A Measure of Switching Costs in the GB Electricity Retail Market

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Consumer switching costs in the Great Britain electricity retail market *

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Abstract

In most liberalised electricity retail markets, incumbent firms still hold the majority of residential consumers. This situation focused the attention of regulatory institutions and energy economists on the determinants of consumers switching decisions. Fewer studies have, however, been devoted to measuring switching costs. In the present paper we calculate these costs in the Great Britain electricity retail market by revisiting the model suggested in Shy, O. (2002), A quick-and-easy method for estimating switching costs, *International Journal of Industrial Organization*, 20, pp. 71–87. The average net cost of switching regional incumbents is €385 while the net cost of switching back to them is negative for customers on standard credit or direct debit plans but positive for prepayment customers.

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1 Introduction

In several countries where electricity markets were liberalised many customers remain attached to incumbent retailers. In Great Britain, competition in electricity intensified quickly with a significant number of entrants offering attractive discounts and services, but still regional incumbents hold a considerable share of consumers in their former monopoly area (more than 60% customers in certain regions). In March 2006 those incumbents, also known as ex-public electricity suppliers (PES), held together with British Gas (BG, thereafter), 99% of domestic electricity customers (BG' own figure is 24%), a situation which has remained unchanged since December 2003 (see Ofgem, 2006).

This inertia focused economists' interest in measuring switching costs and identifying their determinants. Most studies suggest substantial costs of switching to alternative retailers, and more particularly to new entrants both in the residential electricity and gas markets. The literature in this area has however paid more attention to the determinants of switching and search decisions than to measuring switching costs per se. Taking a discrete choice model applied to 986 households in Sweden, Sturluson (2002) estimates switching and search costs. The estimate for the former is about €362. In the United States Goett *et al.* (2000) suggests unfamiliar energy retailers would obtain the same market share as the local utility if it offered a savings of about €75 annually for a typical 3300 kWh household and all of its other attributes where the same.

Other approaches that calculate switching costs rely on calibrated theoretical models of competition between firms. In the Great Britain electricity retail market Green (2000) calculates the profit-maximising price which an unregulated incumbent would set given utility-maximizing customers have a cost to switch the incumbent. The author computes the switching cost (it is endogenous) that solves its model for a given set of calibrating parameters. Assuming they do not exceed two times the incumbent's price and a demand elasticity between – 0.5 and – 0.1, the author predicts levels of incumbents' market share that range from roughly 45% to 55%. These shares and the endogenous number of entrants, six to seven, is indeed very close to what we currently observe in several regions of Great Britain. The incumbent's price is however 75% above that of the entrants, which overestimates actual price differential that does not exceed 25%.[1] In an extension to the previous paper Green (2005) allows for dual fuel offers to compete with those for electricity only. Its analytical solution gives price differentials between electricity incumbents and BG, as a function of the differences in costs between them and the average switching cost. In most regions, the cost of switching from an electricity incumbent to a new entrant is about €540.

In the gas retail market, Giulietti *et al.* (2005) extends a pioneer study from Bennett and Waddams Price (1999) in England that identifies the determinants of switching decisions. Their approach is similar to that of Sturluson (2002). By relating the frequency of switchers to savings on monthly bills they find that with an annual price of €150 above that of its competitors, BG would keep 55% of its customers. A shortcoming of these approaches is that the switching decision does not relate to consumers' perception of switching gain (net of the gross cost of switching) but to gains calculated from actual price differential. Potential savings may not be reflective of switching costs, however. As we will show in the theoretical model of the following section, potential savings merely reflect a bound on switching costs.

Less sophisticated approaches report potential gains as measures of switching gains available to consumers. Waterson (2003) obtains potential gains simply by subtracting the price of each entrant from the incumbents' in their former monopoly area. Order statistics of market prices are

[1] This percentage is for the direct debit market in 2003.

employed in several Ofgem's[2] reports on electricity retail competition and in Giulietti *et al.* (2004). The latter authors assumes that a fall in both switching and search costs from incumbents to entrants result in prices that should move closer over time. Salies (2006) estimates the differential effects on retail charges of large and small retailers in the different distribution regions in Great Britain controlling among other factors for network size and regional customers density. As expected, independent entrant retailers have the lowest impact on charges with predicted annual savings of up to £50, as between the cheapest and the most expensive supplier. This difference was highest in the direct debit market while the effect of Innogy and Powergen groups on charges is greater or equal to the average effect. This seems consistent with large retailers charging higher prices as a result of the existence of higher costs of switching for these firms' customers. It is worth emphasising again that approaches that rely on potential gains are subject to the critic that price differential may be uninformative about equilibrium switching costs. A firm may charge the same price than that of a rival of similar size but the cost of switching between them may take any positive value. This is a result of most theoretical models of price competition when consumers have switching costs (Klemperer, 1995, p. 520).

The purpose of the present paper is to measure consumers' switching costs in the Great Britain electricity retail market by following and refining the model of price competition suggested in Shy (2002). That model borrows from a solution concept previously developed in Morgan and Shy (2000), the Undercut proof equilibrium (hereafter UPE). In the duopoly case, each firm sets its price subject to the constraint that the other firm will not find it profitable to undercut that price and grab all customers. These prices satisfy a weaker concept introduced in Shy (2002, p. 75), the Undercut proof property (hereafter UPP). At equilibrium, UPP prices are function of firms' market shares and unobservable switching costs. Using observations only on prices and market shares, these variables can be mapped into two levels of switching costs (one for each brand). To

[2] Ofgem is the abbreviation for Office for Gas and Electricity Markets, the energy market regulator in Great Britain.

our knowledge, that methodology has been applied for measuring customers switching costs in the banking and telecom retail markets (Shy, 2002) and in broadband Internet between service providers (Krafft and Salies, 2006).

The plan is as follows. In section 2 we revisit the UPP in the two-firm case by giving more precise conditions of the parameter space (market shares and prices) under which switching costs can be measured. Unlike Morgan and Shy (2000), and Shy (2002) we assume consumers have switching costs in the theoretical model. One implication is that the theoretical prediction made by these authors that larger firm charge lower price becomes a particular case. Furthermore, our model takes account of the possibility to find negative switching costs. To permit the introduction of negative switching costs in the Shy's model we allow for an added-value (see Green, 2000) attached to target firms, which leads to the concept of net switching costs not well identified in the previous literature. Section 3 overviews the main components of switching costs in retail electricity markets. We then measure those costs in the 14 regions of Great Britain between the electricity incumbent and the most significant new entrant in terms of market share at the time of the study, Atlantic electric and Gas. Empirical results are discussed in this section. Further discussion and conclusion are reported in Section 4.

2 The underlying model

Two firms a and b sell a homogenous product to N consumers. There are $N_\alpha>0$ brand a-oriented consumers (type α) and $N_\beta>0$ brand b-oriented consumers (type β), with $N \equiv N_\alpha + N_\beta$. Type α consumers perceive a cost s_{ab} of switching to firm b while type β consumers perceive a cost s_{ba} of switching to a. The utility functions of each type of consumer are:

$$u_\alpha=\begin{cases} U_\alpha - T_a & \text{if staying with brand } a \\ U_\alpha - T_b - s_{ab} & \text{if switching to brand } b \end{cases} \tag{1a}$$

$$u_\beta=\begin{cases} U_\beta - T_b & \text{if staying with brand } b \\ U_\beta - T_b - s_{ba} & \text{if switching to brand } a \end{cases} \tag{1b}$$

where U_i denotes gross utility of consumer type $i=\alpha, \beta$. T_a is firm *a*'s price and T_b is firm *b*'s price. Let n_α and n_β denote the number of customers buying brand *a* and *b*, respectively. This numbers depend on prices and switching behaviours of both types of customers:

$$n_\alpha=\begin{cases} 0 & \text{if} \quad T_a > T_b + s_{ab} \\ N_\alpha & \text{if} \quad T_b - s_{ba} \le T_a \le T_b + s_{ab} \\ N & \text{if} \quad T_a < T_b - s_{ba} \end{cases} \tag{2a}$$

$$n_\beta=\begin{cases} 0 & \text{if} \quad T_b > T_a + s_{ba} \\ N_\beta & \text{if} \quad T_a - s_{ab} \le T_b \le T_a + s_{ba} \\ N & \text{if} \quad T_b < T_a - s_{ab} \end{cases} \tag{2b}$$

The following definition extends Shy (2002, p. 75)'s definition of UPP prices.

Proposition 1. $T_a = \dfrac{N(Ns_{ab} + n_\beta s_{ba})}{N^2 - n_\alpha n_\beta}$, $T_b = \dfrac{N(Ns_{ba} + n_\alpha s_{ab})}{N^2 - n_\alpha n_\beta}$, $n_\alpha = N_\alpha$ *and* $n_\beta = N_\beta$ *satisfy the UPP if* $s_{ab} \ge \max\left\{-1 - \dfrac{1}{1+\delta} s_{ba}, -\dfrac{1}{2+\delta} s_{ba}\right\}$, *where* δ *denotes* $(N_\alpha - N_\beta)/N_\beta$.

Proof: see **Appendix**.

Under equal switching costs Shy (2002)'s model predicts that the larger firm charges the lower price. The next proposition shows that this is not generally true. This holds only under some conditions relating markets shares to switching costs.

Proposition 2*. Assume the larger firm is a ($N_\alpha > N_\beta$).*

(a) If $s_{ba}>0$ and $-s_{ba}/(2+\delta)<s_{ab}<(1+\delta)s_{ba}$ then a charges the lower price.

(b) If $s_{ba}>0$ and $s_{ab}>(1+\delta)s_{ba}$ then a charges the higher price.

(c) If $s_{ba}<0$ and $s_{ab} \geq \max\left\{-1-\frac{1}{1+\delta}s_{ba}, -\frac{1}{2+\delta}s_{ba}\right\}$ *then a charges the higher price.*

Assume the larger firm is b ($N_\alpha < N_\beta$).

(d) If $s_{ba}>0$ and $s_{ab}<(1+\delta)s_{ba}$ then a charges the higher price.

Proof: It follows from (6), (7) and (8) in the **Appendix** and the additional assumption $T_a - T_b > 0$ for cases (*b*)-(*d*) and $T_a - T_b < 0$ in case (*a*). [3]

In all cases where prices satisfy the UPP, switching costs are $s_{ab} = T_a^U - N_\beta T_b^U / N$ and $s_{ba} = T_b^U - N_\alpha T_a^U / N$.

Propositions 1 and 2 show that more rigorous conditions relating the values of switching costs to market shares are necessary for UPP prices to be valid predictions of these costs given actual data on prices and market shares. Our refinement of Shy (2002)'s model reinforces the interest in applying it as theoretical frame to understand firms' pricing behaviour in markets where consumers have switching costs. Our model captures situations such as the larger firm does not necessarily charges a lower price and the smaller firm may serve customers with the higher switching cost. But as will be shown in the application of the following section, the model is likely to fail in the particular case where actual prices are identical.

3 Calculation of switching costs in the Great Britain electricity retail market

[3] The proof is available from the author.

Switching costs can limit competition in a mature market like electricity (Green, 2002, p. 2). In residential electricity markets these costs are transaction costs in closing an account with one's current electricity retailer and opening another with a competitor. At the time of our study customers were required to give their old retailer 28 days' notice, pay any outstanding bills owing to them and take a meter reading on the day they change retailer (DTI, 2000, pp. 17–19; Padilla *et al.*, 2003, Annexe C, pp. 11–12). Consumers must also find which retailers operate in their local area, and which offer the best packages for their needs. Although the main determinant of switching is expected savings (DTI, 2001, p. 17) none customer will switch its retailer if alternative offers are indistinguishable with respect to price but also quality. This is very likely to happen in homogenous product industries such as electricity. Cognitive costs seem important too and are essentially a result of brand reputation and one's experience with its current supplier. [4] Thus if one is initially indifferent between services supplied by two competing retailers, the fact of using one brand will change consumers' relative utilities for the products so that they perceive a cost of switching brands. This is a result of people's desire to reduce cognitive dissonance (see Klemperer, 1995, p. 518). [5]

Many customers' costs of switching to a new retailer have parallels in firm's costs of serving new customers. Retailers approached up to 15 millions customers (about 60% of households in GB) this way (Padilla *et al.*, 2003, p. 25). It costs about €55 (at €1.5 for £1) to acquire a domestic customer using doorstep, selling, advertising and mail shots (Ofgem, 1999, p. 52; Ofgem, 2004, Annexe 11, pp. 86–91). NAO (2001, p. 39) reports higher costs of acquiring new customers using

[4] Reputation plays a major role in the Great Britain gas retail market (Giulietti *et al.*, 2005). In utilities markets, most consumers are supplied by default firms, which thus gives these latter serious advantages over unknown new entrants.

[5] Following Klemperer's argument, most electricity customers would like their current retailer's service because they are used to it, and learned to like the benefits it provides (cooking, lighting, heating, watching TV).

direct marketing techniques. They range from €45 to €75. Acquisition costs seem to be a good upper bound proxy for search costs, the average values of which is about €27 as found in Sturluson (2002) for Swedish customers.

We consider the annual bill charged to a typical 3300 kWh customer in December 2003. These data are obtained from the 2004' April report of Ofgem. We choose these data as they include details on the national market share of electricity retailers by payment method and allow comparison with the results found in Green (2005) who follows a different methodology. New entrants supplied 190 000 electricity customers nationally (less than 1% however of the national customers, however). In September 2002, the sum of ex-PES' market shares equals 64% in Great Britain, with a minimum at 57% and a maximum at 83%. Table 1 shows December 2003 data on Ex-PES' market shares.

[Insert Table 1]

We consider Altantic Electric and Gas as the new entrant competing with each regional incumbent. Atlantic was the largest new entrant company supplying about 300,000 gas and electricity customers in April 2004, the month at which it was acquired by Scottish Hydro Electric-Southern Electric. We compute switching costs for three payment methods (standard credit, direct debit and prepayment). In December 2003, Atlantic Electric and Gas had less than 1% of domestic customers who spread as 53% direct debit customers, 39% standard credit customers, and the remaining share pay with prepayment schemes (see Ofgem, 2004, p. 159).

We do not know the particulars shares of electricity customers supplied by this entrant in each region. Given the above figures, we arbitrarily set its share to 1% in every region and to 0.53%, 0.39% and 0.07% for the different types of customers, respectively. Ex-PES' shares of customers in their former monopoly areas are also given in Table 1. The fraction for each customer type is known at the national level (see last column). We apply those percentages in each region for calculating switching costs. Table 2 shows the results.

[Insert Table 2]

It is worth noting here that we measure switching costs of customers who are not switching. As expected the cost of switching from large incumbents to Atlantic is well higher than the cost of switching back to them. These results are those predicted by (c) in Proposition 2. In the non-prepayment markets, customers with high switching costs buy the more expensive brand while customers with low switching costs buy the less expensive brand. Interestingly, these costs vary across payment methods. In the prepayment market, the entrant seems to lock its customers in as the costs of switching back are positive. These costs are however small relative to that of incumbents' customers. This lock-in by the entrant can be explained after looking at price differentials that are close to zero as shown in the last column of Table 2. Incumbents' prices are largest in this market but also too close to those of the entrant to be attractive. The entrant even charges a price equal or greater than that of five regional incumbents. Thus once customers have switched their incumbent they have only little incentive to switch back. Cases (*a*) and (*d*) in Proposition 2 predict this situation apart from that where prices are equal. [6]

The negative costs of switching for entrant's customers in the non-prepayment markets suggest that incumbents are likely to win them back. This however enters in contradiction with the observation that the entrant charges lower prices in these markets. Negative values can be

[6] Our model does not provide valid prediction of switching costs in this situation as the condition that relates market shares to switching costs is precisely $s_{ab}/s_{ba}=(1+\delta)=N_{\alpha}/N_{\beta}$. In the three regions where prices are identical (see Table 2), we obtain s_{ab}/s_{ba}=11.7, 11.2, 9.8 while $(1+\delta)$ is about the 100 value.

supported by borrowing from Green (2000)'s model of customers' choice between an entrant and an incumbent in the electricity retail market where the author assumes consumers perceive net switching costs. To be more precise assume the incumbent is firm *a*. Following Green's notation, the cost of switching back to an incumbent, s_{ba} is a difference between a gross cost of switching s_b (e.g. search and transaction) and an added-value v_{ab} that is the positive extra utility that *b*'s customers attach to *a*. [7] That could represent elements such as reputation and quality of service.

4 Conclusion and discussion

Our results support those found by other authors that switching costs are likely to reach high values. The cost of switching regional incumbents is consistent for example with that obtained for Swedish customers. We found the following interesting result in the prepayment market that it is possible for new entrants to retain customers. This suggests that the entrant's customers would perceive a gross cost of switching too high relative to the value they attach to the incumbent. That value may be low given that both the incumbents and the entrant charge close and high prices relative to those offered to non-prepayment customers. In the latter, the costs to switch the entrant are negative thus supporting that many customers may be inclined to switch back to their default provider or to other reputed and well established incumbents. We measured those costs by using an extension of Shy (2002)'s model that, we hope will reinforce its appeal to policy analysts. Under more rigorous conditions on the values of switching costs and market shares, this extension allowed us for example to predict a new equilibrium where the larger firm charges a higher price.

[7] The gross cost of switching does not depends upon to whom *b*'s consumers switch to.

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Table 1 Market Shares in Dec 2003

BG		(3)
		24
		43,38,17 [(a)]
	(1)	(2)
Innogy		
Npower		
(Midland)	53	
Yorkshire	52	15
Northern	52	
		34,48,13
SSE		
Southern	68	
North Scot.	82	14
Swalec	67	
		41,40,15
EDF Energy		
(LE)		
London	65	
Sweb	63	14
Seeboard	61	
		31,50,15
SPower		
South Scot.	63	11
Merseyside,		

North Wales	55	
		40,38,18
<u>Powergen</u>		
East Midl.	56	21
		40,43,14
<u>TXU Energi</u>		
Eastern	59	
Norweb	49	
<u>Others</u>		1
		53,39,7
Total		100

(1) = Ex-PES' share of electricity customers supplied in their former monopoly area.

(2) = Principal electricity retailers groups shares of national domestic electricity supply by customers supplied. 'Others' is Atlantic Electric & Gas.

(3) = BG's share of domestic electricity customers.

[a] : Share by main payment methods (direct debit, standard credit and prepayment).

Table 2 Switching costs between regional incumbents (Ex-PESs) and Atlantic Electric & Gas

			Switching cost (€)								
			from the Ex-PES to Atlantic			from Atlantic to the Ex-PES			Price difference		
Area	Ex-PES' Retail business	In-Area Ex-PES' Market Share	Direct Debit	Standard Credit	Prepayment	Direct Debit	Standard Credit	Prepayment	Direct Debit	Standard Credit	Prepayment
Eastern	Powergen	0.59	356.64	365.71	336.02	-65.53	-47.83	28.48	73.50	54.00	0.00
East Midlands	Powergen	0.56	356.17	372.86	336.00	-59.11	-48.87	30.00	67.50	55.50	0.00
London	EDF Energy	0.65	355.08	371.00	356.68	-44.70	-31.82	28.62	54.00	37.50	-3,00
Manweb	Manweb	0.55	391.10	412.54	405.50	-53.61	-43.53	21.75	63.00	51.00	15.00
Midlands	Npower	0.53	354.30	374.47	367.67	-48.13	-39.47	22.21	58.50	46.50	15.00
Northern	Npower	0.52	369.01	389.28	392.08	-58.00	-48.06	19.40	69.00	55.50	21.00
Norweb	Powergen	0.49	367.02	381.00	351.17	-62.13	-49.26	35.83	72.00	57.00	0.00
Scottish Hydro	Scottish Hydro E.	0.82	398.38	420.27	402.13	-67.24	-59.39	13.86	73.50	64.50	9.00
Scottish Power	Scottish Power	0.63	408.46	431.18	425.07	-64.94	-54.68	17.14	73.50	61.50	16.50
Seeboard	EDF Energy	0.61	345.90	361.91	347.38	-47.35	-36.10	20.54	57.00	42.00	6.00
Southern	Southern E.	0.68	378.10	400.10	401.11	-60.34	-52.63	10.95	67.50	58.50	16.50
Swalec	Swalec	0.67	413.27	436.93	437.20	-56.55	-47.49	13.88	64.50	54.00	16.50
Sweb	EDF Energy	0.63	387.12	405.01	386.64	-49.54	-35.60	31.66	60.00	42.00	-3.00
Yorkshire	Npower	0.52	349.72	369.92	378.06	-46.57	-37.92	22.49	57.00	45.00	16.50

Sources: Ofgem (2004) and energywatch's website (http://energywatch.com).

Appendix

Proof of **Proposition 1**: for given T_b and n_β, firm *a* chooses the highest price T_a subject to

$$\pi_b = n_\beta T_b \geq N(T_a - s_{ab}) \quad (3)$$

Simultaneously, for given T_a and n_α, firm *b* chooses the highest price T_b subject to

$$\pi_a = n_\alpha T_a \geq N(T_b - s_{ba}) \quad (4)$$

Let's find the UPP prices and associated market shares. It can be shown that (3)-(4) holds with equality. This system has a solution in prices if $N^2 - n_\alpha n_\beta > 0$. We obtain,

$$T_a = \frac{N(Ns_{ab} + n_\beta s_{ba})}{N^2 - n_\alpha n_\beta},\ T_b = \frac{N(Ns_{ba} + n_\alpha s_{ab})}{N^2 - n_\alpha n_\beta} \quad (5)$$

As consumers spread across firms, there are three possible cases for (n_α^U, n_β^U). (*i*): $(0, N)$; (*ii*): $(N, 0)$; (*iii*): (N_α, N_β). Subtract *b*'s price from *a*'s ($T_a - T_b = \frac{N(n_\beta s_{ab} - n_\alpha s_{ba})}{N^2 - n_\alpha n_\beta}$). Cases (*i*) and (*ii*) are not equilibriums. From (2a), (2b), $T_a - T_b > s_{ab}$ is associated with $(n_\alpha, n_\beta) = (0, N)$ whereas price differential at equilibrium from (5) is $T_a - T_b = s_{ab}$. Similarly, $T_a - T_b < -s_{ba}$ is associated with $(n_\alpha, n_\beta) = (N, 0)$ whereas price differential is $T_a^U - T_b^U = -s_{ba}$. In case (*iii*), price differential is $T_a^U - T_b^U = \frac{N(N_\beta s_{ab} - N_\alpha s_{ba})}{N^2 - N_\alpha N_\beta}$. The relative values of s_{ba} and s_{ab} determine several equilibrium.

Denote δ as $(N_\alpha - N_\beta)/N_\beta$.

Under case (*iii*), prices satisfy the UPP if $-s_{ba} \leq T_a - T_b \leq s_{ab}$, i.e.

$$-s_{ba} \leq \frac{N(N_\beta s_{ab} - N_\alpha s_{ba})}{N^2 - N_\alpha N_\beta} \leq s_{ab} \tag{6}$$

This double inequality imposes some restrictions on the relative values of markets shares and switching costs. Replace $N_\beta s_{ab}$ with $N_\beta s_{ab} \pm N^{-1}(N^2 - N_\alpha N_\beta) s_{ab}$ then price differential is:

$$s_{ab} - \frac{N_\alpha(N_\alpha s_{ab} + N s_{ba})}{N^2 - N_\alpha N_\beta} \tag{7}$$

Similarly, if we replace $N_\alpha s_{ba}$ with $N_\alpha s_{ba} \pm N^{-1}(N^2 - N_\alpha N_\beta) s_{ba}$ we obtain

$$-s_{ba} + \frac{N_\beta(N_\beta s_{ba} + N s_{ab})}{N^2 - N_\alpha N_\beta} \tag{8}$$

If switching costs are positive, (6) is easy to verify. Switching costs can however be negative, which requires the constraints that the second terms in both (7) and (8) be simultaneously greater or equal to zero. This leads us to the relationship between market shares and switching costs stated in **Proposition 1**. We finally mention two particular cases which are easy to demonstrate: $s_{ab} = (1+\delta) s_{ba}$ and $\delta \equiv 0$ (firms share the market equally). In the first case, firms charge the same price. In the second case, $T_a - T_b = \frac{2}{3}(s_{ab} - s_{ba})$.

■