Irrationality in Consumers' Switching Decisions: When More Firms May Mean Less Benefit

Revised: August 2005

Chris M. Wilson* and Catherine Waddams Price**♣

ESRC Centre for Competition Policy,
***School of Economics and ****School of Management**
University of East Anglia

Abstract

We report evidence of three types of consumer switching decision errors within the UK electricity market. We identify consumers who do not switch despite substantial available savings, consumers who switch from a cheaper to a more expensive supplier and consumers who switch to a cheaper, but not the cheapest available supplier. Moreover, we find that consumers make more efficient decisions in markets with fewer competitors. This finding is consistent with theories of consumer confusion and "information-overload" rather than other "rational" explanations of consumer mistakes such as perceived differences in firm quality or uncertainty over consumers' own demand.

Keywords: Consumer choice, Switching costs, Behavioural IO

JEL Classification: L00, D12

♣ We are very grateful to Michael Waterson for extensive and valuable discussions. We would also like to thank Matthijs Wildenbeest, James Harvey and participants at seminars at the Centre for Competition Policy and the School of Economics at the University of East Anglia for helpful comments, including Tina Chang, Steve Davies, Morten Hviid, Bruce Lyons, Peter Moffatt and Alistair Munro. The support of the Economic and Social Research Council (UK) is gratefully acknowledged. The usual disclaimer applies. Corresponding author: christopher.wilson@uea.ac.uk, School of Economics, University of East Anglia, NR4 7TJ, UK.

1. Introduction

In this paper we consider decision errors in consumers' switching decisions. Such errors have important consequences for consumer protection and competition authorities; they not only damage consumers' welfare directly by limiting their ability to trade with the firm offering the highest surplus on the market, but they indirectly reduce total consumer welfare by increasing market power. Consumer errors can increase equilibrium profit mark-ups by weakening the relationship between firms' sales and relative surplus offerings (Perloff and Salop 1985, Gabaix et al 2005)[1].

Despite their apparent importance, evidence of consumers' errors in the market place remains scarce and controversial. In this paper, we both confirm the existence of such mistakes and provide evidence to suggest that they result from a form of consumer irrationality. Through the use of a dataset of switching choices made in the UK residential electricity market we consider three types of consumer decision errors. As we shall later discuss, previous studies have found evidence of "under-switching" errors where a consumer does not switch despite apparent benefits available from doing so (perhaps due to switching costs), and "over-switching" errors where a consumer switches despite making losses from doing so; we also consider a third type of error. We define consumer "inaccuracy" when a consumer makes a surplus improving switch, but makes an error in the choice of destination firm by not

[1] Indeed, Gabaix et al show that if errors are made in consumer decisions as a result of noisy product evaluations then the resulting equilibrium profit mark-ups converge to a strictly positive value as the number of firms tends to infinity for many common noise distributions.

choosing the firm which offers the highest available market surplus (perhaps as a result of search costs). Our results show evidence of all three types of mistakes. Of the 87% of consumers in our sample that did not choose to switch, 99% could have saved an average of £43.54 per annum by switching (under-switching). A third of those consumers who chose to switch, switched to a more expensive supplier, losing an average of £16.53 per annum as a result (over-switching). In aggregate, the switching consumers appropriated only a quarter of the total gains available (over-switching and inaccuracy).

Previous studies have asserted that the existence of consumer mistakes does not violate the axiom of rationality. They provide evidence that mistakes are much more likely to arise from fully optimal behaviour with incorrect beliefs or information, rather than a cognitive failure to make an optimal decision. Economides et al (2005) suggest that switching errors result from consumers' perceptions of quality differences between firms; while Miravete (2003) shows that some similar errors in tariff choices can occur due to consumers' uncertainty over their own demand. However, such rational explanations of mistakes are inconsistent with our findings that consumer decisions are less efficient in regions of the UK where the number of competitors is larger, ceteris paribus. Instead, this pattern seems more consistent with an 'irrational' explanation, in which consumers suffer an "information-overload" due to the higher decision complexity resulting from an increased number of options.

By exploring apparently irrational consumer behaviour and its possible effects this paper challenges orthodox competition policy by asserting that, in certain circumstances, consumers can be harmed by increases in choice, and adds to the growing literature and policy debate which emphasises the role of consumers as active participants, rather than passive recipients, of competition policy (e.g. Gans 2005, DTI 2004).

In section 2 we motivate and discuss our empirical approach. The dataset and variable construction are discussed in section 3 and our analysis in section 4. Section 5 provides a discussion, including some policy implications.

2. Empirical Motivation and Methodology

Previous literature has paid little attention to the accuracy of consumer decisions, and has focussed solely on errors in the propensity of consumer to switch suppliers[2]. Only Economides et al (2005) consider consumer over-switching, while for some time the switching cost literature has focussed on evidence of consumer under-switching. [3]

Economides et al (2005) analysed the decisions made by a sample of households in New York State's local telephone market between 1999 and

[2] Although, Waddams Price (2003) reports some early findings from a dataset which overlaps with that used in this paper.

[3] There also exists a wider, related set of evidence considering consumers' mistakes when choosing between tariff options offered by a single firm. For example, Lambrecht and Skiera (2004) consider consumers at a German internet provider. They show that 48% of consumers have a flat rate bias, paying an average 95% excess in fees and 8% of consumers show a pay per use bias, paying an average of 63% more, even 5 months after their choice of tariff. Miravete (2003) argues, however, that consumers in the US telephone market are less prone to bias.

2003. Of the 592 consumers in the sample who switched to AT&T, 44% made an apparent loss, of an average $4.24 per month, while of the 218 consumers who switched to MCI, 36% made a loss of, on average, $4.59 per month. The authors only consider rational explanations for the apparent mistakes, and suggest that perceptions of differences in product quality are a more important explanation of consumer errors than uncertainty over their own demand, as the frequency of mistakes made between firms is greater than the frequency of mistake made between tariffs at a single firm (although the average magnitude of these mistakes is similar). The authors utilise the panel nature of their dataset to model the simultaneous choice of tariff choices (across firms) and consumption, while accounting for unobserved levels of firm quality. The apparent consumer mistakes can be partially explained as the model estimates show the measured mistakes to be offset by a perception among consumers of higher quality at the new firms.

In contrast to Economides et al's approach we aim to identify whether or not mistakes can be attributed to rational explanations by exploiting the 'natural' variation of the number of competitors in each regional market which resulted from the liberalisation of the UK electricity market (further discussed in section 3). This variation provides us with an opportunity to discriminate between rational and irrational explanations of mistakes by analysing how the number of options faced by consumers affects the efficiency of their decisions. Although an increased number of firms may increase competitive pressures and affect the gains *available* in the market, we would not expect the

number of firms per se to influence the efficiency of a rational consumer's decision amongst those gains. Errors due to 'rational' reasons such as perceived quality differences or uncertain consumer demand should be independent of the number of firms in the market. However, an inverse relationship between decision efficiency and the number of consumer options would exist if mistakes arise from an information-overload. Findings in behavioural economics and psychology have suggested that an increased number of options may increase the complexity of the decision so that decisions become prone to decision noise and inefficient[4].

The UK electricity market is particularly appropriate for analysing consumer mistakes because it allows us to measure accurately the level of consumers' errors. The homogeneous nature of electricity helps to identify pure mistakes by reducing the role of non-price explanations, as consumers should make their decisions for tariff-related reasons only. Firms' marketing strategies reflect this homogeneity through their overwhelming emphasis on potential savings. Our sample of consumers viewed the differences in the quality of service between firms as negligible. When asked for their reasons for switching, only 6% of the switching consumers named differences in the quality of product or service between firms as important, while 77% of

[4] For evidence of increased decision noise see Swait and Adamowicz (2001a,b) and Iyengar and Lepper (2000), while additional decision deferral effects, as a result of complexity have been documented by Tversky and Shafir (1992), and Dhar (1997a,b). Iyengar and Lepper showed that consumers were significantly less satisfied and more regretful of their decisions from a choice set of 24-30 possible jams, than when decisions were made from a set of 6 jams.

switching consumers named differences in price [5]. Differences in the quality and reliability of electricity supply arise from the vertically separated distribution function and so are not relevant at the retail level. A full summary is provided in Table 1.

Table 1: Reasons for Switching Suppliers

Reason for switching	Mean	(st.dev)
Cheaper	0.77	0.42
Dual Supply Discounts	0.11	0.31
Influence of Sales Agent	0.10	0.30
Other	0.05	0.21
'Conned'/Unaware of switching	0.04	0.19
Poor service from old supplier	0.03	0.18
Better Service	0.02	0.12
Easier/Convenient	0.01	0.10
No Standing Charge	0.01	0.10
Incentives	0.00	0.05
N	394	

We explore whether consumers' errors are related to the number of competing firms in a way consistent with consumer confusion by formulating two hypotheses. Our first hypothesis concerns the consumers' decision to switch suppliers. Rational consumers' switching decisions should be consistent with hypothesis 1, while in contrast hypothesis 1 should be rejected if consumers are affected by information overload effects.

Hypothesis 1: For any given available gains, a consumers' decision to switch suppliers is independent of the number of firms competing in the market.

[5] In later regressions, we control for this 6% of switching consumers by including a dummy variable, SERVICE.

Our second hypothesis, concerns the accuracy of switching consumers' choice of supplier. Again, rational consumers should behave in a way consistent with the hypothesis, while conversely we should reject the hypothesis if the increased numbers of firms confuse the consumer[6].

Hypothesis 2: For any given gains available, the gains made by a switching consumer are independent of the number of firms competing in the market.

To consider hypothesis 1, we analyse the decision to switch suppliers by modifying an estimation approach used in the switching cost literature[7]. We estimate a binary choice model to explain the probability of a consumer switching suppliers as shown by equation (1).

$$\Pr(Sw_i) = F(\alpha + x_i^P \beta_P + x_i^D{}' \beta_D + N_i \beta_N + \varepsilon_i) \qquad (1)$$

where x_i^P measures the maximum monetary gains available from switching, given the consumer's current supplier, the cheapest available supplier and the consumer's consumption pattern; x_i^D is a vector of any personal demographics

[6] One may suppose that the existence of search costs could prompt a rational consumer to violate hypothesis 2. However optimal search theory shows that this is incorrect. If n firms offer gains to consumer i as draws from a common distribution function $F(x)$ and if consumer i has a marginal search cost of c>0, then the optimal reservation price rule with recall, r, solves $\int_r^\infty (x - r) dF(x) = c$, which is independent of n (Lipmann and McCall, 1976).

[7] For example, Chen and Hitt (2002), Kiser (2002), Sturluson (2002) and Giulietti et al (2005).

which might affect switching costs and N_i is the number of active firms within consumer i's region[8].

The estimation of equation (1) shows us two things. Firstly, we can understand if consumers' decisions to switch suppliers are related, as we would expect, to the monetary gains available. Decisions will be related to the gains available if the coefficient β_P is (significantly) positive. Previous findings typically show that this coefficient is insignificantly different from zero, indicating that decisions are noisy and unrelated to the gains available, especially when consumers believe price differences to be transitory (Giulietti et al, 2005) or when consumers do not participate in price search (Sturluson, 2002). Secondly, we can provide a test of hypothesis 1 by analysing the coefficient β_N. We can reject hypothesis 1 if $\beta_N \neq 0$.

To analyse consumers' switching accuracy, we estimate a new form of equation, (3), not previously seen in the literature. We model the monetary gains made from consumer i's switch, x_i^{SW}, as a function of the maximum available gains, x_i^P, while controlling for a vector of personal characteristics to proxy consumer search costs (which may impede the consumer identifying the best offer), x_i^D, and the number of firms in consumer i's region, N_i.[9]

[8] We are able to include both x_i^P and N_i as explanatory variables due to the econometrically convenient, and economically interesting fact that the two variables have an insignificant correlation of 0.01.

[9] One may additionally think that the spread of the gains distribution may affect consumers' decisions. The coefficient of variation of each consumer's distribution of available gains was

$$x_i^{SW} = \tilde{\alpha} + x_i^P \tilde{\beta}_P + x_i^D{}' \tilde{\beta}_D + N_i \tilde{\beta}_N + \tilde{\varepsilon}_i \quad (3)$$

Hypothesis 2 can be rejected if $\tilde{\beta}_N \neq 0$.

3. Empirical Analysis - The Market

Households in our dataset are located in one of fourteen newly liberalised electricity regions within the UK. By mid-1999 each household could choose to switch away from the original regional incumbent to one of several entrants (with 28 days' notice and no financial penalty). In June 2000, at the time of the survey, the number of active entrants in each region varied between 11 and 17[10].

Any active firm within a region must set tariffs across all three possible payment types: credit, direct debit and prepayment; in practice each firm offered one tariff per payment method. A typical set of tariffs at of the time of the survey is provided as an example in Table 2. For a given payment method, this feature of the market provides an equivalence between the number of firms and the number of tariffs a consumer faces. However, it is unclear how to define the number of firms when one considers joint ownership. For example in Table 2, at the time of the survey, tariffs branded under London Electricty and SWEB were both owned by Electricité de France, while Southern and Scottish Hydro were jointly owned by Southern and Scottish. The relevant consideration for our purpose is how the consumer would

initially included in equations (2) and (3), but was later dropped as it did not prove significant.

[10] Since the time of the survey the market has seen heavy consolidation. See Waddams-Price (2005) for details on the UK's energy market liberalisation and its effects.

regard the options. Listed tariff information typically provides all branded tariffs separately and so the consumer faced with this information, probably ignorant of ownership details, would view the number of firms as the number of branded tariffs presented. We use this classification to define the number of firms, but re-classifying the number of firms as the number of jointly owned enterprises makes only a minor difference[11] and provides qualitatively similar estimation results.

Table 2: Tariffs for Sample Region[12] - Midlands, June 2000

Electricty Supplier	Credit Payment			Direct Debit Payment			Prepayment		
	Fixed	Rate1	Rate2	Fixed	Rate1	Rate2	Fixed	Rate1	Rate2
British Gas (1)	0	10.57	5.65	0	9.01	5.65	0	10.28	6.17
Eastern TXU Energi (2)	2848	6.38	6.28	1856	6.38	6.28	3713	6.72	
East Midland	3541	5.99		2491	5.99		5116	5.99	
London Electricity (3)	3048	5.86		3048	5.86		9202	7.80	
MEB (incumbent) (4)	2159	6.72		2159	6.72		3734	6.72	
Northern Electric+Gas (5)	0	9.14	5.68	0	8.19	5.68	3990	6.52	
Northern Energy Supply UK	3117	6.62		2657	6.42		3745	6.62	
Norweb Energi	4922	5.30		4637	5.21		3734	6.72	
Seeboard (6)	0	11.97	5.34	0	10.82	5.34	4112	6.72	
Scottish Hydro	1873	6.08		1873	6.08		3990	6.52	
Scottish Power	5408	5.26		4883	5.01		3734	6.72	
Southern	3116	6.29		3053	6.16		3990	6.52	
SWALEC	1966	5.67		1886	5.44		3734	6.71	
SWEB (7)	3045	5.86		3045	5.86		4523	7.39	
Utility Link (8)	3595	7.25		3595	7.25		7388	7.68	
Yorkshire (9)	5561	5.76		5561	5.76		8669	5.76	
Independent Energy	4982	5.46		4026	5.46		4497	7.77	

[11] Using the branded firms' classification the average number and standard deviation of firms faced across the sample is 16.3 (1.66), while under the joint ownership classification the figures are 15.1 (1.94).

[12] Tariffs may include a standing charge (Fixed), and up to two rates. Rate 1 (pence/kWh) is charged for values of consumption below the breakpoint and Rate 2 is charged on all other consumption. Breakpoints are indicated in the numerical footnotes given below where additional tariff information is also provided. (1) Break Point 900kWh (2) Break Point 598kWh (3) 3% off Direct Debit if bill exceeds £10.50 (4) 3% off Direct Debit (5) Break Point 1092kWh (6) Break Point 182kWh, £8.40 off credit and direct debit (7) 3% off Direct Debit (8) £10.00 off direct debit if prompt payment (9) £8.40 off credit, £14.70 off direct debit.

Some descriptive statistics of bills for three example consumption levels are shown in Table 3, where all bills are measured annually in pence. As in all regions, direct debit is cheapest and prepayment most expensive, reflecting in part, the relative costs of the payment methods for the suppliers (Waddams Price, 2005)[13]. Most consumers can choose between any of the three payment methods, but those who are in debt to their supplier may be constrained to use prepayment. For this reason and because of their greater budgetary control, prepayment meters are predominantly used by lower income households (Electricity Association, 2001).

Table 3 – Descriptive Statistics of Potential Bills for Example Region

Payment Method	Descriptive Statistic	Consumption (kWh): 1650	3300	5444
Credit	Incumbent Bill	13247	24335	38756
	Max bill / incumbent bill	1.17	1.13	1.11
	Mean bill / incumbent bill	1.00	0.95	0.92
	Min bill / incumbent bill	0.76	0.77	0.78
	Number of suppliers with bill>incumbe	10	2	2
	Coefficeint of variaton of bills	0.09	0.08	0.08
Direct Debit	Incumbent Bill	12850	23605	37593
	Max bill / incumbent bill	1.13	1.12	1.12
	Mean bill / incumbent bill	0.97	0.94	0.95
	Min bill / incumbent bill	0.70	0.75	0.78
	Number of suppliers with bill>incumbe	7	2	2
	Coefficeint of variaton of bills	0.10	0.08	0.08
Prepayment	Incumbent Bill	14822	25910	40331
	Max bill / incumbent bill	1.49	1.35	1.28
	Mean bill / incumbent bill	1.08	1.05	1.03
	Min bill / incumbent bill	0.94	0.93	0.92
	Number of suppliers with bill>incumbe	7	6	5
	Coefficeint of variaton of bills	0.14	0.11	0.10

The tariffs show that significant gains are available from switching at all consumption levels and payment methods. However the prepayment market

[13] The higher charges for prepayment tariffs, which are used predominantly by lower income households, have been the focus of concern by some poverty lobby groups.

is generally more expensive, offers lower potential gains from switching, and includes more entrants pricing above the incumbent.

The Data

The dataset of switching decisions comes from a face-to-face survey of 3417 consumer households in the UK residential electricity market, conducted in June 2000 by the Electricity Association (2001). The survey is intentionally biased towards low-income households, and is not representative of electricity consumers as a whole. This focus reflected government concerns that the benefits of competition would not be shared equally by low income consumers (DTI, 1998). Of the 3417 responses, only 3097 were useable for our purposes because of inconsistent responses; the characteristics of the discarded group did not differ largely from those of other respondents[14]. Within the sample, 394 (13%) households had switched suppliers. This is broadly consistent with the national proportion of such consumers who had switched supplier at that time (OFGEM, 2004). Prices were obtained from the Which? website (www.which.co.uk) for each supplier and payment method in each region at bimonthly periods between the opening of the market and the time of the survey.

Variables

Variables are described with summary statistics in Table 4. The demographic variables include the households' size, social class, income, age, payment type

[14] Most notably, the discarded group were significantly poorer, of lower social class and younger. We choose not to correct for this small selection effect due to our already complex estimations. This is unlikely to alter our hypothesis conclusions.

and the marital status of the respondent, which have been found to be significant in previous switching studies. Variables marked with ^ are only defined for switching consumers.

Table 4: Variable Definitions and Summary Statistics

Variable Name	Variable Definition	Mean	Standard Deviation
aware	The household is aware that they can switch suppliers	0.72	0.45
sw	The houshold switched suppliers	0.13	0.33
Consumer Variables			
gainmax	Maximum gains from switcing available (annual, pence)	4376	5839
swgain^	The actual gains received from switching (annual, pence)	1255	4087
N	Number of alternative firms in local market	15.33	1.66
credit	Payment method: credit	0.24	0.43
dirdebit	Payment method: direct debit	0.11	0.31
prepay	Payment method: prepayment	0.66	0.47
highsoc	Household social grade: A, B or C1	0.23	0.42
midsoc	Household social grade: C2 or D	0.49	0.50
lowsoc	Household social grade: E	0.28	0.45
highinc	Household income: £25000 +	0.11	0.31
midinc	Household income: £12500-£25000	0.21	0.41
lowinc	Household income: Less than £12500	0.48	0.50
incref	Income status refused	0.20	0.40
kids	Number of children under 16 in household	0.87	1.20
adults	Number of adults over 16 in household	1.86	0.94
age	Age of respondent	43.9	16.9
only75	The household has only adults over 75 years of age	0.04	0.19
disable	The household collects some form of disability benefit	0.19	0.46
single	The household respondent is single	0.23	0.42
married	The household respondent is married	0.52	0.50
exmar	The household respondent is widowed or divorced	0.25	0.43
arrears	The household has electricty arrears	0.04	0.20
gassw	The household has previously switched gas supplier	0.23	0.42
nogas	The household has no mains gas supply	0.15	0.36
rent	The household lives in rented accommodation	0.55	0.50
Control Variables			
change	The household has changed payment method	0.32	0.47
compest	A company estimate of consumption has been used	0.04	0.19
dual^	The household switched for dual supply reasons	0.11	0.31
service^	The household switched with concerns about supplier quality	0.05	0.21
	Sample Size	3097	

We first discuss the variables used to measure the gains available and the gains made from switching. If consumers are switching for price reasons alone, the gain from switching from firm 0 to firm j is the associated change in

consumer surplus, $\int_{p_j}^{p0} D(p)dp$, where D(p) is the consumer's demand function, and p_i is the tariff of firm i. Since we cannot estimate consumers' demand functions directly, we approximate the change in consumer surplus by the change in expenditure[15], i.e. $\int_{p_j}^{p0} D(p)dp \cong (p_0 - p_j)C_{t=T}$, where $C_{t=T}$ is the consumer's consumption, derived from a self-reported estimate of the consumer's electricity bill. This assumption is reasonable in two respects. Firstly, short-run demand for electricity is inelastic (Baker et al, 1989). Secondly, we found no major differences in results when we confined our estimations to a sub-group of 1601 consumers who indicated they had perfectly price inelastic demand and a consumption pattern that was stable over time[16]. We define the following measures of consumer gains. GAINMAX measures the maximum gains from switching to the best available offer for that payment method and SWGAIN measures the gains actually made by those consumers who switched. Formally,

$$\text{SWGAIN} = x_i^{SW} \cong (p_0 - p_{sw})C_{t=T} \quad (4)$$

$$\text{GAINMAX} = x_i^{P} \cong (p_0 - p_{\min})C_{t=T} \quad (5)$$

[15] Giulietti et al (2005) make a similar assumption for gas.

[16] The subgroup consisted of households that replied "the same" to the questions: Q. If the cost of electricity went down would you use more electricity or use the same electricity and use the savings for something else? and Q. If the cost of electricity went up would you use less electricity or use the same electricity?, and "No" to the following questions, Q. Has there been any change in your household's circumstance in the last 2-3 years that affected your fuel consumption? and Q. Has your household's electricity ever been disconnected because of unpaid electricity bills?

The use of a self-reported bill measure to create a consumer estimate of their own consumption for calculating these gains allows us to focus on the consumers' own perceived gains, given their consumption beliefs. We therefore exclude mistakes that may arise from consumers' incorrect consumption estimates.

Within the full sample, 4% could not provide expenditure estimates and so their consumption was calculated instead from their suppliers' bill information. We control for this group of consumers by creating the dummy variable COMPEST, which later proved insignificant, despite findings elsewhere that show the divergence of the two parties' estimates (Mathieu and Waddams Price, 2005).

We calculated maximum and realised gains assuming no change in payment method when consumers switched. To check the validity of this assumption, we used information on whether respondents had changed payment method while at their current address. For the 32% of households who had done so, we included a variable CHANGE, which proved insignificant. We conclude , surprisingly, that including any change in payment method at the time of switching would not have affected our results. To identify the relevant tariffs at the date of switching (which was unknown, but had occurred since liberalisation, eighteen months before our survey) we used the dataset of tariffs for all the suppliers in each region. Tariffs were stable between October 1999 and April 2000, so only two set of tariffs, those prevalent in this period

and in June 2000 are relevant. Two sets of results were estimated, using each of these tariff sets; these differed very little. As the rate of switching was accelerating at the national level we report the results using the most recent June 2000 tariffs.

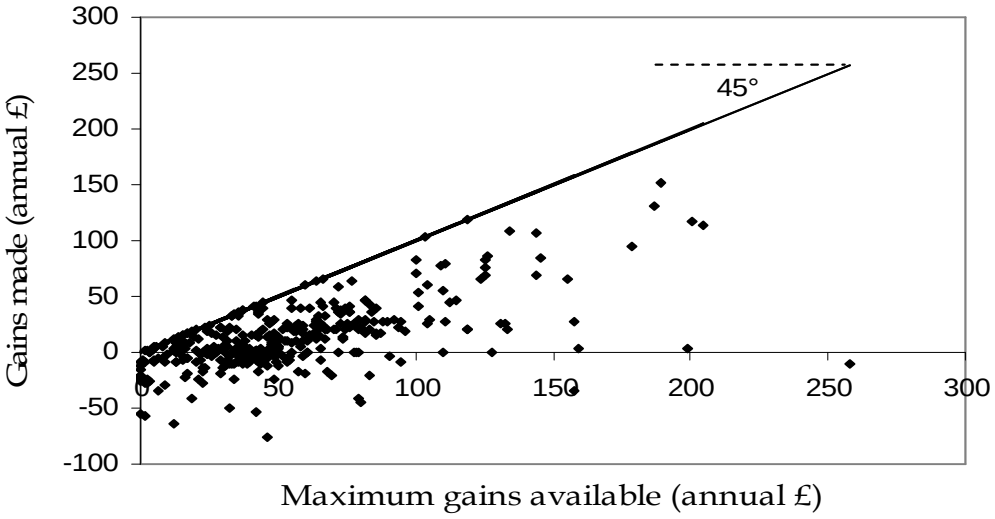
4. Estimation and Results

We first report some descriptive statistics of the incidence of consumer errors. Under-switching, which may arise from switching costs, is not the main focus of the current enquiry, but we note that of the 1834 consumers who were aware of the option to switch but did not choose to do so, 98.8% could have reduced their bill by switching suppliers, realising an average annual saving of £43.59 (standard deviation of 67.23).

Of more direct interest for our hypotheses are the incidences of over-switching and inaccuracy amongst the switching consumers. These errors are shown graphically in Figure 1 for the 394 households who switched. High levels of over-switching were found, as 32% (st.dev 47) of switching consumers changed to an entrant charging more than the firm they were switching from, resulting in an average annual loss of £16.53 (43.33). Further, the average annual gain from switching made by consumers was only £12.55 (40.87), which compares very poorly to the average maximum annual gain available to them of £53.91 (43.84). Consumers therefore displayed high levels of inaccuracy by appropriating only 23% of the available surplus, with only 7% of those who switched choosing the supplier which yielded the maximum

surplus. Such foregone gains are consistent with a search cost explanation. As in Economides et al (2005) we find that the incidence of benefits and errors from switching varies widely across consumers.

Figure 1: Switching Gains Made Relative to Maximum Gains Available



We now consider the first of our estimations. We estimate equation (2), following Giulietti et al (2005) by using a bivariate probit model with sample selection. This enables us to control for awareness of choice of supplier (28% of the households were not aware of the possibility of switching).

Formally, we define a first latent variable to model consumer i's awareness and a second latent variable to model the decision to switch, once aware. This process is shown in equations (6) and (7).

$$y^*_{AWi} = x_i^{D\prime}\beta_1 + N_i\beta_2 + \varepsilon_{AWi} \quad (6)$$

$$y^*_{SWi} = x_i^{P}\beta_3 + x_i^{D'\prime}\beta_4 + N_i\beta_5 + \varepsilon_{SWi} \quad (7)$$

The consumer is aware of the possibility of switching if $y^*_{AWi} > 0$, and 0 if not; and switches only if $y^*_{SWi} > 0$ and $y^*_{AWi} = 1$. Model estimation assumes that the two error terms $\varepsilon_{AWi}, \varepsilon_{SWi}$ are distributed with a bivariate normal distribution and an unspecified correlation of ρ (see Giulietti et al for more details).

In equation (6), following Giuletti et al, we model awareness as a function of individual demographics, x_i^D; while we also add the number of firms in the consumer's region, N_i, to reflect potential increase in promotional activities. Equation (7) replicates equation (2), while adding the variables CHANGE, COMPEST as discussed earlier to control for changes in payment method, and the use of company's bill estimates respectively[17,18].

Results of the estimation are reported in Table 5 where marginal effects are calculated for the average consumer. The awareness equation acts only as a control stage in our study, but the coefficients are as expected and consistent with previous studies. For the average consumer, awareness increases with the number of suppliers, is higher for those in middle and high social groups, increases with age but at a decreasing rate, is lower for those who are single, higher for those who have switched gas and lower for those who do not have a gas supply. The fact that awareness increases with the number of firms, but

[17] To identify the model we hypothesise that a consumer who rents their property or a consumer who has arrears with their current company should not differ in awareness from the average consumer, but may be limited in their ability to switch due to the influence of a landlord or their current supplier. Thus, the variables RENT and ARREARS are omitted from the first stage equation. Results seem robust to this choice.

[18] We were forced to omit the variable capturing low social class from all of the regressions as it was highly correlated with our low income variable, LOWINC.

is lower for prepayment consumers is consistent with a strong marketing effect, since entrants were much more reluctant to recruit prepayment consumers, who were perceived to be less profitable.

Table 5 – Estimation of the Switching Decision[19]

aware	Marginal Effect	z
N	0.14	2.74**
dirdebit	0.16	1.49
prepay	0.05	1.57
highsoc	-0.09	-4.56**
midsoc	0.08	3.40**
highinc	0.06	2.93**
midinc	0.00	-0.04
lowinc	0.02	0.86
incref	-0.04	-1.61
kids	-0.01	-0.67
adults	0.01	1.05
age	0.01	2.92**
age2	0.00	-2.73**
only75	-0.10	-1.61
disable	-0.01	-0.31
single	-0.05	-2.07*
exmar	-0.06	-2.31*
arrears	-	-
gassw	0.07	3.81**
nogas	-0.21	-7.74**
rent	-	-

sw | aware	Marginal Effect	z
gainmax	0.00	-0.34
N	0.01	1.61
dirdebit	0.06	1.93
prepay	-0.17	-2.54**
highsoc	0.00	0.18
midsoc	0.00	-0.02
highinc	-0.04	-1.45
midinc	(base	case)
lowinc	0.01	0.47
incref	-0.02	-1.44
kids	0.01	1.21
adults	0.01	1.40
age	0.00	0.39
age2	0.00	-0.57
only75	-0.03	-0.81
disable	0.02	1.14
single	-0.02	-1.38
exmar	0.00	0.15
arrears	0.01	0.29
gassw	0.17	2.62**
nogas	-0.02	-0.66
rent	0.00	0.29
change	0.02	1.00
compest	0.01	0.39

Summary Statistics	
n	2226/3097
Log-Lik	-2595
Wald	268**
McF R2	0.02
rho	0.34
LR	0.07

[19] All significant tests are indicated by * for the 5% level and by ** for the 1% level. Where applicable, coefficients are relative to the base case of a consumer who is married, of low social class, middle income and who pays by credit. The Wald statistic tests the joint significance of all coefficients. Rho refers to the estimated correlation between the two equations' error terms, which tested to be significantly different from zero by a LR test.

Estimates of the second stage reveal that consumers' decisions to switch, once they are aware of the possibility, are not responsive to the maximum savings available, providing some support for the presence of consumer under- or over-switching[20]. However, we cannot reject Hypothesis 1, as switching decisions seem unrelated to the number of competitors and so mistakes in this regard appear consistent with rational explanations.

In our second estimation we model the gains realised by switchers. We employ a standard Heckman correction model to correct for the fact that we were only able to observe the gains made from switching for those consumers who switched. The first stage models the compressed decision to switch (in (8)), while the second stage models the gains made from switching in (9), which repeats equation (3). In addition we also add the control variables CHANGE and COMPEST again, while further adding the SERVICE variable to capture those switching consumers who considered firm quality to be important, and the variable DUAL for consumers who reported that they switched to benefit from dual supply discounts offered by firms to those who purchase both electricity and gas from them[21].

[20] Further results from the control variables indicate that prepayment consumers are 20% less likely to switch perhaps reflecting the lack of marketing to this market. An average consumer is more likely to switch if she has already switched gas companies, which mirrors a similar result found by Giulietti et al.

[21] Identification of the model was made possible by omitting the variables that measured whether the consumer had a gas supply or had electricity arrears, NOGAS and ARREARS from the second stage. These variables were thought to influence the probability of switching suppliers, but not the ability of a consumer to make an efficient choice of supplier, having decided to switch.

$$y^*_{SWi} = x_i^P \beta_1 + x_i^{D''}{}' \beta_2 + N_i \beta_3 + \varepsilon_{SWi} \quad (8)$$

$$y^*_{SWGi} = x_i^P \beta_4 + x_i^{D'''}{}' \beta_5 + N_i \beta_6 + \varepsilon_{SWGi} \quad (9)$$

where switch (and, by implication, aware) = 1 if $y^*_{SWi} > 0$ and to account for the selection problem, SWGAIN= y^*_{SWGi} only if Switch=1, and where we assume that the error terms are distributed with a bivariate normal distribution.

Estimations of the second stage are reported in Table 6 (we do not report the first control stage, as it repeats our previous switching estimate). For the average consumer, we note that, as expected, the maximum gains available are a very significant predictor of the gains made, gains are positively related to whether the consumer uses a prepayment meter, and negatively influenced by household size and whether the consumer is disabled. However the main result of interest for hypothesis 2 shows that an increase in the number of firms reduces the gains appropriated by the consumer relative to the maximum available. Hypothesis 2 is rejected. Consumer errors in this second estimation appear consistent with an explanation of irrationality induced by decision complexity, rather than by conventional, rational explanations.

Finally, the estimated correlation between the error terms in the two equations is significantly negative, -0.97. Thus, unobservable variables affecting consumers' decision making capabilities appear either to encourage

Table 6 – Estimation of the Gains Made From Switching

gains | sw	Marginal Effect	z
gainmax	0.70	18.84**
N	-506	-4.10**
dirdebit	-761	-1.40
prepay	5333	9.66**
highsoc	-344	-0.83
midsoc	-303	-0.69
highinc	200	0.32
midinc	(base	case)
lowinc	-133	-0.28
incref	317	0.58
kids	-479	-3.05**
adults	-575	-2.65**
age	22	0.43
age2	-0.17	-0.32
only75	979	1.19
disable	-759	-2.02*
single	-129	-0.22
exmar	-487	-0.96
rent	-765	-1.87
arrears	-	-
nogas	-	-
change	-78	-0.19
compest	-1549	-1.91
dual	90	0.24
service	262	0.09

Summary Statistics	
n	394/3097
Log-Lik	-4667
Wald	407**
McF R2	0.03
rho	-0.97
LR	131**

Refer to Table 4 for the first switching stage. All significant tests are indicated by * for the 5% level and by ** for the 1% level. Where applicable coefficients are relative to the base case of a consumer who is married, of low social class, middle income and who pays by credit. The Wald statistic tests the joint significance of all coefficients. Rho refers to the estimated correlation between the two equations' error terms, which tested to be significantly different from zero by a LR test.

switching while prompting inaccuracy, or to discourage switching while improving accuracy. The first of these explanations is consistent with the widely publicised effects of misleading, door-to-door sales activities by suppliers which have plagued the industry since its liberalisation[22].

[22] This was such a problem in the early stages of opening the energy markets, when our was survey was undertaken, that several bodies launched investigations and campaigns to reduce such incidences of "mis-selling" (e.g. energywatch, 2002, OFGEM, 2002, OFT, 2004). In 2002, London Electricity was fined two million pounds for such activities. In addition, Table 1 shows that some consumers within our sample cited the efforts of salesmen as an important factor in their decision to switch.

5. Discussion and Conclusions

Our paper adds to a small literature documenting evidence of consumer decision errors in their choice between firms. We confirm previous findings that show a large proportion of consumers choose to switch supplier despite making apparent losses from doing so, and we provide new evidence to show the poor accuracy of consumers' decisions. Roughly a third of switching consumers over-switched in a way that apparently reduced their surplus, and in aggregate, switching consumers only appropriated a quarter of the maximum gains available. We suggest that these errors can, at least in part, be explained by irrational behaviour. Consumers' mistakes seem to be positively related to the number of competitors in the market, consistent with an information overload hypothesis of consumer confusion. This finding cannot easily be accounted for by rational explanations of consumer mistakes involving consumers' perceptions of difference in firm quality or uncertainty about their own demand.

Our analysis has some limitations. Firstly, low income consumers are over-represented in our sample and the magnitude of our estimates may not be replicated in the wider consumer population. Secondly, as we have already noted, the presence of misleading sales activities that prompt consumers to switch inaccurately may provide a secondary explanation for the estimated relationship between consumer mistakes and the number of competitors; this would be the case if and only if firms rely more heavily on such sales tactics as the number of competitors increase.

Our finding that consumers suffer from increased decision noise in markets with larger number of competitors is important for competition and consumer protection authorities. While increases in numbers of competitors may increase the total gains available through competition, an increased number of competitors may also limit the consumers' ability to appropriate these gains, and further, may damage competition itself by increasing equilibrium market power. The interconnection of competition and consumer protection policy in these matters is clear when one considers possible policy recommendations. The least controversial of these would suggest the improvement of consumers' access to tariff information. Alternatively, it may not be the access to information per se that is important, but the access to information in an easily understood format. The existence of complex, non-linear tariffs may contradict this principle and welfare could increase if authorities forced firms to compete with cognitively simpler tariffs. However, even more controversially, welfare improvements might be achievable if authorities limited the number of competitors or options faced by the consumer. Indeed, consumers may benefit from such a restriction of competitors within our market. The negligible correlation (+0.01) between maximum available gains and the number of firms suggests that a restriction in the number of firms could leave the level of competition unchanged while improving decision efficiency, enabling consumer surplus to increase. This apparently perverse conclusion parallels Hortacsu and Syverson's (2004) cautious advice that a limit to the number of U.S. mutual funds could be

welfare enhancing due to the benefits from (efficient) reductions in search behaviour and increased usage of economies of scale, despite the potential losses in competitive effects on price and product variety. The findings of this paper provide some further weight to such arguments and more generally, suggest that competition authorities should account for possible limitations in consumers' decision making capabilities when designing competition policy.

References:

Baker P. et al (1989) *"Modelling Household Energy Expenditure Using Micro-Data"* Economic Journal vol.99 p.720-738

Chen P.Y. and Hitt L.M. (2002) *"Measuring Switching Costs and the Determinants of Customer Retention in Internet-Enabled Business: A Study of the Online Brokerage Industry"* Information Systems Research vol. 13 p.255-274

Dhar R. (1997a) *"Consumer Preference for a No-Choice Option"* Journal of Consumer Research vol.24 p.215-231

Dhar R. (1997b) *"Context and Task Effects on Choice Deferral"* Marketing Letters vol. 8 p.119-130

DTI (2004) *"Extending Competitive Markets: Empowered Consumers, Successful Business"* July 2004

Economides N., Seim K. and V.B. Viard (2005) *"Quantifying the Benefits of Entry into Local Phone Service"* Working Paper January 2005

Electricity Association (2001) *"Affording Gas and Electricity: Self Disconnection and Rationing by Prepayment and Low Income Credit Consumers and Company Attitudes to Social Action"* available at www. ccp.uea.ac.uk/publications.asp#2001

energywatch (2002) *"Doorstep and Telephone Selling: A Guide for Gas and Electricity Consumers"* Information Sheet

Gans J.S. (2005) *"Protecting Consumers by Protecting Competition: Does Behavioural Economics Support this Contention?"* Competition and Consumer Law Journal vol. 13(1) p.40-50

Gabaix X., Laibson D. and Li H. (2005) *"Extreme Value Theory and the Effects of*

Competition on Profits" Working Paper March 2005

Giulietti M., Waddams Price C. and Waterson M. (2005) *"Consumer Choice and Industrial Policy: A Study of UK Energy Markets"* Economic Journal, Forthcoming October 2005

Hortacsu A. and Syverson C. (2004) *"Product Differentiation, Search Costs and Competition in the Mutual Funds Industry: A Case Study of S&P 500 Index Funds"* Quarterly Journal of Economics vol. 119 (2) p.403-456

Iyengar S.S. and Lepper M. (2000)*"When Choice is Demotivating: Can One Desire Too Much of a Good Thing?"* Journal of Personality and Social Psychology vol.79 p.995-1006

Kiser E.K. (2002) *"Predicting Household Switching Behaviour and Switching Costs at Depository Institutions"* Review of Industrial Organisation vol. 20 p.349-365

Lambrecht A. and Skiera B. (2004) *"Paying Too Much and Being Happy About It: Causes and Consequences of Tariff Choice Biases"* Working Paper March 2004

Lippman S.A. and McCall J.J. (1976) *"The Economics of Job Search: A Survey"* Economic Inquiry vol.14 p.155-189

Mathieu, L. and Waddams Price, C. (2005) "*Energy Expenditure of Low Income Consumers: Evidence from Consumers and Suppliers*" Working Paper

Miravete E.J. (2003) *"Choosing the Wrong Calling Plan? Ignorance and Learning"* American Economic Review vol. 93(1) p.297-310

OFGEM (2002) *"OFGEM Keeps up Pressure on Suppliers to Reduce Misselling"* The Office of Gas and Electricity News, Press Release 30 January 2002

OFGEM (2004) *"Domestic Competitive Market Review"* April 2004

OFT (2004) *"Doorstep Selling: A Report on the Market Study"* Office of Fair Trading, May 2004

Perloff J.M. and Salop S.C. (1985) *"Equilibrium with Product Differentiation"* Review of Economic Studies vol. 52 p.107-120

Sturluson J.T. (2002)*"The Importance of Consumer Search and Switching Costs for Competition in Electric Power Retailing"* Working Paper July 2002

Swait J. and Adamowicz W. (2001a) *"Choice Environment, Market Complexity and Behaviour: A Theoretical and Empirical Approach for Incorporating Decision*

Complexity into Models of Consumer Choice" Journal of Organizational Behaviour and Human Decision Process vol. 86 (2) p.141-167

Swait J. and Adamowicz W. (2001b) *"The Influence of Task Complexity on Consumer Choice: A Latent Class Model of Decision Strategy Switching"* Journal of Consumer Research vol.28 p.135-148

Tversky A. and Shafir E. (1992) *"Choice Under Conflict: The Dynamics of Deferred Decision"* Psychological Science vol.3 p.358-361

Waddams-Price C. (2003) *"Spoilt for Choice? The Costs and Benefits of Opening UK Residential Energy Markets"* Working Paper December 2003

Waddams-Price C. (2005) *"The Effect of Liberalizing UK Retail Energy Markets on Consumers"* Oxford Review of Economic Policy vol.21 (1) p.1-17