Pricing in the UK retail energy market, 2005 - 2013

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Abstract

UK governments and the energy regulator have shown increasing concern about the health of competition in the residential energy market, following their pioneering deregulation at the end of the last century. We identify the effects of introducing the non discrimination clauses in 2009, a major regulatory intervention and the first since deregulation. We explore the effect of this intervention on the price movements of the six major players, and find that the nature of competition in the industry has changed, with less effective rivalry between the regional incumbents and large regional competitors following the intervention; companies seem to have 'retreated' to their home regions, leaving a market where pricing behaviour resembles more closely a duopoly between British Gas and the regional incumbent.

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1. Introduction and history

2008 marked a change in the UK energy regulator's attitude to the residential retail market. While it had previously pioneered and championed retail competition in this sector, it became increasingly concerned with the fairness of the competitive process, seeing the competition glass much more as half empty than half full. We explore the effect of this change in policy on the industry by identifying changes in the way that the major suppliers to the retail market have set their prices. The debate continues to be driven by political and consumer concerns, and to be fuelled by political intervention, ranging from ex cathedra statements by the prime minister that he would ensure that everyone was on the cheapest tariff in the market (Cameron, 2012) to the promise of a seventeen month price freeze if the Labour party is elected in 2015 (Miliband, 2013), and counter moves from the government to remove taxes which fund energy efficiency measures from prices (Osborne, 2013).

Until 1996, each residential consumer in Great Britain was served by two monopolists – a national gas supplier, British Gas[4] (known as Scottish Gas in Scotland), and one of fourteen regional electricity suppliers. The energy markets were opened between 1996 and 1999, and each of these monopoly suppliers entered each others' markets. A process of consolidation through takeover and exit led by 2002 to the emergence of five major successors to the electricity incumbents, each previously the monopoly supplier in two or three regions, and British Gas. These firms dominated supply, with other entrants gaining less than 1% of the market over the next decade, and with no long term survivors amongst these entrants, who were taken over or exited the market. The regulator reduced barriers to entry after some years, and by the end of 2013 there were several new entrants, whose joint share of the market had grown to 3%, the largest for many years. Nevertheless supply continues to be dominated by the Big 6.

Analysis of energy prices from these firms at the time when the last price caps were removed from the retail sector[5] in 2002 showed that while parts of the market were competitive, incumbency mark-ups remained, suggesting considerable consumer inertia; and price variations did not reflect differences in costs for consumers using prepayment (pay as you go) meters, indicating considerably less well developed competition in this market (Salies and Waddams Price, 2004). The removal of price caps on incumbent suppliers, coincided with the end of a period of consolidation in the industry which culminated in the establishment of the Big 6. In the three years following that consolidation the surviving companies chose price structures which effectively separated the market, with some offering tariffs particularly attractive for users of large quantities, and others offering tariffs which were better for users of small amounts of electricity (Davies et al., 2014). These

[4] Piped gas is not available in many rural areas, so around 17% of households do not use gas.
[5] Distribution and transmission prices remained regulated.

seem to have evolved from the repeated interaction of the companies in the regional electricity and national gas markets rather than from any explicit collusion; they are consistent both with innovation in the market and as an effective way of softening "head-on" competition between suppliers. The very rapid increase in wholesale energy costs after 2005 seems to have destabilised this tariff pattern.

However one pattern which continued in these later years, and which resulted in substantial regulatory intervention, was the persistence of an 'incumbent mark-up' of around 10%, similar to the level identified when the price caps were removed in 2002 (Salies and Waddams Price, 2004). In its 2008 Energy Supply Probe, the regulator identified such price differences between regions as a symptom of competition concern and a major problem for fairness; they introduced a new license condition (25A, which we refer to as the non-discrimination clause, or NDC), to prevent companies charging higher mark-ups to consumers in their home regions than in others, i.e. the same incumbent mark-ups which had been identified at the time of deregulation[6]. The regulator pursued this policy on the grounds of fairness, and a concern that vulnerable consumers were more likely not to have switched, and so be paying higher prices (Ofgem, 2008), despite acknowledging potential damage to competition (Ofgem 2009). The regulator was also motivated by complaints from potential entrants from outside the industry that the heavy discounts offered by major players out of their home markets acted as a barrier to entry to smaller players without a home base where they could charge higher prices to recoup their costs. Following representations from the Big 6, they were allowed to compete through special offers to attract new consumers, so long as these were temporary; as predicted[7], such special offers resulted in a proliferation of tariffs, and concerns that consumers, particularly vulnerable groups, might not fully understand the temporary nature of those offers, since when they expired consumers were generally returned to higher 'default' tariffs.

The 2008 supply probe also introduced other measures to improve competition and remove barriers to switching, including an annual statement to prompt consumer awareness, tighter rules on mis-selling of energy and restrictions on how far companies could prevent switching by consumers who owed them money. However after accumulated evidence that the market had been damaged by the NDCs (Hviid and Waddams Price, 2012; Littlechild, 2012) the regulator reversed its decision to renew the clauses in 2012, but announced continued vigilance in this regard and introduced a number of other constraints on tariffs to simplify choices for consumers.

In this paper we examine the evolution of electricity price movements of one major tariff since 2005, in particular the interaction between different firms in the market. Prices doubled between 2005 and 2013 (from about £250 to £500 a year) and have recently

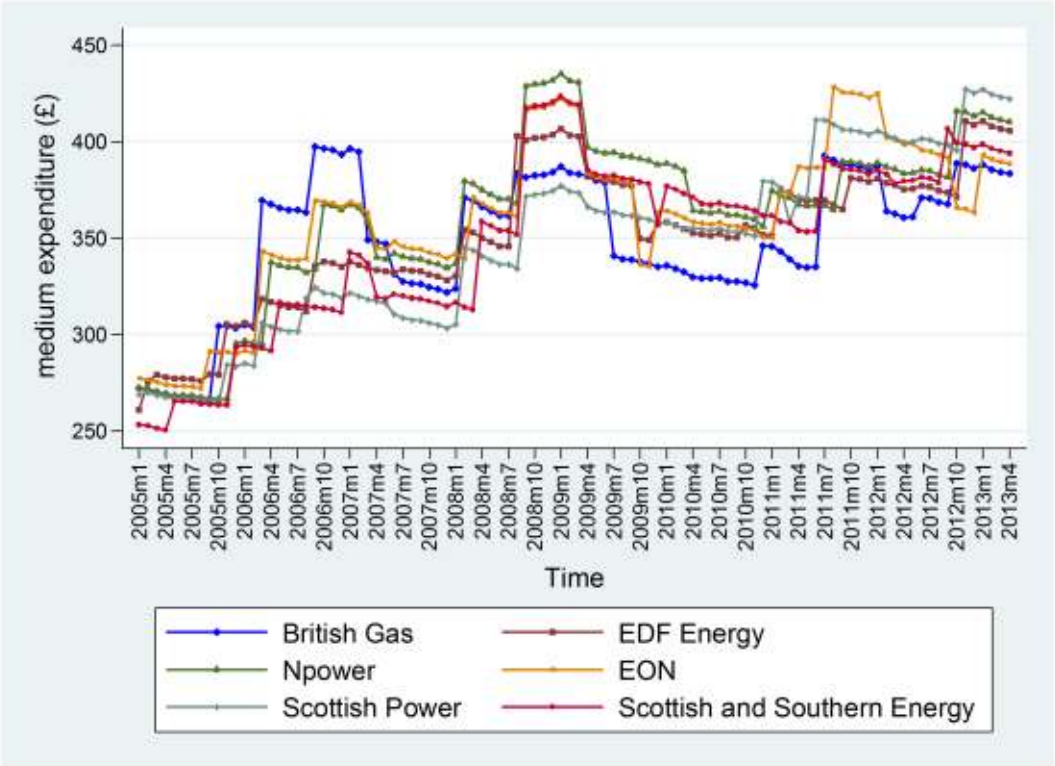
[6] The regulator simultaneously implemented a European directive, requiring that differences in the terms and conditions offered in respect of different payment methods is cost reflective, in license condition SLC 27.2A. While this is not the focus of our analysis, we comment briefly on its potential effect in the conclusions.
[7] See for example the evidence from Waddams (2009) to the Ofgem consultation.

become the focus of considerable political attention (Miliband, 2013; Cameron, 2012). We find that the pattern by which firms set their prices changed at the time of the NDC, confirming concerns that this intervention has adversely affected the nature of competition in the industry. This supply side change has been mirrored by falling consumer engagement in the market, with switching rates halving between their peak in 2008 and 2013 (DECC, 2013). The next section presents descriptive statistics on price changes in the residential market and explains the data, and their limitations. Section 3 uses causality tests to identify price leadership, and section 4 discusses the policy implications and concludes.

2. Tariffs and data

Since 2005, the level of retail energy prices has risen in real terms, but with some decreases as well as increases. This rising trend in prices is shown in figure 1 for each of the main suppliers, using an unweighted average across all regions of the annual bill of a direct debit electricity consumer on the standard tariff, using a medium quantity.

Figure 1: Annual electricity charges by 'Big 6' for consumer paying by direct debit and using 3300kWh per annum (deflated using CPI, average across regions)



Data Source for all graphs and analysis: Consumer Focus Price Comparison Factsheets and authors' calculations

Figure 2 shows these data grouped according to type of supplier in each region, namely incumbent (which varies between regions), cheapest and median offer from among the rest of the Big 5 (i.e. other than British Gas) and British Gas. To distinguish between these companies and smaller firms who have entered the industry from outside, we label these large companies with regional electricity incumbency regions as majorsaway when operating outside their home areas. The gap between the average incumbent and median majoraway bills before 2008 illustrates the background to the regulator's introduction of the NDC which prevented suppliers from charging higher margins in areas where it was incumbent than where it was outside its home region. The regulator had found that in the period leading up to 2008 suppliers had charged around ten per cent more in incumbent areas (where consumers stayed with it as default provider unless they switched provider) than in other areas (where the majoraway had to tempt consumers away from the incumbent provider in that region). Of course the identity of the cheapest (and median) majoraway varies both between regions and across time periods, since we are interested in the best challenge to the incumbent at any one time.

Figure 2a: Annual electricity charges for a consumer paying by direct debit and using 3300kWh per annum (deflated using CPI, average across regions)

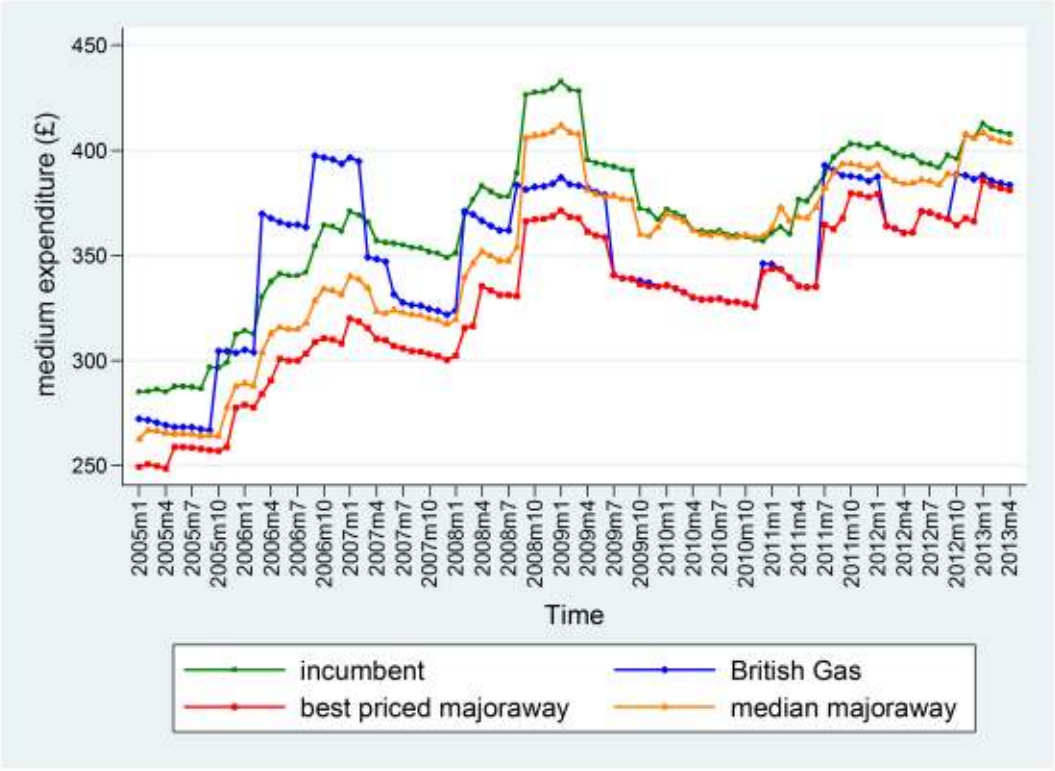


Figure 2b: Annual electricity charges for consumer paying by direct debit and using 3300kWh per annum (deflated using CPI)

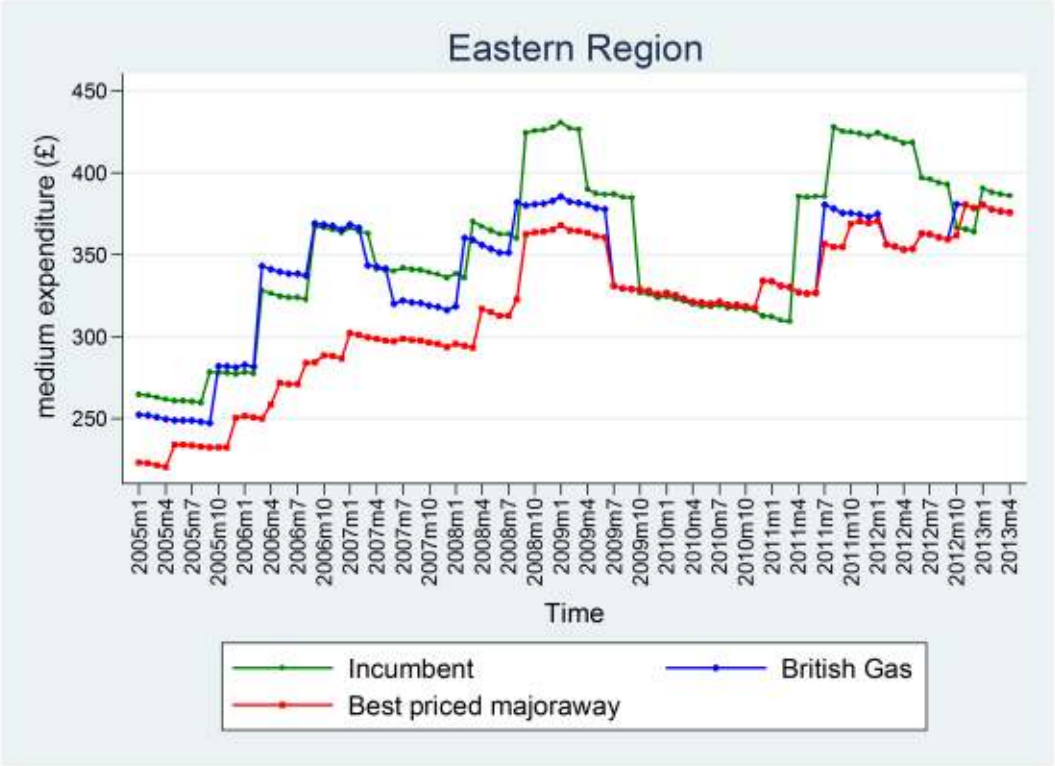


Figure 2a shows the convergence of prices following the imposition of the NDC in 2009, and these reductions in differentials are shown in more detail in figures 3 to 5. We see this pattern even more clearly in some individual regions, for example the Eastern region, shown in Figure 2b. Price differences between incumbent and the best majoraway started to fall in early 2009 and reached their lowest point, where they remained for the following two years, around April 2011 (figure 3). The difference between the charges of the incumbent and British Gas changed considerably over the period. After a period of relatively high prices, British Gas made significant price reductions in 2007 to close the gap with incumbents, and by early 2008 its prices became more competitive than those of incumbents. The average incumbent-British Gas price spread has stayed above zero and relatively flat since then (figure 4). The British Gas strategy is reflected in price differences between British Gas and the best majoraway (figure 5), with a decreased gap after the price cuts, and a further decrease in price differences after the imposition of the NDC (figure 5).

Figure 3 Difference in annual electricity charges between incumbent and best priced majoraway (consumer using direct debit payment and 3,300 kWh per year, deflated using CPI), average across regions

Figure 4 Difference in annual electricity charges between incumbent and British Gas (consumer using direct debit payment and 3,300 kWh per year, deflated using CPI), average across regions

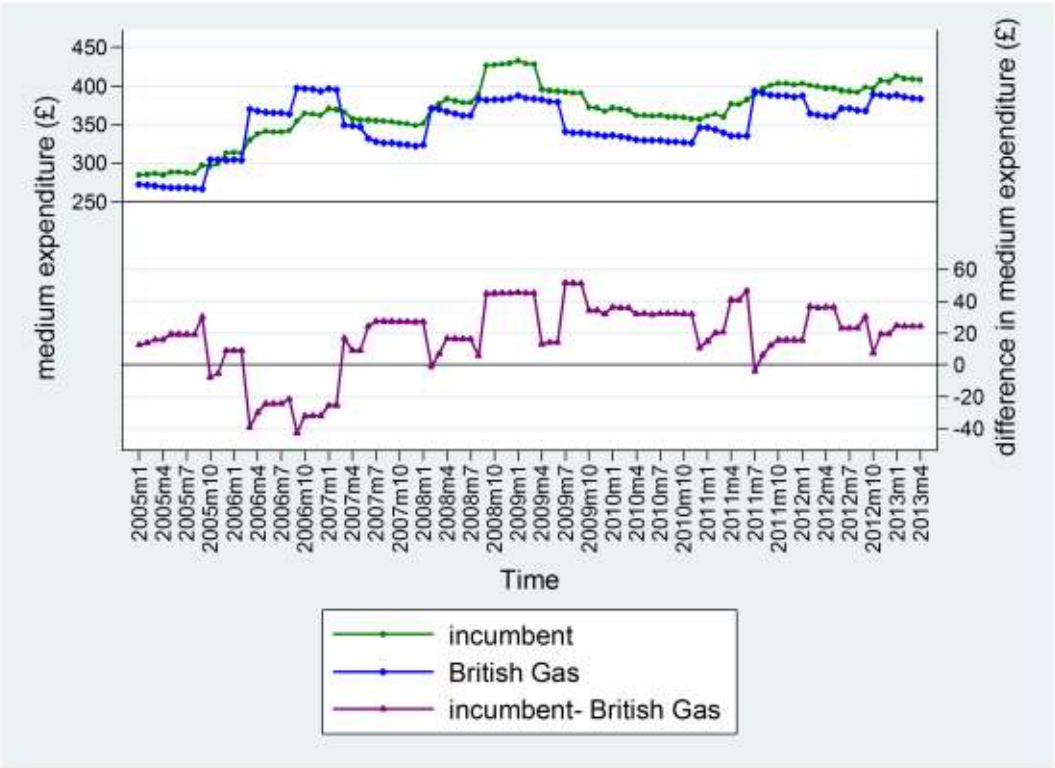
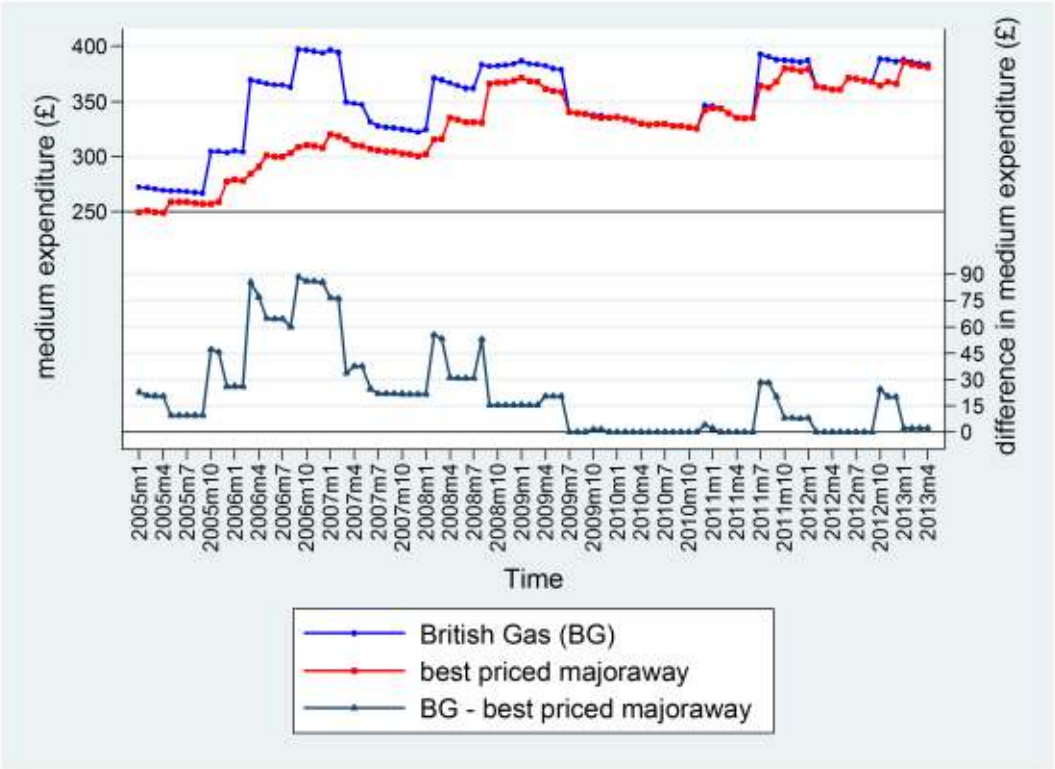


Figure 5 Difference in annual electricity charges between British Gas and best priced majoraway (consumer using direct debit payment and 3,300 kWh per year, deflated using CPI), average across regions



We explore the implications of these differences for competition in the retail market. Hviid and Waddams Price (2012) showed that because the 'strong' market of each of the major players (where they were traditional incumbents) coincided with the 'weak' markets of competitors (where they had no incumbency base), and British Gas took a national approach, the NDC was likely to lead each company to concentrate on its home markets and compete less aggressively in others, resulting in higher prices.

Initial high level evidence suggests that this is precisely what has happened. Price differentials between standard tariffs have indeed fallen; since companies were allowed to offer special offers, these increased dramatically, enabling the companies to segment the market, and focus their competitive actions away from the standard tariffs. Switching rates have fallen, confirming widespread evidence (Ofgem, 2008, p.152, Giulietti et al., 2005, Flores and Waddams Price, 2013, Waddams Price et al., 2013) that potential price gains are the main drivers of consumer activity in the residential energy market. Published figures at an aggregate level, and monthly figures obtained from the regulator at regional level, show a dramatic fall in switching rates following the introduction of the non-discrimination clauses. If the other polices which the regulator introduced at the same time to remove barriers to switching were effective, these figures may understate the fall in switching due

to the NDC alone. On the other hand, companies gradually withdrew from direct marketing from 2011 onwards, which will itself presumably have reduced switching rates.

Because of the volatility of upstream costs, particularly wholesale energy prices, it is difficult to identify directly whether price differentials between incumbents and majorsaway narrowed because incumbent prices fell (as the regulator intended) or because majoraway prices rose as competitive constraints weakened. However figures from the regulator on the profitability of the 'Big 6' seem to indicate the latter, as the profit margins rose from levels near zero when the clauses were introduced, to margins of just over £100 per consumer in 2013 (Ofgem, 2013).

In this paper we explore the changes in companies' pricing behaviour which followed the introduction of the package of reforms arising from the 2008 Energy Supply Probe and the NDC. We do this by analysing the pattern of price behaviour amongst the big six companies for their 'standard' electricity customers (off line, of average quantities, and paying by direct debit, the payment method used by most consumers switching energy supplier). These data are taken from price sheets published by Consumer Focus which show the main tariffs for the Big 6; while later information includes online tariffs, the earlier publications do not, so we restrict our analysis to offline tariffs. Since the non-discrimination tariffs provided incentives for companies to use special offers to compete (because these were not tied to prices charged in home markets), competition shifted somewhat to these non-standard tariffs, which are not published. To the extent that companies no longer expect to recruit new consumers through standard tariffs, our analysis will therefore overstate any dampening effect on competition; we return to this in our conclusions.

3. Patterns of price changes and causality tests

This section analyses differences in suppliers' pricing behaviour; to explore the effect of the NDC, we divide the data into two subsamples, before and after the introduction of the clauses. We omit the period from July 2008 to August 2009 as a transition period, since discussions about the new conditions started around June 2008 and were already affecting differentials before the publication of the Probe in October 2008, but were not formally imposed until September 2009.

3.1 Model Specification

Figures 1-5 above show the variation in price differences between suppliers. To explore how suppliers price retail electricity relative each other, we fit a Vector Autoregressive Model (VAR) model to estimate the relationship between price changes (including changes in

previous periods) of the incumbent, British Gas and the best priced majoraway[8] in each region. An advantage of using the VAR model is that it treats all variables as being endogenous and does not require prior restrictions on the structure of the model. Effectively, we allow the data to speak, and the pricing relationships between the suppliers identified by the VAR model should be a good statistical representation of the underlying pricing model.

A standard VAR, written as $VAR\ (p)$, is a model in which K variables are specified as linear functions of p of their own lags, p lags of the other $K-1$ variables, and additional exogenous variables. We specify a p-order VAR model of price changes introduced by the incumbent, British Gas and the best priced majoraway, with exogenous variables including seasonal dummies and a time trend as follows:

$$y_t = v + A_1 y_{t-1} + \ldots + A_p y_{t-p} + B_0 x_t + u_t \quad (1)$$

Where $y_t = (\Delta p_t^M, \Delta p_t^B, \Delta p_t^I)'$ is a 3×1 vector, and $\Delta p_t^M, \Delta p_t^B, \Delta p_t^I$ are the price changes of the best majoraway, British Gas and incumbent, respectively, in period t;

A_1 to A_p are 3×3 matrices of the parameters to be estimated;

x_t' is a 4×1 vector of exogenous variables, namely quarterly dummy variables and a time trend;

B_0 is a 3×4 matrix of coefficients;

v is a 3×1 vector of parameters (constants);

and u_t is assumed to be white noise.

If the u_t are distributed with a zero mean, $i.i.d.$ vector process, and y_t and x_t are covariance stationary and are not correlated with the u_t, consistent and efficient estimates of the B , the A and v are obtained via seemingly unrelated regression, yielding estimators that are asymptotically normally distributed.

Since all the equations for the variables y_t have the same set of regressors on the right hand side, equation-by-equation OLS estimates are equivalent to the conditional maximum likelihood estimates. In the above VAR model, effectively we have 3 equations estimated, namely of the current price change of the best majoraway, incumbent and British Gas

[8] Since our analysis concerns the behaviour of the Big 6, who controlled 98% of the market during this period (100% of it for most of it) we omit other entrants from this analysis. The identity of the best majoraway is likely to change from time to time, so this does not necessarily represent changes in prices offered by a single company, unlike price changes for British Gas and the incumbent.

respectively, with the same regressors, i.e. the price changes of the same players and the same exogenous variables in each equation on the right hand side.

To determine the selection of lag length (the value of p), we use a sequence of log likelihood ratio (LR) tests using a maximum of four lags[9]. We also implement a Lagrange-multiplier (LM) test for autocorrelation in the residuals of the VAR models (as presented by Johansen, 1995) to ensure that the disturbance is not auto-correlated. Test statistics are reported in the appendix. LM tests with a maximum five lags are implemented that show no hint of model misspecification for all regions. Statistics for two lags are reported in the appendix. Note that before we estimate the VAR model, Dicky-Fuller unit root tests confirm that all price changes are stationary in each region. Prior to the VAR model specification, we also conducted cointegration tests and do not find robust evidence of cointegration of the price series of the suppliers[10] in the regions in each period.

After fitting the VAR model, we conduct Granger causality tests[11] to test the statistical significance of causality from one supplier's price changes to another. For instance, $I_{t-p} \rightarrow M_t$ in columns 2 and 3 of tables 1 and 2 reports whether past price changes of the incumbent influence the current price changes of the cheapest majoraway.

3.2 Results

Table 1 shows the results of the VAR model and Granger causality tests in Period 1, before June 2008. The coefficients reported measure the effect of one set of price changes on the price changes being explored, while controlling for all other variables (including previous price changes by both the supplier itself and other actors in the market, a time trend and seasonal factors). Columns 2, 4, 6 and 8 show the coefficients of each of the equations, and columns 3, 5, 7 and 9 the results of the Granger causality tests[12]. Causalities of price changes which are not significant under the Granger causality tests are not reported[13]. In seven out of fourteen regions, Granger causality tests (column 3) confirm that the best majoraway responds to the incumbent's price changes in the two previous periods (column

[9] For a given lag p, the LR test compares a VAR with p lags with one with $p-1$ lags. The null hypothesis is that all the coefficients on the pth lags of the endogenous variables are zero. To use this sequence of LR tests to select a lag order, we start by looking at the results of the test for the model with the most lags. The first test that rejects the null hypothesis is the lag order selected by this process (also see Lutkepohl, 2005 p.143–144 for more information on this procedure). We also do another set of LR tests post estimation which are reported in the appendix.

[10] Note that if prices are cointegrated between the suppliers, the VAR model may be mis-specified as it ignores a long-term adjustment term in the specification and only focuses on short-term adjustments. In the absence of co-integration, VAR specification is appropriate.

[11] A variable x is said to Granger-cause a variable y if, given the past values of y, past values of x are useful for predicting y. After fitting a VAR model (see the above) for each equation of each endogenous variable that is not the dependent variable in that equation, the test computes and reports Wald tests that the coefficients on all the lags of an endogenous variable are jointly zero. The null hypothesis is that each of the endogenous variables does not Granger-cause the dependent variable in that equation.

[12] The coefficients of lagged price of best majoraway itself are not reported in the table.

[13] For full results and diagnostics please see the appendix.

2). In all these cases the best majoraway responds in the opposite direction to the incumbent's price changes, indicating that as the incumbents accelerated their price increases (decreases) the best majorsaway moderated their price changes. For instance, in the Midlands region, if the incumbent had added to its price increase by £100 in the previous periods, the best majoraway would typically respond by reducing its price increase by around £23.50.

The pricing responses of the best priced majoraway to incumbents can be explained by the following strategy. If the incumbent accelerates its price increases, the best priced majoraway will slow its price increases to attract the incumbent's customers; whereas when an incumbent slows down its price increase (say after a price rise), the best priced majoraway will accelerate its price increase to raise more revenue from existing customers, and perhaps to give it more scope for undercutting the incumbent in the next round of incumbent price increases. This suggests that other majors were providing some constraint on incumbents' charges, despite the incumbency mark-up.

The effect of British Gas price changes on those of the cheapest majoraway shows more positive coefficients (columns 4 and 5); in twelve of the regions, an acceleration in price changes by British Gas is associated with an acceleration in the price changes of the best majoraway (column 4), confirmed by Granger causality tests (column 5). British Gas price changes also have a positive effect on the incumbents' price changes in nine of the fourteen regions (column 6), again confirmed by Granger causality tests (column 7). However the influence of the incumbent's price changes on British Gas is in the reverse direction in two regions (column 8). These statistical results from the VAR model and Granger causality tests show evidence of price leadership by British Gas in this period, since the price changes of both the best priced majorsaway and of the incumbents tend to follow those of British Gas.

It is striking that the pattern of causality between price changes implemented by the different types of suppliers follows ownership of the incumbent in each region, as recorded in column 1. For example, the seven regions where the incumbent's price changes have a negative influence on those of the best majoraway include all three regions where RWE Npower owns the incumbent, all three where E.On does so, and one of the three where SSE owns the traditional supplier. The two regions where the best majoraway's prices are not influenced by British Gas are two of the three where the incumbent is SSE. Such ownership patterns are also reflected in the influence on incumbents' price changes themselves by British Gas. The five regions where Granger causality tests find no evidence of causality comprise all those where EdF or Iberdrola owns the incumbent. The reverse direction of causality, where the incumbent's price changes influence those of British Gas, occurs only in two of the three regions where the incumbent is SSE.

Table 2 shows the results from the VAR model and Granger causality tests in Period 2 after September 2009, when the NDC was imposed. The negative responses of the price changes of the best majoraway to those of the incumbent is seen in only one region, Southern, a

region where this was not evident in period 1. In the three regions where the incumbent is owned by NPower there is no evidence that the best majoraway responds to the incumbent's price changes, compared with a negative result in period 1; in the three regions where the incumbent is owned by E.On the relationship has gone from negative to positive; in the two regions where Iberdrola owns the incumbent the relationship has gone from insignificant to positive; and there are mixed changes in the regions where the incumbents are owned by EdF or SSE. However the general pattern is that the incumbents' price changes now influence those of the best majorsaway in a more positive way (nine regions), indicating that the best majorsaway are imposing less of a constraint on the incumbents' price changes than in period 1. For instance, in the Manweb region, if the incumbent adds to its previous price increase by £100, the best majoraway will follow and add to its price increase by between £36 and £42. Compared to the pricing behaviour in period 1, the change in the pricing pattern in period 2 implies that rather than recruiting customers in non-incumbent regions, majorsaway are showing signs of retreating to their incumbent regions to focus on the revenue of their own incumbent customers.

This is consistent with the predictions of theory (outlined in Hviid and Waddams Price, 2012). If they had continued with the pricing strategy displayed in period 1, the NDC clauses would require any constraint on price increases in suppliers' non-incumbent areas to be matched by a similar deceleration of price increases in their incumbent regions. Therefore the NDC deters the best-priced majorsaway from exerting their previous constraint on regional incumbents. Since we have omitted the period when the price adjustments were implemented in response to the NDCs, these results capture the mutual response of companies after the clause was imposed, rather than the process of compliance itself.

Columns 4 and 5 of table 2 show that past price changes of British Gas continue to lead the current price changes of the best majorsaway in eleven of the fourteen regions, but the exceptional regions have changed. After the NDC it is the three regions where the incumbent is owned by Npower which are the exception (rather than the two where the incumbent is owned by SSE).

A major change between the two periods is in the way that price changes by British Gas and the incumbent influence each other. After the non discrimination clause, column 6 in table 2 shows that price changes of the incumbent follow those of British Gas in 5 regions, with the statistical significance of the causality is confirmed by Granger causality tests (column 7). Note that in the period before the NDC was introduced, the causality from British Gas to the incumbent is significant in nine regions (see table 1 column 6 and 7). Column 8 in table 2 shows that price changes of British Gas follow those of the incumbent in five regions (confirmed by Granger causality tests, column 9 in table 2), while in the period before the NDC was discussed, the causality was only significant in two regions, and in a negative direction, i.e. British Gas imposed some constraint on the incumbent in these regions. After the imposition of the clauses, in half the regions the coefficients are more positive, with no

qualitative change in the other regions. Again there is a strong ownership pattern: the seven affected regions are all those where the incumbent is owned by Eon or Iberdrola, along with two of the three owned by SSE. Observation of British Gas prices shows that they continued to follow a national policy, so we would not expect its behaviour to moderate the competition softening effect of the NDC. We have no reason to believe that there has been any difference in cost changes between the major companies, and their national market shares have stayed remarkably stable over the period. Regional market shares are more difficult to obtain, except to note a fall in the average share of the incumbent from 50% in 2005 to 33% in 2013 (DECC, 2013). Most of this fall (to 36%) had occurred before the imposition of the NDC in 2009.

To confirm whether these differences in pricing pattern are due to the NDC, we also change the cut-off dates of the two periods arbitrarily. We re-estimate the VAR model for period 1 by moving the cut-off point twelve months later, to include the period when its imposition was widely anticipated (from Jan 2005 to Jun 2009), and find that the negative causality from the incumbent to best majoraway disappears across all regions (instead we find positive causality from the incumbent to the best majoraway for 5 regions (Manweb, London, Scottish Power, Seeboard, and Sweb). Similarly, if we re-estimate the VAR model for period 2 by moving the cut-off point 6 months before NDC was discussed (i.e. consider the period from Jan 2008 to Apr 2013), we find less significant positive causality from incumbent to British Gas across the regions. Whether or not we observe a distinctive change in the causalities before and after the cut-off point in our VAR model is sensitive to the period chosen, namely before widespread discussion of their introduction and their imposition. This confirms that suppliers' pricing behaviour is, indeed, responding to the NDC.

4. Conclusion

The analysis suggests that before the introduction of the NDC clauses, the best priced majorsaway were broadly constraining regional incumbents' price increases. However, after the clauses were imposed, the best priced majorsaway's prices were much closer to the incumbent, so that if the incumbent accelerated its price increases, the best priced majoraway would follow. This indicates that the constraint on incumbent price increases has weakened, with majorsaway based in other regions likely to be less aggressive outside their own home regions after the NDC. The evidence strongly suggests that British Gas was the price leader of both the best majoraway and the incumbent in the period before the NDC. After the NDC, while the best priced majorsaway continued to follow British Gas, the price leadership by British Gas of the incumbent is less strong. In five out of fourteen regions, the

incumbent is leading British Gas, and in another five British Gas is leading the incumbent. This suggests that each regional market is closer to a duopoly between the regional incumbent and British Gas, as regional incumbents now focus more on their home regions.

We conclude that the NDC has changed the nature of competition in the tariff which we have analysed. This is the main tariff used by dual fuel customers, particularly those who are likely to switch supplier. But as predicted and, to some extent intended, the focus of competition moved after the NDCs to the special offers which companies were allowed to introduce. Unfortunately the number and variety of these tariffs does not make them amenable to a simple analysis of the kind presented here.

While we cannot analyse the special tariffs, we note three aspects of this diversion of competition. The first is the encouraging message that the companies introduced them at all, suggesting a continuing appetite to segment the market and continue to compete in some parts, despite the potentially comfortable life of retreat to incumbent regions which the NDC offered. The second is that at the end of the special offers, consumers who took no further action would default onto regular tariffs of the kind whose analysis we report, so they may reflect long term consumer experience, even for those who took advantage of limited time special offers. The third is that both falling switching rates and rising profits after the NDC, suggest that companies did indeed compete less aggressively following their introduction. However we believe that other remedies introduced by Ofgem at the same time, including non discrimination clauses related to payment method[14], were likely to be procompetitive, so any dampening of competition is indeed likely to flow from the NDC itself.

The last few years have also seen a small but significant increase in the number of new entrants to the industry, and in their market share. This is no doubt in response to the increasing profit levels in the sector, and a competitive fringe would be expected to be attracted to an industry with characteristics of co-ordination among the major players. Their entry is also a tribute to Ofgem's efforts to remove entry barriers, one of the objectives of the NDCs themselves, which included the benefits of being exempt from some social and environmental obligations, though barriers to expansion remain[15]. Insofar as the large players reduce price levels in response to these new entrants, and are unable to recoup their additional costs from only one (inert) group of consumers because of non discrimination requirements, their entry will benefit all consumers.

Ofgem's introduction of the NDC was primarily on equity grounds, to prevent companies from charging higher prices to inactive consumers in their home regions. While the differential between the standard tariffs levied in different regions has indeed fallen, the increasing profits indicate that this levelling is almost certainly at the cost of consumers out

[14] The payment related non discrimination clauses are more likely to be procompetitive because the suppliers would agree on their 'strong' markets (see Hviid and Waddams Price 2012).

[15] Environmental and social obligations are applied to companies with more than 250,000 consumers

of region, rather than through lower prices to those sticky customers at home. Indeed the increase in profits by around £100 per consumer, compared with an average price differential before the NDC of less than £30[16], suggests that all consumers are paying higher prices as a result. So while equity may have improved, this is likely to have been at the 'absolute' expense of just those consumers whom the regulator sought to protect.

In reviewing the remedies introduced after the 2008 supply probe (which included the NDC), and in response to the falling switching rates and large array of tariffs (partly generated by the NDC itself), at the end of 2013 the regulator implemented restrictions on the number of tariffs which each company could charge, in order to simplify consumer choice. These are another form of non-discrimination clause, since they constrain the range of prices which companies can offer to potential consumers. The early consequences are, as one might expect, the withdrawal of many of the lowest priced offers, some of which had been taken up by vulnerable groups. The effect of these new restrictions will depend on whether the companies' appetite for competition which was revealed through their array of special offers will lead them to make good offers across the board, or whether they will follow the pattern demonstrated in this paper of reducing rivalry and retreating to established markets. Pricing strategies are also affected by government intervention. The 2013-14 review of the market by the competition and regulatory authorities is a welcome opportunity to consider the market as a whole, including the likely long term effect on the competitive process of past and potential future interventions by regulators and politicians.

[16] Figures from Ofgem, 2013 and calculated from Ofgem 2008

Table 1: Results for period 1 –before the non discrimination clause (Jan 2005- Jun 2008)

1		2	3	4	5	6	7	8	9
Region	**Incumbent owner**	$I_{t-p} \rightarrow M_t$		$B_{t-p} \rightarrow M_t$		$B_{t-p} \rightarrow I_t$		$I_{t-p} \rightarrow B_t$	
		VAR coefficient	GC test	VAR coefficient	GC test	VAR coefficient	GC test	VAR coefficient	GC test
Eastern	E.On	P=2: -0.124	8.18 (0.02)	P=2: 0.301	25.80 (0.00)	P=1: 0.376	5.49 (0.06)		
East Midlands	E.On	P=2: -0.112	5.59 (0.06)	P=2: 0.350	32.24 (0.00)	P=1: 0.396	6.89 90.03)		
London	EdF			P=2: 0.305	23.79 (0.00)				
Manweb	Iberdrola			P=1: 0.168 P=2: 0.306	16.41 (0.00)				
Midlands	NPower	P=1: -0.235	10.80 (0.01)	P=2: 0.335	30.15 (0.00)	P=1: 0.428 P=2: 0.322	20.04 (0.00)		
Northern	NPower	P=1: -0.212	10.51 (0.01)	P=2: 0.302	32.77 (0.00)	P=1: 0.323 P=2: 0.349	15.05 (0.00)		
Norweb	E.On	P=2: -0.209	14.95 (0.00)	P=2: 0.340	39.32 (0.00)	P=1: 0.378	5.74 (0.06)		
Scottish Hydro	SSE	P=2: -0.174	6.72 (0.08)	P=1: 0.450 P=2: 0.287	79.76 (0.00)	P=2: 0.539	24.45 (0.00)	P=1: -0.716	13.42 (0.00)
Scottish Power	Iberdrola			P=1: 0.144 P=2: 0.245	8.41 (0.02)				
Seeboard	EdF			P=2: 0.177	8.25 (0.02)				
Southern	SSE					P=2: 0.315	8.68 (0.01)		
Swalec	SSE					P=2: 0.276	13.56 (0.00)	P=2: -0.609	6.59 (0.09)
Sweb	EdF			P=2: 0.202	11.44 (0.00)				
Yorkshire	NPower	P=1: -0.180	6.03 (0.05)	P=2: 0.284	23.45 (0.00)	P=1: 0.370 P=2: 0.432	20.42 (0.00)		

$I_{t-p} \rightarrow M_t$ column reports the coefficients of price changes in the past (up to p lags) of incumbent in the best majoraway equation, i.e. how the price changes of incumbent in the past affect current price changes of best majoraway; $B_{t-p} \rightarrow M_t$ column report the coefficients of price changes in the past (up to p lags) of British Gas in the best majoraway equation, i.e. how the price changes of British Gas in the past affect current price changes of best majoraway; $B_{t-p} \rightarrow I_t$ column report the coefficients of price changes in the past (up to p lags) of British Gas in the incumbent equation, i.e. how the price changes of British Gas in the past affect current price changes of incumbent; $I_{t-p} \rightarrow B_t$ column report the coefficients of price changes in the past (up to p lags) of incumbent in the British Gas equation, i.e. how the price changes of incumbent in the past affect current price changes of British Gas;
GC test is the Granger causality test; only significant coefficients of lagged price changes are reported in the table.

Table 2 Results for period 2 after the non discrimination clause (Sep 2009- Apr 2013) **A B C D** Qualitative changes between the periods

1		2	3	A	4	5	B	6	7	C	8	9	D
Region	**Incumb own**	$I_{t-p} \rightarrow M_t$		**ch**	$B_{t-p} \rightarrow M_t$		**ch**	$B_{t-p} \rightarrow I_t$		**ch**	$I_{t-p} \rightarrow B_t$		**ch**
		VAR coeffic't	GC test		VAR coeffic't	GC test		VAR coeffic't	GC test		VAR coeffic't	GC test	
Eastern	E.On	P=3: 0.196	16.90 (0.00)	+	P=1: 0.366 P=3: 0.284	9.04 (0.03)		P=3: 0.624	6.29 (0.10)		P=3: 0.319	19.47 (0.00)	+
East Midlands	E.On	P=3: 0.252	21.73 (0.00)	+	P=1: 0.417 P=3: 0.276	10.55 (0.01)				-	P=3: 0.437	22.79 (0.00)	+
London	EdF				P=2: 0.324 P=3: 0.276	12.87 (0.01)		P=1: 0.350 P=3: 0.422	8.43 (0.04)	+			
Manweb	Iberdrola	P=1: 0.421 P=2: 0.360	24.60 (0.00)	+	P=3: 0.364	19.26 (0.07)					P=1: 0.808 P=2: 0.354 P=3: 0.321	42.95 (0.00)	+
Midlands	NPower			+			-			-			
Northern	NPower			+			-			-			
Norweb	E.On	P=3: 0.209	16.16 (0.00)	+	P=1: 0.292 P=3: 0.163	7.96 (0.05)		P=3: 0.672	12.35 (0.01)		P=3: 0.421	25.02 (0.00)	+
Scottish Hydro	SSE	P=1: -0.312 P=2: -0.311 P=3: -0.354	14.28 (0.00)		P=1: 0.211) P=2: 0.273 P=3: 0.541	34.71 (0.00)				-			+
Scottish Power	Iberdrola	P=1: 0.582 P=2: 0.430	23.01 (0.00)	+	P=3: 0.340	15.28 (0.00)					P=1: 0.917 P=2: 0.474 P=3: 0.416	28.41 (0.00)	+
Seeboard	EdF				P=2: 0.269	7.47 (0.06)		P=1: 0.589 P=3: 0.588	25.69 (0.00)	+			
Southern	SSE	P=1: -0.176 P=2: -0.267 P=3: -0.440	12.90 (0.01)	-	P=2: 0.341 P=3: 0.534	29.13 (0.00)	+			-			
Swalec	SSE				P=3: 0.450	16.54 (0.00)	+			-			+
Sweb	EdF	P=2: 0.297	6.30 (0.10)	+	P=2: 0.226	7.51 (0.06)		P=1:0.338 P=3: 0.444	22.17 (0.01)	+			
Yorkshire	NPower			+			-			-			

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Appendix:

The following two tables show the full results with the LM test (testing auto correlation in the residual terms) and LR test (testing lag length).

Table A1 Results for period 1 –before the non discrimination clause (Jan 2005- Jun 2008)

Region	$I_{t-p} \rightarrow M_t$	$B_{t-p} \rightarrow M_t$	$B_{t-p} \rightarrow I_t$	$I_{t-p} \rightarrow B_t$	LM test (chi2)	LR test	No. of Obs.	R-sq
Eastern	P=2: -0.124 (-1.58)	P=2: 0.301***(4.64)	P=1: 0.376*** (2.32)		P=1: 4.63 (0.86) P=2: 10.11 (0.34)	P=2*: 33.60 (0.00) P=1: 19.76 (0.02)	39	E-eq: 0.62 I-eq: 0.32 B-eq: 0.29
East Midlands	P=2: -0.112 (-1.35)	P=2: 0.350***(5.13)	P=1: 0.396***(2.61)		P=1: 5.49 (0.79) P=2: 9.11 (0.43)	P=2*: 38.90 (0.00) P=1: 20.51 (0.02)	39	E-eq: 0.62 I-eq: 0.32 B-eq: 0.22
London	P=1: -0.288* (-1.78)	P=2: 0.305*** (4.84)			P=1: 11.47 (0.24) P=2: 8.77 (0.46)	P=2*: 26.77 (0.00) P=1: 9.27 (0.02)	39	E-eq: 0.48 I-eq: 0.28 B-eq: 0.22
Manweb		P=1: 0.168** (1.88) P=2: 0.306*** (3.91)			P=1: 13.41 (0.14) P=2: 16.74 (0.06)	P=2*: 20.55 (0.00) P=1: 32.64 (0.02)	39	E-eq: 0.61 I-eq: 0.44 B-eq: 0.20
Midlands	P=1: -0.235*** (-3.12)	P=2: 0.335*** (5.48)	P=1: 0.428*** (4.11) P=2: 0.322*** (2.53)		P=1: 5.59 (0.78) P=2: 6.53 (0.69)	P=2*: 32.76 (0.00) P=1: 18.42 (0.03)	39	E-eq: 0.52 I-eq: 0.44 B-eq: 0.18
Northern	P=1: -0.212*** (-3.03)	P=2: 0.302*** (5.72)	P=1: 0.323*** (2.95) P=2: 0.349*** (2.83)		P=1: 9.75 (0.38) P=2: 3.77 (0.93)	P=2*: 41.78 (0.00) P=1: 18.97 (0.03)	39	E-eq: 0.50 I-eq: 0.46 B-eq: 0.16
Norweb	P=2: -0.209*** (-3.10)	P=2: 0.340*** (6.01)	P=1: 0.378*** (2.28)		P=1: 9.75 (0.38) P=2: 11.84 (0.22)	P=2*: 45.35 (0.00) P=1: 17.66 (0.04)	39	E-eq: 0.60 I-eq: 0.27 B-eq: 0.16
Scottish Hydro	P=2: -0.174** (-2.00)	P=1: 0.450*** (8.79) P=2: 0.287*** (3.31)	P=2: 0.539*** (2.83)	P=1: -0.716*** (-2.75)	P=1: 8.39 (0.49) P=2: 7.44 (0.59)	P=3*: 26.32 (0.00) P=2: 31.41 (0.00)	38	E-eq: 0.73 I-eq: 0.63 B-eq: 0.32
Scottish Power		P=1: 0.144* (1.65) P=2: 0.245*** (2.76)			P=1: 14.53 (0.11) P=2: 6.82 (0.66)	P=2*: 23.88 (0.01) P=1: 6.75 (0.66)	39	E-eq: 0.42 I-eq: 0.21 B-eq: 0.15

Seeboard		P=2: 0.177*** (2.87)	P=2: 0.151* (1.64)		P=1: 5.38 (0.80) P=2: 4.14 (0.91)	P=2*: 21.73 (0.01) P=1: 8.50 (0.49)	39	E-eq: 0.31 I-eq: 0.25 B-eq: 0.07
Southern			P=2: 0.315*** (2.67)	P=2: -0.488** (-1.94)	P=1: 11.05 (0.27) P=2: 9.13 (0.43)	P=2*: 28.30 (0.00) P=1: 2.52 (0.98)	39	E-eq: 0.25 I-eq: 0.44 B-eq: 0.15
Swalec	P=2: -0.234* (-1.70)	P=2: 0.154* (1.82)	P=2: 0.276*** (3.43)	P=2: -0.609** (-2.10)	P=1: 5.18 (0.82) P=2: 11.80 (0.23)	P=3: 23.89 (0.00) P=2*: 13.93 (0.12)	38	E-eq: 0.24 I-eq: 0.54 B-eq: 0.26
Seweb		P=2: 0.202*** (3.35)			P=1: 5.56 (0.78) P=2: 3.79 (0.92)	P=2*: 16.72 (0.05) P=1: 6.63 (0.68)	39	E-eq: 0.34 I-eq: 0.24 B-eq: 0.10
Yorkshire	P=1: -0.180** (-2.40)	P=2: 0.284*** (4.82)	P=1: 0.370*** (3.42) P=2: 0.432*** (3.23)		P=1: 5.36 (0.80) P=2: 4.45 (0.88)	P=2*: 25.67 (0.01) P=1: 23.78 (0.01)	39	E-eq: 0.24 I-eq: 0.54 B-eq: 0.26

Note:

- A VAR model is a seemingly unrelated regression model with the same endogenous explanatory variables (p lags of price changes of best majoraway, incumbent and British Gas in our case) in each equation, i.e. the equation of price changes of best majoraway, incumbent and British Gas.
- $I_{t-p} \rightarrow M_t$ column report the coefficients of price changes in the past (up to p lags) of incumbent in the best majoraway equation, i.e. how the price changes of incumbent in the past affect current price changes of best majoraway. T-statistics are reported in the brackets. *** , ** and * indicates statistical significance level at 1%, 5% and 10% respectively.
- $B_{t-p} \rightarrow M_t$ column report the coefficients of price changes in the past (up to p lags) of British Gas in the best majoraway equation, i.e. how the price changes of British Gas in the past affect current price changes of best majoraway. T-statistics are reported in the brackets. *** , ** and * indicates statistical significance level at 1%, 5% and 10% respectively.
- $B_{t-p} \rightarrow I_t$ column report the coefficients of price changes in the past (up to p lags) of British Gas in the incumbent equation, i.e. how the price changes of British Gas in the past affect current price changes of incumbent. T-statistics are reported in the brackets. *** , ** and * indicates statistical significance level at 1%, 5% and 10% respectively.
- $I_{t-p} \rightarrow B_t$ column report the coefficients of price changes in the past (up to p lags) of incumbent in the British Gas equation, i.e. how the price changes of incumbent in the past affect current price changes of British Gas. T-statistics are reported in the brackets. *** , ** and * indicates statistical significance level at 1%, 5% and 10% respectively.
- Only significant coefficients of lagged price changes are reported in the table.
- LM test column report P-values of the test of autocorrelation in the residual and the null hypothesis is that there is no autocorrelation at lag p.
- LR test column report the log likelihood ratio test post estimation, starting with the model with most lags. For a given lag p, the LR test compares a VAR with p lags with one with $p-1$ lags., the null hypothesis is that all the coefficients on the pth lags of the endogenous variables are zero. P-values are reported in brackets.* indicates the optimal lag length which is the number of lags selected for estimation except in region 12. In region 12, total number of 3 lags is used to ensure 0 auto-correlation in the disturbance term.
- R-sq column report the R-sq of each equation. E-eq, I-eq and B-eq refer to the best majoraway equation, the incumbent equation and the British Gas equation.

Table A2 Results for period 2 –before the non discrimination clause (Sep 2009- Apr 2013)

Region	$I_{t-p} \rightarrow E_t$	$B_{t-p} \rightarrow E_t$	$B_{t-p} \rightarrow I_t$	$I_{t-p} \rightarrow B_t$	LM test (chi2)	LR test	No. of Obs	R-sq
Eastern	P=3: 0.196*** (4.00)	P=1: 0.366*** (2.53) P=3: 0.284** (1.96)	P=3: 0.624* (1.65)	P=3: 0.319*** (4.40)	P=1: 14.05 (0.12) P=2: 12.01 (0.21)	P=3*: 33.62 (0.00) P=2: 6.01 (0.74)	44	E-eq: 0.44 I-eq: 0.39 B-eq: 0.38
East Midlands	P=3: 0.252*** (4.58)	P=1: 0.417*** (2.98) P=3: 0.276* (1.93)		P=3: 0.437*** (4.75)	P=1: 11.18 (0.26) P=2: 11.27 (0.26)	P=3*: 36.91 (0.00) P=2: 8.44 (0.49)	44	E-eq: 0.48 I-eq: 0.34 B-eq: 0.41
London		P=2: 0.324*** (2.81) P=3: 0.276** (2.07)	P=1: 0.350** (2.17) P=3: 0.422** (2.52)		P=1: 8.75 (0.46) P=2: 6.21 (0.72)	P=3*: 17.55 (0.04) P=2: 24.51 (0.00)	44	E-eq: 0.37 I-eq: 0.29 B-eq: 0.17
Manweb	P=1: 0.421*** (4.65) P=2: 0.360*** (2.86)	P=3: 0.364*** (3.42)		P=1: 0.808*** (6.38) P=2: 0.354** (2.01) P=3: 0.321*** (1.98)	P=1: 10.91 (0.28) P=2: 2.58 (0.98)	P=3*: 36.34 (0.00) P=2: 12.80 (0.17)	44	E-eq: 0.54 I-eq: 0.26 B-eq: 0.54
Midlands		P=3: 0.325* (1.82)			P=1: 3.63 (0.93) P=2: 4.78 (0.85)	P=3*: 19.80 (0.02) P=2: 10.19 (0.34)	44	E-eq: 0.17 I-eq: 0.30 B-eq: 0.15
Northern					P=1: 4.70 (0.86) P=2: 9.13 (0.43)	P=3*: 29.65 (0.01) P=2: 11.21 (0.26)	44	E-eq: 0.20 I-eq: 0.33 B-eq: 0.15
Norweb	P=3: 0.209*** (3.84)	P=1: 0.292** (2.23) P=3: 0.163* (1.92)	P=3: 0.672***(3.25)	P=3: 0.421*** (4.98)	P=1: 10.61 (0.30) P=2: 6.23 (0.72)	P=3*: 40.40 (0.00) P=2: 6.42 (0.70)	44	E-eq: 0.45 I-eq: 0.38 B-eq: 0.43
Scottish Hydro	P=1: -0.312*** (-3.16) P=2: -0.311***(-2.59) P=3: -0.354*** (-2.93)	P=1: 0.211**(1.97) P=2: 0.273***(2.54) P=3: 0.541*** (5.66)			P=1: 8.39 (0.50) P=2: 10.92 (0.28)	P=3*: 38.79 (0.00) P=2: 7.10 (0.63)	44	E-eq: 0.49 I-eq: 0.31 B-eq: 0.17
Scottish Power	P=1: 0.582***(4.59) P=2: 0.430*** (2.79)	P=3: 0.340*** (2.69)	P=1: 0.331** (2.21)	P=1: 0.917*** (5.11) P=2: 0.474** (2.16) P=3: 0.416** (2.22)	P=1: 9.11 (0.43) P=2: 4.64 (0.86)	P=3*: 27.01 (0.00) P=2: 18.39 (0.03)	44	E-eq: 0.48 I-eq: 0.39 B-eq: 0.46
Seeboard	P=2: 0.290** (2.03)	P=2: 0.269* (1.86)	P=1: 0.589*** (4.00) P=3: 0.588*** (4.22)		P=1: 7.40 (0.60) P=2: 4.58 (0.87)	P=3*: 25.41 (0.00) P=2: 25.82 (0.00)	44	E-eq: 0.34 I-eq: 0.48

								B-eq: 0.14
Sourthern	P=1: -0.176*(-1.66) P=2: -0.267** (-2.09) P=3: -0.440*** (-3.56)	P=2: 0.341*** (2.92) P=3: 0.534*** (5.01)			P=1: 8.11 (0.52) P=2: 10.72 (0.30)	P=3*: 37.09 (0.11) P=2: 8.88 (0.49)	44	E-eq: 0.45 I-eq: 0.33 B-eq: 0.22
Swalec	P=1: -0.252** (-2.00) P=2: -0.273* (-1.86) P=3: -0.262* (-1.78)	P=3: 0.450*** (4.02)			P=1: 6.51 (0.69) P=2: 8.11 (0.52)	P=3*: 26.57 (0.00) P=2: 7.84 (0.55)	44	E-eq: 0.33 I-eq: 0.31 B-eq: 0.15
Seweb	P=2: 0.297** (2.09)	P=2: 0.226** (2.10)	P=1: 0.338** (3.08) P=3: 0.444*** (4.26)		P=1: 4.98 (0.84) P=2: 4.48 (0.88)	P=3*: 24.44 (0.00) P=2: 19.64 (0.02)	44	E-eq: 0.33 I-eq: 0.45 B-eq: 0.13
Yorkshire					P=1: 5.10 (0.82) P=2: 8.80 (0.46)	P=3*: 25.72 (0.00) P=2: 9.81 (0.37)	44	E-eq: 0.18 I-eq: 0.31 B-eq: 0.13