Electricity retailers' competition:

From survival strategies to oligopolistic behavior

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Abstract

Introducing competition at the retail level with strict unbundling was thought to imply major development of "asset-light retailers" who own neither generating nor distribution assets. This reference model was envisioned even in an oligopolistic market, where retailers compete on price and where retail and wholesale prices should be subsequently aligned. However, in sharp contrast to this theoretical premise, asset-light retailers' entry proved problematic in practice. New entrants frequently went bankrupt, left the market, or were taken over. Some evolved towards integration into generation for market hedging purposes. Because of capacity constraints, retail competition could not be a Bertand-like price competition. Generally in a setting of multimarket competition, retail markets become the field of parallel pricing behaviors. Departing from this unexpected result, the paper shows the necessity of vertical integration through physical hedging by comparing the risk profiles of different portfolios of hedging. It then goes on to study the effects of market structures on retail pricing behaviors. For this purpose, we compare the British and Norwegian markets, both considered in the literature as benchmarks of competitive markets, but with different multimarket setting, to highlight the price parallelism of British retailers.

Keywords: Retail market, Competition, Market power

1. Introduction

In countries which have made serious attempts to liberalize their electricity industries, often the development of retail competition has failed to give the expected results, particularly for residential & commercial consumers. In Great Britain, mass-market retail competition does not work effectively for the benefits of customers, as shown by the British regulator's inquiry in 2008 (Ofgem Supply probe) and its subsequent radical propositions to enhance retail market functioning (OFGEM, 2011). Several studies on the Nordic countries (Johnsen and Olsen, 2008; Olsen et al, 2006) also point towards difficulties experienced in Swedish and Finnish retail markets due to lack of consumers information as well as industry structure. These are set in stark contrast to the Norwegian retail market.

The reference paradigm of competitive decentralized electricity markets (which promote pure players in generation and retail) simultaneously requires the unbundling of network activities and retail as well as restrictions in vertical integration between generation and retail (Hunt 2002; Hunt and Shuttleworth, 1997). Therefore, it was thought that introducing competition at the retail level would give rise to a group of asset-light retailers who own neither distribution networks nor generating assets. By offering innovative retail contracts, asset-light retailers were expected to induce fierce price competition between entrants and regional or national incumbents, the latter of whom were themselves vertically broken-up by the competitive reforms, in their respective former license areas.

In this reference model of competitive decentralized markets, all retailers have an identical sourcing cost, set by the spot price. In this setting, retail profits are constrained because retailers are strongly incentivized to reduce their retail mark ups prices when spot prices are falling, in order to keep their market shares. The resulting competition (whether in the form of standard pure and perfect competition or in the oligopolistic price competition), is expected to put pressure on both sourcing costs (including minimizing the hedging costs of electricity sourcing) and operational costs (billing, marketing, information systems). If certain conditions are met -transparent information, no switching cost for consumers, and on small entry and exit costs – then electricity retail competition should be on price in a setting of Bertrand-like competition. As is well known, such competition should be fierce with cost-reflective prices (i.e. to retail prices aligned on wholesale prices). Subsequently, such competitive setting should result to low profits, even with a small number of competitors.

The reality of retail competition, however, is in sharp contrast to the theoretical premises. The fate of the asset-light retailers, in fact, was characterized by bankruptcy, market-exiting, take-overs, or an evolution towards vertical integration into production in every country. Even in Great Britain, presented as a successful liberalized market with regional incumbents restricted by regulation to acquire generation assets up to 1998 (Helm, 2003; Thomas, 2006), twenty new entrants left the retail market since 2000 despite a pro-competitive institutional environment (Oxera, 2008). The few remaining entrants are positioned on a niche market (such as supply of "green" electricity from exclusively renewable sources) with an insignificant total level of market shares (0.5% in 2010). In Norway, another benchmark in terms of electricity liberalization, with a market in which retail business is very fragmented for historical reasons between hundred of municipalities, there were some temporary entries on the market -retailers having another core business (such as Statoil), or two independent retailers which succeeded in building up a quite large customers base -but they subsequently gave up the business or have been bought by established retailing-distribution groups.

Departing from these observations, our paper analyses first the viability of the asset-light retailer model in liberalized electricity markets. We demonstrate that physical hedging (i.e. vertical integration into generation) is the only efficient risk management strategy in liberalized markets. It is confirmed by the fact that most of the markets which have been liberalized along the decentralized market model, are characterized by a move towards oligopolistic competition between mainly vertically integrated retailers (Henney, 2006). This phenomenon raises the issue of imperfect competition on electricity retail markets under a setting of both oligopoly between vertically integrated retailers and multimarket competition, which we analyze in a second step. The purpose of the paper is to explain the progressive structuring of the retail markets and the type of imperfect competition which results from this by a move away from the Bertrand-like competition. We adopt an original perspective by analyzing electricity retailers as intermediaries whose main function is to manage market risks on behalf of their customers. Indeed, the complexity of electricity markets and the hourly spot price variability justify the existence of electricity intermediaries who receive from customers a "mandate" of delegated risk managers. This function incites them to be vertically integrated to avoid bankruptcy, which then incites them to depart from a Bertrand-like price competition. Then, in the new setting of an oligopoly of quasi-vertical retailers, they are prone to adopt parallel pricing behaviors to maximize their retail mark-ups along a wholesale price cycle because they compete in a multimarket configuration.

The literature on electricity market can be classified in two categories: an empirical literature on the social efficiency of retail competition and a theoretical one on models of imperfect competition. The empirical stream has studied the costs & benefits of extended retail competition (Green & Mc Daniel, 1998; Joskow, 2000; Littlechild, 2000, 2005, 2009; Defeuilley, 2009), and more specifically retail competition benefits for consumers (Waddams-Price, 2004 and 2008; Waddams-Price & Wilson, 2007), in particular the costs and gains from switching to a new retailer (Giulietti and al., 2004). In the second stream of literature, models of imperfect competition on the different stages of the electricity industry analyzed the impact of extended competition on efficiency, in particular the combined effects on generation investments and wholesale prices (Green, 2004). The impact of vertical relations between producers and retailers on the performance of wholesale markets, via the exercise of retailers' oligopsonic market power (Bushnell and al, 2008) was also studied. The issues of market power and market performance were also studied empirically through the eventual lag between the respective moves of wholesale and retail prices (Johnsen and Olsen, 2008; von der Fehr and Hansen, 2010; Giulietti and al, 2010), and we use this type of questioning in the second part of the paper. Nevertheless this paper belongs to the first empirical stream and aims to show the limitation of retail competition as far as this is supposed to be socially efficient.

The paper is organized as follows. Section 2 analyses electricity supply as an intermediary function focused on risk management. It compares numerically, the risk profiles of different sourcing portfolios to show the comparative advantage of physical hedging. Section 3 studies the effects of the non-fulfillment of a Bertrand price competition conditions on the dynamic of competition within a multimarket competition. For that purpose, we compare the British and the Norwegian retail markets, given that the Norwegian competition is not structured as a multimarket competition and consequently resembles somewhat to a Bertrand-like competition. For the two demonstrations we choose to rely on two different methods: assessment of different portfolios of hedging contracts by the Value at Risk method (VaR) in the section 2 and empirical analysis of the suppliers' mark-up by descriptive statistics in the section 3 . Given the absence of data on retail prices to industrial clients, the paper focuses on retail competition on the residential and commercial segments, following the whole literature on retail competition (Giulietti et al, 2010; Davies et al, 2007; Green, 2004).

2. Risk management as the core function of electricity retailers

Through their sourcing for resale, electricity retailers are market intermediaries. Pure retailers buy electricity on the day ahead market, contractually from producers (forward and or futures contracts of several months), or through virtual power plant (VPP) for delivery to their residential and/or industrial customers through retail contracts of different durations. Given that most residential customers are deeply risk averse to short-run price volatility and equally reluctant to undertake the actions required to continually monitor and control usage,[i] they tend ideally to opt for fixed retail prices contracts (Chao and al, 2005). Therefore, electricity is essentially sold through annual retail contracts at a uniform fixed price whatever the level of spot prices, or through variable price contracts in which the retail price is readjusted only at few regular steps. In these standard retail contracts, prices are fixed somewhat above the average cost of service while wholesale prices change every hour or half hour. By choosing such retail contracts, customers delegate risk mitigation to retailers. This service, essentially providing the inter-temporal smoothing of prices, is rewarded through a risk premium included in the contractual fixed price[ii]. Therefore, by protecting consumers against intra-annual price variations and intra-week price volatility, fixed retail prices are implicit call options on quantity limited by the capacity of the connection.

2.1 The risks of electricity intermediation

Intermediaries' classical functions, as identified by the literature, are informational (Freixas & Rochet, 1997 ; Allen & Gale, 1997) and transactional (Benston and Smith, 1976 ; Campbell and Kracaw, 1980 ; Fama, 1980) with two types of intermediaries: physical and financial. The former (e.g. a discount store) adds value to a product through transformation, conditioning, and differentiation whereas the latter (e.g. a bank) provide financial expertise and advisory services to protect savers against the complexity and risks of financial markets. However, electric intermediaries are neither purely physical nor purely financial intermediaries, but represent a hybrid case. In sharp contrast to classical physical intermediaries, electricity retailers cannot benefit from storage, to smooth the supply and demand fluctuations on the market. Moreover, they cannot ration output for two reasons: they do not physically deliver electricity and the short-term demand of electricity is price-inelastic. Besides, electricity cannot be physically transformed and by its physical nature is a homogeneous good. Product differentiation is possible, only through the enrichment of offers such as dual fuel contract where electricity and gas supply is bundled, energy efficiency services and green-certified electricity. Additional services such as flexible billing and maintenance as well as pricing innovations can also be offered as a way to differentiate products.

Last but not least in terms of intermediation specificity, electricity retailers have been imposed by the regulator the contractual responsibility to settle financially and balance physically their upstream and downstream portfolios of electricity in order to facilitate the real time system balancing task assumed by the TSO in liberalized electricity systems. This financial matching on very short-term markets (almost on a real time basis without storage) is related to a virtually physical matching[iii] between the electricity bought and sold. These specific features give rise to structural quantity risk and price risk.

An electricity retailer is exposed to a quantity risk on the demand side over the short-term horizon (from a few days, a few hours, to real time exposure) due to unanticipated load variations, (e.g. related to the imperfect predictability of weather conditions)[iv]. This risk is amplified for the supply to residential customers where the retail contract is designed in reference to a "load profile" which organizes an imperfect market segmentation that allows a collective mechanism of metering instead of metering the consumer real consumption. Since electricity is not economically storable, all imbalances will have to be instantaneously settled on the spot market at unforeseeable prices in particular during peak periods when supply is even more inelastic. The non-storability accentuates the complexity inherent to the classical matching function between any intermediary's sourcing portfolio and selling portfolio as analysed by Hackett (1992), Gehrig (1993), and Spulber (1999). Furthermore, the strong positive correlation between price and demand in electricity wholesale markets (Stoft, 2002; Chao et al. 2005) makes any adjustment very costly[v]. In turn, this load/price positive correlation represents an important rationale for hedging.

Another source of quantity risk is the eventual loss of market shares, given customers' right to switch retailers. Market shares variations will generate vertical imbalances constraining retailers to sell or buy any over or under-contracted quantity at uncertain spot prices. Financial losses will occur in the absence of hedging mechanisms, which are capable of matching hourly demand variability. Quantity risks systematically translate into price risks. The price risk is generated by the discrepancies between the selling price of electricity on the retail market (generally a one year or more fixed price contract on the residential & commercial segment or a smoothed indexed price in some other cases) and the price of complementary spot transactions to offset the disequilibrium between a retailer's sourcing portfolio and selling portfolio.

To minimize volume- and price-risks, retailers will aim to invest in physical assets with different technologies and also contractually hedge a proportion of their aggregated load requirements through the purchase of hourly electricity blocks with a minimum physical capacity of 1 MW[vi]. However, in the absence of mathematical models able to measure each individual stochastic electricity demand, retailers will define their sourcing by relying on the imperfect market segmentation of "load profiling". Besides hedging risks through contractual sourcing, retailers can also potentially rely on interruptible retail contracts to manage their uncertain delivery obligations. With an interruptible retail contract, a retailer virtually sells a forward contract to its customer and buys a call option from him. The seller of the forward contract (i.e. the electricity retailer) can exercise the call option if the electricity spot price exceeds the strike price, effectively cancelling the forward contract at the time of delivery. Interruptible contracts allow for interruptions of electricity supply in exchange for either an overall discount in the contractual price of electricity delivered or for financial compensation for each interruption (Baldick et al, 2006).

2.2 The need for physical hedging

We now demonstrate through numerical simulations on risk profiles of different hedging portfolios, how physical hedging is necessary for managing risk. For that purpose, we use the value at risk method to compare several simple portfolios of hedging contracts for the supplier's sourcing and selling By the VaR method as it ius used by Boroumand and Zachmann (2009) in a detailed way. [vii] We assume that financial contracts are efficient risk hedging instruments and perfect substitutes to vertical integration, following a number of authors (Chao et Huntington, 1998; Hunt et Shuttleworth, 1998; Hunt, 2002). We demonstrate in particular that this assumption does not hold since a retailer cannot reproduce the risk-reducing benefits of physical hedging by contractual hedging. The risk profiles of the considered portfolios of hedging are measured with the traditional Value at Risk (VaR) indicator (Danielsson, 2007). The Value at Risk (VaR) is an aggregated measure of the total risk of a portfolio of contracts and assets. The VaR summarizes the expected maximum loss (worst loss) of a portfolio over a target horizon (one year in this paper) within a given confidence interval (generally 95%). Thus, here VaR is measured in monetary units, Euros[viii]. As the maximum loss of a portfolio, the VaR(95%) is a negative number. Therefore, maximizing the VaR is equivalent to minimizing the portfolio's loss. We rely on the Value-at-Risk because it is a relevant measure of the downside risk of a portfolio and is for example used as preferred criteria for market risk in the Basel II agreement. The Value-at-Risk for the 95% confidence interval that we use in the remainder of the paper is the one hundred fiftieth lowest of the 3000 payoffs.

Payoff of the assets and contracts within the portfolios

A retailer is assumed to have concluded a retail contract (the retail contract is given *ex ante* and is therefore not a portfolio's parameter of choice*)* with its customers, implying stochastic demand $\tilde{V}_t$ (for $t = 1{:}T$). The demand distribution is known to the retailer and the uncertainty about the actual demand $\tilde{V}_t$ is completely resolved in time t.

To fulfill its retail commitments, the retailer can buy electricity on the spot market at the uncertain spot market price $\tilde{P}_t$.[ix] The spot market price distribution is known to the retailer. To reduce its risk from buying an uncertain amount of electricity at an uncertain price, the retailer can conclude financial contracts and/or acquire physical generation assets. All contracts (including the retail contract and the physical assets generation volumes) are settled on the spot market that is assumed to be perfectly liquid. Thus, the payoff streams depend on a given number of spot market realizations (one year, i.e., 8760 hours). For example, an annual baseload forward contract implies buying the agreed volume of electricity at the contractual price for 8760 hours.

In table 1, five different contracts/assets – namely a retail contract, a forward contract, a semi baseload power plant, a call option[x] on the spot price and a put option on the spot price[xi] given the spot price – are introduced with their payoffs. If for example, the electricity spot price ($\tilde{P}_t$) is above the strike price of the options (X), there is a positive payoff of the call option, while the payoff of the put option is zero. The payoff of the power plant depends on the installed capacity of the plant (V_{plant}) and its marginal cost (mc). The payoff of the retail contract is the only one which depends on the stochastic demand $\tilde{V}_t$. By subtracting the expected value ($E(\cdot)$) from the gross payoff, all contracts/assets are assumed to have zero expected value. That is, we assume that in a perfect market (no market power, no transaction costs, full transparency, etc.) arbitrage would not allow for the existence of systematic profits. Without this assumption, the method for the evaluation of contracts and assets would drive our results. Indeed, the net loss calculated for each portfolio would be strongly determined by the valuation method of the assets or contracts within the portfolio. By assuming a zero expected value, the net loss of different portfolios can be compared without bias inherent in the types of contracts or assets composing the portfolio.

Table 1: Payoffs of different contracts/assets given the spot price ($\tilde{P}_t$)

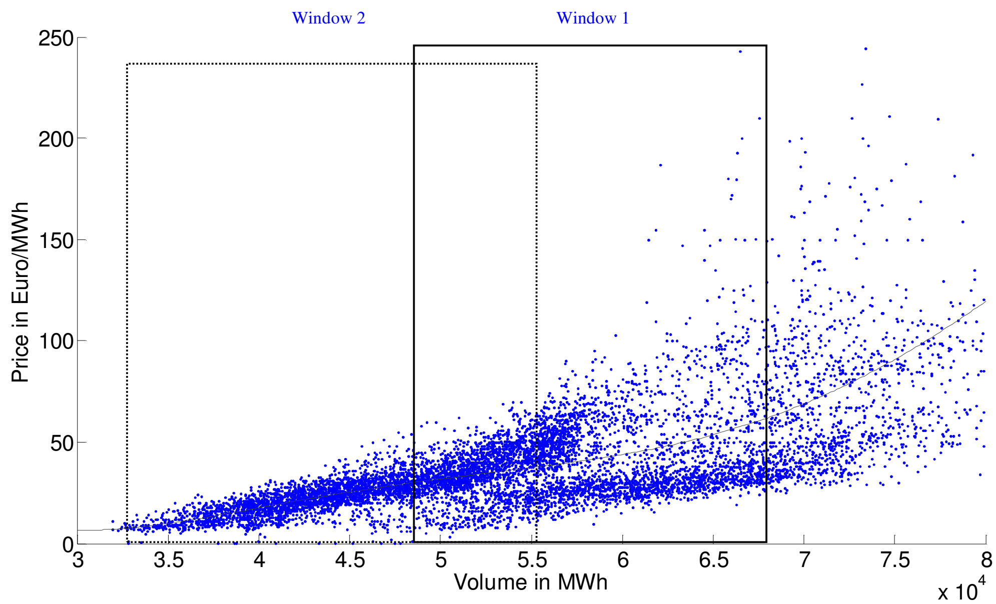
Contract	Payoff
Retail Contract	$\pi_{retail,t} = -\tilde{P}_t \times \tilde{V}_t + E(\tilde{P}_t \times \tilde{V}_t)$
Forward	$\pi_{forward,t} = V_{forward} \times \tilde{P}_t - E(V_{forward} \times \tilde{P}_t)$
Power Plant	$\pi_{plant,t} = V_{plant} \times max(\tilde{P}_t - mc, 0) - E\left(V_{plant} \times max(\tilde{P}_t - mc, 0)\right)$
Call Option on Spot	$\pi_{call,t} = V_{call} \times max(\tilde{P}_t - X, 0) - E\left(V_{call} \times max(\tilde{P}_t - X, 0)\right)$
Put Option on Spot	$\pi_{put,t} = V_{put} \times max(X - \tilde{P}_t, 0) - E\left(V_{put} \times max(X - \tilde{P}_t, 0)\right)$

Methodology of numerical simulations

To simulate the payoffs, some assumptions on the distribution of the electricity spot price and retail volume have to be made. We rely on real data from the French electricity market from 2006 and 2007. The hourly prices are obtained from the French electricity exchange Powernext and the corresponding loads are obtained from the network operator RTE. Electricity prices depend non-linearly on the total load (see figure 1). Thus, load and prices are strongly (although not perfectly) correlated (46% in the sample period) and load increases have a stronger impact on prices than load decreases. To obtain realistic simulations, we sort the observed price-load combinations by load. Then, the central points (medians) of 3000 windows of 8760 neighboring observations are drawn from a truncated normal distribution.[xii]

Note that, due to the normal distribution, windows with a median load closer to that of the observed sample are more likely to occur than windows with a median that is very different from that of the real data. Finally, from each of the 3000 windows, we draw randomly with replacement 8760 hourly price-load combinations. Consequently, the expected median of the observed data (load) is equal to that of the simulated data.[xiii]

Figure 1: French Prices and Volumes in 2007



The marginal generation cost of the power plant is set to the median of the simulated spot prices $mc = 39.0$ Euro/MWh, thus representing a peak load power plant. The strike price of the options is set to the expectation value of the spot price $X = E(P_t) = 43.0$ Euro/MWh. This is done to make call options and power plants distinguishable as they are equivalent according to table 1 if $X = mc$. The intuition of setting the marginal cost to the median price is that thus, the power plant will run exactly 50% of the times. The intuition of setting the strike price to the mean price is that the option is "at the money" in this case.

The risk minimization

We can calculate the cumulated annual payoffs of the 8760 hourly price/volume combinations for all 3000 simulations given the portfolio ($V_{forward}, V_{plant}, V_{call}$ and V_{put}):

$$\pi^i = \sum_{t=1}^{8760} \left[\pi_{retail,t}(\tilde{P}_t^i, \tilde{V}_t^i)\right] + \left[V_{forward} \times \pi_{forward,t}(\tilde{P}_t^i)\right] + \left[V_{plant} \times \pi_{plant,t}(\tilde{P}_t^i, mc)\right] + \left[V_{call} \times \pi_{call,t}(\tilde{P}_t^i, X)\right] + \left[V_{put} \times \pi_{put,t}(\tilde{P}_t^i, X)\right]$$

Thus, π^i is the annual payoff of the i^{th} price and volume simulation given the portfolio defined by $V_{forward}, V_{plant}, V_{call}$ and V_{put}.

Using an optimization routine[xiv], the portfolio that produces the lowest VaR(95%) can be identified. The objective is to find the portfolio consisting of 1 MWh baseload retail contract and a linear combination of financial contracts as well as physical assets that reduces the retailers' risk. Thus, the factors for the other contracts/assets are also measured in MWh. If the retailer, for example, sold two retail contracts of 1 MWh and wished to hedge this deal with only forward contracts (compare #4 in table 2), he would have to buy (2 x 0,98 MWh) 1.96 MWh forwards. Any imbalance between the electricity sold and purchased (or produced) is settled in the spot market. The volume generated by the power plant is constrained to be positive, while call option, put option and forward contracts could be both bought and sold at the market (i.e., negative quantities are allowed). In five different scenarios we constrain the volume of certain contract types to zero. Thus, the cost to substitute one type of contract by another type for hedging a retailer's risk can be assessed.

Table 2: Portfolios containing one retail contract and hedging contracts that maximize the VaR(95%)

#	Used assets	Retail	$V_{forward}$	V_{plant}	V_{call}	V_{put}	VaR(95%)
1	All contracts	1	-0.04	0.26	1.24	-0.27	-2,088
2	without options	1	0.09	1.33	-	-	-2,131
3	only options	1	-	-	1.47	-0.28	-2,092
4	only forward	1	0.98	-	-	-	-12,942
5	only power plant	1	-	1.46	-	-	-2,201

The optimal portfolio if all assets are allowed (portfolio #1) has a VaR(95%) of -2,088 euros. Portfolio #1 consists of selling 0.04 MWh of forward, generating 0.26 MWh with the plant, buying 1.24 MWh on a call option, and selling 0.27 MWh with the put option. Portfolio #2 consists of buying 0.09 MWh forward and producing 1.33 MWh. Portfolio #3 consists of buying 1.47 MWh with a call option and selling 0.28 with the put option. Portfolio # 4 consists of buying 0.98 MWh forward. Portfolio #5 consists of generating 1.46 MWh.

Without plants or forwards, a VaR(95%) very close to that of the unconstrained optimal portfolio (#1) can be attained if options are allowed (#3). If options cannot be chosen, the risk management characteristics of #3 can be reproduced without options if power plants and forward contracts are allowed (portfolio #2). With only forward contracts allowed (#4), the VaR(95%) is more than six times bigger than if both power plants and forward contracts are available portfolio choices (portfolio #2).

Through this analysis we provide evidence that a retailer can hedge the market risks originating from a standard retail contract by either a combination of forwards and options or by a combination of forwards and physical assets whose payoffs feature option-like characteristics. However, in all observed electricity markets, liquid derivatives (financial options) are absent (Geman, 2005; Hull, 2005). Thus, the only real choice for a retailer is to hedge its retail obligations through physical assets. In our example the VaR (95%) with physical assets (such as portfolio #5) decreases by more than five times compared to a situation where only forward contracts are used (portfolio #4). Consequently, as long as electricity options are not sufficiently liquid, retailers will strive to vertically integrate to better hedge their risk exposure.

3. Vertical integration, multimarket competition and strategic behavior

In an oligopolistic competition without vertical integration (i.e. by assuming that all retailers can source electricity on indefinite quantities from the spot market), retail competition should be on price (i.e. with retail prices aligned on wholesale prices). Price competition should subsequently lead to lower profits, even with a small number of competitors. Indeed, in absence of capacity constraints between firms with identical costs, competition for a homogeneous product looks like a Bertrand price-competition, respecting three main conditions[xv] (Tirole, 1988). In the presence of partially or completely vertically integrated retailers, however, we must depart from this theoretical assumption. Indeed, retailers with physical generation assets face capacity constraints[xvi]. The latter impedes any competitor to capture the market entirely. The hypothetical alternative would be a setting of quantity-competition where retail prices are misaligned with the marginal price of sourcing, which must be aligned with the wholesale spot price, including a reasonable mark-up on the top of the wholesale price . Indeed, the price of internal transactions between the generation and the supply arms of a vertically integrated company is aligned on the spot price, which also represents the opportunity cost[xvii]. Therefore, we have a theoretical explanation of eventual misalignment of wholesale and retail prices.

In order to explain empirical observations of such misalignments between wholesale and retail prices on the markets studied (British and Norwegian), we consider another dimension of electricity retail competition within a country. This dimension, rooted in the institutional history of an electricity supply system, is the multimarket dimension of retail competition in the former historic areas of public utilities. Indeed, in each geographic area, competition is mainly between the incumbent and entrants who are themselves incumbent in another area. Competition can be enlarged to gas and electricity retail markets, given that gas incumbent in a geographic area (or in its national area when it used to be the national monopoly) compete with its dual fuel offers against electricity incumbents in their historical areas.

Multimarket competition theory identifies potential entrants as existing firms on adjacent markets. In such configuration, firms meet the same rivals in several markets, which stabilizes the competitive game nationally (Gimeno and Woo, 1999). Each retailer is conscious that any conquering strategy on different regional markets will generate down price alignments of all competitors in all regional markets and, subsequently a general erosion of profits. Thus, no retailer has interest in misaligning its pricing strategy from the implicit coordinated strategy, thus leading to a phenomenon of "mutual forbearance" (Jayachadran et al, 1999). This phenomenon rooted in the absence of competitive entries in each area explains the emergence of tacit collusion without need of explicit price agreements (Vives, 1999). Parallel pricing can emerge in a setting of multimarket competition, in particular, when all incumbents are entrants in other markets. In electricity and gas retail markets, it is a fact that there are very few entrants in a geographical market, who are not incumbents in other geographical markets.

To analyze pricing strategies, we observe asymmetrical time-lags in the pass-through of wholesale price changes to retail prices or even a misalignment between retail and wholesale prices alongside a wholesale price cycle. This approach for identifying oligopolistic behavior in retail competition on a commodity market is inspired by Borenstein et al. (1996 and 1997) who studied the retail market of two oil product prices (heating oil and gasoline). These authors showed asymmetry of responses to changes in crude oil price with faster responses to increases than to decreases for gasoline price, but not for heating fuel. The authors interpreted this as reflecting short-run market power exercised by retail gasoline companies. This short-run market power is explained by buyers' imperfect information, comparatively to the heating fuel market.

On electricity retail markets where competitive pressure is already restricted through product differentiation and innovation, the lag between retail and wholesale prices movements could be explained by several factors: the lack of competitive pressures from imperfectly informed customers, the passiveness of many customers stuck to their historic retailer, and the incentives of retailers to adopt parallel pricing behaviors which are inherent to the setting of multimarket competition. We select Norway and Great Britain, because, if we observe a misalignment of retail prices on wholesale prices in one market and not in the other, the role of market structure in this difference can be separated.

Indeed in both markets, consumers are well informed and do not support high switching costs by difference to other retail markets such as the Finnish and the Swedish ones (Henney, 2006; Ofgem, 2008; Olsen et al., 2006; VaasaETT, 2010). Market institutions allowing customers to be informed[1] [xviii]and to easily switch are as much developed in both markets, as it is reflected by high switching rates in both markets (table 3).

Table 3 : Comparative switching rates in Great Britain and Norway for 2009

	Great Britain	Norway
Annual Switching	19%	8.1%
Cumulative switching	48%	44%

Source : Ofgem, 2010, "*Customer Engagement with the Energy Market – Tracking Survey",* March 2010 (Ipsos Mori) & VaasaETT 2010, *World Energy Retail Market Rankings Report 2010.*

The character of market transparency of the two retail markets allows us to isolate the "multimarket competition" dimension as determinant of the competition. So this comparison will show different pricing behaviors alongside a wholesale price cycle. As these two retail markets are well documented and have been deeply analyzed by detailed econometric studies, in particular the Norwegian one, comparison can be backed to the results of these original studies (in particular for Norway Lewis et al, 2004; Olsen et al., 2006;; Elkforsk, 2007; Johnsen and Olsen, 2008; von der Fehr and Hansen, 2010; VaasaETT, 2010).

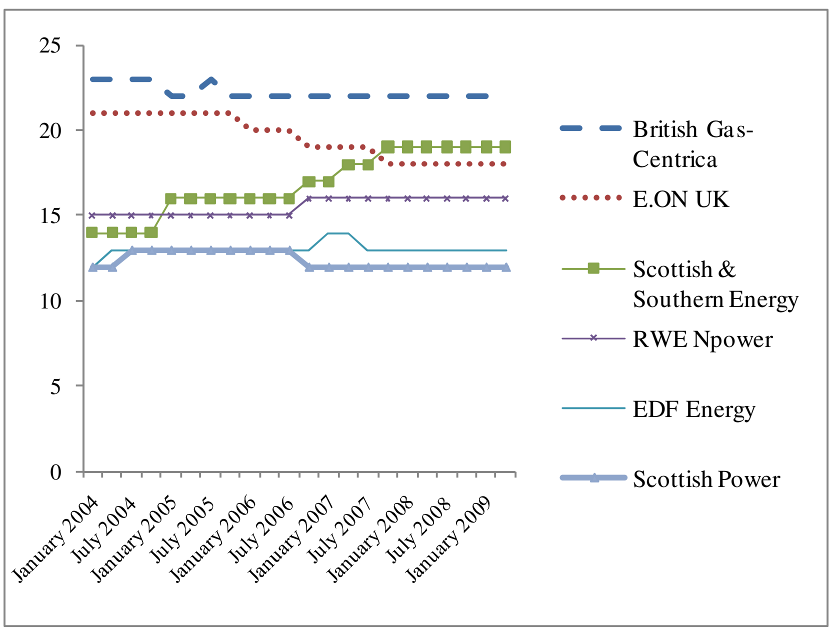
3. 1. The industrial structures of the British and Norwegian retail markets

We first characterize the industrial structures of the two retail markets.

- **The British market structure**

Before liberalization, the British retail activity was structured around twelve Regional Electricity Companies (REC) in England and Wales, two vertical electricity firms in Scotland, and one national gas distribution incumbent (British Gas-Centrica). The electricity regulation imposed the vertical separation between generation, transmission and supply, with restriction on vertical integration between generation and supply for historic retailers up to 1998 and with clear unbundling between supply activity and grid. The completion of the liberalization process on the residential market segment (achieved in 1999) was followed by a strong market concentration (the twelve historical incumbent retailers in England and Wales and the two Scottish retailers were controlled by only six companies in 2005) while it gave rise to a multimarket competition on the former historical supply areas. Independent retailers did not succeed in developing a sustainable business, as mentioned above. Any entrant in a region is an incumbent in at least one other region, with the notable exception of British Gas-Centrica which has a singular position by being simultaneously the national gas incumbent in the former national gas license area, and an electricity entrant in competition with the former electricity incumbents in all regions. This market structure explains that retail competition mainly developed by the dual fuel offer, in which consumers are being offered electricity and gas in a single contract. Selling electricity and gas separately or within a dual fuel offer, their market shares are stable (figure 2 on electricity market shares), after a first period of fierce competition consecutive to the opening up of the residential segment in 1998-1999 and Centrica's entry (Ofgem, 2004, Defeuilley and Mollard, 2009).

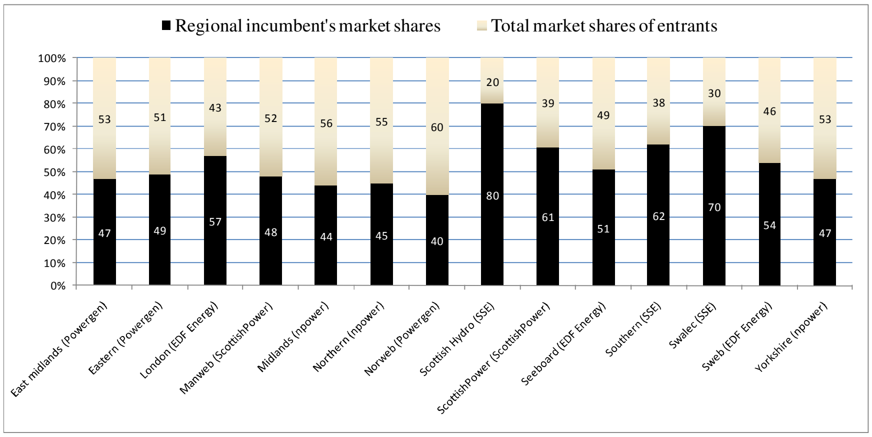
Figure 2: Electricity residential market shares from 2004 to 2009



Source : Companies' annual reports 2004-2009

It is noticeable that in every region, the regional incumbent, who can rely on a core business of sticky consumers, remains the market leader (figure 3).

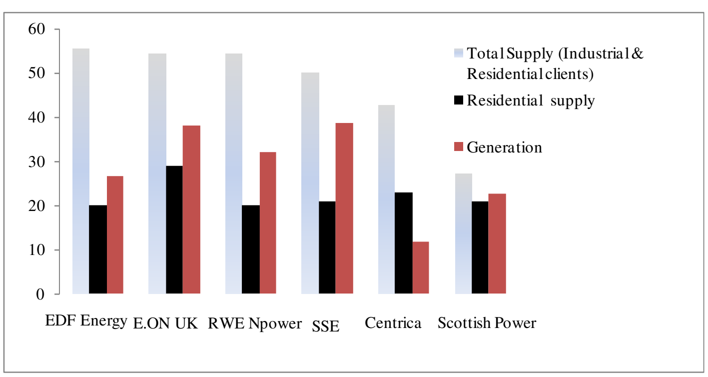
Figure 3: Respective share of incumbents and entrants in the 14 regional areas



Source : Ofgem, 2008

The six retailers become quasi-vertically integrated and virtually able to cover physically, not only their residential sales, but also a large part of their industrial sales (figure 4). In Norway, the retail sector is very fragmented (table 4) with different types of companies in terms of both size and ownership. Since a certain move of concentration between 1995 and 2004, there are around 150 retailers, but most of them are municipalities.

Figure 4. Degree of vertical integration of the six big retailers on both residential and industrial segments in 2008 (unit: TWh)



Source : Companies annual reports 2004-2009

Table 4: Comparison of the retail market structures in Great Britain and in Norway

Type of unbundling	Legal unbundling since 2000	Legal unbundling for business of more than 100,000 customers
Number of retailers in 1994	14	224
Number of retailers in 2004/2007	Total 10-15 With more than 50 000 customers : 6	Total 150-160 With national coverage : 17
Market shares on the retail market		
Largest	22%	30-40%
Largest 3	59%	50-60%
Largest 6	99%	60-65%
Market shares on the residential market		
Largest	22%	20-25%
Largest 3	59%	35%
Largest 6	99%	45-50%

Source : Lewis et al. 2004 ; van der Fehr et Hansen , 2008

In Norway, there is no strategic move towards vertical integration. Indeed, ownership of generation plants or long term access to hydro plants generation by some retailers is related to historical reasons. These municipal or regional ownerships of hydro plants were maintained throughout the liberalization process. Conversely there are no entities with generation as the core business, at the exception of the national hydro producer Statkraft which produces around 30% of the Norwegian electricity and sells 80% of its production (45 TWh on 58 TWh) to large industrial consumers and municipalities. Statkraft is weakly integrated in the retail supply (with only 400,000 customers).

The Norwegian market is much less concentrated and could be considered as more competitive than the British one. While only 1% of the British consumers are supplied by niche electricity retailers other than the “big 6”, in Norway’s case over 50% of the consumers are supplied by those other than the main 5 retailers. As mentioned previously, there have been some temporary entries on the market, like retailers having another core business (as Statoil), or independent retailers with electricity retailing as their core business. Two notable examples are Norgesenergie and Frokbrukerkraft, which both succeeded in building up a quite large customer base, but were eventually bought by established retailing-distribution groups (respectively Hasflund and Agder Energy). There has been also a market concentration mostly explained by larger retailers taking over the business of their smaller neighbors (von der Fehr and Hansen, 2010). Importantly, of the 158 retailers in 2007, only 17 have a consistent business outside their historic area. The others, which are under municipal or district ownership, do not supply electricity outside their historical area.

In the 27 regions, the historic regional retailer on average keeps a dominant position of 73% (the market shares of the respective dominant retailers varies from 29.8% to 95%) while the number two's share averages at 10% (NVE, 2008, von der Fehr, 2008). Those who sell electricity outside their area do not have an extended coverage: the Norwegian authority NVE shows that, 11 top retailers are in the top five in 2 to 5 areas, and only 5 retailers (namely Fjordkraft, Gudbrandsdal, Lyse, SKS, Ustekveikja) compete in 11 or more areas. The top eleven retailers therefore represent the main competition to the incumbent retailers in each area and only 5 retailers appear to be the truly national and effective retailers. This fragmented structure with no homogenous positions of respective incumbents in areas outside their home territory, does little to contribute to the development of a multimarket competition.

Competition in Norway is also influenced by a phenomenon whereby retailers who do not compete in other areas are not endowed with a market culture and do not seek profit maximization. They do not behave as private and strategic players in the market. Typically, local municipalities own concessions on hydraulic facilities that provide them with cheap power and thus chose the easy option to strictly follow the Nordpool price to set their retail prices, and applying a constant retail mark up (von der Fehr and Hansen, 2010). Statkraft, the main generator which is long in generation, sells part of its electricity at cheap prices to municipalities. They use their own hydro-electricity and the one bought from Stakraft to keep their retail prices at low levels for their local customers and their non-core customers in other areas. Those who do not look for profit maximization represent a sort of competitive benchmark for the regulator who relies on them as a "shaming mechanism" against the more highly priced retailers (Lewis et al, 2004).

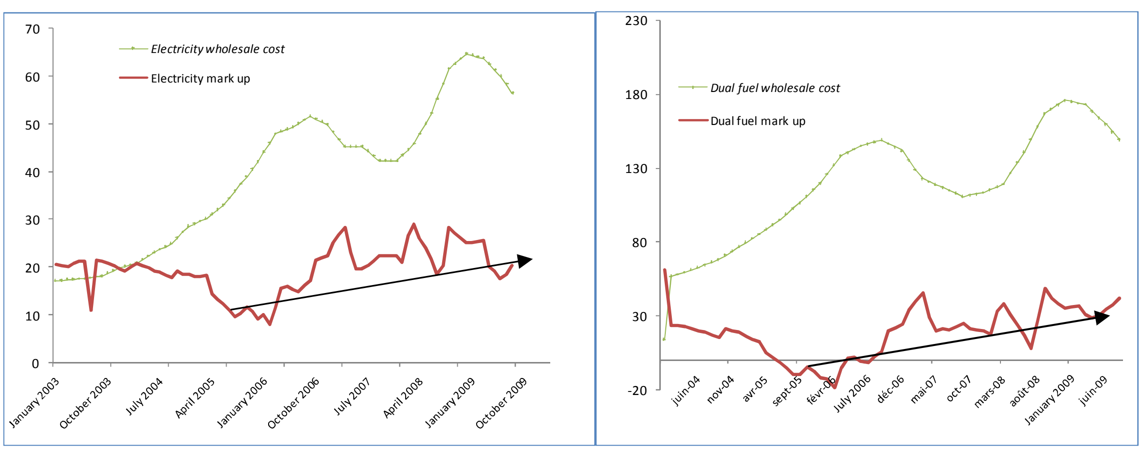
3.2. Wholesale costs and retail mark up: Great Britain *versus* Norway

Comparing the evolutions of wholesale and retail prices in Great Britain and Norway illuminates contrasting results. Alongside the wholesale price cycle, there is not a strong alignment between spot and retail prices on the British market, as shown by the electricity retail mark-up curve's evolution (figure 5 as shown by the arrow). In contrast, there is a strong alignment in Norway between wholesale and retail prices leading to a constant mark-up.

Figure 5: Trends in year-ahead wholesale price and retail mark-up on electricity and dual fuel retail markets (in £ per MWh)

Electricity

Dual fuel



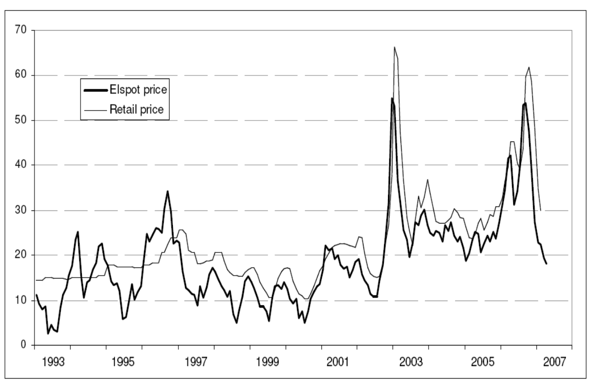
Source : Ofgem 2008, and Spectron Data 2003-2010

To compare the evolution of wholesale and retail prices, we use monthly averages of the one year forward electricity price following the British regulator (Ofgem, 2008). This method makes sense for the British retail market, since the price of annual retail contracts are based on the one year forward price. By using market-based prices to estimate wholesale costs (even where retailers rely on different sourcing mechanisms such as generation and long-term contracting), we price electricity according to the opportunity cost i.e. the price which retailers are able to resell it on the wholesale market. The Average Revenue per User (ARPU) is the average annual bill paid by a residential consumer and weighted in relation to the share of each three payment methods for a standard consumption of 3.3 MWh per year. ARPU is calculated from the real monthly prices charged by the "big 6" retailers and here it is expressed in £ per MWh[xix]. Then retail mark up is given by subtracting from the ARPU, the wholesale price, network & metering costs, and environmental charges per MWh. We proceed in the same way for the dual fuel retail market by mixing the sourcing costs of electricity and gas[xx]. It can be seen in Figure 5 that the retail mark up follows an increasing trend despite the wholesale prices' net rise alongside the wholesale price cycle and regardless of the step of the price cycle. In fact an inquiry was requested by the regulator in 2008 notably on this matter.

Comparing the electricity retail mark-up with the dual fuel retail mark-up highlights the more competitive dynamic of the dual fuel segment where the mark-up is more impacted by wholesale prices movements (with even a negative mark-up between July 2005 and July 2006). From the beginning of liberalization of residential markets to 2005, the former electricity incumbents and British Gas-Centrica were using the dual fuel offer to price discriminate between their passive core customers and their new dual fuel customers to corner market shares in other geographical markets (Nalebuff, 2004). Then, after stabilization of market shares, profits have been positive with no impact of price moves, but at a lesser extent than for the sole supply of electricity. For dual fuel submarket, profits remain lower than for electricity. This is explained notably by the fact that dual fuel customers are less sticky than electricity core customers since they have already switched at least once and are presumably more engaged in the competitive game.

In contrast, Norwegian wholesale and retail prices are strongly aligned, given the dominance of variable retail price contracts (figure 6)[xxi]. Electricity retail prices incorporate spot prices' fluctuations with a smoothing effect, and only with a short lag (von der Fehr & Hansen, 2010; Johnsen and Olsen, 2008; Ekforsk, 2007). This lag is explained by the regulatory delay of two weeks to change retail prices in Norway. The average Norwegian mark-up of the different retailers is small and stable in absolute value during the period 2003-2008 : between 1.3 to 3.9 €/MWh (1 and 3 ore/kWh with the exchange rate of 7.766 NKr for 1€ in 2007), depending on the retailers (von der Fehr and Hansen, 2009, p. 18), while in Great Britain the average mark-up on the electricity retail price of the big 6, (which is quite similar between them, as seen below), varies between 14.0 and 29.7 €/ MWh (respectively 9.5 and 20.0 £/MWh with the 2007- average exchange rate £/€ of 1.484) during the period between 2003 and 2010. [xxii]

Figure 6: The alignment of electricity retail price and spot price in Norway (øre/kWh) between 1993 and 2007



Source : Johnsen and Olsen, 2008

Note. On the Norwegian retail market,the retail price of two types of offered contracts (the so-called spot price contract and standard variable price contract) with a price highly correlated with the wholesale price) with the wholesale price as done by Johnsen and Olsen (2008) because it covers around two thirds of the transactions with the residential and the commercial segment

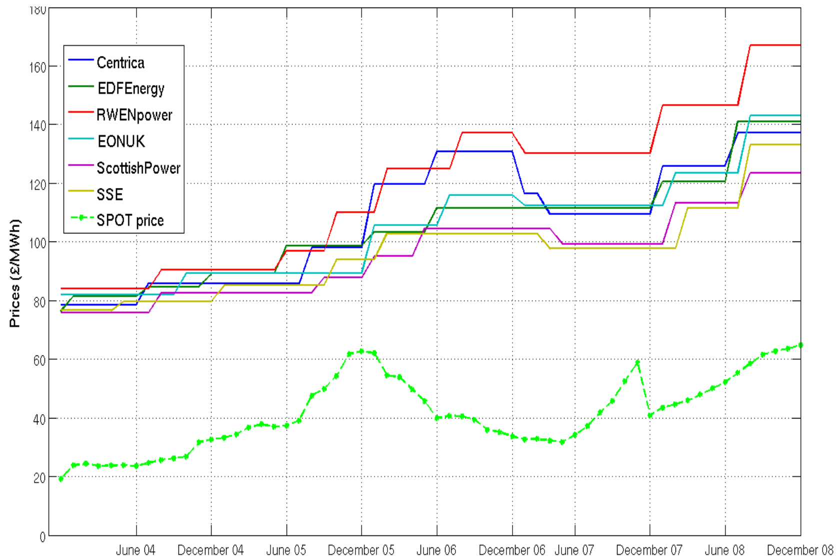
In Norway, since 1998, year of the effective openness of the residential and commercial segment to competition, there is a strong alignment of wholesale and retail prices (more precisely the energy part of the retail price) with a constant and quite small mark-up even during periods of large price variations shows that Norwegian retailers use the wholesale price as an opportunity cost to their production. They do not seize the opportunity of having higher mark ups during periods of prices fall or very low spot prices. A comparison to the British market suggests that it does not result from differences in customers' informational and switching costs but is related to two features. The first one is the fragmented structure of the Norwegian retail market with particular characteristics: a number of municipalities which behave virtuously and serve as a benchmark for the regulator to hinder oligopolistic pricing of active competitors. The second one is the absence of multimarket competition.

3.3. Individual pricing strategies along the wholesale price cycle in the British and Norwegian markets

- **The British retail market**.

Its structure with six vertically integrated retailers interacting repeatedly on 15 markets -the 14 historical regional areas and the national gas market area – without threat of entries leads to a lack of competitive pressure which is reflected in the parallelism of pricing behaviors (figure 7). In this setting of multimarket competition, retailers' price behaviors show that they all follow one single strategy which consists in securing short term profits through higher prices than the wholesale market price instead of offering low prices to corner market shares on a longer run. This process which is continuously at work alongside the wholesale price cycle is amplified when wholesale prices decrease.

Figure 7: Trends in retailers' revenues per MWh and wholesale prices between 2004 and 2008



Note: In the calculations, the retail prices are the averages national prices of each retailer for a standard annual consumption level of 3.3 MWh. The six average prices are calculated from the three prices (one for each payment method) of each retailer in each region (14 regions). Then we divide these resulting six national mean prices by 3.3 in order to compare their evolution to the curve of the smoothed (exponential smoothing) spot price per MWh.

After a first period of fierce competition in the respective historical areas between 1998 and 2003, no retailer had interest in misaligning its pricing strategy from implicitly coordinated pricing between each other. Figure 7 highlights the parallel rapid increases of the retail standard contractual prices offered by the "big 6" retailers when the wholesale price increases, while no systematic decreases are observed when the wholesale prices fell. We refer in this sub-section to the spot price instead of the 1-year forward price as done above since the retailers themselves claim that their retail prices increases are consecutives to spot prices' raises while they even do not follow the spot price downwards move after the change of the wholesale price (Ofgem, 2008).

Analysis of individual annual contract prices shows clearly that retailers increased their prices between January 2004 and December 2008 on different but very close periods in relation to spot price increases. As shown by figure 7, wholesale price fell strongly between January 2006 and June 2007 and again from December 2007 with no significant effects on retail prices in 2007 and even 2008. Consequently, whatever the level of wholesale prices, not only mark-ups are maintained in periods of fall of wholesale prices, but in fact they increased leading to an asymmetric pattern.

Retailers justified these price increases, citing the spot price increase triggered by gas price increases and the introduction of a carbon price (Ofgem, 2008). However, when spot prices fell strongly from 2006 (figure 7), the fall was very partially transferred to retail prices arguing that their weighted average cost of sourcing was above the spot price. On average because of the parallel movements in retail prices, net increase had no impact on market shares between 2004 and 2009 (figure 2), showing that a high level of switching (19 % in 2009 for instance) does not by itself mean lively competition. Therefore with the help of this set of multimarket competition, retailers prefer to adopt parallel pricing behaviors in order to benefit from a collective market power, which enables profit maximization to the detriment of consumers' surplus. Retailers rely on their basis of passive customers and market leadership position in their former historic regions to maintain high profits whatever the level of spot prices.

- **The Norwegian retail market**

In Norway, there are no parallel pricing behaviors despite the numerous points of contacts within a market structure which could be perceived *a priori* as a multimarket one. In fact as mentioned, if they are up to 35 nation-wide retailers, only 17 have consistent business outside their historical area and only 5 which compete in more than 10 areas appear to be the truly effective national retailers. This fragmented structure with no homogenous diversification of the respective incumbents in areas other than their own, do not lead to a multimarket competition. In fact strong differences of price between areas which had motivated the early Norwegian reform at the beginning of the nineties have vanished progressively, in particular since the suppression of switching fees in 1997 (Johnsen, 2003) and since mid-2003, the publication of price geographical retail prices by the Norwegian Competition Authority (NCA). This reflects the fact that, whatever the size and market share of a retailer in its historical area and its geographical coverage in other areas, the fragmented structures allow competitive pressures on incumbents in each area without any temptation of parallel behavior. Certainly different authors (Olsen et al., 2006; Elsforsk, 2007; van der Fehr and Hansen, 2009) identify that retailers exploit the reluctance of their core customers in their historical area to switch supplier, keeping up the price on the default contract in its area, which is the standard variable-price contract. But this contract is the same variable price contract in the different areas where they would want to develop market shares; accordingly, if they do so, it will not attract consumers from other regions; in short they would not seek to expand their market shares outside their historical area while they could be under the pressures of entrants with lower mark-up.

Concerning the possible difference in mark-ups between retailers, von der Fehr and Hansen (2009, p.18) analyze, from the geographical prices weekly published by NCA, the nationwide retailers' mark-ups for consumers with an annual consumption of 20 000 kWh[xxiii]. They show that the average mark-up of retail prices over wholesale prices of each of 35 nationwide retailers is quite identical and stable, whatever the direction the wholesale price moves. Most retailers kept their mark-up constant or slightly decreasing, during the price cycles reflecting the scarcity or the abundance of hydrologic conditions, although there are very few exceptions of both upwards and downwards adjustments.[xxiv]

Moreover it appears that there is no systematic difference between the larger retailers' prices and the other retailers' prices. These alignments are confirmed in a 2004 snapshot comparison of the different contracts price for 20000 kWh-consumers by L.O. Fosse (2004), from the Norwegian regulatory authority NVE. It shows that electricity cost in spot-price contract from the 5 largest retailers are only 3.2 percent higher than from the 5 cheapest suppliers which are the non-profit maximizing municipalities, while in standard variable contract and 1-year fixed price contracts the difference is 6.2 and 7.0 percent respectively.

Table 5. Electricity costs per year for 20,000 kWh/y households in Norway in 2004

	Average 5 largest suppliers (ore/y)	Average 5 cheapest suppliers (ore/y)	Ratio largest/cheapest
Spot price with mark-up	6651	6447	3.2%
Standard variable price	7052	6639	6.2%
1-year fixed price contract	7375	6895	7.0%

Source: O.Fosse, (2004), *The Norwegian end-user market*, Office of Electricity Market report, NVE.

The different mark-ups have also tended to move downwards to a slightly lower level, which van der Fehr and Hansen (2009) explain by the threat of new entrants coming in with lower mark-ups than those of incumbents (von der Fehr and Hansen, 2009). The existence of a competitive pricing benchmark with the municipalities, helps also the Competition Authority to exert pressures to limit excessive pricing from larger retailers in their historic area where they tend to display higher prices on their passive customers. To sum up on the Norwegian market, the retail prices follow wholesale prices to a large extent, with a mark-up that remains low and the largest suppliers' price offers do not show oligopolistic behavior because of the fragmented market structure. This is in stark contrast with oligopolistic multimarket configuration and parallel pricing behaviors.

In sum, multimarket competition settings at the distribution stage following liberalization naturally echo the historical market structures of each country's electricity industry. This comparison shows that, even when conditions of information transparency and absence of switching costs are realized, multimarket competition settings help the adoption of parallel behavior in pricing. Norwegian retail market structure which is not in this setting allows a Bertrand-like price competition to develop.

4. Conclusion

As intermediaries in the very specific trade - of a non-storable commodity and with a short term price-inelastic demand which impedes any rationing of demand - electricity retailers are strongly incentivized to rely on physical hedging to manage their quantity and price risks given the radical uncertainty of hourly electricity demand. This, on the other hand implies a vicious cycle. The more retailers are vertically integrated, the less likely a liquid contract market will develop, thus forcing asset-light retailers to leave the market or to be acquired by generators and move towards a supply system characterized by vertical integration. Such move towards vertical integration was indeed observed in the countries which have undertaken serious measures to liberalize their electricity markets.

Yet vertical integration does not allow the development of Bertrand-like competition. Retailers do not behave as asset-light retailers of a homogeneous product in a competitive market. As they mutually compete within their respective historic areas while entrants cannot survive, they can adopt parallel pricing behaviors whatever their differences in levels of physical hedging and average wholesale costs. This setting enables them to transform spot price rises and falls into profits and to exercise a collective market power at the expense of consumers. This clearly conflicts with the initial objectives of inducing retail competition and raises questions about its potential benefits for residential customers.

This suggests one general statement: In a setting of multimarket competition, the chances of being able to find a remedy for the lack of competitive pressure in retail markets look slim. This multimarket setting appears to be inherent to electricity and gas retail markets and rooted in the history of electricity and gas distribution, given the difficulty experienced in inducing competition in this field, because of the absence of intensive innovations which has been the key of the success of competition in the telecom industry by challenging the incumbents' advantage. When residential retail markets were opened to competition in Great Britain and North America, doubts were expressed by skeptical economists who otherwise, were favorable to electricity markets liberalization, as R. Green (1998, 2004) and P. Joskow (2000).

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[i] In part because customers have limited options to alter usage patterns or to invest in alternative appliances and production technologies, and generally they can obtain financial hedges against fluctuating rates (Chao et al, 2005).

[ii] This risk mitigation effect originates from the difference between low volatility of spot prices over the long term compared to the high volatility of fuel and power prices in the short term (Geman, 2005). Therefore, customers are exposed to trends and only gradually over time.

[iii] The physical matching is virtual since electricity intermediaries have no control on the physical exchange of electricity between producers and consumers.

[iv] Weather uncertainty can be theoretically mitigated through weather derivatives which exploit the correlation of electricity consumption with temperature. However, due to their speculative feature, difficulty of pricing, and lack of liquidity, weather derivatives are very seldom used by electricity retailers (Geman, 2005).

[v] Indeed, retailers will need to buy electricity when demand and consequently spot prices are high. Conversely, any contractual surplus of electricity will have to be sold when demand and spot prices are low. In both configurations, spot market interventions happen at the worst periods.

[vi] Electricity bloc with a capacity below 1 MW (called electricity “ribbon”) cannot be bought in advance (Hunt, 2002).

[vii] We apply this methodology in a much more detailed in Boroumand, R.H & Zachmann, G., (2009).

[viii]For further details please refer to Ph.Jorion.(2000).

[ix] We ignore balancing markets. This can be justified by the fact that most of the adjustments of retailers take place in the day ahead market.

[x] Many papers develop models with financial options (see for example Willems and Morbee, 2008; Deng and Oren, 2006)

[xi] A put option on the spot price, gives the retailer the right to sell electricity on the spot market at a given price.

[xii] The mean of this distribution is 8760, representing the central point of the 2 years data. The variance of the central points is 8760/4. The distribution is truncated below 8760/2 and above 17520-8760/2 to fit the data sample.

[xiii] Due to the non-normal (joint) distribution of the observed data, the mean of the simulated load is slightly lower (54 instead of 55 GW) than that of the observed loads in 2006-2007. The mean price of the simulated data is slightly lower than that of the observed data (43 instead of 45 Euro/MWh) and the median of the simulated prices is higher than that of the observed data (39 instead of 38 Euro/MWh). The variance of the mean (median) price across the 3000 simulations is 29 (20).

[xiv] We use the „fmincon“ routine in Matlab. As the routine does not necessarily converge for this non-linear problem (especially for the three and four assets case), we rerun the optimization for each case with 100 different randomly drawn starting values. The result of the best run can be considered sufficiently close to the global optimum, as all results tend to be within a fairly narrow range.

[xv] The process leading to such equilibrium is simple: if a firm’s price is higher than those of its competitors, the later would capture all the market. Therefore, the firm has to offer a price slightly inferior but the competitors would react similarly until none of them is in a position to reduce its price, making losses otherwise. In this setting, the only possible equilibrium is the one where the price is aligned on the identical cost of any of the firms. However, there are conditions for such result: product homogeneity (which is the case for electricity), identical costs to reach an equilibrium with all the firms (which is almost the case), but with no capacity constraints (each firm can potentially take all the market).

[xvi] Kreps and Scheinkman (1983) show that the Bertrand equilibrium is analogous to a Cournot equilibrium when limits are imposed on productions by the original capacities of the players.

[xvii] If the variable cost of the retailer's marginal equipment electricity is inferior (versus superior) to the spot price, it will benefit respectively the supply (versus generation) arm of the company; the effect on the total mark up is neutral.

[xviii] On the British market the specific website EnergyWatch gives informations on the retail prices of the different suppliers in different regions, In Norway the competition authority the NCA, has developed a specific information system on the retail prices in the different districts

[xix] In the first step, the three regional prices for each retailer (one price per payment method: "direct debit" price, "standard credit" price, and "prepayment" price) are weighted and averaged to give a single national price per consumer and payment type. Then, in the second step, these national averages are weighted by proportion of customers on each payment method and by market share of each retailer.

[xx] The ARPU and mark-up of dual fuel are calculated following the same methodology as for electricity. The wholesale cost of dual fuel is resulting from adding the wholesale cost of sourcing electricity and gas for the corresponding quantities of a dual fuel contract.

[xxi] Spot price is the Elspot Price and retail prices are weighted averages for all retailers and all different contract types ("standard variable", "spot price", and "fixed price"). There are no dual fuel offers in Norway.

[xxii] In relative terms, the situation would appear closer: indeed the average mark-up varies between 7.2% and 13% of the wholesale price in Norway in time and between companies, while in Great Britain, the average mark-up (between companies) varies between 8.9% and 29.6% of the wholesale price in time on the same period. If admittedly the relative term on the British market does not appear so far from its equivalent in Norway, the absolute value remains dramatically different because of the difference of absolute levels of prices.

[xxiii] 20 000 kWh consumers are the large majority of residential consumers, given the large deployment of electrical space-heating.

[xxiv]In their numerical analysis, von der Fehr and Hansen (2009), p.18) represent the mark-up evolution of the 35 nation-wide retailers in a quite compactness of the mark-up evolution curves "bundle" in their figure 8, but in spite of this compactness, this figure captures both the relative stability of respective mark-ups at a low level, and some differences between retailers.