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STRATEGIES OF AN INCUMBENT CONSTRAINED TO SUPPLY ENTRANTS: THE CASE OF EUROPEAN GAS RELEASE PROGRAMS

Cédric CLASTRES

Laurent DAVID

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Centre de Recherche en Economie et Droit de l'Energie
CREDEN - Equipe du LASER
Université de Montpellier I
Faculté des Sciences Economiques -C.S. 79606
34960 Montpellier Cedex 2, France
Tel. : 33 (0)4 67 15 84 03
Fax. : 33 (0)4 67 15 84 04
e-mail : cedric.clastres@univ-montp1.fr

Strategies of an incumbent constrained to supply entrants: the case of European gas release programs[1]

Cédric Clastres

Université de Montpellier I - Faculté des Sciences Economiques

CREDEN

CS 79606 - 34 960 Montpellier Cedex 2 - France

E-mail: cedric.clastres@univ-montp1.fr

Laurent David

Gaz de France - Resarch Division

361 av. du president Wilson - BP 33 - 93211 La Plaine Saint Denis

E-mail: laurent-m.david@gazdefrance.com

Abstract

To accelerate the development of competition in gas markets, some European regulators (in United Kingdom or in France) have decided to implement gas release programs. These programs compel the incumbent to sell gas that is no longer sold to its customers to its competitors. A first intuition would suggest that such a measure could give the incumbent an incentive to let its own costs rise in order to raise its rival's ones. With a duopoly model, we found some cases where incentives to raise costs do exist but, in most of the cases there is no such incentives.

Key Words: gas release, strategic behavior, oligopoly markets

JEL-codes : L13, L29, L59, L95

1. INTRODUCTION

European Gas markets are opening slowly to competition. In order to accelerate the competition pace, some European regulators decided to implement asymmetric regulations that most often combine market share restrictions and gas release programs. Market share constraints are settled as a target market share by the

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regulator. Gas release programs can be implemented alone but they often accompany market share constraints. It has been the case for the United Kingdom, Spain and Italy. Nonetheless, in France, Germany and Austria, gas release programs have not accompanied committed market share reductions. As the incumbent has to lose market shares, gas release programs compel the incumbent to sell gas that is no longer sold to its customers to its competitors. A first intuition concerning gas release program would suggest that such a measure, if it was no time limited, could give the incumbent incentives to let the negotiated prices of its long term contracts rise in order to raise its rivals' cost.[2]

To question whether an incumbent has incentives to let its own costs rise in order to raise its rivals' ones, we consider an oligopoly market where participants compete in quantities. We concentrate on a duopoly case where an incumbent has to provide its competitor with an input that cannot be got from another sources. This input can be access to an essential facility for example. Within the framework of a gas release program, this input is the gas molecule imported by the incumbent.

The case of a duopoly in which one of the competitors has an influence on its rivals' cost has been widely treated in economic literature. Few recent papers proposed this kind of model without capacity constraint. Among the authors interested by this question, Economides (1998) looks for the incentives to raise its downstream rivals' cost for a vertically integrated firm which is a monopolist on the input market. He shows that incentives to raise rivals' cost do exist but they are restricted to the rivals' cost. If the cost of its downstream subsidiary were also to be raised by the strategic decision of the upstream monopolist, the latter would not implement this strategy. In other words, the integrated firm has no incentive to raise the whole industry cost.

In 2001, Weisman and Kang, starting from a similar model than the Economides'one, show that an integrated firm has an incentive to raise its downstream rivals' cost, when this firm is no less efficient than these rivals. These two models deal with non price discrimination, the monopolist can affect the cost of its downstream rivals with other means than the input price. Sibley and Weisman (1998) propose a model where a regulated monopolist is subject to two contrary incentives. The first one leads the upstream monopolist to raise its rivals' costs in order to decrease competitor's sells and to increase its own offers and the price on the final market. But the second one leads it to decrease its rivals' costs to increase competitor's purchases on the intermediate

[2]The netback value is always used in European gas market. Thus, the incumbent can be limited to increase its cost to the extent wanted. The gas price must stay competitive with others energy prices (fuel oil domestic).

market. They show the first effect overcomes the second if incumbent's market share is high enough.

Our approach is somewhat complementary to these ones in the sense that we consider a kind of integrated firm where the upstream level is characterized by fixed cost (long term contracts with take-or-pay clauses) and the downstream level by a seller on the final market. The upstream monopolist is compelled by the regulator to offer the input to its downstream rival at its unitary cost. So, in our model, the incumbent cannot raise its rival cost by another way than the input price. As this input price is fixed by the regulator to the price supported by the upstream level, raising rival's cost in our model means raising the cost of the whole industry. Another feature of our model is the fixed cost paid by the integrated firm whereas within Economides' model, for example, costs are variable. The specificity of our model allows us to catch the problem raised by gas release programs implemented in Europe. We show that the integrated firm could have incentives to raise the whole industry cost but these incentives are restricted to very specific cases where the input quantity hold by the incumbent is quite low and the share of this quantity that it has to offer to its competitor is quite high. Section 2 of our paper describes our model and the different possible equilibriums and section 3 identifies the incentives for the incumbent to let unitary cost grow.

2. THE MODEL

Suppose an integrated firm that has bought a capacity K_o which unit cost is u. This capacity could be a long term contract gas portfolio K_o which was negotiated previously. This integrated firm (the incumbent) must offer a proportion[3] $\alpha \in [0, 1]$ of its capacity K_o to its competitor on the downstream market at a price r. The incumbent is an upstream monopolist in the sense that its competitor has no other available source of supply. The regulator determines both α and r values. We suppose that r equals u.[4] Variables K_o, α, u (and thus r) are exogenous. European gas release experiences show that gas release prices are often set in line with the incumbent's importation costs. Few information are available on gas release proportion setting.

Let q_o and q_e the quantities respectively sold by the incumbent and its competitor.[5]

Our Cournot game has to deal with two constraints. The competitor (or gas release) constraint $q_e \leq \alpha K_o$ (C_1), stipulates that it cannot sell a quantity higher than the one it got from the incumbent. The two operators

[3] We can suppose a fixed released quantity like a proportion α but it does not change our results

[4] But our results hold if $r = u + \epsilon$ with $\varepsilon > 0$.

[5] We will indice by "o" variables related to the incumbent and by "e" those related to the competitor.

cannot sell more than the incumbent's supplies, in other words there is a market constraint that applies to both operators : $q_e + q_o \leq K_o$ (C_2).

The demand function of the final market is a linear one, $P(q) = 1 - q$.[6]

The profit expressions are

$$\Pi_o(q_e, q_o, r) = P(q_e + q_o)q_o - uK_o + rq_e \tag{1}$$

for the incumbent and

$$\Pi_e(q_e, q_o, r) = P(q_e + q_o)q_e - rq_e \tag{2}$$

for the competitor. The optimal quantities (and associated prices) must respect the two previous constraints.

The two operators simultaneously choose their strategies. They maximize their own profits subject to the two constraints. They try to play their best reply strategy to the other one's strategy. If they cannot play it, they are constrained. The optimal solutions are those of the simultaneous optimization program :

$$\begin{cases} \underset{q_o}{Max}\Pi_o(q_o, q_e, r) = P(q)q_o - K_o u + rq_e \\ \underset{q_e}{Max}\Pi_e(q_o, q_e, r) = P(q)q_e - rq_e \end{cases} s/c \begin{cases} q_e \leq \alpha K_o & (\lambda_e) \\ q_e + q_o \leq K_o & (\mu_o, \mu_e) \end{cases}$$

Let λ_e be the multiplier value of the competitor constraint (C_1). Taking into account the result of Breton and Zaccour (2001), each firm has a multiplier value associated to C_2. They are μ_e for the competitor and μ_o for the incumbent. That means that each one has a different relaxation cost of the market constraint of one unit.

To solve this problem, we use the Khun and Tucker's conditions. We at first consider constraint C_1 and add in a second step constraint C_2. This solution allows us to find without complication different zones where operators play one equilibrium. Four equilibriums are solutions of this maximization program. They depend on parameters α, K_o and r. These parameters define zones where multipliers take different values. We can represent these equilibriums in a (K_o, α) graph, for a given r (figure 1). We can have all different cases with the variation of r. Finally, we obtain four different areas where one equilibrium can be played by the two firms.

[6] Our results always exist with a more general linear demand function $P(q) = a - bq$ with $a > 0$ and $b > 0$. But, because of small values of q, some of them only exist with an elastic demand.

PROPOSITION 1. *For any given r, the plane defined by (K_o, α) with $\alpha \in [0,1]$ can be split into parts according to the curve defined by $\lambda_e = 0$ with*

$$\lambda_e = \frac{1}{2} - \frac{3}{2}\alpha K_o - r. \tag{3}$$

Under this curve the competitor is constrained by the gas release supply, thus its strategy is $q_e^\kappa = \alpha K_o$. Above this curve, it is no longer constrained and able to play its best reply function to the quantity proposed by the incumbent on the final market.

PROPOSITION 2. *Each of the two zones defined by $\lambda_e = 0$ can be split again according to the market constraint (C_2), i.e. according to the curves defined by $\mu_o^\kappa = 0$ with*

$$\mu_o^\kappa = 1 + \alpha K_o - 2K_o \tag{4}$$

for the lower zone $(\lambda_e > 0)$ and by $\widehat{\mu}_o = 0$ with

$$\widehat{\mu}_o = -3K_o + 2 - r - \widehat{\mu}_e \tag{5}$$

and $\widehat{\mu}_e \geq 0$ for the upper zone $(\lambda_e < 0)$. On the left sides of these curves, the market constraint is active whereas on the right side it is not.

Depending on the values of α, K_o and r, four kinds of equilibriums are possible.

First one: the two constraints are binding which implies $\lambda_e > 0$ and $\mu_o^\kappa > 0$. The equilibrium strategies are noted by "κ”, they are the following ones

$$\begin{cases} q_e^\kappa = \alpha K_o \\ q_o^\kappa = (1-\alpha) K_o \end{cases} \tag{6}$$

In the zone where this equilibrium can be reached (zone 1a in the figure 1), the incumbent’s supplies K_o are too small to make the two constraints inactive. Both players want to sell its maximum quantity, i.e. αK_o for the competitor and $(1-\alpha)K_o$ for the incumbent.

Second one: only the C_1 constraint is active $(\lambda_e > 0)$. Within this zone, α is too small to allow the competitor to play its best-reply function; its best strategy is playing its maximum quantity. The incumbent, because of great values of its supplies, can play its best-reply function; the market constraint is inactive. We have a third

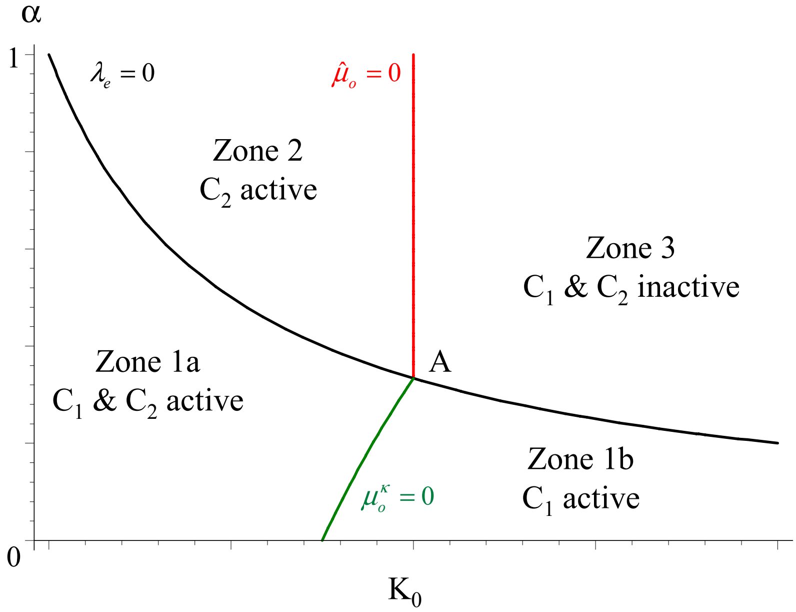

FIG. 1 Four equilibrium zones

equilibrium, noted by "κ" and "m" (zone 1b in the figure 1):

$$\begin{cases} q_e^\kappa = \alpha K_o \\ q_o^m = \frac{1}{2} - \frac{1}{2}\alpha K_o \end{cases} \tag{7}$$

Third one: only the market constraint is binding (C_2). This zone (2 in the figure 1) is characterized by a multiplicity of equilibriums. This multiplicity has been demonstrated by Breton and Zaccour (2001). Characteristics of this second equilibrium, hatted ($\widehat{x}$), are the following:

$$\begin{cases} \widehat{q}_e = 2K_o + \widehat{\mu}_o - 1 \\ \widehat{q}_o = 1 - \widehat{\mu}_o - K_o \end{cases} \tag{8}$$

with $\widehat{\mu}_o = -3K_o + 2 - r - \widehat{\mu}_e$ and $\widehat{\mu}_e > 0$. We select one of these equilibriums by setting $\widehat{\mu}_e = 0$. For gas industries, this choice is relevant insofar as the incumbent is in charge of the obligation of supply, the competitor puts no value on relaxing the market constraint. In this area, α is high enough to make constraint C_1 inactive but the market constraint remains active because of the small incumbent's supplies.

Fourth one : none of the two constraints is binding. The two operators can play their best-reply function.

This fourth equilibrium is the classic Cournot one, noted by "c":

$$\begin{cases} q_e^c = \frac{1}{3} - \frac{2}{3}r \\ q_o^c = \frac{1}{3} + \frac{1}{3}r \end{cases} \tag{9}$$

When gas release programs are implemented in a country, gas release quantities are often totally sold.[7] Thus, the gas release constraint is often active. The explanation is very intuitive : the gas release gives to competitors an easier access to natural gas supplies at a more competitive price.

Remark 1. The four zones defined above all exist if $r \in \left[0, \frac{1}{2}\right[$. If $r \geq \frac{1}{2}$, then $q_e^c \leq 0$. In addition, the zones 1a and 1b disappear. Only zones 2 and 3 remain in the (K_o, α) plane for a given r. But, as $q_e^c \leq 0$, the Cournot equilibrium is not a feasible one. Then, only the zone of multiple equilibriums can be reach. We will assume in the following that $r \in \left]0, \frac{1}{2}\right[$. If $K_o > \frac{2}{3} - \frac{1}{3}r$ and $r > \frac{1}{2}$, then the competitor does not buy any quantity and the incumbent is in a monopoly situation. In this case, the regulator does not implement a gas release program.

The three curves $\lambda_e = 0$, $\mu_o^\kappa = 0$ and $\widehat{\mu}_o = 0$ define our different areas. We can see they will depend on variables α, K_o and r. They are decreasing functions of r, except $\mu_o^\kappa = 0$ that is constant in r. If r increases, $\lambda_e = 0$ and $\widehat{\mu}_o = 0$ move towards the origin of axes. The three curves ($\mu_o^\kappa = 0$, $\widehat{\mu}_o = 0$ and $\lambda_e = 0$) are respectively the frontier of the market constraint activity and the competitor constraint activity. The intersection point of these curves, named point A, has its coordinates in the (K_o, α) plane equal to $(K_o^A = \frac{2}{3} - \frac{1}{3}r, \alpha^A = \frac{1-2r}{2-r})$ for a given r. They are decreasing functions of r. If r increases, the point A is moving towards the origin of axes and it is always on constant curve $\mu_o^\kappa = 0$. In the following section we will consider that the regulator fixes the input price to its unitary cost, i.e. $r = u$. Then, according the profit it can obtain with the different zones, the incumbent could have incentives to let its cost u grow in order to move from one zone to another one. Indeed, the incumbent profit is determined by two kinds of revenues : first by sales on final market, second by input sales to its competitor.

Let its cost grow has then two effects : it increases its own supply costs and decreases the competitor's input purchases; it can sell a higher quantity at a greater or at a constant price on the final market.

3. INCENTIVES TO RAISE COST

[7] If it is not, it's because exogenous contraints exist in the gas market, like difficult and complex acces to transport facilities for example.

To identify the incentives to manipulate cost that the incumbent could have, we must explicit the incumbent's profits according the four zones defined previously using (1) combined with (6) to (9) .

Zone 1a (C_1 and C_2 binding):

$$\Pi_o^{\kappa}(u) = K_o - \alpha K_o - K_o^2 + \alpha K_o^2 + u\alpha K_o - K_o u \tag{10}$$

Zone 1b (C_1 binding):

$$\Pi_o^{\kappa,m}(u) = \frac{1}{4} - \frac{1}{2}\alpha K_o + \frac{1}{4}\alpha^2 K_o^2 + \alpha K_o u - K_o u \tag{11}$$

Zone 2 (C_2 binding):

$$\widehat{\Pi}_o(u) = 3K_o - 1 + 2u - 2K_o^2 - 3K_o u - u^2 \tag{12}$$

Zone 3 (no active constraint):

$$\Pi_o^c(u) = \frac{1}{9} + \frac{5}{9}u - \frac{5}{9}u^2 - K_o u \tag{13}$$

As mentioned above, an increase of u leads to a move of the curves ($\lambda_e = 0$ and $\widehat{\mu}_o = 0$) defined in the (K_o, α) plan towards the origin of axis. If it let its cost u grow, the incumbent could thus move from zone 1a to zone 2, from zone 2 to zone 3 and from 1b to 3. It could have such incentives to raise its cost in order to raise its profit.

3.1. Intra zone incentives

Proposition 3. *As long as the gas release constraint is binding, then the incumbent has no incentive to raise its cost.*

Proof. Relations (10) and (12) indicate that, within zone 1a and 1b, profits are decreasing function of the unitary cost of supply u. Indeed, the competitor sells αK_o and the incumbent can sell wether $(1-\alpha)K_o$ or $\frac{1}{2} - \frac{1}{2}\alpha K_o$ depending on the market constraint. That implies that an increase of u has no effect on the supply cost of the competitor or on the market price. The only effect is on the incumbent's supply costs. ∎

Concerning zone 2, (12) indicates that the profit function is concave and reaches its maximum for

$$u_2^* = 1 - \frac{3}{2}K_o. \tag{14}$$

Depending on the initial value of u, the incumbent will have incentive to let its cost increase or decrease in order to reach u_2^*.[8]

Within zone 3, the profit function is also concave (13) and reaches its maximum for

$$u_3^* = \frac{1}{2} - \frac{9}{10}K_o. \tag{15}$$

Having u_3^* positive implies $K_o < \frac{5}{9}$. Or, relation (5) implies that to be in zone 3, the quantity hold by the incumbent have to be such as $K_o > \frac{5}{7}$. These two conditions are incompatible which means that the incumbent's profit is a decreasing function of the supply cost u.

Proposition 4. *If the gas release constraint is not binding and if the market constraint is active, then the incumbent could have incentives to let its cost grow, depending on the initial values of this cost and of parameters α and K_o.*

Proof. Relation 12 indicates that within zone 2, the incumbent's profit is increasing function of u for $u < u_2^*$. Thus, if initial value of u is such that $u < u_2^*$, then an increase of u until u_2^* implies an increase of the incumbent's profit. This result is independant of elasticity but it is quite high if demand is elastic. ∎

An increase in u reduces the quantity sold by the competitor ($\widehat{q}_e$) and thus the quantity the latter buy from the incumbent. For the incumbent, this increase raises the quantity it can sell to the final customers. So, the increase in revenues generated by the rise of the sell on the final market overcomes the loss generated by the decrease of the quantity sold to the competitor and finally the increase in u leads to an increase of the incumbent's profit.

3.2. Inter zone incentives

By letting u grow, the incumbent could move from zone 1a to zone 2. The threshold value of u is given by (3). Let u_1 be this threshold value. Solving $\lambda_e(u) = 0$ gives us

$$u_1 = \frac{1}{2} - \frac{3}{2}\alpha K_o \tag{16}$$

.

[8] This values can be reach only if $\frac{1}{3} \leq K_o < \frac{2}{3}$.

If its unitary cost places the incumbent in zone 2, a rise of this cost could bring him in zone 3. The threshold value is given by (5). Let u_2 be this threshold value given by $\widehat{\mu}_o(u) = 0$. We obtain

$$u_2 = 2 - 3K_o \tag{17}$$

.

So, insofar as parameters K_o and α make it possible, the incumbent's profit can be written as follow,

$$\Pi_o(u) = \begin{cases} \Pi_o^{\kappa}(u) & \text{if} \quad 0 < u \leq u_1 \\ \widehat{\Pi}_o(u) & \text{if} \quad u_1 < u \leq u_2 \\ \Pi_o^{c}(u) & \text{if} \quad u_2 < u < \frac{1}{2} \end{cases} .$$

Starting from 1b, the incumbent could reach zone 3 by letting its cost grow. In this case the incumbent profit is $\Pi_o'(u) = \begin{cases} \Pi_o^{\kappa,m}(u) & \text{if} \quad 0 < u \leq u_1 \\ \Pi_o^{c}(u) & \text{if} \quad u_1 < u < \frac{1}{2} \end{cases}$. We can now determine how $\Pi_o(u)$ and $\Pi_o'(u)$ evolve with u in order to identify any incentive for the incumbent to let its cost increase.

Recalling relations (10) to (13), it appears that $\Pi_o^{\kappa}(u)$ is decreasing and $\widehat{\Pi}_o(u)$ is increasing for $0 < u < u_2^*$. So, depending on the initial value of u (let note this value u_0) there might be an incentive for the incumbent to move from zone 1a to zone 2.

To identify the values of K_o and α for which u_2^* exists, we must compare this value with u_1. In other words, couple (K_o, α) should be such as $u_2^* - u_1 > 0$.

If, starting from zone 1a, an incentive to increase cost exists, then there exist positive value $\delta > 0$ such as $\widehat{\Pi}_o(u_0 + \delta) - \Pi_o^{\kappa}(u_0) > 0$ where u_0 is the initial value such as $0 < u_0 \leq u_1$. The difference $\widehat{\Pi}_o(u_0 + \delta) - \Pi_o^{\kappa}(u_0)$ is a concave function in δ. It is positive for δ such as $\delta_1 < \delta < \delta_2$ where $\delta_1 = -\frac{3}{2}K_o + 1 - u_0 - \sqrt{\Phi}$, $\delta_2 = -\frac{3}{2}K_o + 1 - u_0 + \sqrt{\Phi}$ and $\Phi = -K_o\left(4(1 - K_o - u_0)(1 - \alpha) - K_o\right)$.

The values δ_1 and δ_2 and therefore the incentive to move from zone 1a to zone 2 exist if $\Phi > 0$. Φ is an increasing function of u_0. It is positive only if $u_0 > u_i$ where $u_i = \frac{1}{4}\frac{4(1-\alpha)(1-K_o)-K_o}{1-\alpha}$.

Finally, the couples (K_o, α) should verify three conditions in order to allow an incentive for the incumbent to let its cost grow (cf. figure 2, p.11): $\widehat{\Pi}_o(u)$ must have an increasing part, that is to say $u_2^* - u_1 > 0$ ((K_o, α) located on the left of the curve $u_2^* - u_1 = 0$); $u_1 - u_i > 0$ (above the curve $u_1 - u_i = 0$); $u_1 > 0 :$ $\lambda_e < 0$ for $u = 0$ (above the curve $u_1 = 0$) $:$ as the initial value of u have to be such as $\lambda_e > 0$, then the incentives to raise u in order to move from zone 1a to 2 can only be found for couples (K_o, α) located under the curve $u_1 = 0$.

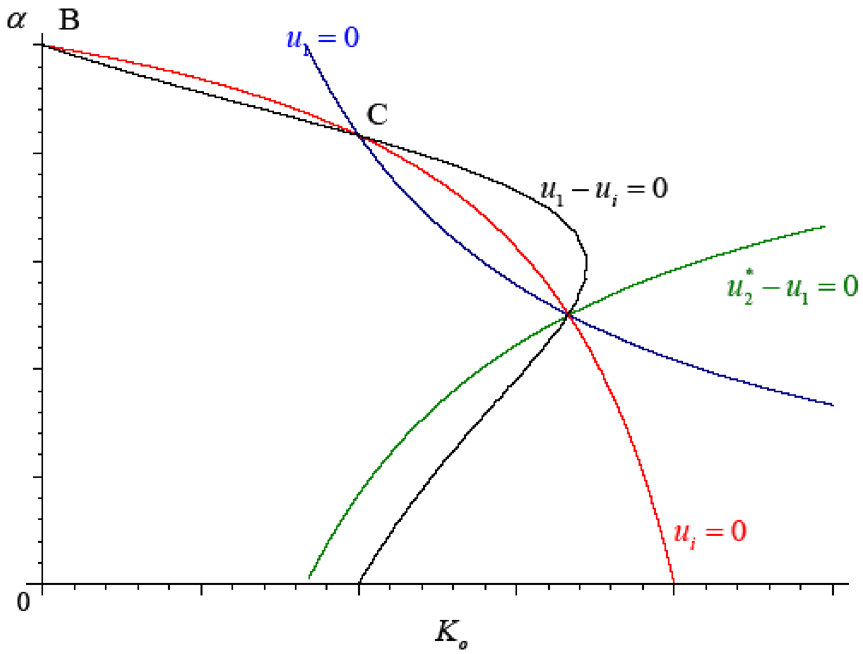

FIG. 2 Interzones incentives

Finally, the only region where incentives for the incumbent to let its own cost grow exist is between point B and C and above the curve $u_1 - u_i = 0$ on figure 2, i.e. for high values of α ($\frac{5}{6} \leq \alpha < 1$) and relatively low values of K_o ($0 < K_o \leq \frac{2}{5}$).

In addition to these three conditions, we can distinguish between cases where $u_i \leq 0$ and cases where $u_i > 0$. If $u_i \leq 0$ (couples (K_o, α) located above the curve $u_i = 0$ on figure 2), then whatever the initial value of the unitary cost is, there is an incentive for moving from zone 1a to zone 2. If $u_i > 0$ (couples (K_o, α) located under the curve $u_i = 0$ on figure 2), then the incentive to let the unitary cost grow will exist only for initial value of this cost such as $u_0 > u_i$. In other words, if the initial value of the unitary cost is relative low ($u_0 \leq u_i$), then the incumbent will prefer reducing its cost rather than letting them grow.

Proposition 5. *If the input capacity hold by the incumbent is quite limited and if the gas release proportion is high, then it could have an incentive to let its unitary supply cost grow in order to switch from a situation where the market constraint and the competitor constraint are binding towards a situation where only the market constraint is active.*

The figure 2 defines the values of the parameters such as, starting from zone 1a, higher profits in zone 2 can be obtained by an increase of unitary cost of supply (u).

There could not be other incentives of this kind because from zone 2 to zone 3 (figure 1, p. 6), or from zone 1b to zone 3, profits are continuous and decreasing in u.

Proposition 6. *For small values of α, the incumbent has always incentives to be efficient, regardless of the elasticity of demand.*

Proof. For small values of α, there are no inter or intra incentives. For a linear demand, elasticity is small for high values of q (in our model, for high values of K_o). There are no incentives for smaller values of α regardless of K_o values. ∎

4. CONCLUSIONS

In order to identify the incentives that an incumbent in gas industry could receive if it is submitted to a gas release program, we propose a model where an incumbent has to be the supplier of its competitor at a regulated price. We show that four kinds of equilibriums can be obtained depending on the fixed capacity of input hold by the incumbent and the share of this capacity that it has to offer to its competitor. This share of capacity is exogenously defined by the regulator and the price set to the unitary cost. In a second step, we show that, in most of the cases, the incumbent's profit is a decreasing function of its unitary cost of supply. But there are some cases (low capacity and high share of released input) where it could have an incentive to let its cost grow in order to raise its cost. In these cases the strategic effect of raising the cost overcomes the direct effect of reducing profits.

This model fits to the worries raised by European gas release programs. As incumbents in European gas industries are linked to extra European producers by long term contracts, their supplies can be considered as fixed and they can only have a leverage on the cost by renegotiation rather than on the capacity. In most of the cases in Europe, long term contracts correspond to end-users demand and the share of gas that had to be released by the incumbents vary from 3% to 5%. So there is a very limited risk to that these release programs had lead to an incentive similar to the one we discover.

As regulators are supposed to look for the maximum welfare, one extension of our paper could the identification of the optimal share of input that an incumbent has to offer to its competitor.

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