Supply competition and price behaviour in the UK electricity supply industry

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Supply competition and price behaviour in the UK electricity supply industry

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Abstract

This work investigates the evolution of electricity prices for domestic customers in the UK since the introduction of competition. The empirical analysis is based on a panel data set containing detailed information about electricity supply prices over the period 1999 to 2003. The analysis aims to test theoretical hypotheses about the nature of consumers' switching and search costs. The econometric analysis of persistence and price dispersion provides only limited support for the view that the market is becoming more competitive and also indicates that there remain significant potential benefits to consumers from searching alternative suppliers.

Keywords: electricity supply, price competition, convergence, dynamic panels.

JEL classification: L43, L13, L94, C22, C23

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1. Introduction

Competition in UK energy supply has arguably proceeded further than any other country. Not only have *all* UK consumers have been able to choose their electricity supplier since May 1999, but also since March 2002 there has been *no* supply price regulation. Therefore, an experiment of world importance is taking place, concerning the behaviour of consumers and their suppliers[1]. As one manifestation of this, firms from many other countries are participating in the market in order to gain experience of live competition at work; US, German and French firms have taken significant stakes in the UK supply industry.

The focus of this paper is on the development of tariff structures for domestic customers over time as these developments in the market have taken place. Here, one null hypothesis would be that, as a result of competition, prices converge together quickly. An alternative is that prices would remain somewhat dispersed, as a consequence of significant search and switching costs and product differentiation. Under this alternative, we might expect that particular events would trigger changes in the distribution of prices; for example the freeing of a particular class of consumers from price regulation may have influenced the price vector they face. By examining the pattern of prices and changes in this pattern over time, we aim to tease out information about search costs, switching costs and the extent to which the market is competitive in practice.

In the background of this study, we should note that there are a number of important institutional features facilitating the development of competition in the market in question. When the market was broken up into generation, transmission, distribution and supply, the link between supply and distribution was broken. Transmission and supply remain regulated, but any competent potential supplier may obtain a licence. Thus, by knowing the (regulated) prices for transportation, and writing contracts for wholesale electricity, a supplier is able to design a tariff to attract consumers away from their incumbent supplier. Ancillary services, such as meter reading, may also be purchased on the market, but suppliers retain responsibility for billing, in a single bill to cover all vertical levels. A standardised system of identifying customers by their meter number facilitates their accurate transfer between suppliers.

[1] Just as, a decade ago, the UK was a world leader in competition in electricity generation.

As industry regulator, OFGEM is charged with overseeing the development of competition. Energywatch, a related body, has a duty to provide consumers with information regarding suppliers. Amongst other measures, they discharge this duty by providing regularly updated price comparison sheets on their website, covering every active supplier. In addition, they provide comparative information such as numbers of complaints about particular suppliers. Commercial companies may also provide price comparison services, so long as these cover the market and do not favour suppliers selectively, and several such services are active currently. They provide facilities to “click through” in order to switch supplier through their intermediation (indeed, this is the means by which they make money). The typical consumer is thus able to make an informed choice amongst around ten suppliers. However, all the major companies also engage in their own marketing activity, commonly using a sales force that moves from door to door within an area. The sales pitch focuses on price, with a secondary emphasis on service (but in both cases tends to be rather unspecific). At time of writing, around 39% of customers are supplied by a firm that is not their incumbent supplier[2].

The competitors in electricity supply are of three main types. Supply was a regionally-based activity, and prices generally differ as between the 14 regions still (costs also differ, as a result of transport cost differences)[3]. Thus one category of competition comes from suppliers extending their activities across regions (usually, maintaining a differential in prices). A second category comes from companies engaged previously in the supply of gas. Prime amongst these is British (in Scotland, trading as Scottish) Gas, which provided a national integrated service for the supply of gas, but other gas supply companies, some associated in part with oil companies, entered the electricity market[4]. The third force is independent suppliers; contrary to some expectations, these have tended not to be companies with a strong knowledge of mass market consumer activity or billing.

Besides differentiation by area, scope exists for companies to differentiate between various broad classes of customer. There are three main ways of paying bills, namely by (monthly) Direct Debit (DD), by Quarterly Bill (QB) (paid in arrears) and by Prepayment Meter (PM). These involve different supply costs, DD being the cheapest and PM the most expensive. Since all suppliers’ tariffs are at least two-part, companies can also differentiate between low

[2] The gross rate of switching is higher, because some people switch back.
[3] That is, the price you can buy at depends upon where you live, i.e. your postcode.
[4] The gas market was opened to competition earlier. In some ways, though, it is less interesting analytically, since it is national not regional in nature, so that there is less variation to observe. British Gas remains the most important operator in the gas market.

and high consumers[5]. There is also a distinction between completely online offerings and tariffs that are available to consumers who may sign up through a range of possible approaches.

In the last few years, with the growth of the internet as a means for consumer purchases, there has been considerable interest amongst economists concerning the role it may play in reducing the impact of search costs on consumer purchases and therefore perhaps on reducing the variance in prices consumers may encounter and on making markets more competitive. This study is unique in examining the effect on prices as the market under study is opened up to competition, in a context where a *complete* listing of prices is available on the internet. Thus additional quotes are available at zero additional charge. It is also relevant to note that shipping costs, which complicate or even bedevil price comparisons in other areas, are always included in this case. The savings from shopping around can be, though are not always, considerable.

Section 2 of the paper briefly develops some hypotheses we wish to test using the data then section 3 explains our approach. Results are covered in section 4 and section 5 concludes. Based on the evidence of pricing comparisons, there is only limited indication that the market is becoming competitive.

2. Hypotheses

Our underlying assumption in this analysis is that firms set prices conscious of consumer reactions; they will need to assess the competitiveness of their tariffs and adjust them over time in response to consumer behaviour in order to capture a segment of the market. Thus tariffs reveal firms' views about the nature of the market[6]. At its most basic, a new player who charges a price above an incumbent supplier cannot hope to gain customers. More relevant is the decision by an entrant as to how much to shade price below the incumbent. This will depend upon the firm's evaluation of search and switching behaviour, together with its expectations about the behaviour of others. We also assume that within an area, for each class of consumer, costs are the same for each supplier save the incumbent.

[5] In this paper we are concerned only with domestic consumers. Pricing to other consumers is not transparent to the outside observer. We also will not consider at present "dual fuel" deals and the (increasingly less important) "Economy 7" tariffs.

[6] We know from our work on consumer behaviour (Giulietti et al, 2003) that consumers do perceive substantial switching costs as between incumbent and entrant.

The consumer behaviour with which we are concerned is the switch from their incumbent supplier to another supplier. Changing electricity supplier involves both search and switching costs. Divergences in price between the incumbent and others thus reflect both search and switching costs. However, divergences in prices between non-incumbent suppliers presumably reflect search cost influences, not switching cost influences. Hence the basis of our analysis is that the presence of *divergences between non-incumbent suppliers' prices can be related solely to search cost phenomena (by design of the market), whilst divergences between incumbents' and non-incumbents' prices can be related to both search and switching costs*. If search costs are negligible, non-incumbents will all set the same price. If not, search cost theory suggests that price dispersion will remain and *that the identity of the lowest price suppliers will change over time* (Varian, 1980; Baye and Morgan, 2001). However, presumably as (or if) search costs fall, prices will move closer together.

Baye and Morgan argue after surveying various contributions that a relevant statistic is the gap, G, between the lowest and next lowest price. Heuristically, if prices approach marginal costs, and if firms are efficient, then Bertrand-type behaviour would indicate that G approaches zero. This is the more likely, the larger the number of firms, under their argument. Within their framework, involving easy internet search, only the lowest price is paid by consumers who search. Thus one relevant statistic to examine is G. As a result of mixed strategies followed by the players, search cost theory suggests that price dispersion will remain and *that the identity of the lowest price suppliers will change over time.* This implies that G shows no clear trend if search is seen as expensive. Alternatively however, if we assume that search costs fall over time, there will be effects on prices, with G shrinking. Since the number of suppliers has also shrunk somewhat over time, there is a clear expectation that G will fall if search costs fall.

In our case, most if not all posted prices will be actively used in transactions; the number of consumers is very large compared with the number of prices on offer. Hence the range of prices from largest to smallest, R, offered by non-incumbents also becomes of relevance. Again, if convergence occurs with market maturity, and supplier numbers fall, the clear prediction is that R should shrink. On the other hand, if search is rather partial, R may remain significant.

To summarise, our hypotheses regarding the development of prices are:

H1: Under convergence[7], G and R will shrink over time.

H2: Under persistence[8], G will not show a clear pattern over time. R will not shrink.

A second set of hypotheses link the incumbent's price with other prices on offer. Since the first set of hypotheses relate to search theory, we wish to link the second set with switching, whilst minimising the impact of search activity on the results. A minimal search would consist of choosing one company at random, from which to ascertain a price. In this case, the relevant value is the median price amongst non-incumbents, which will on average be the result of one search. The gap, M, between the incumbent's price and the median non-incumbent price becomes the statistic of interest. If as a result of observing others' experiences, switching costs are perceived to fall over time (that is, if people see how easy switching in fact is), then M will fall over time. On the other hand, if consumers face psychic costs of switching that are arrayed on a distribution, we may conjecture that those with the lowest perceived switching costs switch first and others do not switch because they perceive the costs as too high. In this latter case, companies seeking to gain share at the expense of the incumbent face having to provide increasingly attractive offers over time to capture increasingly intransigent consumers. This alternative predicts that M increases over time.

Rather than making a search at random, another alternative would be that the consumer decides to switch to British Gas (BG) as a provider. BG is the best-known provider of electricity and has engaged in extensive national promotional campaigns and claims to be the largest electricity supplier in the UK[9]. Thus, for a majority of consumers, carrying out no active search, they would be aware that BG would be an opportunity. Therefore, as an alternative to the above, we can define a gap B, between the incumbent's price and BG's. Our hypotheses are:

H3: If switching costs fall (rise) over time, M and B will fall (rise)

and

[7] We use the term "convergence" in the sense of Baye and Morgan (2001), to mean prices moving towards each other. An alternative terminology is to use convergence to mean stationarity in the time series econometric sense of reverting to a particular value after a shock. We will attempt to distinguish by calling the latter stationarity, but in our empirical work we examine both types of convergence.

[8] Persistence is used here in the sense of an antonym of convergence as defined.

[9] This is a significant claim, since all its customers will have switched away from an incumbent supplier.

H4: The magnitude M (B) is indicative of the size of perceived switching costs.

3. Data and methodology

Our analysis of the changes in the electricity retail prices since the introduction of competition takes into account geographical, product market and temporal dimensions. Our data set consists of a balanced panel of 29 bimonthly price observations over the period February 1999 to October 2003. Over this period the number of firms operating in the market ranges between 18 and 7. Data were obtained from the Consumer Association website initially and, later, from the Ofgem and "energywatch" websites.

As previously discussed, electricity retail prices for domestic consumption in the UK differ by payment method and geographical location. As a result of this, our data set comprises 84 cross-sectional units corresponding to the 14 supply regions[10], 3 payment methods (direct debit, quarterly bills and prepayment meters) and 2 levels of consumption. We distinguish between high (4950 KWh per year) and low (1650 KWh per year) consumption in order to reflect the two-part nature (generally comprising a standing charge and a unit rate) of most electricity tariffs[11]. This allows us to consider 6 different products whose price is set by residential energy supplier. All the companies for which data have been collected and all the tariffs they offered (including internet-only tariffs) are used in the calculation of G, R, M, and B. In order to construct these variables for our analysis we calculated average yearly bills for customers on low and high consumption levels for each of the main type of payment.

Some sample charts are shown below in figures 1-3, as an illustrative example, based on data at an aggregate level. The price pattern observed at a regional level, however, is not dissimilar to the one observed at a national level. These illustrative charts relate to one particular class of consumer, namely high consumption direct debit consumers.

These charts suggest the following possibilities.

[10] These regions are: Eastern, East Midlands, London, Midlands, Manweb (Greater Manchester), Northern, North Western, South Eastern, Scottish Hydro (West Scotland), Scottish Power (East Scotland), Southern, South Wales, South West and Yorkshire.

[11] In June 2000 British gas removed the standing charge from its domestic electricity and gas charges and substituted it with two consumption related unit rates, therefore maintaining a two-part tariff structure. Most, but not all domestic energy suppliers followed this move, which was the major strategic pricing move over the period under examination.

1. Hypothesis 2 is upheld over hypothesis 1. The Range appears to have been increasing for around the last 18 months and there is no discernible trend in the Gap, indicating that persistence in the spread of prices rather than convergence is the norm[12]. The gap is in line with some other studies (e.g. Baye et al, 2002) and indicates a relatively competitive market in terms of the two lowest bids. The range is quite large.
2. Examining hypothesis 3, the indications are that switching costs are growing over time, presumably because increasingly recalcitrant consumers have to be attracted.
3. Latterly, implied switching costs are over 10% of the bill; this is a surprisingly large value.

In order to perform a rigorous test of our hypotheses concerning the evolution of electricity tariffs in the five years since the introduction of competition we need to consider the price path to convergence in order to distinguish fluctuations around prices from movements of trend. The literature on the 'law of one price' has adopted several empirical tests of price convergence, particularly in the international trade area (Frankel and Rose (1996), but also with reference to internal US (Cecchetti et al., 2000, consumer price indices across US cities) and European (Goldberg and Verboven, 2001, cars across European countries) markets.

Recent contributions in these areas rely on the econometric theory of unit root testing in order to provide evidence of the convergence of prices to a 'common' average in the sense of mean reversion. This work is based on panel data spanning over countries and time, which has desirable properties in terms of the inference that can be made about stationarity, even when the number of time observations available is rather limited (Im, Pesaran and Shin (IPS), 2003).

However, our initial graphical analysis of the dataset indicates the presence of a potential complication in our case: a positive trend in most of our series. For this reason in our stationarity analysis we investigate the possibility that our series are stationary either around a mean or around a deterministic trend, once we have accounted for the possibility that the trends identified in the graphical analysis were the result of a dynamic stochastic process (i.e. the presence of a unit root). Our unit root testing procedure follows the guidelines about dynamic specification offered in IPS (2003) and the subsequent modified version of this test put forward in Pesaran (2003).

[12] There is a noticeable upward trend in Gap towards the end of our sample period. This is because two internet-only suppliers had been the cheapest but one ceased its internet-only offering, rendering the lowest two offers less homogeneous in character.

IPS present a method to test for the presence of unit roots in dynamic heterogeneous panels that considers a sample of *N* cross section units observed over *T* time periods. The IPS test averages the (Augmented) Dickey-Fuller statistic obtained across the *N* cross-sectional units of the panel (denoted as $\tilde{t}bar_{NT} = 1/N \sum_{i=1}^{N} \tilde{t}_{iT}$, where $\tilde{t}_{iT}$ is the ADF test for the i^{th} cross-sectional unit), and show that a suitable standardisation of the $\tilde{t}bar_{NT}$ statistic, denoted as $Z_{\tilde{t}bar}$, follows a standard normal distribution.

A critical assumption underlying the IPS panel unit root test is the cross section independence among the individual time series in the panel. Failing to account for potential cross-sectional dependence leads to over-rejection of the IPS test statistic, the extent of which is related to the degree of this dependence. In order to overcome this deficiency, Pesaran (2003) suggests augmenting the standard (Augmented) Dickey-Fuller regressions with the cross section averages of lagged levels and first-differences of the individual series in the panel. The resulting cross-sectionally augmented IPS test statistic is then compared with the critical values tabulated by Pesaran, corresponding to the models without intercepts or trends, models with individual-specific intercepts, and models with individual-specific intercepts and linear trends (see Pesaran’s Tables 3a to 3c).

The cross-sectionally augmented unit root tests for panel data applied to our data indicate that all the series analysed are stationary around a deterministic trend, with the exception of the marginal case of random gain[13]. This has allowed us to include interactions of a trend variable with fixed effects in all our regressions.

Our four estimating equations have the following form:

$$\Delta \ln(Y_{p,r,t}) = a_{p,r} + a_{p,r} * trend + b Y_{p,r,t-1} + \sum_{l=1}^{L} g_l \Delta \ln(Y_{p,r,t-l}) + J\, nfirms_{r,t} + e_{p,r,t} \quad (1)$$

[13] In the stationarity analysis the critical values used to assess the significance of the convergence coefficients (or more precisely to test the null hypothesis of units root in the data) correspond to those presented in Pesaran (2003) for the case of T=30 (time observations) and N=100 (cross-section units) which is closest to the dimension of our data set (T=29 and N=84). The test regressions do not include lags of the dependent variable as these turned out to be insignificant. The results of the panel unit root test statistics are not reported here, but are available from the authors upon request. .)

Where Y refers to the variables G, R, B and M discussed above p, r, t identify a product, region and time period, respectively. ? indicates the first difference operator, ? $Y_{p,r,t} = Y_{p,r,t} - Y_{p,r,t-1}$. The first differences in the lagged dependent variable are included to account for potential serial correlation in the error term, as in the augmented Dickey-Fuller regressions for unit root testing[14]. The inclusion of five lags of these first differences reduces the number of available time observations to be used for estimation to 23, so that the total number of observations available is 1932 (T=23 and N=84)

This specification allows us to assess the speed of any convergence process (reversion to a trend) based on the sign and size of the estimated ß coefficient; we expect to observe a negative sign for ß if the process is stationary, while ß = 0 indicates that the effect of a shock on prices is permanent. The estimated value of ß is used to calculate the approximate half-life of a shock on the relevant dependent variable, based on the formula: – ln (2) / ln (1+ ß).

In order to control for region and product-specific factors that might affect the companies' pricing behaviour, regional and product dummies ($a_{p,r}$) are included in the estimating equation[15]. On the other hand, the inclusion in equation (1) of the number of firms operating in the different regional markets (*nfirms*), which varies by region and time only, is aimed at controlling for the effects of changes in market structure and the nature of competition as firms enter or exit the market.

For the purpose of our analysis of price divergence over time, the sign and magnitude of the coefficients associated with the interactions between fixed effects and the time trend are the most relevant, because they allow us to test the various hypotheses about the presence or lack of convergence in the sense discussed in the previous section. The presence of a significant positive (negative) trend term would provide evidence in support of an increasing (decreasing) gap or range in average bills over time for different products and regions, reflecting the underlying evolution of consumers' search costs as a result of competition. On the other hand the presence of a trend in the bill differentials between the median supplier or British Gas and the incumbent would allow us to describe the evolution of customers' switching costs in this market and its estimated variation over time.

[14] In all equations, 5 lagged first differences are introduced. This results from a selection process based on the significance level of relevant ? coefficients, having started with L= 6.

[15] In all the estimated equations the fixed effects terms where jointly significant at the 1% level.

Given the relatively long time dimension of our panel we allow the estimated parameters to vary over time. In particular we are interested in identifying the presence of structural breaks in the dynamic model that are driven by changes in the institutional framework. Accordingly, we carry out recursive estimations that allow us to observe gradual changes in the estimated parameters as new observations are added to the regression. Furthermore we allow for the estimated coefficients to vary at the time of two known institutional changes associated with the removal of price controls by the regulator: in April 2001 for direct debit customers and in April 2002 for quarterly bill and prepayment meter customers, as well as BG's strategic move removing standing charges.

All the equations are estimated using Least Squares Dummy Variable estimator which has been shown to provide efficient and unbiased estimates for balanced panels of dimensions close to ours (Judson and Owen, 1999). The t-statistics calculated for all the estimated coefficients are based on White heteroskedasticity-consistent standard errors and covariances.

4. Discussion of results

4.1 Analysis of persistence

In examining results, we first consider the issue of persistence, then move on to identification of trends. All results are based upon empirical versions of (1) above. To investigate persistence, we examine estimates of coefficient β from (1) within a fairly general formulation incorporating a full range of intercept and slope dummies. Our estimates in Table 1 of the effect of exogenous shocks on prices for the whole period since the introduction of competition indicate a fairly rapid process of stationarity for all the variables analysed. The estimated convergence coefficients are all negative, ranging between -0.4 and -0.64, and significantly different from zero, as required for convergence. These values correspond to an approximate half-life of the shock of 3 months for gap (G), range(R) and BG gain (B) and 4 months for the random gain (M).

The speed of adjustment coefficients have also been estimated allowing for variation over time in order to account for the potential effects of institutional changes after mid-2000. When the convergence coefficients are interacted with time dummies from April 2001 we observe a faster level of convergence of 2 months at the beginning of the period and then a significant reduction in speed of convergence after April 2001 of 6 months or more for Gap and B.

4.2 Trends in price dispersion

Various formulations of the equations explaining price dispersion may be found in Tables 1-3. The coefficients on the variable interacting a time trend with the fixed effects give an indication of the gradual movement of our indexes of price dispersion over time. The detailed information available about electricity prices also allows us to distinguish between the movements of prices across geographical and across product market dimensions. In order to account for all the possible sources of cross-sectional variation in the trend we considered all possible interactions between different cross-sectional dimensions, using quarterly billed high consumption level customers as our base case.

The estimated coefficients listed in Table 1 may first be analysed on a payment method and consumption level basis. According to the table, average bills and potential savings from switching for quarterly bills and direct debit consumers have been increasing over time in most regions, although this phenomenon has been less marked for low consumption direct debit customers, as highlighted by the significant negative coefficients particularly in the case of Gap. For prepayment meter users the trend seems to be in the opposite direction compared with the other payment methods, with significant negative coefficients for both Gap and Range. This phenomenon seems to apply especially to high consumption levels, with limited evidence of any significant difference from other payment methods for low consumption prepayment users.

In order to assess the variability of these results across the geographical dimension we carried out a series of Wald tests aimed at identifying the presence of a significant difference in trends across the 14 electricity regions. The results of these tests lead us to accept the null hypothesis that the coefficients are equal across regions for quarterly bills and direct debit customers for both high and low levels of consumption. However the null hypothesis is rejected for prepayment meter users with low consumption and, more strongly, for those with high consumption levels.

In the light of these results we carried out some further regressions aimed at assessing the potential effects of institutional changes after mid-2000 using regional averages for the different payment method and consumption levels. Given the relatively large number of cross-sectional dimensions in our data set, this approach allows us to keep the number of parameters to estimate and interpret reasonably manageable, without losing too much relevant information about the variables of interest. Table 2 contains the information relative to the 3 payment methods while Table 3 refers to different levels of consumption.

Looking first at payment methods, we observe a negative trend (i.e. prices moving closer together) for all payment methods and all indexes with the exception of Gap, where the series is initially stationary around a constant. After June 2000 however, we observe a positive trend in average bills and potential savings for all payment methods with the exception of prepayment meters where the trend remains negative, particularly for Gap and, after the removal of price controls in April 2002, for Range[16]. The trend in the Gap in average bills for direct debit consumers does not seem to be affected significantly by institutional changes and remains insignificantly different from zero throughout the period.

When looking across different consumption levels in Table 3, we initially observe a negative trend in both cases with the exception of Gap, which is constant over the initial period. The Gap in average bills for high consumption increases after June 2000 but this change is compensated by a reduction after April 2001. Other indices also show a significant increase in the trend for both levels of consumption after June 2000.

The general trend in the price indexes of interest to this analysis is also partly reflected in the estimated effect of changes in market structure, measured here by the number of firms operating in the market. For three of our four groups of regressions (with R, B and M as dependent variables) it has a positive and significant impact. Firm numbers have been decreasing over our time period as a result of consolidation through mergers and this process seems to have associated with a reduction in most of the measures of price dispersion. The number of firms in the market does not seem to have any significant effect on the size of the Gap between lowest and second lowest price.

The most significant result from this series of estimations are those in Table 2 concerning the impact of removal of price controls for Direct Debit customers in April 2001 and for all customers in April 2002. These changes were accompanied by an increase in the Range,

[16] We must remember however that we have previously identified some regional variability for this payment method, so national averages do not give us a complete picture.

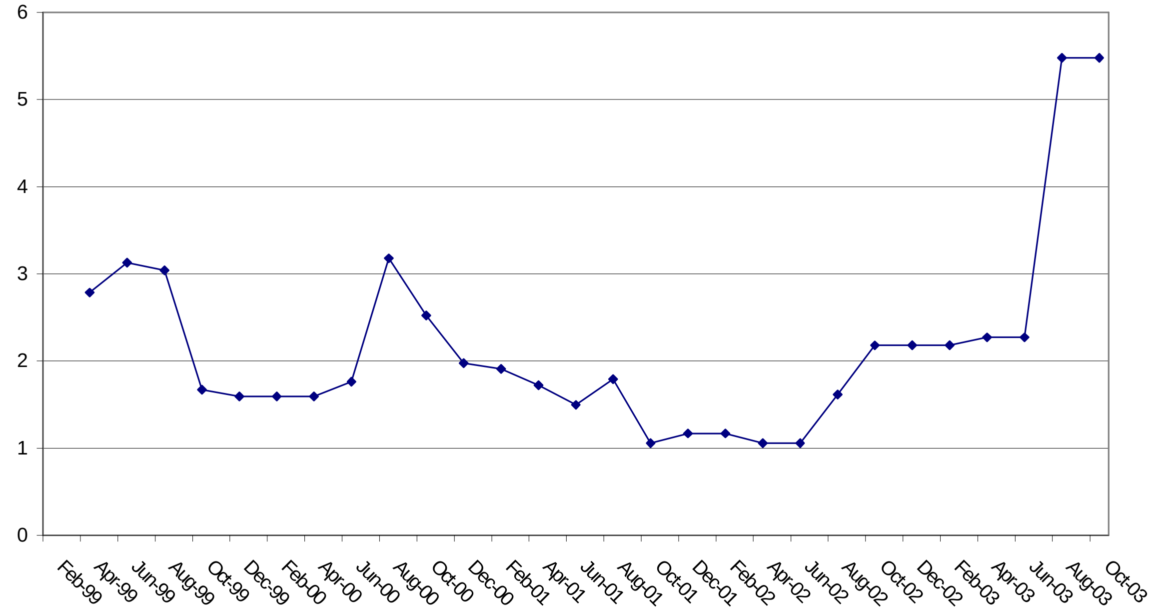
Median and B measures for both DD and QB customers, indicative of a less competitive environment being created. The picture for Prepayment customers is a little more mixed, with some shrinkage in the Range of prices offered after controls in that area were removed.

5. Conclusions

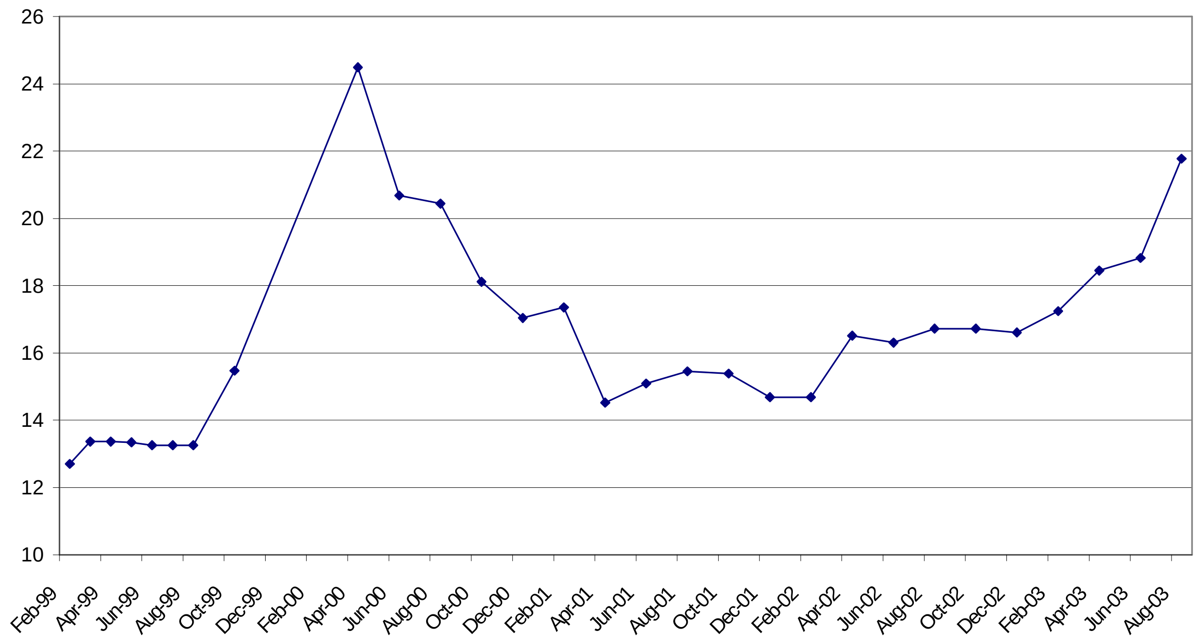
On one view, electricity supply is a homogeneous good market in which consumers quickly learn through either their own or others' experience how easy it is to switch suppliers in order to save money. As a result, companies aiming to capture new business would need to price competitively and companies wanting to retain business would need to ensure their offer did not move too far out of line with entrant offers. Hence as companies learnt more about their competitors' moves, differences in the trend values of prices would tend to shrink. The surprising thing is that this seems not to have happened with the opening up of UK electricity supply to competition.

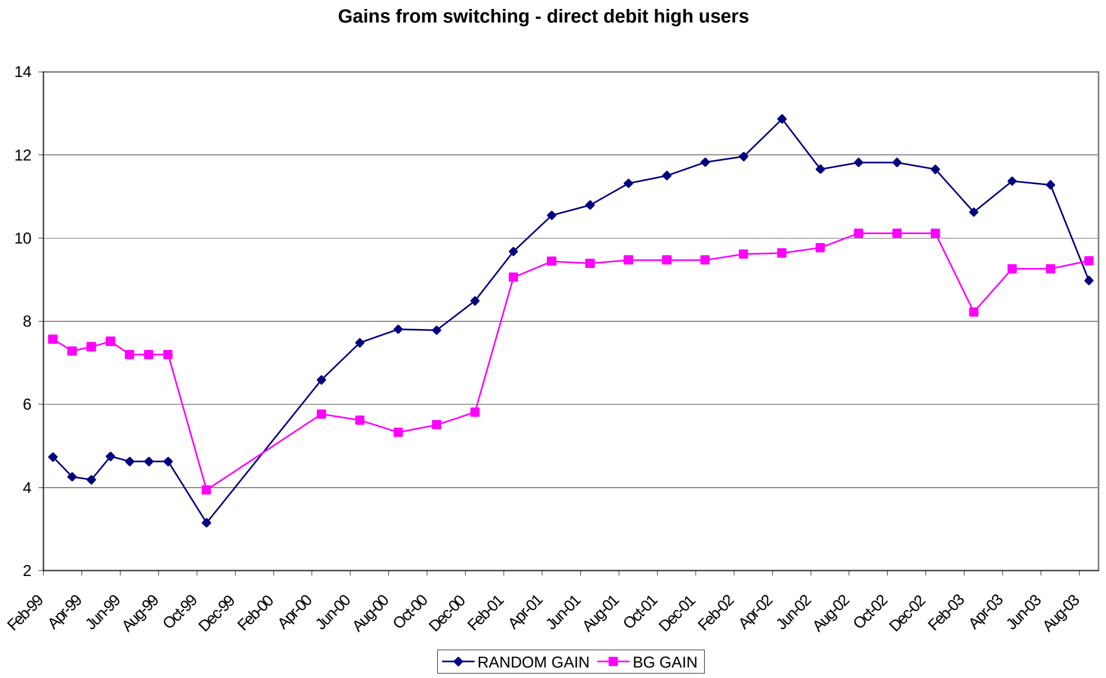
Of course, during a part of the period we are observing, price controls were operative on incumbent players. However removal of these controls has, if anything, led to the gains from switching supplier away from the incumbent to grow over time. Thus, whilst the market has not seen major anticompetitive moves by established players, not has it seen a fully competitive market emerge, by any means. This conclusion is reinforced by the fact that retail electricity prices overall have not fallen to the extent of price falls in wholesale prices over the period since a market has developed (OFGEM, 2003). It remains to be seen what will happen once wholesale prices trend upwards.

Gap in lowest bills - direct debit high users



Bill range - direct debit high users





Gains from switching - direct debit high users
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Aug-03
RANDOM GAIN
BG GAIN

Table 1- Trend intereraction by region and products

Regressors	ΔX = ΔG		ΔX = ΔM		ΔX = ΔB		ΔX = ΔR	
	Coeff.	t-Stat	Coeff.	t-Stat	Coeff.	t-Stat	Coeff.	t-Stat
X(-1)	-0.517	-10.747	-0.401	-10.149	-0.640	-13.586	-0.557	-12.104
NFIRMS	-0.016	-0.405	0.135	3.210	0.287	6.924	0.260	2.767
T*DEA	0.115	1.590	0.011	0.178	0.237	4.210	-0.005	-0.038
T*DEM	0.131	2.601	0.062	1.150	0.210	3.565	0.038	0.247
T*DLD	0.079	1.107	0.042	0.757	0.198	4.133	0.017	0.119
T*DMD	0.138	3.123	0.052	0.931	0.205	3.146	0.165	1.082
T*DMW	0.045	0.965	0.113	3.059	0.310	9.161	0.060	0.508
T*DNT	0.120	2.723	0.073	1.042	0.245	2.800	0.201	1.475
T*DNW	0.047	1.107	0.025	0.823	0.186	5.798	-0.091	-0.940
T*DSE	0.084	1.381	0.025	0.499	0.293	5.836	-0.034	-0.320
T*DSH	0.049	1.498	0.104	3.521	0.126	4.545	-0.052	-0.977
T*DSP	-0.007	-0.232	0.108	3.078	0.182	8.585	0.079	1.694
T*DST	0.070	1.143	0.099	2.885	0.307	8.277	0.088	0.640
T*DSA	0.086	2.216	0.110	3.302	0.214	6.298	0.029	0.255
T*DSW	0.016	0.294	0.063	1.691	0.239	5.341	-0.034	-0.276
T*DYK	0.150	3.951	-0.043	-0.770	0.117	2.081	0.247	1.680
T*DEA*DDD	-0.082	-1.021	0.049	0.421	-0.030	-0.353	0.016	0.068
T*DEM*DDD	0.034	0.477	0.079	0.881	-0.001	-0.013	0.076	0.274
T*DLD*DDD	0.049	0.484	0.047	0.711	0.017	0.297	0.096	0.343
T*DMD*DDD	-0.103	-1.791	0.086	1.026	0.043	0.541	-0.047	-0.181
T*DMW*DDD	0.037	0.419	-0.018	-0.283	-0.060	-1.229	0.075	0.405
T*DNT*DDD	-0.066	-1.018	0.165	1.730	0.098	0.990	-0.096	-0.359
T*DNW*DDD	-0.041	-0.664	0.058	0.861	-0.004	-0.071	0.017	0.087
T*DSE*DDD	0.042	0.481	0.131	1.357	0.018	0.219	0.103	0.516
T*DSH*DDD	0.044	1.109	-0.033	-0.650	-0.021	-0.511	0.007	0.093
T*DSP*DDD	0.045	0.973	-0.067	-1.172	-0.081	-2.647	0.002	0.029
T*DST*DDD	-0.061	-0.902	-0.005	-0.078	-0.083	-1.856	-0.019	-0.078
T*DSA*DDD	-0.057	-0.880	0.035	0.636	-0.014	-0.213	-0.019	-0.100
T*DSW*DDD	-0.053	-0.716	0.045	0.727	0.002	0.032	0.049	0.224
T*DYK*DDD	-0.014	-0.278	0.198	2.537	0.087	1.292	-0.071	-0.263
T*DEA*DPP	-0.206	-1.567	0.093	1.053	-0.057	-0.601	-0.333	-1.232
T*DEM*DPP	-0.148	-1.015	0.094	0.926	-0.043	-0.382	-0.818	-2.631
T*DLD*DPP	-0.143	-1.154	-0.003	-0.048	-0.054	-0.898	-0.187	-0.720
T*DMD*DPP	-0.301	-2.905	0.182	2.092	-0.044	-0.564	-1.159	-4.475
T*DMW*DPP	-0.213	-1.874	0.017	0.263	0.107	1.412	-0.327	-1.641
T*DNT*DPP	-0.347	-2.825	0.189	2.111	0.178	1.646	-0.822	-3.584
T*DNW*DPP	-0.140	-1.355	0.045	0.926	0.049	0.718	-1.047	-3.689
T*DSE*DPP	-0.315	-2.650	0.090	1.772	-0.190	-2.927	-0.428	-1.915
T*DSH*DPP	-0.095	-1.520	0.059	1.582	0.043	1.158	-1.334	-7.537
T*DSP*DPP	0.105	2.797	-0.019	-0.434	-0.061	-1.605	-0.288	-2.871
T*DST*DPP	-0.306	-2.310	0.071	2.193	-0.002	-0.052	-0.886	-3.503
T*DSA*DPP	-0.276	-2.264	0.022	0.595	0.118	1.978	-0.527	-2.631
T*DSW*DPP	-0.044	-0.572	-0.010	-0.272	-0.193	-4.077	-0.066	-0.379
T*DYK*DPP	-0.385	-3.629	0.227	2.756	0.162	2.297	-0.837	-3.660
T*DEA*DDD*DL	-0.072	-0.956	-0.004	-0.029	0.013	0.122	-0.288	-1.167
T*DEM*DDD*DL	-0.198	-2.566	-0.122	-1.064	0.006	0.051	-0.159	-0.528
T*DLD*DDD*DL	-0.251	-2.083	0.050	0.531	0.065	0.757	-0.492	-1.723
T*DMD*DDD*DL	-0.082	-1.428	-0.253	-1.840	-0.224	-1.376	-0.160	-0.554
T*DMW*DDD*DL	-0.138	-1.484	0.024	0.343	0.083	1.354	-0.276	-1.202
T*DNT*DDD*DL	-0.042	-0.534	-0.225	-1.339	-0.227	-1.244	-0.058	-0.200
T*DNW*DDD*DL	-0.023	-0.299	-0.027	-0.290	0.074	0.763	0.010	0.047

Table1 -Trend interaction by region and products (CONTINUED)

Regressors	ΔX = ΔG		ΔX = ΔM		ΔX = ΔB		ΔX = ΔR	
	Coeff.	t-Stat	Coeff.	t-Stat	Coeff.	t-Stat	Coeff.	t-Stat
T*DSE*DDD*DL	-0.182	-2.040	0.147	1.014	0.160	1.079	-0.217	-0.922
T*DSH*DDD*DL	-0.043	-0.818	0.052	0.736	0.016	0.353	-0.002	-0.015
T*DSP*DDD*DL	-0.026	-0.611	0.021	0.276	0.032	0.770	-0.059	-0.569
T*DST*DDD*DL	-0.082	-0.742	0.009	0.125	0.058	0.960	-0.373	-1.578
T*DSA*DDD*DL	-0.092	-0.966	0.030	0.475	0.007	0.094	-0.324	-1.410
T*DSW*DDD*DL	-0.009	-0.149	-0.084	-1.039	-0.060	-0.729	-0.172	-0.764
T*DYK*DDD*DL	-0.124	-2.055	-0.249	-2.302	-0.126	-1.268	-0.227	-0.697
T*DEA*DPP*DL	0.113	0.913	0.131	0.929	0.017	0.140	0.639	2.363
T*DEM*DPP*DL	0.165	1.041	0.019	0.141	-0.102	-0.687	0.787	2.414
T*DLD*DPP*DL	0.080	0.619	0.057	1.415	-0.009	-0.097	0.341	1.312
T*DMD*DPP*DL	0.285	2.616	-0.135	-1.792	-0.101	-1.721	-0.266	-0.979
T*DMW*DPP*DL	0.010	0.084	0.051	0.474	-0.027	-0.245	0.378	1.953
T*DNT*DPP*DL	0.062	0.483	-0.059	-0.354	-0.022	-0.138	0.032	0.140
T*DNW*DPP*DL	0.012	0.092	0.149	1.917	0.031	0.290	0.021	0.059
T*DSE*DPP*DL	0.229	2.075	0.505	4.298	-0.009	-0.142	0.688	2.253
T*DSH*DPP*DL	-0.066	-1.117	0.000	0.004	0.003	0.085	-0.359	-1.813
T*DSP*DPP*DL	0.148	3.787	0.047	0.612	0.016	0.209	0.314	3.031
T*DST*DPP*DL	0.084	0.633	0.005	0.104	0.002	0.039	0.395	1.633
T*DSA*DPP*DL	0.029	0.194	0.055	0.925	0.003	0.030	0.667	3.587
T*DSW*DPP*DL	-0.069	-0.726	0.022	0.628	-0.011	-0.234	0.198	1.110
T*DYK*DPP*DL	0.062	0.528	-0.062	-0.778	-0.121	-1.511	0.014	0.065
+ Fixed effects								
+ Five lags dependent variable								
R-squared	0.254		0.246		0.340		0.291	
Adjusted R-squared	0.186		0.178		0.280		0.227	
S.E. of regression	2.294		1.799		1.785		5.142	
F-statistic	3.762		3.613		5.691		4.547	
Probability (F-statistic)	0.000		0.000		0.000		0.000	
Mean dependent variable	0.119		0.154		0.101		-0.015	
S.D. dependent variable	2.543		1.985		2.103		5.849	
Sum squared residual	9318.8		5734.6		5642.3		46818.8	
Durbin-Watson statistic	2.107		2.087		2.193		2.100	

Notes:

The model includes region dummy variables for Eastern (DEA), East Midlands (DEM), London (DLD), Midlands (DMD), Manweb (Greater Manchester) (DMW), Northern (DNT), North Western (DNW), South Eastern (DSE), Scottish Hydro (West Scotland) (DSH), Scottish Power (East Scotland) (DSP), Southern (DST), South Wales (DSA), South West (DSW) and Yorkshire (DYK). Product dummy variables for Direct Debit (DDD) and Prepayment Meter (DPP). Consumption dummy variable for low consumption levels (DL). T denotes a linear trend term. Five lags of the dependent variable are included to account for potential residual serial correlation. t-statistics are based on White heteroskedasticity-consistent variance-covariance matrix.

Table 2 - Trend interactions by payment method with structural breaks

Regressors	ΔX = ΔG		ΔX = ΔM		ΔX = ΔB		ΔX = ΔR	
	Coeff.	t-Stat	Coeff.	t-Stat	Coeff.	t-Stat	Coeff.	t-Stat
T*DDD	-0.001	-0.006	-1.055	-7.958	-0.942	-6.926	-1.062	-2.630
T*DPP	-0.066	-0.443	-0.630	-5.019	-1.059	-8.869	-1.213	-3.433
T*DQB	-0.175	-1.279	-0.749	-7.443	-0.853	-7.944	-1.909	-5.041
T*DDD*DU_JUN00	-0.001	-0.047	0.035	2.647	0.046	3.367	0.041	0.774
T*DPP*DU_JUN00	-0.053	-2.459	0.036	2.932	0.060	5.581	0.056	0.956
T*DQB*DU_JUN00	0.044	2.032	0.013	1.204	0.048	4.548	0.241	4.626
T*DDD*DU_APR01	-0.024	-0.344	0.649	7.221	0.515	5.494	0.443	2.091
T*DPP*DU_APR01	0.349	3.916	0.444	5.157	0.610	7.270	0.955	4.762
T*DQB*DU_APR01	0.062	0.896	0.446	6.669	0.458	6.137	0.855	4.492
T*DDD*DU_APR02	0.009	0.360	0.158	6.414	0.265	12.154	0.177	2.835
T*DPP*DU_APR02	-0.242	-7.390	0.079	3.016	0.251	11.660	-0.338	-4.646
T*DQB*DU_APR02	0.054	1.981	0.117	6.382	0.248	14.869	0.261	4.370
+ X(-1)								
+ NFIRMS								
+ Fixed effects								
+ Five lags dependent variable								
R-squared	0.258		0.322		0.433		0.238	
Adjusted R-squared	0.216		0.284		0.401		0.196	
S.E. of regression	2.251		1.679		1.627		5.246	
F-statistic	6.227		8.516		13.696		5.603	
Probability (F-statistic)	0.000		0.000		0.000		0.000	
Mean dependent variable	0.119		0.154		0.101		-0.015	
S.D. dependent variable	2.543		1.985		2.103		5.849	
Sum squared residual	9268.0		5157.4		4843.7		50328.5	
Durbin-Watson statistic	2.131		2.040		1.971		2.053	

Notes:

The model includes product dummy variables for Direct Debit (DDD) Quarterly Bill (DQB) and Prepayment Meter (DPP). DU_JUN00, DU_APR01 and DU_APR02 are step dummy variables that take the value of one after June 2000, April 2001 and April 2002, respectively, and zero otherwise, to account for the potential effect of the institutional changes described in the main text. T denotes a linear trend term. Five lags of the dependent variable are included to account for potential residual serial correlation. t-statistics are based on White heteroskedasticity-consistent variance-covariance matrix.

Table 3 - Trend interactions by consumption level with structural breaks

Regressors	ΔX = ΔG		ΔX = ΔM		ΔX = ΔB		ΔX = ΔR	
	Coeff.	t-Stat	Coeff.	t-Stat	Coeff.	t-Stat	Coeff.	t-Stat
T*DL	-0.198	-1.644	-0.862	-7.051	-1.160	-9.539	-0.951	-2.933
T*DH	0.025	0.220	-0.775	-9.752	-0.742	-9.738	-1.522	-4.783
T*DL*DU_JUN00	0.095	1.432	0.554	6.666	0.653	7.863	0.540	3.091
T*DH*DU_JUN00	0.148	2.399	0.478	9.424	0.401	7.700	0.795	4.811
T*DL*DU_APR01	0.023	0.981	0.117	4.923	0.281	14.553	-0.014	-0.253
T*DH*DU_APR01	-0.129	-5.376	0.116	7.637	0.231	15.052	0.028	0.471
T*DL*DU_APR02	0.001	0.030	0.029	2.467	0.064	5.535	0.038	0.824
T*DH*DU_APR02	-0.003	-0.161	0.033	4.058	0.038		0.187	4.466
+ X(-1)								
+ NFIRMS								
+ Fixed effects								
+ Five lags dependent variable								
R-squared	0.208		0.297		0.439		0.190	
Adjusted R-squared	0.166		0.259		0.409		0.147	
S.E. of regression	2.323		1.708		1.618		5.402	
F-statistic	4.912		7.897		14.616		4.395	
Probability (F-statistic)	0.000		0.000		0.000		0.000	
Mean dependent variable	0.119		0.154		0.101		-0.015	
S.D. dependent variable	2.543		1.985		2.103		5.849	
Sum squared residual	9889.4		5348.6		4795.8		53485.1	
Durbin-Watson statistic	2.084		2.011		1.972		1.995	

Notes:

The model includes consumption dummy variable for low (DL) and high (DH) level consumers. DU_JUN00, DU_APR01 and DU_APR02 are step dummy variables that take the value of one after June 2000, April 2001 and April 2002, respectively, and zero otherwise, to account for the potential effect of the institutional changes described in the main text. T denotes a linear trend term. Five lags of the dependent variable are included to account for potential residual serial correlation. t-statistics are based on White heteroskedasticity-consistent variance-covariance matrix.

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