The Effect on Retail Charges of Mergers in the GB Electricity Market

The opening of the residential UK electricity sector in 1999 motivated several studies of its impact on both the level and structure of retail charges, and on incumbents' market power. Using regional observations on tariffs offered in January 2004, the present paper supports previous results about the responses of simulated retail charges from actual tariffs to distribution and transmission costs, customers density, the length of low voltage underground circuit, and show new. We investigate whether vertically integrated suppliers have a particular effect on charges *ceteris paribus* the effect of cost drivers and supplier-related factors.

I. INTRODUCTION

The GB retail electricity sector was opened to competition in May 1999. This process had an immediate impact on the level of tariffs and services offered to consumers. Although much research has been devoted to switching behaviour (Giulietti *et al*., 2006; Waterson, 2003; Ofgem, 2001, 2002, 2003), third degree price discrimination and incumbents market power (Otero and Waddams Price, 2001), little information is available about the effect on tariffs of ownership structures corrected for cost drivers, regional and supplier-related variables in geographically distinct markets. Using 2002's price data Salies and Waddams Price (2004) examine similarities of brand coefficients within existing ownership group but find weak evidence of this.

Relying on tariffs offered in January 2004, the present paper contributes to highlight the effect on charges of mergers in a more effective way. We test for the particular average effect on charges of each ownership group after we control for economies of size and customers density. We pay particular attention to EDF Energy, the merged London and Seeboard group companies. We expect technical synergies may exist between distribution networks owned by EDF because they are in contiguous regions (London, East and South East of England). Spector (2003) emphasises that the idea that a merger allows firms to exploit scale economies is not convincing if it does not also generate technical synergies. These synergies would lead to lower charges to customers.

This paper is structured as follows. In section II we briefly review the changes in ownership structure that have occurred in GB electricity supply between May 2002 and January 2004. We focus on their probable effect on the degree of competition and remaining ex-incumbents' market power. We then introduce the data, the econometric model and the hypotheses to be tested in section II. The results are given and discussed in section IV. We conclude in section V.

II. CHANGES IN MARKET STRUCTURE

The ownership structure of each supplier whose charges we shall examine is summarised in the following table and compared with that of April-May 2002 (this is the period analysed in Salies and Waddams Price, 2004).

[Insert Table 1]

A more detailed picture of distributors and suppliers' ownership structure in the GB residential electricity market at January 2004 is given in Appendix (see also Electricity Association, 2003a, b). Concentration increased since April 2002 as a result of acquisitions, with only up to 5 ex-Public Electricity Suppliers and 3 new entrants in most areas, in addition to internet and other suppliers (ex-Public Electricity Suppliers, thereafter ex-PES, are also known as Regional Electricity Companies). Almost all suppliers operate in the fourteen distribution regions that constitute England, Scotland and Wales. Basicpower does not operate in Scotland at the time of this study for reasons unknown to us, and this is still true.

Following the present analysis, in April 2004 Scottish Hydro Electric-Southern Electric (SSE) acquired Atlantic. Powergen purchased TXU's British generation and retail operations. These mergers raise competition concerns although they may have different detrimental effects given they involve firms with significantly different market shares. A merger between two firms with relatively high market shares may have less impact on competition than one in which a large supplier merges with a smaller rival (RBB, 2002).

The magnitude of the coefficient multiplying ownership group dummies in comparison with the intercepts of other groups will help us to test for particular merger effects in the data. [1]

III. DATA AND ECONOMETRIC MODEL

Retail charges relate to 14 regions, and up to 8 brand names per region. We consider here a single payment method at three levels of consumption. Distribution charges were taken from distributors' published statements of charges for connection to and use of the distribution system (Ofgem, 2004). They form 15-30% of a customer's final bill. They vary across distribution region according to the charges levied by the local distribution company, but are levied in the same manner to all suppliers using that distribution network. They are generally in the form of a two-part tariff: a charge per consumer and a charge per unit of electricity carried. We note prepayment distribution charges are different to credit and direct debit charges. Transmission charges form about 13% of the bill and vary from region to region. Transmission charges are from the National Grid Transco web site (see National Grid Transco, 2003), and are those levied during the period 16:00 hours to 19:00 hours. [2] Descriptive statistics are shown in Table 2.

[Insert Table 2]

For each level of consumption q = 1650, 3300, and 4950 kWh, we estimate the two following model

(1) $$c_{rj}(q) = \alpha_{1m} d_{rm}(q) + \alpha_2 t_r(q) + \alpha_3 n_r + \alpha_4 u_r + \alpha_5 i_{rj} + \sum_g \alpha_{6g} o_{gj} + \varepsilon_{rj}$$

where indices *r, j*, denote distribution region and supplier, respectively. The payment method is standard credit. "*(q)*" specifies variables the value of which varies with *q* [3] ; besides

c_{rj} = retail charge in region *r* from supplier *j*

d_r = distribution charge in region *r*

t_r = transmission charge in region *r*

n_r = total number of distribution customers per square km in region *r* (density)

u_r = length of underground circuit in region *r*

i_{rj} = 1 if supplier *j* is the incumbent in region *r*; 0 otherwise (incumbency dummy)

o_{gj} = 1 if supplier *j* belongs to ownership group *g*; 0 otherwise (group dummy)

We estimate three regression equations, one for each simulate level of annual demand, relating retail charges to the cost elements which we could identify, to market characteristics and to incumbency and group dummies.

Salies and Waddams Price (2004) estimated a model similar to (1) with brand instead of group dummies. Brand dummies capture any effect of suppliers reflected in tariffs (including costs of purchasing electricity). Our model gives us an opportunity to test whether suppliers that are not vertically integrated with other market participants tend to price less compared with integrated suppliers. In this model we replaced brand dummies with fewer group dummies that measure the impact on retail charges of the various ownership groups present in the market at the time of the analysis. There are five mutually exclusive ownership groups: Powergen, Scottish Hydro Electric and Southern Electric, Scottish Power, EDF Energy, Innogy, plus the three non-ex-PES as listed in Table 1.

Given the results found in Salies and Waddams Price (2004), we expect variations in costs across regions to be closely reflected in tariff variations (α_1 to be close to 1) and α_2 not exceeding one third (reflecting the shorter consumption period to which transmission charges correspond). We consider both the number of customers and distribution area through a ratio of the two. It is expected that more dense (urbanised) areas allow suppliers to reduce per customer marketing costs for a given size of network, which would be indicated by a negative value for α_3. The length of low voltage underground circuit is used as a proxy of the size of the network. Underground circuit length is highly correlated with the number of distribution customers (the correlation coefficient equals 0.88). Its effect on charges shall be measured by α_4. A negative value for this coefficient would more generally show economies of scale.

Additional power of incumbents (the Ex-PES), who had retained a market share of between 50% and 85%, would be reflected in higher tariffs, and a positive coefficient for the incumbency dummy, α_5. A positive and significant value for this coefficient may reflect positive costs of switching Ex-PES (Waterson, 2003).

Salies and Waddams Price (2004) using April 2002 data test for heterogeneity between suppliers by examining the significance of brand dummy coefficients. Here we test the hypothesis whether vertical integration has a relatively significant effect on charges through α_6. Unlike these authors who relied on signs of the estimated coefficients on brand dummies, the present analysis shows some improvement as we test for the significance of group dummy coefficients statistically; group dummies replace brand dummies. We note our model may be seen as a constrained version of a model with brand dummies.

We do not include a constant; thus, no base group is considered. This shall avoid near-colinearity problems and vacuous interpretation of the constant. Following Salies and Waddams Price (2004) found we estimated a 2-equation seemingly unrelated regression equation (SURE) model for standard and direct debit tariffs. We only report results of the standard credit equation.

As there is a possibility of non-constant residual variance within each equation resulting from the spatial dimension of our data, we tested for conditional heteroskedasticity of unknown form within each equation using White's (1980) test. We reject homoskedasticity at the 5% level of significance in the direct debit equation at 1650kWh. We may interpret this result as a stronger attempt from supply businesses to differentiate their tariff in this market. As will be shown later, this result shows regional incumbents still enjoy market power particularly in the direct debit market where most switching has occurred. The model's coefficients are reported in tables three.

IV. RESULTS AND DISCUSSION

We first consider the responses of retail charges to distribution and transmission charges. As expected the coefficient on distribution charges is significantly different from zero at the 5% level of significance. If we assume a 95% confidence interval centred about one, distribution costs are almost fully passed on to customers, except in the direct debit and prepayment equations at 1650kWh. Ofgem (2003, p.38) reports more households are switching to non-prepayment markets and low-income customers switch less often. Regarding transmission charges, our results are also similar to Salies and Waddams Price (2004) with a coefficient about one third due to the short consumption period to which these charges correspond (peak period from

16:00 to 19:00 hours). If in each equation at 3300kWh we multiply by three the estimated coefficient on the transmission variable then we obtain a value that ranges from about 0.7 to 0.8.

[Insert Table 3]

We find economies of density at 1650 kWh and less significantly at 3300 kW. Closely related, the negative impact on retail charges of the length of the underground circuit in all markets would reflect economies of size: a customer's bill is lower in distribution regions that have more kilometres of circuit underground. The low significance of the coefficient multiplying density might result from a too high correlation between this variable and circuit's length variables (the correlation coefficient equals 0.88). The existence of those economies leads us to reject the hypothesis that urban and rural customers benefit equally from competition. Besides NAO (2001, p.8) reported rural customers are less likely to change their electricity supplier than those who live in urban areas because many customers change their supplier in response to a visit from a sales agent, and direct marketing of electricity has so far been less intensive in rural areas.

This negative relationship between retail charges and both the size of the network and the number of customers per square km reflects first technical economies at the distribution stage: heavy investments give an incentive to distributors to spread their costs among a high number of connected households. This situation could support the increasing concentration through horizontal integration in the retail sector; given the existence of decreasing per customer distribution charges paid by suppliers they have an interest in servicing a large number of customers. The two-part structure of distribution tariffs in all but the Sweb regions implies technical economies of scale in that per unit distribution charge necessarily decreases when the amount of supplied energy to consumers increases.

As expected, Atlantic and Basicpower have the lowest impact on charges with potential average annual savings (see Waterson, 2003) of up to £50 pounds for the cheapest supplier relative to the most expensive. Note that these savings do not account for consumer perception of switching costs. This difference was highest in the direct debit market at 4950kWh (we do not report this result). The effect on charges of Innogy and Powergen groups are, at the converse, greater or equal to the average effect. This seems consistent with integrated suppliers charging higher prices raising competition concerns. It is well known that the existence of consumers switching costs gives a further incentive to firms for grabbing more customers, which necessarily advantages old suppliers in the market (Farrell and Klemperer, 2004).

Interestingly, EDF has, on average, a lower impact on charges than SSE and Innogy. We suspect a more efficient vertically integrated structure and pricing strategy. We note EDF Energy includes Seeboard and Eastern distribution businesses that are in contiguous neighbour regions. It is worth noting as Spector (2003) emphasises that the idea that a merger allows firms to exploit scale economies is not convincing if it does not also generate technical synergies through learning for example. Technical synergies may exist between distribution networks owned by EDF because they are in contiguous neighbour regions (London, Eas and South East).
SSE seems also efficient at low consumption levels compared with Powergen, Scottish Power, Innogy and British Gas, but overall less efficient than EDF group. Unlike this latter, SSE owns very distant networks, one in Scotland and the other in

the South of England, which, according to our previous discussion, would not favor technical synergies.

V. CONCLUSION

Using regional observations on tariffs offered in December 2003, the present paper investigated the particular effect on the relationship between annual retail charges and cost drivers of various integrated structures. We find evidence of different pricing strategies by ownership groups, which suggest that the effect on retail charges of integrated suppliers vary depending on the spatial dispersion of the merged networks.

Overall these results supports Salies and Waddams Price (2003, 2004) who also pointed out the negative (respectively positive) effect on unit rates and bills of a change in the number of customers (respectively the distribution area). Our density variable, however, provides a more flexible interpretation as the particular influence on charges of rural (less dense) areas proves to be significant. Alongside this variable the size of the network underground leads to a similar result than the number of customers: coefficient estimates range from –0.7 to –0.3. For example, if the underground circuit increases by 3000km, then retail charges would decrease by a pound in the standard credit market at 1650kWh.

We could bring more information in the discussion by extending the range of consumption levels considered or using longitudinal data. This would have the further advantage of increasing the number of observations for brands such as Manweb, SWEB, Swalec, and Seeboard.

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Endnotes

[1]. This group acquired SWALEC in 2000 thus we do not ignore the influence of SWALEC acquisition.

[2]. For Scottish Power and Scottish Hydro regions, we employed data from 2002-03 period as only these were available to us, in the appropriate format (p/kWh) when completing the present document. Prepayment distribution standing charges were replaced with their non-prepayment equivalent when the data was missing, which occurs in 4 regions. At 1650kWh, this substitution is not too inaccurate as the extra charge for prepayment customers does not exceed £10, i.e. 15% of distribution charges (or less than 3% of retail charges).

[3]. Given the non-linear structure of most tariffs offered by network utilities (see Wilson, 1997), these models have some advantage over models considering a single mean level of consumption. V.-Cervera and J-Málaga (2001) and Ofgem's works also consider more than one level of annual demand. This methodology is appropriate as most tariffs intersect at some level of consumption reflecting various pricing strategies and tactics to attract targeted consumers; some suppliers prefer to target low energy demand customers while others offer attractive tariffs to customers whose annual demand exceeds an average level known to suppliers.

Table 1. Supply Brands and Ownership structure in April 2002 and January 2004 [a]

April 2002	January 2004
Ex-PES within the same ownership	
London Electricity (SWEB)	EDF Energy (London Energy, SWEB Energy, Seeboard Energy) [b]
SEEBOARD	
ScottishPower (Manweb)	ScottishPower (Manweb)
Npower (Northern, Yorkshire)	Npower (Northern, Yorkshire)
Scottish Hydro Electric and Southern Electric (SWALEC)	Scottish Hydro Electric and Southern Electric (SWALEC)
Powergen	Powergen (Eastern, Norweb)
TXU-Europe (Eastern, Norweb)	
Non ex-PES	
Amerada, Atlantic, Basicpower, British Gas	Atlantic [c], Basicpower, British Gas

[a] Mergers are underlined, and acquisitions represented with parentheses with the name of the owner before the parenthesis.

[b] LE Group completed acquisition of SEEBOARD in July 2002. Before that date, SEEBOARD was held by American Electric Power. LE Group changed its name to EDF Energy in 2003, and its supply brand, London Electricity, changed its name to London Energy.

[c] Amerada became part of Powergen.

Table 2. Descriptive statistics - January 2004 [(a)]

	Mean	Std. Dev.	Minimum Value	Maximum Value
Total charge p/ annum for standard credit				
1650 kWh	14 593	1244	12 300	17 900
3300 kWh	24 553	1906	21 100	29 500
4950 kWh	34 520	2927	29 700	42 000
Total charge p/ annum for direct debit				
1650 kWh	13 470	1145	11 400	16 300
3300 kWh	23 215	2036	19 300	28 000
4950 kWh	32 939	19 077	27 200	39 700
Total charge p/ annum for prepayment				
1650 kWh	15 922	1885	11 800	22 000
3300 kWh	26 547	2308	21 900	33 900
4950 kWh	37 187	2890	31 000	45 900
Distribution charge p/annum, non prepayment				
1650 kWh pa	3793	632	2687	4735
3300 kWh pa	5919	1079	4275	7933
4950 kWh pa	8044	1732	5720	11 449
Distribution charge p/annum for prepayment				
1650 kWh pa	4045	891	2687	5833
3300 kWh pa	6170	1128	4275	7933
4950 kWh pa	8296	1680	5720	11 449
Transmission charge p/ annum				
1650 kWh	2009	957	136	3478

3300 kWh	4018	1915	272	6956
4950 kWh	6028	2873	409	10 434
Distribution customers, 000	1961	679	673	3381
Size of distribution area, sq kms	15 928	11 300	667	54 500
Density (distribution customers/ sq kms)	356	780	12	3124
Underground circuit (km)	22 081	8466	8917	36 302

[(a)] Charges are inclusive of VAT.

Table 3. Standard Credit; Dependent variable: annual bill

	Annual consumption					
	1650kWh		**3300kWh**		**4950 kWh**	
Distribution Charge	.86	***	1.03	***	.89	***
	(.12)		(.07)		(.07)	
Transmission Charge	.54	***	.26	***	.16	***
	(.08)		(.03)		(.03)	
Density (customers / km^2)	–.23	**	–.16	*	–.20	
	(.09)		(.08)		(.13)	
Underg. Lines (×1000)	–.32	***	–.38	***	–.69	***
	(.09)		(.09)		(.13)	
Incumbent	7.51	***	18.69	***	29.74	***
	(2.64)		(1.82)		(2.63)	
Suppliers (pounds)						
Atlantic Energy&Gas	101.46	***	167.07	***	256.51	***
	(7.65)		(6.41)		(8.16)	

Utility Link (Basic power)	116.68	***	176.89	***	260.51	***
	(7.64)		(6.34)		(8.06)	
Powergen	111.06	***	191.49	***	296.07	***
	(7.44)		(6.40)		(8.14)	
SSE	104.51	***	182.75	***	284.68	***
	(7.46)		(6.43)		(8.19)	
Scottish Power	119.88	***	186.18	***	276.83	***
	(7.44)		(6.40)		(8.15)	
EDF Energy	103.30	***	175.69	***	272.72	***
	(7.48)		(6.44)		(8.20)	
Innogy	111.94	***	182.27	***	286.07	***
	(7.58)		(6.40)		(8.14)	
British Gas	113.74	***	179.28	***	270.44	***
	(7.45)		(6.41)		(8.16)	
Adj. R^2	.731		.909		.919	

Notes: *standard errors* in parentheses. *. Significant at 10%. **. Significant at 5%. ***. Significant at 1%.

Appendix. Ownership structure in the UK residential electricity market at December 2003

		Ultimate Owner	EDF	E. ON	EDF	Public	Aquila Inc. First E. Corp.	Owned Private	Public		Public	EDF		Investor Owned	Investor Owned	Owned Private
		Owner	EDF Energy	Powergen	EDF Energy	Scottish Power	Aquila Sterling First Energy	Mid American	United Utilities	SSE Power Distribution	Scottish Power	EDF Energy	SSE Power Distribution	PPL	PPL	Mid American
		Distributor	EDF Energy Networks	East Midlands Electric	EDF Energy Networks	Scottish Power Manweb	Aquila Networks	Northern Electric Distribution	United Utilities Electric	Scottish H. Electric Power Distribution	Scottish Power Distribution	EDF Energy Networks	Southern Electric Power Distribution	Western Power Distribution	Western Power Distribution	Yorkshire Electric Distribution
		Trading Name	EPN	EME	LPN	SP Manweb	Aquila	NEDL	United Utilities	S+S	SP Distribution	SPN	S+S	WPD (South Wales)	WPD (South West)	YEDL
Ultimate Owner	**Owner**	**Supplier** / **Region**	Eastern	E. Midlands	London	Manweb	Midlands	Northern	Norweb	Scottish Hydro	Scottish Power	Seeboard	Southern	South Wales	South Western	Yorkshire
E. ON	Powergen	Powergen	I	I	E	E	E	E	I	E	E	E	E	E	E	E
EdF (State)	EDF Energy	London Energy	E	E	I	E	E	E	E	E	E	N	E	E	N	E
Public	Scottish Power	ScottishPower Manweb	N	N	N	I	N	N	N	N	N	N	N	N	N	N
RWE	Innogy	npower	E	E	E	E	I	N	E	E	E	E	E	E	E	N
RWE	Innogy	Northern Supply	N	N	N	N	N	I	N	N	N	N	N	N	N	N
Public	SSE [a]	Scottish Hydro Electric	E	E	E	E	E	E	E	I	E	E	N	N	E	E
Public	Scottish Power	ScottishPower Energy Retail	E	E	E	N	E	E	E	E	I	E	E	E	E	E
EdF	EDF Energy	Seeboard Energy	N	N	N	N	N	N	N	N	N	I	N	N	N	N
Public	SSE [a]	Southern Electric	E	E	E	E	E	E	E	N	E	E	I	N	E	E
Public	SSE	SWALEC	N	N	N	N	N	N	N	N	N	N	N	I	N	N
EdF	EDF Energy	Sweb Energy	N	N	N	N	N	N	N	N	N	N	N	N	I	N
RWE	Innogy	Yorkshire Supply	N	N	N	N	N	N	N	N	N	N	N	N	N	I
Sempra Energy, John Shannon, etc.		Atlantic Electric and Gas	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Utility Link		basicpower	E	E	E	E	E	E	E	N	N	E	E	E	E	E
Centrica		British Gas	E	E	E	E	E	E	E	E	E	E	E	E	E	E
		Number of Suppiers	8	8	8	8	8	8	8	7	7	8	8	8	8	8

I = Incumbent, E = Entrant, N = Neither. [a] SSE counts for one supplier