%)	431 (62%)
Households with 1 or 2 children	373 (28%)	223 (32%)
Households with pensioners	335 (25%)	156 (23%)

[16] The explanatory variables in this Probit model were: adult- equivalent household size, OAP households, housing tenure, socio-economic category, educational attainment, income, population density, number of households who changed address in the area in the previous year.

[17] The decision to address the attrition bias in a separate stage of estimation with respect to the switching decision was driven by the desire to avoid complexity in the estimation process which would make the calculation of marginal effects intractable, since this would have required the estimation of three-stage sequential probit model. We are confident that our estimates are unbiased based on the insignificant effect of the 'lambda' factor.

Following these preliminaries, we model the decision to change supplier as a 2-stage decision process where the choice of supplier is conditional on being aware of the possibility of changing. We assume that the underlying process behind consumers' awareness and switching decisions can be represented by a latent variable (identified by an asterisk) model described in the following relationships.

$$y^*_{i1} = x_{i1}'\beta_1 + \varepsilon_{i1} \quad (8)$$

and

$$y^*_{i2} = x_{i2}'\beta_2 + \varepsilon_{i2} \quad (9)$$

where i indicates the i^{th} consumer, the subscript 1 relates to the awareness equation and the subscript 2 to the switching decision. ε_{i1} and ε_{i2} are normally distributed N(0,1), not necessarily independent of each other. x_{i1} identifies a vector of factors affecting awareness (see equation (1)) and x_{i2} a vector of factors affecting the decision to change supplier (equation (7)). As explained in the previous section, there is partial overlap between the variables contained in x_{i1} and x_{i2}.

We will observe $y_{i1} = 1$ if $y^*_{i1} > 0$ and $y_{i2} = 1$ if $y^*_{i2} > 0$ *and* $y_{i1} = 1$, i.e. a consumer will be able to change supplier only if he/she is aware of this possibility. This decision making process can be analysed using a bivariate probit model with partial observability of the type discussed in Meng and Schmidt (1985), allowing for some degree of correlation between the unobserved factors affecting the two stages of the decision making process, captured by ε_{i1} and ε_{i2}. The parameters of the awareness and switching equations are estimated jointly in one step and this is reflected in the procedure for the calculation of marginal effects, discussed in more detail below.

The likelihood function for this bivariate probit model is:[18]

$$\ln L(\beta_1, \beta_2, \rho) = \Sigma_i \{ y_{i1}\, y_{i2} \ln F(x_i\beta_1, x_i\beta_{2,;}\rho)$$
$$+ y_{i1}(1 - y_{i2}) \ln [\Phi(x_i\beta_1) - F(x_i\beta_1, x_i\beta_{2,;}\rho)]$$
$$+ (1 - y_{i1}) \ln \Phi(-x_i\beta_1)\} \quad (10)$$

The joint probability that individual i is aware of supply competition and switches supplier is:

$$P[y_{i1}=1, y_{i2}=1] = \Phi_2(x_{i1}'\beta_1, x_{i2}'\beta_2, \rho) \quad (11)$$

where Φ_2 is the cumulative distribution function of the bivariate standard normal and ρ measures the degree of correlation between ε_{i1} and ε_{i2}. The unconditional probability of being aware is:

$$P[y_{i1}=1] = \Phi[x_{i1}'\beta_1]. \quad (12)$$

The marginal effects of different factors on the probability of being aware are calculated on the basis of this *marginal* probability.

The marginal effect of continuous variables in x_{i1} is calculated as the product of the vector of maximum likelihood estimated coefficients (β_1) and the value of the marginal density evaluated at the means of the explanatory variables (see Greene, 2000, p.851-2). The effect of the change in a dummy variable from 0 to 1 is obtained by partitioning x_{i1} into the dummy variable of interest (d) and a vector containing all the remaining variables (x^*_{i1}) and calculating the following difference:

$$P[y_{i1}=1; d_i=1] - P[y_{i1}=1; d_i=0] = \Phi[x^*_{i1}'\chi_1 + \delta_1] - \Phi[x^*_{i1}'\chi_1] \quad (13)$$

where δ_1 identifies the coefficient associated with the dummy variable of interest and χ_1 the vector of coefficients associated with all the other explanatory variables in the first-stage equation (see Stewart and Swaffield, 1999).

[18] See Meng and Schmidt (1985), p. 74

The calculation of the marginal effects of different factors on the probability of changing supplier is based on the probability of changing supplier *conditional* on being aware of this possibility:

$$P[y_{i2}=1 \mid y_{i1}=1] = \Phi_2 (x_{i1}' \beta_1, x_{i2}'\beta_2, \rho)/ \Phi(x_{i1}'\beta_1) \quad (14)$$

In the general case, when $\rho \neq 0$, a change in the variables contained in x_{i2} alone will affect the conditional probability only via the arguments of the joint distribution (Φ_2). On the other hand, a change in variables contained in both x_{i1} and x_{i2} will affect the probability both via the arguments of the joint distribution (Φ_2) and via the arguments of the conditioning distribution (Φ). Both these effects and corresponding probability levels are included in the tables of results. The calculation of the marginal effects of dummy variables is based on a change in value from 0 to 1. We extended the exploration of consumer choice by conducting a bivariate probit model of whether consumers were considering switching (without at this stage specifying the conditions), contingent on their awareness.

4. Results and implications

Results from the first model of whether consumers had switched, contingent on their awareness that this opportunity was available, are reported in table 2, and from the second model of whether they were considering switching (also contingent on awareness) in table 3. Tables 2 and 3 contain the estimation results from the most parsimonious model we could identify, incorporating a common set of explanatory variables for ease of comparison. The parsimonious model was identified by comparing the likelihood ratio of a model including all the explanatory variables identified in the theory with a model where some variables were omitted (these are listed in the footnotes to the tables). The joint significance of the omitted variables is 5% or less. The reported models slightly underestimate the proportion of switchers and potential switchers relative to the observed sample, but are better at estimating the probability of being aware. The goodness of fit, as measured by the McFadden's likelihood ratio index (LRI), is in line with similar studies of this kind. In both tables we observe a negative and significant level of correlation between the error terms in the awareness and (considering) switching equation, supporting our choice of joint estimation for the two equations.

Table 2: Double hurdle model of switching behaviour

AWARENESS AND SWITCHING EQUATION				
RESULTS FOR BIVARIATE PROBIT MODEL				
AWARENESS EQUATION				
variable	**marg effect**	**coefficient**	**p>z**	**mean**
Constant	-	0.226	0.355	1.000
OAP households	-0.086	-0.356	0.036	0.090
Non-BT telephone customer	0.046	0.238	0.114	0.263
Prepayment meter user	-0.189	-0.690	0.000	0.082
Elapsed time	0.027	0.137	0.000	10.307
Elapsed time squared	-0.011	-0.003	0.003	148.536
PROPORTION WHO ARE AWARE				0.865
PROBABILITY OF BEING AWARE				0.870
SWITCHING EQUATION				
variable	**marg effect**	**coefficient**	**p>z**	**mean**
Constant	-	-0.792	0.000	1.000
Bill savings	-0.019	-0.054	0.005	4.006
Reluctance of BG*bill savings	0.033	0.127	0.015	0.340
Missing bill value dummy	-0.116	-0.351	0.015	0.12
Importance of savings	0.115	0.332	0.001	0.525
Importance of supplier reputation	-0.136	-0.395	0.000	0.382
Income	0.001	0.230	0.254	1.399
Income squared	-0.001	-0.051	0.291	3.971
Low income dummy	0.062	0.183	0.223	0.247
Population density	0.008	0.024	0.074	4.857
Changed car insurance	0.102	0.276	0.019	0.179
Changed house insurance	0.097	0.266	0.062	0.117
Non-BT telephone customer	0.117	0.185	0.111	0.263
Expected time to switch	0.055	0.158	0.181	0.189
Ease of switching	0.071	0.203	0.073	0.246
RHO (1,2)	-0.898		0.000	
LR test p-value			0.967	
LRI measure of goodness of fit			0.116	
PROPORTION OF SWITCHERS				0.234
PROBABILITY OF SWITCHING				0.180
UNCONDITIONAL PROBABILITY OF SWITCHING				0.207

Notes to table 2: Other variables included in the awareness equation which were not statistically significant at 10% are: age, bill size, disability, educational attainment, educational attainment*income, unemployment, income, income-squared, household size, direct debit customer, changed car/house insurance, changed bank, population density. Other variables included in the 'switching' equation are: age, educational attainment, disability, unemployment, bill savings*income, household size, direct debit customer, prepayment meter customer, changed bank, risk attitude.

Table 3: Double hurdle model of considering switching

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

Notes to table 3: Other variables included in the awareness equation which were not statistically significant at 10% are: age, bill size, educational attainment, educational attainment*income, disability, unemployment, income, income-squared, household size, direct debit customer, changed car/house insurance, changed bank, population density. Other variables included in the 'considering switching' equation are: age, educational attainment, disability, unemployment, bill savings*income, household size, direct debit customer, prepayment meter customer, changed bank, risk attitude.

Once aware of the possibility, the probability of switching is just under 20%, and of considering a switch about 26%. The main factors revealed as influencing awareness are: the stage of competition (increasing at a decreasing rate, and peaking at about 22 months, a period exceeded for very few of our ample); prepayment meter use, and being a household of old age pensioners (OAPs), both of which reduced awareness. Other potential factors seem not to be important, apart from some evidence of a positive effect of changing telephone supplier.

Turning next to the determinants of changing supplier, we consider first the results with respect to savings. Around 12% of the sample were unable to provide information about the size of their bill, and so may be presumed to be the least concerned about making savings on it. This group is very substantially less likely to switch supplier than the average (with a marginal effect of 12%). Among the remainder who *were* able to give sufficient expenditure information to calculate likely savings, there is a large difference between consumers who consider BG will be reluctant to match other suppliers, hence viewing potential savings as long term; and those who believe it *will* match, and therefore see the savings as only available short-term. The latter group exhibit the "wrong" sign on potential savings in Table 2, albeit with a very small marginal impact for an increase of £1 in savings, whilst the former group, who view savings as longer term, demonstrate a significantly larger positive impact on likelihood of switching of an increase in savings level. We conclude from this that it is only longer-term savings that matter sufficiently for switches to be made. The interaction term, (income*bill savings) fails to attain significance.

All these effects are conditional on consumer views about financial savings versus other features of supply. Consumers who represent themselves as more price sensitive through the

greater importance they attach to savings, are very significantly more likely to switch supplier, whilst those who view supplier reputation as very important are significantly less likely to do so. In this respect, the emphasis of the marketing literature reviewed earlier on non-price factors is directly relevant, i.e. in practice the products appear to be differentiated across suppliers. Our risk variable fails to explain any differences in switching behaviour.

The results from Table 3, showing whether a consumer is considering switching, are, if anything, closer to economic theory than those for households who have already switched. There is a bigger marginal effect (50% more than in the switching equation) of an increase in the level of savings on considering changing supplier for the group of consumers who believe that the savings will persist over time. Moreover the effect of a change in the level of savings on considering switching is insignificant where the difference is not expected to persist.

So far as the search cost factors are concerned, previous switching in markets for conceptually similar products (telecoms, car and household insurance) has a strong positive impact on the likelihood of switching gas suppliers. Indeed, each has a substantial marginal impact upon the outcome[19]. This implies a cumulative impact, whereby some consumers develop experience in moving between suppliers which makes them more likely to engage in further similar actions. In Table 3, but not Table 2, there is evidence of a significant impact of income-related search costs, represented by an inverted U-shaped relationship with income, but more low income households are considering switching. The educational attainment variable does not achieve significance, somewhat surprisingly.

[19] The impact of the experience of changing telecoms supplier is more moderate than the other two once we have accounted for the positive impact on awareness.

Looking at the potential effects of suppliers' targeting, people living in more densely populated areas are more likely to change suppliers. This effect, together with the quadratic impact of income on the willingness to consider moving (seen in table 3), is consistent with the suppliers' marketing policies discussed earlier in the paper. There is no impact of prepayment meter users on switching. However, it is worth observing from Table A3 that OAPs and prepayment meter users are both (significantly) more likely to be poor and below the low-income threshold. Our estimator may find it difficult to distinguish between these variables.

Finally, turning to switching costs, those who make light of switching, in the sense of not viewing difficulty of switching as important, or who expect the process to take less time, are more likely to switch and to consider switching. Thus anticipated switching costs influence the outcome, as well as search costs.

As for the households whose needs the regulator is required to take into account, pensioner households are less likely to be aware of the possibilities for switching but not less likely to switch once aware. Low-income households are more likely to consider switching but not more likely to have done so when the questionnaire was administered. People living in rural areas are somewhat less likely to switch. We found no evidence of a different level either of awareness, switching behaviour or attitudes among people with disabilities.

5. Savings required to switch and their implications for incumbent's market power

5.1 Assessing market power

At the time of our survey only a small proportion of customers had switched supplier, whilst others had contemplated it but not made the move. We address the question of whether the market could be considered competitive with so few switchers by analysing the particular monetary values for which our surveyed consumers are willing to contemplate switching and the likely behaviour of suppliers. For example, for monthly savings of £8 per month or more (feasible at the time of the survey) around 38% of our sample say they would switch supplier[20]. Table 4 assesses the profitability of an incumbent which keeps its prices above those of the new entrants from these responses by our sampled consumers, and provides a quantitative measure of the monopoly power held by the incumbent, derived from exploiting the perceived costs that inhibit consumers from changing supplier.

Columns a and b in Table 4 show how many consumers say that they would switch for each level of difference between the incumbent's and an entrant's price. By subtraction, column c shows the incremental number of consumers who would switch away as a result of the increase in the gap between the prices charged by an incumbent and a competitive entrant. We assume the typical entrant's price is pitched at average incremental cost of serving a new consumer (the competitive price)[21]. From column c the marginal revenue for the incumbent

[20] Note that firms are required to publish tariffs, and are not allowed to strike individual bargains with consumers.

[21] Following the rise in spot market prices above the incumbent's take-or-pay prices in 2000-01, the costs of servicing consumers are likely to be broadly comparable between incumbent and entrants, with the incumbent perhaps incurring some higher 'legacy' costs.

from successive price increases above any given level can be estimated, namely the difference between the supplier's gains through higher margins from the consumers who remain with it (column d), and the losses from those who leave for another supplier (column e)[22]. Until the monthly saving from switching supplier goes beyond £8, the net gain for the incumbent is positive, and thereafter negative, so the incumbent will find it profitable to maintain a price £8 per month, or almost £100 per year, above average incremental cost, since even with such a differential, around 55% of customers will remain "loyal" to the incumbent[23]. In such an equilibrium the majority of customers who stay with the incumbent would pay a price around 33% above the competitive level, even on the most favourable assumptions, hardly the hallmark of a strongly competitive market, and similar to the conclusion to the one drawn in Green (2000)[24].

[22] For simplicity, this calculation assumes that the consumers who leave are in some sense average consumers. Clearly some consumers are more likely to switch than others and on average they will consume more than non-switchers. However the difference in magnitudes of the revenues in table 4 is such that this simplification will not materially affect the incumbent's decision.

[23] We found that the level of savings required to switch was not significantly different between non-switchers and those who had already made a change.

[24] In that sense, we provide an alternative, arguably more direct, answer to the question examined by Green (2000).

Table 4: Benefits for British Gas of keeping price above competitors' price levels (derived from numbers of consumer switches at various monthly savings levels compared with BG prices, 692 respondents).

Monthly saving, £s	**Would Switch**	**Additional Switchers**	**Gain from raising price, £s**	**loss from raising price, £s**	**Net gain from raising price, £s**
a	**b**	**c**	**d**	**e**	**d-e**
1	11				
2	42	31	650	31	619
4	148	106	1088	212	876
6	265	117	854	468	386
8	313	48	758	288	470
10	473	160	438	1280	-842
12	487	14	410	140	270
14	504	17	376	204	172
16	532	28	320	392	-72
20	571	39	484	624	-140
Sample	692				

Source: Direct calculations from survey results.

5.2 The welfare effects of opening the market

In this section we assess the welfare impact of competition under different scenarios. The first (interim) reflects the price differentials and switching rates observed in our survey; in the second (optimistic equilibrium), with the same number of switchers, the incumbent matches the entrants' price; and in the third (pessimistic equilibrium) the incumbent fully exploits the monopoly power identified above. We maintain the assumption that entrants price at marginal cost. Interview evidence from entrant firms (Brigham and Waterson, 2003) indicates that the cost of signing up an additional customer (from another firm) is around

£50-60[25], say £12.50 per switcher per year[26]. Firms may pay to attract consumers from whom no profit is expected in the short run if they anticipate raising prices above marginal costs in the future (see our discussion of oligopoly behaviour below). Earlier, we argued that consumer surplus would provide a good measure of the benefits to consumers of a fall in price as a result of switching their gas supplier. We now calculate the effect of introducing competition on consumer and total surplus[27], which are summarised in table 5.

In our interim scenario (at the time of the survey) just over 20% of gas consumers had switched supplier, for average monthly saving of around £4 (Table A2), closely corresponding to the proportion who say they would switch for this amount (Table 4). The savings are 13.8% of the average bill of £346.80 (across our sample). If each switching consumer has a price elasticity of –0.34 (Baker et al,1989), consumption would increase by 4.7%[28], generating an additional welfare triangle of (£48*0.0469*0.5) i.e. £1.13 per annum, if demand is approximately linear in the region of current price. The total increase in surplus for each consumer is the triangular area plus the transfer of £48. However, using the standard welfare calculus that weights equally benefits received by firms and by consumers (and by

[25] This is much lower than the implicit price for consumers who have not switched, bought in company takeovers. In 2002 London Electricity paid £309 per SEEBOARD customer, and Powergen £280 for customers of the ailing TXU company (Gow, 2002). These are average prices per customer, some of whom will have switched to the companies taken over, and indicate significant benefit to incumbency.

[26] We assume for the moment that switchers will stay with firms around four years, so that the fixed 'recruitment costs' are incurred every four years for the switcher group.

[27] Here we are maintaining the assumption that the product of the typical entrant is essentially perfectly substitutable for the product of the incumbent. Therefore, we assume there are no effects along the lines of those evaluated by Petrin (2002), for example.

[28] Lower income consumers have lower consumption but more elastic demand, and vice versa, so income has a complex but countervailing effect here.

different consumers), the direct social welfare gain is only the triangular area of £1.13 per switching consumer, or £4.3 million per annum in total. Since price caps were still in place at the time of our survey, all the benefits from lower prices can be attributed to the competitive process. The costs incurred by the entrants amount to a total of 48 million pounds per year for 20% of the market switching on our current assumptions. The net welfare effects of competition at this stage of the market are positive only if consumer surplus is weighted 23% more heavily than producer surplus.

In our optimistic scenario, the incumbent reduces price to match the entrants, so that all consumers benefit through increased consumer surplus, even at low levels of switching. Our sample of consumers is very optimistic that the incumbent will match - only around 1 in 12 believe the incumbent will be reluctant to match the fall in price by the entrant. Here the welfare triangle and the transfer from the incumbent both increase five fold. Total 'efficiency' gains are 21 million pounds per year, and the annual expenditure by entrants remains at £48 million. Total annual gains by consumers are £933 million, and losses by firms £960 million. Even in this optimistic case benefits are positive only if consumer surplus has a slightly greater weight in the social welfare function than does firm profit. Alternatively the recruitment cost of £50 per consumer may fall over time, or switchers may not have to be recruited so often for the threat of switching to be credible, so the cost to entrants would be lower, yielding positive net benefits even with equal welfare weighting.

A variant of this optimistic scenario might occur if, for example, consumers revise their beliefs about the incumbent's behaviour, increasing the switching rate. This factor has a big impact on switching behaviour - Figure 1 extrapolates from our results of Table 2 to show the crucial impact on switching of different assumptions about the incumbent's behaviour. In the case where consumers become gradually disabused of the notion that the incumbent will

match prices, more of them will switch and the margin over rivals' prices that the incumbent can profitably maintain will fall.

An alternative pessimistic scenario might follow removal of price regulation on the incumbent, if it is able to exploit the monopoly power identified in table 4. Compared with the regulated monopoly situation, 45% of consumers would switch, each gaining just under £50; but 55% would stay with the incumbent, who would find it profitable to raise its price by another £48 a year above the competitive price. As well as the transfer through the higher price of around 14%, their demand would fall by about 5%, (which itself might moderate the price rise by the incumbent somewhat), generating a net welfare (triangle) loss of about £1.13 each per annum. Overall there would be a slight loss in net annual consumer welfare of two million pounds, since more consumers face higher prices than have gained by switching. Of course if the welfare of the switchers is weighted much more than that of non-switchers, or if their elasticity is significantly higher, the process might still yield net consumer gains. In addition entrants expend around £107 million per year in attracting switchers. These three situations are summarised in the first three columns of table 5. .

Table 5: Welfare gains and losses compared with regulated monopoly, £ million
(gains positive, losses negative)

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

Even in the optimistic scenario, the costs incurred by entrants outweigh the efficiency 'triangle' of net consumer surplus gains. In the pessimistic scenario, the incumbent is able to exert so much monopoly power relative to the regulated 'baseline' that consumers are worse off overall, though producers are better off, even after paying to persuade consumers to switch. We have omitted any measure of non financial consumer search and switching costs – the very costs whose perception inhibit consumers from taking advantage of the potential financial gains. Our survey shows that most consumers think these are higher (in terms of time involved) than is the case in practice.

In the last columns of table 5 we use our consumer observations to show two interpretations of the situation observed in early 2003 when 36% of consumers had switched, the incumbent's prices had been deregulated, the average price gap between incumbent and entrants had narrowed to £35, and the number of major players in the market had reduced to 6, including the entrant. Again, one column shows an optimistic interpretation, the other pessimistic. In the optimistic case, we assume that entrants still supply at marginal cost, and the reduced mark-up represents a move towards matching by the incumbent. The pessimistic interpretation, in contrast, attributes the reduced price gap to exertion of some oligopoly power in the industry as a whole, so that there are no savings for non-switchers, and switchers still pay £13 above marginal cost. These last two columns, like the first, represent an interim observation, unlike the potential equilibrium optimistic and pessimistic scenarios discussed above. In the next section we look at likely longer-term developments and policy implications.

6. Concluding Comments

In conclusion we return to examine the questions raised in the introduction. Most people, it seems, are unlikely on present trends to change their gas supplier. Although they know they have the opportunity, they find the search and switching costs too high relative to the benefits to tempt them to make the move, given their limited experience to date. We identify the barrier as related both to search and, to a lesser extent, to *perceptions* of switching costs since the switching cost variables such as time required to switch and importance of ease of switching achieve statistical significance in our regression results. However the stronger impact comes from the search cost variables which are higher for those with little previous switching experience in other markets.

Such findings suggest that policies to improve switching rates in financial or utilities markets are likely to have positive externalities in other markets, reflected in the Department of Trade and Industry (2000) consumer policy. Reluctance to change is not due mainly to a lack of awareness; awareness is increasing over time, but by now will have levelled off. It seems that a subset of people is temperamentally predisposed to making a change, but this group currently is not large enough to make a big impact on the incumbent's entrenched position. Put another way, a majority of customers is willing to tolerate the incumbent's prices being substantially above entrants' prices, in part because the search costs are misperceived as higher than they are. As a result, unless people's views about reputation of new suppliers and behaviour of the incumbent change, the incumbent left to determine its own tariffs (i.e. unregulated) will have an incentive to keep prices high. Moreover even the most optimistic view of an equilibrium based on the direct consumer evidence of our survey does not render

positive welfare benefits, measured in conventional terms, because of the expenditure producers need to incur to overcome these perceived search costs and recruit switchers.

These findings should be put into the broader context of the market we are examining. The same firms supply both the major UK energy markets, gas and electricity, and consolidation is related to changes, including upstream reform, in both. Of the two, gas was the more likely to generate benefits from competition because of the incumbent's initial cost disadvantages. The UK is a leader in liberalisation and generating the benefits of competition in these areas. Yet our results suggest that the market is likely to remain in a significantly less than competitive state. This is a rather pessimistic scenario, since it implies a friction-ridden operation of the market mechanism in an important area of consumption for most households. Moreover it shows a significantly distributionally regressive impact of the benefits that do accrue, despite the regulator's new statutory duties to take account of the needs of low-income consumers under the Utilities Act 2000. Since our surveys took place, there have been some grounds for optimism since the incumbent has lowered its mark-up over entrants somewhat. But given consolidation in the market, this could develop into an oligopoly where mark-ups over marginal cost remain high for all suppliers, or become even higher.

Welfare gains from the competitive process could be increased either by reducing perceived search costs, so that either more consumers switch or the incumbent believes that they will do so; or by reducing the cost of acquiring switchers. If the market is to work better, more consumers need to be aware that the process is not, generally, beset with difficulty[29]. This suggests subsidising information in some way to reduce search costs, unless these perceived costs are expected to decline naturally over time, but such subsidies are an additional cost of

[29] One example is the direct comparison of prices provided through the energywatch website.

the process. Given his commitment to opening the market, the regulator was probably correct to remove price caps. However the benefits of opening the market in the UK have yet to exceed the costs.

Given the current situation, our analysis suggests that alongside additional effort to reduce search costs, continued regulatory surveillance of the incumbent's considerable market power and the developing oligopoly is required. More generally, the findings illustrate the importance of consumer choice in the formation of market power and in the benefits of opening monopoly markets opened to competitors. As the Secretary of State, Stephen Byers, said "Active consumers who are prepared to check and shop around to ensure they get a good deal are a key driving force in helping to create truly competitive markets" (Department of Trade and Industry, 2000). Choice alone is not sufficient - consumers must be prepared to exercise that choice if deregulation is to yield benefits.

Appendix

Table A1: Variable descriptions	
Variable name	**Description**
Age	Respondent's age in years
Awareness	1 if respondent answers yes to the question "In your area, are you able to switch gas supplier?", 0 otherwise
Bill savings	Difference between current monthly bill and alternative bill that would have to be paid if supplied by cheapest supplier, based on range (low, medium, high) of consumption levels, and current payment method.
Bill size	The monthly equivalent amount of a customer's current bill in £
Changed bank	1 if respondent has changed bank in the last 12 months, 0 otherwise
Changed car / house insurance	1 if respondent has changed company providing car / household insurance in the last 12 months, 0 otherwise
Direct debit customer	1 if gas payments are made by direct debit, 0 otherwise
Disability	1 if member of household receives disability benefits, 0 otherwise
Ease of switching	1 if respondent does not consider the ease or difficulty with which one can switch supplier as an important factor in deciding whether to change supplier, 0 otherwise.
Educational attainment	1 if respondent has completed compulsory education only, 0 otherwise
Elapsed time	Number of months since competition was introduced in the area where respondent lives
Expected time to switch	1 if estimated time required to change supplier is less than an hour, 0 otherwise
Household size	Number of adults in household+0.5*number of children
Housing tenure	Data not employed within our sample, since all are owners
Income	Gross yearly personal income of respondent in £, divided by 10000
Importance of supplier reputation	1 if respondent considers the incumbent supplier's reputation as a very important factor in deciding whether to change supplier, 0 otherwise
Importance of savings	1 if respondent considers the level of savings offered as a very important factor in deciding whether to change supplier, 0 otherwise
Low income dummy	1 if gross personal income is less than £10000, 0 otherwise
Missing bill value dummy	1 if respondent has not provided information about the size of their most recent gas/ electricity bill, 0 otherwise
Non-BT customer	1 if telephone services not provided by British Telecom, 0 otherwise
OAP households	1 if household comprises OAPs only, 0 otherwise
Population density	Thousand of residents per Km, by enumeration district where the interviewee resides (source Census 1991)
Prepayment meter user	1 if gas/ electricity prepayment meter is installed in the house, 0 otherwise
Reluctance of BG/ supplier	1 if respondent considers British Gas/ incumbent electricity supplier as reluctant to match rivals' lower prices, 0 otherwise
Risk attitude	Qualitative scale of degree of risk aversion from 1 (most risk averse) to 7 (risk inclined).
Switched gas (electricity) supplier	1 if respondent has changed gas (electricity) supplier, 0 otherwise
Unemployment	1 if not in employment according to ILO definition, 0 otherwise
considering switching	1 if respondent was considering switching at the time of the interview, 0 otherwise

Table A2 Descriptive Statistics – Gas consumers (N=692)				
Variable name	Mean	Std Dev	Minimum	Maximum
Awareness	0.863	0.344	0	1
Switched gas supplier	0.234	0.402	0	1
Considering switching	0.324	0.454	0	1
OAP households	0.090	0.286	0	1
Elapsed time	10.3	6.507	6	32
Elapsed time squared	148.5	230.5	36	1024
Prepayment meter user	0.0863	0.275	0	1
Bill savings	4.006	3.171	0	22.8
Reluctance of BG * bill savings	0.340	1.477	0	18.6
Missing bill value dummy	0.12	0.325	0	1
Importance of savings	0.525	0.500	0	1
Importance of supplier reputation	0.383	0.486	0	1
Expected time to switch	0.189	0.392	0	1
Ease of switching	0.246	0.431	0	1
Income	1.4	1.419	0	15
Income squared	3.971	14.054	0	225
Low income dummy	0.247	0.432	0	1
Population density	4.857	3.737	0.03	24.4
Non-BT telephone customer	0.263	0.441	0	1
Changed car insurance	0.179	0.384	0	1
Changed house insurance	0.117	0.322	0	1

Table A3 Correlation matrix – gas consumers												
Variable	**Awareness**	**Switched gas supplier**	**Considering switching**	**OAP households**	**Elapsed time**	**Elapsed time squared**	**Prepayment meter user**	**Bill savings**	**Reluctance of BG * bill savings**	**Missing bill value**	**Importance of savings**	**Importance of supplier reputation**
Awareness	1	0.201***	0.199***	-0.066	0.074*	0.054	-0.094***	0.029	0.010	0.147***	0.041	-0.014
Switched gas supplier		1	0.790***	-0.057	0.042	0.032	-0.059	-0.028	0.156***	-0.042	0.126***	-0.079**
Considering switching			1	-0.088**	0.005	0.006	-0.063*	0.002	0.147***	-0.039	0.186***	-0.063*
OAP households				1	0.052	0.057	-0.057	-0.046	-0.038	0.056	-0.117***	0.013
Elapsed time					1	0.976***	-0.061*	-0.059	-0.040	0.126***	-0.076**	-0.032
Elapsed time squared						1	-0.067	-0.053	-0.040	0.122***	-0.069*	-0.035
Prepayment meter user							1	-0.349***	-0.061	-0.094**	0.033	-0.031
Bill savings								1	0.199***	-0.301***	0.086**	0.046
Reluctance of BG * bill savings									1	-0.076**	-0.006	0.023
Missing bill value										1	-0.085**	-0.090**
Importance of savings											1	0.184***
												1

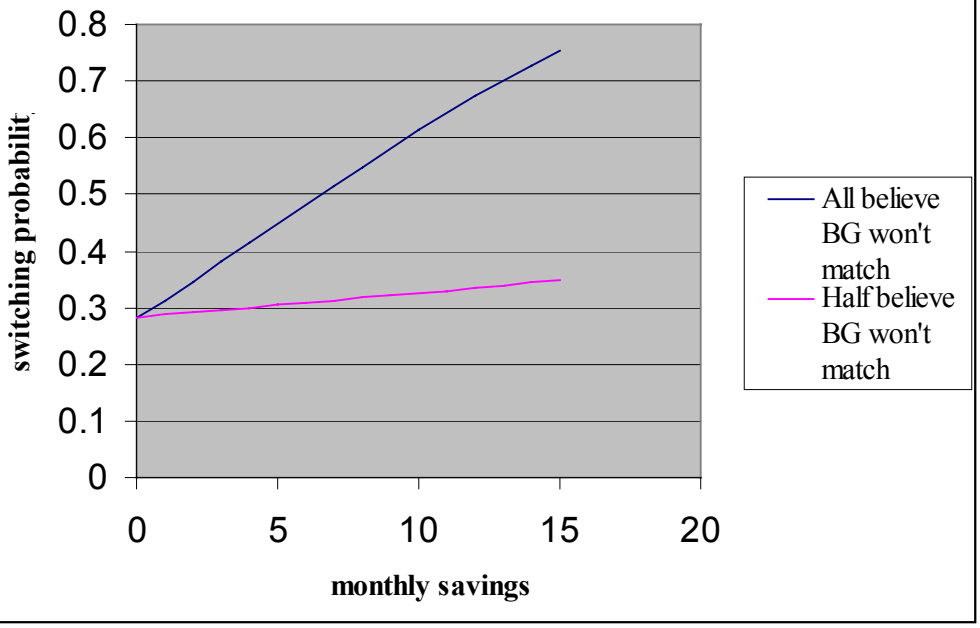
N=692, *, **, *** = significant at 10%, 5% and 1% level, respectively

Table A3 Correlation matrix – gas consumers

Variable	Expected time to switch	Ease of switching	Income	Income squared	Low income dummy	Population density	Non-BT telephone customer	Changed car insurance	Changed house insurance
Awareness	0.043	-0.016	0.025	0.019	-0.054	-0.047	0.057	-0.036	-0.025
Switched gas supplier	0.060	0.064*	-0.032	-0.049	-0.005	0.062*	0.140***	0.112***	0.085**
Considering switching	0.091***	0.051	0.013	-0.035	-0.018	-0.011	0.184***	0.084**	0.036
OAP households	0.081**	0.009	-0.141***	-0.067*	0.266***	-0.034	-0.072**	-0.107***	0.027
Elapsed time	-0.018	-0.023	0.005	0.003	-0.031	-0.048	-0.057	-0.028	-0.060
Elapsed time squared	-0.020	-0.022	0.023	0.010	-0.033	-0.067*	-0.057	-0.037	-0.054
Prepayment meter user	-0.011	0.012	-0.141***	-0.064*	0.194***	0.088**	0.060	-0.085	-0.044
Bill savings	-0.005	-0.016	0.199***	0.141	-0.143***	-0.063	-0.028	0.071**	0.027
Reluctance of BG * bill savings	0.015	0.002	0.008	-0.013	-0.015	-0.009	-0.025	0.109***	0.007
Missing bill value	-0.065*	-0.076**	0.001	0.034	-0.036	-0.073*	-0.029	-0.010	0.018
Importance of savings	0.024	0.207***	0.053	0.037	-0.025	-0.012	0.135***	0.045	0.059
Importance of supplier reputation	0.059	0.269***	-0.051	-0.026	0.024	0.014	0.056	-0.050	0.074*
Expected time to switch	1	0.058	0.026	0.040	0.005	-0.062	-0.021	0.053	-0.015
Ease of switching		1	0.017	-0.001	-0.016	-0.055	0.033	0.005	0.064*
Income			1	0.851***	-0.401***	-0.094***	-0.004	0.083**	0.012
Income squared				1	-0.153***	-0.070*	0.025	0.057	-0.015
Low income dummy					1	0.093***	0.008	-0.154***	-0.042
Population density						1	0.172***	-0.042	-0.001
Non-BT telephone customer							1	0.046	-0.013
Changed car insurance								1	0.123***
Changed house insurance									1

Table A4 Descriptive Statistics – Electricity consumers (N=863)				
Variable name	Mean	Std Dev	Minimum	Maximum
Awareness	0.819	0.385	0	1
Switched electricity supplier	0.039	0.214	0	1
Considering switching	0.250	0.499	0	1
OAP households	0.180	0.348	0	1
Elapsed time	-2.729	2.44	-6	1
Prepayment meter user	0.137	0.344	0	1
Reluctance of electricity supplier	0.043	0.203	0	1
Missing bill value dummy	0.233	0.423	0	1
Importance of savings	0.506	0.500	0	1
Importance of supplier reputation	0.385	0.487	0	1
Expected time to switch	0.173	0.459	0	1
Ease of switching	0.279	0.449	0	1
Income	1.208	1.026	0	15
Income squared	2.512	14.198	0	225
Low income dummy	0.277	0.448	0	1
Population density	4.808	3.815	0.02	24.4
Non-BT telephone customer	0.229	0.421	0	1
Changed car insurance	0.174	0.432	0	1
Changed house insurance	0.121	0.496	0	1

Figure 1: Switching probability under different assumptions



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