The NOME Law: Some Implications for the French Electricity Market*

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Abstract

The French law 'Nouvelle Organisation du Marché de l'Electricité' makes available, at a regulated price, withdrawal rights to source low-cost electricity production from nuclear plants owned by the incumbent. Downstream market retailers benefit from such a measure, up to a given amount fixed by the law, to compete with the incumbent. Our analysis assesses whether this production release programme is likely to result in a lower retail price. We show that whether pro-competitive effects arise depends not only on the amount of the preassigned capacity but also on the rules used to allocate it to retailers.

JEL classification: D43; L50; L94.

Key words: electricity markets, NOME law, retail competition.

1 Introduction

The French 'Nouvelle Organisation du Marché de l'Electricité'[1], or NOME law hereafter, makes available withdrawal rights, at a regulated price, to access low-cost electricity production from nuclear plants owned by the incumbent. Although electricity can be generated from other sources, the nuclear fleet becomes *de facto* an "essential facility" to downstream

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[1]That is 'New Organization of Electricity Markets.'

electricity retailers. These latter will benefit from such a measure, up to a given amount fixed by the law, as from January 2011 until 2025. The main short-term objective of this reform is to enhance competition for price-sensitive industrial electricity consumers, and in the perspective of further price liberalization, also for residential electricity consumers. To this end, the law NOME also prescribes a gradual removal of all end-user regulated tariffs, reaching complete price liberalization in 2016. In this paper we analyze whether the law NOME is likely to deliver its promises. Furthermore, we study to which extent the increase in competition depends on the rule chosen by the regulator to allocate nuclear generation withdrawal rights among downstream retailers. To our knowledge, this paper is the first to model the impact of the NOME law on retail competition[2].

Although we focus on a reform to be implemented in the French electricity market, we believe our analysis sheds light on the ongoing debate regarding the real extent of retail competition in electricity markets (see Defeuilly, 2009 and Littlechild, 2009 for an overview). Indeed, how to enhance competition at the downstream level remains a concern, as many papers point out. For instance, Joskow and Tirole (2006) show that retail competition has attractive welfare properties only if real time consumption can be accurately measured. Green (2003) finds that an electricity retailer facing competition will be limited in its ability to pass on the costs of long-term contracts, should the spot price fall below the price in those contracts. This creates a distortion as the optimal level of contracting for retailers is not attained. Von der Fehr and Hansen (2010) find that retailers exert market power by exploiting the reluctance of some customers to switch suppliers in Norway. Our paper tackles a novel issue. In a scenario in which the technological structure of the upstream electricity market translates into a strong cost advantage for the incumbent retailer only, we study whether and under which conditions opening the access to low-cost generation enhances the development of fair downstream competition. More broadly, our paper contributes to the analysis of market power mitigation measures such as horizontal divestiture or capacity release programmes (Weigt *et al.*, 2009).

We focus on a scenario in which retailers compete *à la* Cournot. Before the implementation of the NOME law, the incumbent retailer has a competitive advantage. This is likely to be the case for a retailer vertically integrated with a nuclear generator (*e.g.*, the French historical supplier). New entrants have higher sourcing costs, as long as they are vertically integrated with non-nuclear electricity generators or they buy electricity from the wholesale market at a price typically higher than the sourcing cost for the incumbent retailer. In the

[2]Other papers on the French electricity market reform have discussed in factual terms expected welfare gains from the introduction of regulated access to nuclear electricity (Crampes *et al.*, 2009, Finon, 2010), or the legal foundations of the law (Lévêque *et al.*, 2010).

benchmark scenario, new entrants have the smallest market share as the incumbent is the only one who can benefit from low-cost electricity generation. This can be considered harmful to retail competition.

The choice of a quantity competition model relies on Bushnell *et al.* (2008)'s result that the behavior of vertically integrated firms competing in retail electricity markets can be best predicted by a Cournot game[3]. We acknowledge that this stylized setting abstracts from some dimensions of electricity markets but we believe that it best captures several important features to assess whether the NOME law is likely to succeed in reaching its objective, that is strengthening competition in the retail business. To this end, we modify the benchmark model of asymmetric Cournot competition assuming that the NOME reform makes available withdrawal rights to a given amount of the incumbent's lower cost input, in a modelling framework similar to Dixit (1980). The access price to the low-cost electricity is set by the regulator at the marginal production cost of nuclear plants. Since both the amount and the price of NOME reassigned production are chosen by the regulator, the incumbent is not strategic on them. These assumptions represents the key differences between the analysis herein and Dixit's model.

We further modify Dixit's setting by considering different rules for redistributing low-cost generation, as well their implications in terms of competitiveness and welfare. This allows us to assess the impact on competition of several implementation options for the NOME law which have not been clarified yet. We consider two cases: one in which the share of withdrawal rights is fixed, and another one in which such share is a function of each retailer's market share. The former case, called the 'exogenous distribution scenario', corresponds to the idea that withdrawal rights depend on the retailers' portfolio of consumers in the years preceding the implementation of the law. The second case addresses the fact that the NOME law foresees an ex-post verification to ensure that the reassigned production is aligned to the real demand addressed to retailers. Then, the retailer benefiting from the distribution may take into account the impact of its market strategy on the distribution outcome. This case is referred to as the 'endogenous distribution scenario'.

Regarding the computation of these shares, both in the endogenous and in the exogenous scenario, a further remark is needed. The allocation can be done either on the basis of the entrants' relative market shares (that is, excluding the incumbent in this computation) or on the basis of their absolute market shares. The first scenario we deal with, the one of relative market shares, may be relevant in the long-run, when competitors will develop to such an extent that their total supply exceeds the NOME capacity, thereby requiring some form of

[3]Similar results can be found in other papers dealing with vertically integrated firms. See, for example, Mansur (2007).

rationing. In the short-run, and given the extent of competition on the French retail market, it is likely that not all the NOME capacity will be redistributed, in which case the scenario of absolute market shares is more realistic[4].

We show that the total amount of withdrawal rights plays a pivotal role in shaping market outcomes. The intuition may be explained as follows in the case of exogenous redistribution: when that amount is small, the redistribution does not change the incumbent competitors marginal incentive to produce. The equilibrium outcome then coincides with the outcome before the redistribution and the NOME law merely amounts to a financial transfer between the incumbent and the entrants, with no benefit for end users.

When the level of NOME capacity is intermediate, the situation improves for end users as the competitors who benefit from withdrawal rights substitute their high-cost supply with the lower-cost one provided by the NOME law. However, the entrants content themselves with reselling exactly the NOME capacity, so that the development of competition on the retail market is fully driven by the level of redistributed generation. Finally, a sufficiently large NOME capacity allows leveling the playing field between all the retailers.

Whether pro-competitive effects arise also depends on the rules defining the allocation of these rights, an issue overlooked by the current debate on French energy policy. The distribution rule can foster competitive effects. Indeed, when comparing the endogenous redistribution rule with the exogenous one, we argue that the former makes entrants more aggressive on the retail market, as they take into account that a larger market share on the retail market allows them to benefit from a larger amount of the NOME capacity.

Other implementation rules of the NOME programme are also likely to affect the reform outcome. Setting a cession price above the marginal cost of low cost generation may hinder the pro-competitive effect of the law. In particular, when the endogenous distribution rule applies, we show that a positive access markup makes the incumbent softer on the retail market.

The paper is organized as follows. In Section 2 we describe the context of the French retail market in which the law is introduced and the energy policy discussion regarding the NOME law that has taken place so far. In Section 3 we explain our modelling framework as well as the benchmark results of standard Cournot competition when firms have asymmetric sourcing costs. Section 4 is devoted to the analysis of the NOME law, both with exogenous and endogenous distribution rules. In Section 5 we extend our model to the case of a cession price higher than the incumbent's marginal cost and to the scenario with several competitors. We conclude in Section 6.

[4]Indeed, in this case, when entrants are small enough so that their combined production remains below the NOME capacity, full redistribution cannot be realized.

2 The context

2.1 The retail electricity market

Since July 2007, almost all electricity consumers are able to choose their electricity supplier[5]. According to the 2009 market outlook produced by the French regulatory agency CRE[6], this represents 446 TWh of electricity consumption.

Clients may have one of the following three type of contracts: *(i)* a contract at the market price; *(ii)* a contract at a regulated tariff called the TaRTAM[7] for industrial consumers, scheduled to disappear in June 2010; or, *(iii)* a contract at a regulated tariff[8] that can only have the historical provider as a counterpart. The incumbent's competitors only serve 4% out of 141 TWh sold yearly to the residential sector and 13.3% out of 299 TWh sold yearly to the industrial sector[9].

This lack of competition has already prompted some regulatory responses. Since September 2001 part of the historical producer's nuclear capacity is auctioned to competitors by a mechanism called VPP (which stands for 'Virtual Power Plant'). VPPs allow competitors to reserve nuclear capacity for a certain period varying between 3 and 48 months. The capacity reserved by VPPs (which represents just 16 TWh yearly) may be used or not and its price is defined by a market mechanism: an ascending price auction in multiple rounds[10].

2.2 Changes introduced by the NOME law

The NOME law has received approval on December 2010 and is set to be applied from January 2011 until 2025[11]. The law gives access up to 100 TWh produced yearly by the historical supplier's nuclear plants (plus 20 TWh from 2013 on), which represents approximately one fourth of EdF's nuclear production. Two main features differentiate this mechanism from the VPPs. First, the access price is determined by the Ministry of Energy and the Ministry of Economics, advised by the CRE; it is therefore not determined by a market mechanism. Second, there is an obligation to use these withdrawal rights to supply the French retail market only. To this end, the project includes an ex post financial penalty if there is evidence

[5] That is, all interconnected consumers.

[6] CRE stands for 'Commission de Régulation de l'Energie.'

[7] TaRTAM stands for 'Tarif réglementé transitoire d'ajustement du marché.'

[8] See http://www.cre.fr/fr/marches/marche_de_l_electricite/marche_de_detail for details on the different options regarding this tariff.

[9] For a list of competitors see http://www.cre.fr/fr/marches/observatoire_des_marches/#a1.

[10] Auctions take place, in mean, once every three months. The price paid by each auctioneer depends both on the reservation's duration and on wether it concerns peak or base load. For more detail on the way those auctions were organized in France as compared to other countries see Ausubel and Crampton (2010).

[11] The complete text of the law is available at http://www.legifrance.gouv.fr.

that electricity sourced under the conditions set by the NOME law does not fulfill this requirement.

The incumbent's competitors, due to their higher sourcing costs, are not able to offer retail prices lower or equal to the tariffs offered by the historical supplier. In this regard, Solier (2010) shows that the mean price of base one-year-ahead future contracts, which constitute the bulk of retailers' sourcing costs, is always higher than (sometimes double) EdF's tariffs. By reducing these sourcing costs, the law favors the development of retail competition. This is accompanied by the removal of any price regulation on this market from 2015[12].

The law also contains additional provisions (such as an obligation scheme to ensure the diffusion of efficient investments in base-load and peak generation, and a reform in the local electricity tax) that aim to amend the European Commission observations regarding the functioning of the French retail market.

Many authors have debated over the likely effectiveness of the law. Crampes *et al.* (2009) conclude that the increase in competition as well as innovation incentives will be insufficient as compared to its administrative costs. In the same line, Lévêque and Saguan (2010) examine the impact assessment carried out by the government in April 2010 and argue that it is too optimistic on the competition enhancing effect of the law. The same concern is also shared by the French Competition Authority[13]. Finon (2010) highlights the difficulty of having a retail price aligned to the cost of nuclear generation.

While rich, this debate lacks a formal analysis of the impact of the NOME law on the retail market. We focus on the post 2015 period where the retail market will be fully deregulated and develop a simple model to understand whether the NOME distribution of nuclear production fosters competition . We argue that whether the NOME law may actually meet its objectives depends on characteristics of its implementation which are neither decided nor discussed so far.

3 Benchmark

The market structure we consider is as follows. One incumbent firm A has a technology which allows to supply an input at unit cost c_A. The input is then used, on a one-to-one basis and at no additional cost to produce an output sold on a retail market.

Firm A faces several identical competitors on the retail market, denoted by $B_1, ..., B_n$.

[12] As first suggested by the Champsaur Report (2009), the previously described distribution is accompanied by a gradual liberalization of the retail price for electricity. From January the 1st of 2011 industrial consumers will no longer benefit from regulated tariffs. Consumers with an intensity lower than 36 kVA will still be served at the regulated tariffs but also the latter will disappear in 2015.

[13] See http://www.autoritedelaconcurrence.fr/pdf/avis/10a08.pdf

These competitors are less efficient than A: $c_A < c_{B_i}$, $i = 1...n$. This efficiency differential is a shortcut to describe two features of the French electricity market. First, only the historical incumbent has access to the nuclear technology to supply electricity; indeed, retail competitors use less efficient technologies. Second, retail competitors may source the input from a wholesale market (either spot or forward) where the prevailing price is larger than the marginal cost of the most efficient nuclear technology.

Total supply on that market is denoted by $Q \geq 0$. Firms compete à la Cournot on the retail market and the inverse demand is given by $p(Q)$, with $p'(Q) < 0$ and $p''(Q) < 0$.

To highlight the main forces driving our results, we shall often assume that firm A faces only one competitor on the retail market. Let us call that competitor by firm B, and its marginal sourcing cost as c_B. For each result, we comment on how it ought to be amended when the incumbent A faces several competitors.

Firm A chooses production level q_A so as to maximize $[p(Q) - c_A]q_A$, which yields the following first-order condition[14] (where $Q = q_A + q_B$):

$$p'(Q)q_A + p(Q) - c_A = 0. \tag{1}$$

Equation (1) implicitly defines firm A's best-response BR_A.

Similarly, firm B chooses q_B so as to maximize its profit $[p(Q) - c_B]q_B$, which yields:

$$p'(Q)q_B - p(Q) - c_B = 0. \tag{2}$$

The previous expression gives the corresponding best-response of firm B denoted by $BR_B(c_B)$.

Under our assumptions, best-responses are decreasing so that quantities are strategic substitutes. We also focus on the relevant cases where the stability condition is satisfied (see Dixit, 1986)[15]. A standard revealed preferences argument then shows that the equilibrium production of the efficient firm A is larger than the production of the inefficient firm B, that is: $q_A^b(c_A, c_B) > q_B^b(c_A, c_B)$, where superscript b refers to this benchmark scenario. The incumbent retailer thus squeezes the market share of its competitors as he is the only one who can benefit from the cost advantage of the nuclear fleet.

[14]The second-order condition is satisfied under our assumptions.

[15]This is the case if, for instance, $p''(.)$ is sufficiently small.

4 Impact of the NOME law on retail market competition

4.1 Possible interpretations of the NOME law

The implementation of the NOME law is depicted as follows. The regulator chooses the maximal amount K of A's lower cost production to be redistributed. Firm B receives a fraction of that amount. Incumbent A receives a unit payment $w < c_B$ in compensation for the withdrawal rights. Price w is regulated and, for the moment, we assume that it coincides with the unit cost of the most efficient sourcing technology: $w = c_A$. Moreover, the production distribution does not constrain A's production.

In its current state, when it comes to the distribution of nuclear electricity from the incumbent to retailers, there are several competing interpretations of the NOME law. First, the share of the withdrawal rights K given to A's competitors might be either exogenous or endogenous. Second, the share given to an entrant may be computed on an absolute or on a relative basis.

To illustrate, the regulator may allocate the withdrawal rights on the basis of past market shares on the retail market: if firm B has a market share α on the retail market then it benefits from a distribution of αK. If market shares are computed on the basis of past behaviors, then firm B anticipates that its actual supply has no impact on the amount obtained from the distribution process. In that scenario, distribution is exogenous and based on absolute market shares.

Firm B may also recognize that the larger its market share today, the larger the amount it will be assigned tomorrow. To capture this dynamic effect in our static framework, we consider another case in which firm B's portion of K is given by its retail market share $\frac{q_B}{q_A+q_B}$. This rule is labelled endogenous distribution and is, again, computed on the basis on absolute market shares. This interpretation seems to fit with the spirit of the NOME law. Indeed, at the beginning of each year, competitors are required to provide business plans describing their forecasted market shares for the coming year; the regulator then assigns withdrawal rights on the basis of these prospective plans.

The difference between the cases of absolute and relative market shares relates to the following point. The regulator may want to assign the whole NOME production to A's competitors in order to boost competition on the retail market. In that case, the whole K is redistributed to A's competitors and each of these competitors receives a fraction which coincides with its relative market share, i.e. its market share with respect to all competitors of A: $\frac{q_{B_i}}{\sum_{j=1}^{n} q_{B_j}}$ for firm B_i. Past or projected market shares may be used in this computation.

From our understanding of the law, the scenario of absolute market shares is the most relevant one in the short-run. Indeed, the maximum amount redistributed exceeds the current production level of the incumbent's competitors on the retail market. However, in the long-run, we can foresee a situation in which competitors will develop and their joint market share is above K. The regulator is then likely to allocate withdrawal rights amongst A's competitors on the basis of their relative market shares.

There are similarities and differences between the various possible interpretations. In what follows, we first consider the case of absolute market shares under the assumption that firm A faces only one competitor. In this context, we assess the competitive effects of the NOME law under both the exogenous and the endogenous distribution rules. We then extend the analysis to the case of relative market shares and multiple competitors on the retail market.

4.2 Exogenous distribution

Let us now consider the case in which a fixed amount αK of A's low-cost production is redistributed to its competitor B. As retailer A is not constrained, its profits are now:

$$\Pi_A = [p(Q) - c_A]\, q_A + (w - c_A) \min\{q_B; \alpha K\} = [p(Q) - c_A]\, q_A, \tag{3}$$

since K is sold at the unit cost ($w = c_A$). A's profit function is thus the same as in the benchmark model and its best-reply is still given by (1). Firm B's profit writes as follows:

$$\Pi_B = \begin{cases} [p(Q) - c_A]\, q_B & \text{if } q_B \leq \alpha K; \\ [p(Q) - c_B]\, q_B + (c_B - c_A)\alpha K & \text{if } q_B > \alpha K. \end{cases} \tag{4}$$

Firm B's reaction depends on wether q_B is smaller or larger than αK. Notice in particular that firm B's profit function is continuous but not differentiable at $q_B = \alpha K$; this affects the way firm B best-responds to the quantity produced by firm A, as in Dixit (1980). More precisely, suppose first that firm B operates in a region such that $q_B \leq \alpha K$. Firm B perceives a marginal cost c_A and thus produces $BR_B(c_A)$ solution of:

$$p'(Q) q_B + p(Q) - c_A = 0. \tag{5}$$

This is firm B's best-response provided that the solution of (5) is smaller than αK, or, equivalently, that q_A is not too large[16]. If firm B operates in a region such that $q_B > \alpha K$,

[16]Indeed, remember that quantities are strategic substitutes in our setting.

then it perceives a marginal cost c_B and produces q_B solution of (2); this requires that q_A is sufficiently large. Finally, for values of q_A in between the two thresholds defined previously, firm B best-responds by producing the same quantity αK. Firms A and B's best-responses are graphically represented below. The equilibrium of the game lies at the intersection of the best-responses.

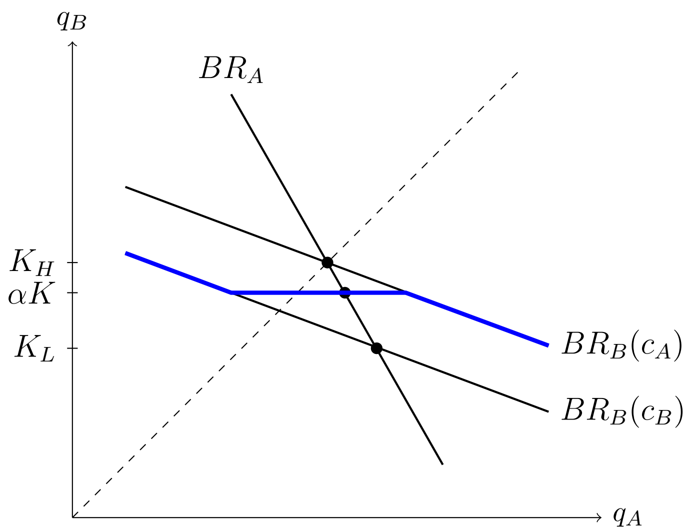

Figure 1: Equilibrium under exogenous distribution.

The interesting feature is that the equilibrium depends on the amount redistributed to firm B:

- If K is large, then NOME distribution leads the retail market to a symmetric Cournot equilibrium, since firm A's and firm B's best-responses are given by (1) and (5) respectively. Equilibrium quantities are then given by $q_A^b(c_A, c_A)$ and $q_B^b(c_A, c_A)$. Law NOME thus increases the retail market competitiveness as compared to the benchmark case. For this case to emerge at equilibrium, the distribution must satisfy $\alpha K \geq K_H = q_B^b(c_A, c_A)$. Note that firm B does not use all the withdrawal rights it has been provided with.

- If the amount redistributed is small, then the firms' best-replies are given by (1) and (2) respectively and equilibrium quantities are equal to those in the benchmark case. Hence, when $\alpha K \leq K_L = q_B^b(c_A, c_B)$, law NOME does not change the retail market outcome. It allows firm B to substitute partly its inefficient technology with A's efficient technology.

- Last, for intermediate levels of redistributed amount (that is for $K_H < \alpha K < K_L$), the equilibrium involves firm B producing exactly at the amount of its withdrawal rights. With respect of the benchmark case, the distribution of capacity entails a larger total production and a lower price on the retail market. Consumers are better off. Note however that this increase in competition can be deemed somewhat 'artificial' as firm B merely resales the production it has bought from firm A.

Summarizing, we obtain:

Proposition 1. *Under exogenous distribution of the incumbent's production, there exists two thresholds $K_L < K_H$ such that:*

- *If $K \leq K_L$, the equilibrium outcome is given by the benchmark (pre-distribution) case. Only welfare and firm B's profit increase with K.*

- *If $K \geq K_H$, the equilibrium outcome coincides with the symmetric Cournot outcome at the most efficient technology. Any distribution in excess of K_H does not improve either welfare or consumers surplus.*

- *For $K_L < K < K_H$, the least efficient firm's market share is given by the level of redistributed withdrawal rights. Welfare and consumers surplus increase, and the industry profit decreases, with K.*

Proof. Immediately follows from previous reasoning. □

If the distribution programme is very ambitious ($K \geq K_H$), efficiency gains fully realize. Instead, if the redistributed production is below K_L, the NOME transfer translates in higher profits for B of an amount $(c_B - c_A)\alpha K$ but does not result into a lower price. For intermediate values of redistributed production, the larger αK, the lower the market price. Moreover, B benefits from a subsidy which falls below $(c_B - c_A)\alpha K$.

Policy-makers may perhaps foresee that firm B will use the redistributed production it is granted with in order to boost its market share on the retail market. The analysis unveils that this argument has some limits since firm B's incentives are driven by its marginal opportunity cost of supplying the downstream market, which is not always affected by the distribution of K. The most striking illustration of this reasoning is that any distribution below the production level of firm B in the benchmark has no impact on the equilibrium outcome. Finally, Proposition 1 may provide a benchmark to determine the amount of production to be redistributed: for a distribution to have a positive impact on welfare, the level of distribution must be at least as large as the production level of firm B in pre-distribution benchmark.

A last point can be raised. The law has adverse effects on the incentives to invest in cost-efficient production capacities. The intuition is simple: the distribution of withdrawal rights provides firm B with an efficient technology at a low price; hence, it has less incentives to improve its own production technology as such improvements apply to smaller base.

4.3 Endogenous distribution

The law NOME foresees that the distribution of access rights will be allocated in proportion of retailers' portfolios of customers. If firms receiving low-cost electricity anticipate this, the distribution rule becomes endogenous. To capture this mechanism, let us consider that B obtains the amount $\frac{q_B}{q_B+q_A}$ of K.

Retailer A's best-reply function is still given by (1). Competitor B, instead, considers the following profit function:

$$\Pi_B = \begin{cases} [p(Q) - c_A]\, q_B & \text{if } q_B \leq \dfrac{q_B}{q_B+q_A}K; \\ [p(Q) - c_B]\, q_B + (c_B - c_A)\dfrac{q_B}{q_B+q_A}K & \text{if } q_B > \dfrac{q_B}{q_B+q_A}K. \end{cases} \tag{6}$$

Notice that the inequality $q_B \leq \frac{q_B}{q_B+q_A}K$ is equivalent to $q_B \leq K - q_A$ or $Q \leq K$. Hence, with respect to the exogenous distribution case, the nature of the constraint is remarkably different. If $Q \leq K$, firm B best-responds to firm A by setting a quantity characterized by (5). If $Q > K$, we obtain the following characterization of firm B's best-response:

Lemma 1. *Consider $Q > K$. Firm B's best-response lies in between $BR_B(c_A)$ and $BR_B(c_B)$. Moreover, provided that $K(c_B - c_A)$ is small enough, quantities are strategic substitutes over the relevant range.*

Proof. The first-order condition associated to firm B's maximization problem is:[17]

$$p'(Q)q_B + p(Q) - c_B = -K(c_B - c_A)\frac{q_A}{Q^2}. \tag{7}$$

Since the right-hand side is strictly negative, this implies that the best-response lies strictly above $BR_B(c_B)$. Equation (7) can be rewritten as follows:

$$p'(Q)q_B + p(Q) - c_A = \frac{c_B - c_A}{Q^2}\left[Q^2 - Kq_A\right].$$

[17] The second-order condition is satisfied when $Q > K$.

This implies that for $Q > K$, B's best-response lies above $BR_B(c_A)$. Straightforward manipulations show that firm B's best-response is decreasing in q_A provided that:

$$p''(Q)q_B + p'(Q) + K(c_B - c_A)\frac{Q - 2q_A}{Q^3} < 0.$$

The first two terms are negative under our assumptions. The last term may become positive, in particular when firm B produces are larger quantity than firm A; provided that $K(c_B - c_A)$ remains small enough, this effect can be neglected so that quantities remain strategic substitutes. □

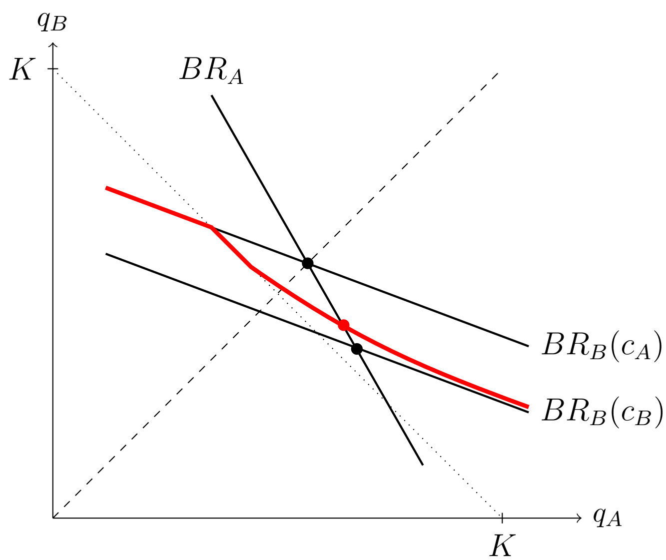

Figure 2: Equilibrium under endogenous distribution.

Figure 2 summarizes the analysis. With respect to the endogenous distribution case, firm B's incentives to supply are now quite different. In particular, firm B becomes more aggressive on the retail market. In order to better understand this point, Figure 3 represents the marginal cost of firm B under the exogenous and the endogenous distribution rule.

Hence, with respect to the exogenous distribution rule, firm B's marginal cost is smaller under the endogenous distribution rule. Indeed, firm B foresees that any increase in its production is accompanied by an increase in the amount of withdrawal rights distributed, giving rise to a lower opportunity cost of production (i.e., c_A). Therefore, firm B's incentives to produce are strengthened under the endogenous distribution rule.

As can been hinted from Figures 1 and 2, the two rules governing the distribution of withdrawal rights generate quite different incentives to supply for the retailers. A general

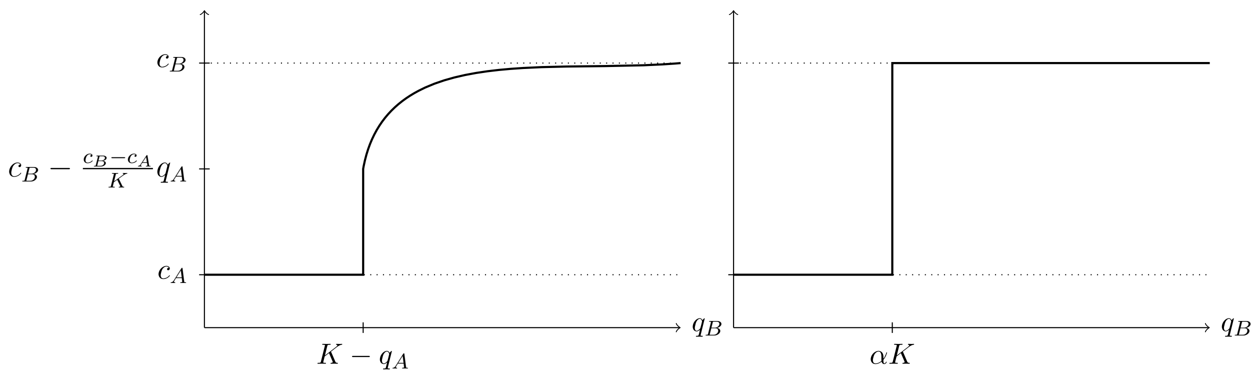

Figure 3: Marginal cost of firm B under endogenous (left panel) and exogenous (right panel) distribution.

comparison is arbitrary since the equilibrium outcome in the exogenous case is affected not only by the level of K but also by the choice of α. Differently put, for a given level of withdrawal rights K, one can find values of α such that the equilibrium outcome under the exogenous distribution is more, or less, competitive than under the endogenous rule.

Nevertheless, the comparison can be assessed in the most natural case in which, under the exogenous rule, α is given by firm B's market share in the benchmark outcome. Then we obtain the following proposition.

Proposition 2. *Assume* $\alpha = q_B^b(c_A, c_B)/[q_A^b(c_A, c_B) + q_B^b(c_A, c_B)]$. *Then:*

- *If* $\alpha K \leq K_L$, *the endogenous rule leads to a more competitive outcome than the exogenous one.*

- *If* $\alpha K \geq K_H$, *both rules lead to the same outcome.*

- *If* $K_L < \alpha K < K_H$, *the comparison is ambiguous.*

Proof. Consider that $\alpha K = K_L$. This amounts to $K = K_L/\alpha = q_A^b(c_A, c_B) + q_B^b(c_A, c_B)$. This implies that the benchmark equilibrium quantities belong to the constraint $q_A + q_B = K$. Then, one can see from Figure 2 that the endogenous distribution leads to a more competitive equilibrium than the exogenous one. This comparison holds for any $K \leq K_L$.

Consider now that $\alpha K = K_H$, which amounts to $K = q_B^b(c_A, c_A)/\alpha$. Since $\alpha < 1/2$, this implies that $K > q_A^b(c_A, c_A) + q_B^b(c_A, c_A)$. This implies in turn that the quantities in the symmetric Cournot equilibrium lie in the area below the constraint $K = q_A + q_B$. Then, one can see from Figure 2 that the equilibrium under the endogenous rule always coincides with the symmetric Cournot outcome. The same comparison holds when $\alpha K \geq K_H$.

For intermediate values of αK, the comparison is ambiguous. $\square$

The endogenous rule always increases the marginal efficiency of retailer B. However, this is in general not sufficient to ensure that the endogenous rule outperforms the exogenous one in terms of retail market competitiveness. Our analysis unveils that the details governing the allocation of the withdrawal rights play a critical role in shaping the competitors' behavior and the market outcome.

5 Extensions

5.1 Cession price higher than marginal production cost

Herein we analyze the case in which firm A is allowed to sell the low-cost electricity at a cession price w higher than the sourcing cost[18] c_A. When $q_B < \alpha K$, firm B's best-response $BR_B(w)$ is a downward translation of $BR_B(c_A)$: for a given supply of firm A, firm B reduces its supply.

Let us start with the exogenous rule. The fact that the cession price is $w > c_A$ does not affect firm A best-response. The impact on the equilibrium outcome is immediately inferred from Figure 1.

With endogenous distribution, the analysis is more involved. The new feature is that firm A's best-response is also affected by the distribution. Indeed, firm A's profit function writes as follows:

$$\Pi_A = \begin{cases} [p(Q) - c_A]\, q_A + (w - c_A) q_B & \text{if } q_B \leq \dfrac{q_B}{q_B + q_A} K; \\ [p(Q) - c_A]\, q_A + (w - c_A) \dfrac{q_B}{q_B + q_A} K & \text{if } q_B > \dfrac{q_B}{q_B + q_A} K. \end{cases} \tag{8}$$

As long as $q_A \leq K - q_B$, the best-response of firm A is still given by BR_A. If, however, $q_A \leq K - q_B$, it becomes characterized by the following first-order condition:

$$p'(Q) q_A + p(Q) - c_A = (w - c_A) \frac{K}{(q_A + q_B)^2} > 0. \tag{9}$$

Comparing Equation (1) and Equation (9), we deduce that a cession price strictly above the marginal cost of production provides firm A with an incentive to withhold its supply. Indeed, by being less aggressive, firm A protects its less efficient rival and thus the profit it earns from the cession of the withdrawal rights. This might comes as a surprise in a Cournot context, where firms conjecture that their rivals keep their quantities constant at the time of

[18] We will always consider the case in which $w < c_B$, as otherwise firm B has no incentives to buy withdrawal rights.

deciding their own output. However, this becomes immediate once one recognizes that the amount effectively distributed depends on market shares.

To summarize, the endogenous rule makes the retail competitor more aggressive; however, this effect is counterbalanced by the markup of the cession price over the marginal cost. Simultaneously, a positive access markup makes the incumbent softer on the retail market. These effects are all the more pronounced that the cession price is large[19].

5.2 Relative market shares and several entrants

We discuss here how the qualitative results obtained so far can be used to analyze situations with more than one competitors.

In the short run, the French retail electricity market is likely to be populated with only few small entrants. In the exogenous scenario, the amount of withdrawal rights obtained by a given entrant is proportional to its past market share. As long as the total supply of the entrants is smaller than the maximum amount of access rights stipulated by law NOME, the constraint faced each entrant writes as $q_{B_i} \leq \alpha_i K$ and its best-response, defined with respect to the total quantity of its competitor $Q_{-i} = q_A + \sum_{j \neq i, j=1,\ldots,n} q_{B_j}$, could be represented graphically exactly as in Figure 1, except that the horizontal axis represents now Q_{-i}. The best-response of each firm B_i has the same features as in the case of a single entrant developed in Section 4.2.

In the endogenous case, the analysis is again very similar to the one undertaken in Section 4.3. However, the rule of absolute market shares is at odds with endogenous distribution as this implies that the whole access rights will never be fully redistributed no matter the size of the entrants.

As competition intensifies on the retail market, entrants enlarge market shares and their total supply may exceed the maximum amount of access rights to be distributed. Some rationing must be implemented. One natural way to allocate the scarce resource among the entrants is to consider relative market shares. The constraint faced by each competitor of firm A becomes $q_{B_i} \leq \frac{q_{B_i}}{\sum_{j=1,\ldots,n} q_{B_j}} K$, or equivalently $\sum_{j=1,\ldots,n} q_{B_j} = Q - q_A \leq K$. Notwithstanding these differences, one can see that the very same effect as those underlined in Section 4.3 pushes the entrants to be more aggressive as they expect to get a larger share of the NOME rights.

[19] As expected, the comparison between the exogenous and the endogenous rule remains ambiguous.

6 Conclusion

This paper contributes to the ongoing debate on competition policy in electricity markets analyzing the impact of the NOME law in the structure of the French retail market. Our main result is that the key determinant for enhancing competition is the rule used by the regulator[20] to redistributed low-cost generation: allocating withdrawal rights as a function of actual competitors' market shares results in a lower retail price as compared to a scenario without redistribution. If the cession price of withdrawal rights is set above the marginal cost of nuclear generation this affects adversely the incumbent's incentives to supply. Given the inherent difficulty of measuring precisely the marginal cost of the nuclear technology, we expect that this question will raise a debate in the regulatory arena.

The current paper could be extended by explicitly modelling a vertically integrated structure analyzing at the same time competitive effects in the upstream and in the downstream market for electricity. Our framework could also be used to analyze in greater depth investment incentives provided by this kind of cession initiatives. These extensions are left for future research.

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