Pricing behaviour at capacity constrained facilities

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Abstract

Entry of new firms can be difficult or even impossible at capacity constrained facilities, despite the actual cost of entering is low. Using a game theoretic model of incumbent firms' pricing behaviour under these conditions, it is found that under the assumption of Bertrand competition and firms having different costs, the optimal pricing behaviour imply price stickiness and upward pricing. The findings further suggest a competitive behaviour of incumbents of disposing weaker opponents only if, it leads to weaker competitors entering the market and to use weaker opponents to shelter the incumbent. The results propose a new explanation of the mixed empirical findings on incumbent pricing to entry and suggest that competition authorities should use an effect-based approach to detect the behaviour.

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1.0 Introduction

In most models of industrial organisation entry of firms is assumed to be easy, costless and no physical limit is placed on the number of firms that a market can accommodate. If there is a "limit" it is due to the level of market demand or due to initial assumptions about market structure. In some markets it is not first and foremost market demand that determines the number of firms the market can accommodate, but the physical size of the facility or marketplace that matters. For example the number of airlines able at a given time to operate at an airport is determined by the airport's physical size, as well as its ability to provide efficient and adequate support for the airlines at the airport. Another example is the numbers of competing products that a store has shelve space for, the physical size of the store determines the shelve space and the number of competing products; the number of competing parking lots a city has room for, is restrained by the city's physical boundaries; the number of stores in a shopping mall by the size of the shopping mall; a shipping port's ability to accommodate all ship sizes or types; etc.

When a market's capacity to accommodate firms is linked to its physical size, the market is comparable to a town's marketplace. A marketplace has only room for a limited number of vendors of a particular type and size, and there is a trade-off between the number of vendor types and the size of vendors. Further, the number of products a vendor is able to supply is linked to the size of the stall the vendor is able to have. Thus, the total number of vendors and the number of products is linked to the physical size of the marketplace, as well as the level of competition and the vendors' relative competitive strength.

Whether or not market structure is determined by demand or physical restraints, new entrants usually increase competition, leading to lower prices forcing incumbents to cut prices, reducing profits and forcing incumbents to become more efficient and innovative. As such entry of firms has important effects on incumbent firms' pricing and on consumer welfare. As a result incumbents have strong incentives to deter entry. Incumbent firms may employ different strategies to deter entry and quite a number of theoretical models have been made to explain the strategies of incumbents, and under which conditions they employ them. Alongside with the theoretical contributions, a large number of empirical studies have been made to test the theoretical models, but the empirical studies make various predictions on incumbent pricing behaviour and are much less conclusive than the theoretical research (Smiley, 1988, Geroski, 1995, Simon, 2005).

Generally, empirical studies on incumbent's responses to entry, find that entry can reduce, has no effect, or even increases incumbent's prices, even within the same industry (Frank and Salkever, 1997; Yamawacki, 2002).

The mixed results is not only a challenge for theoretical and empirical research, it also provide no guidance for policy makers, turning to more or less alternative policies to increase entry or to increase the level of competition among the existing firms, for example freed or new space at congested airports in Europe is allocated primarily to new entrant airlines.

I propose a new explanation to the mixed empirical findings. I propose that incumbent pricing behaviour should be seen from the point of view of locational space as a physical restraint on entry. In this setting, incumbent pricing behaviour should be understood by considering firm specific variables, as well as incumbent incentives of competing locally, relative to that of potential entry.

A literature review of some of the many theoretical and empirical contributions on pricing behaviour of incumbents, when faced with entry are presented in section 2.0. In section 3.0 a game theoretic model is developed and then used to analyse optimal pricing strategies under asymmetric information, in a game with incomplete information and observable actions. The solution concept of the game is a behavioural rule, stating how to play the game. The findings implies a competitive behaviour of incumbents of disposing weaker opponents only if, it leads to weaker competitors entering the market. Further, to avoid stronger opponents, weaker opponents are used by the incumbent to shelter the market. Thus, the results can explain the somewhat mixed empirical findings, by claiming that they are a result of differences in incumbent incentives to compete at the facilities. The findings of the model are then compared to how the European Union's (EU) competition authority investigate predatory pricing to determine whether the suggested pricing behaviour is anti-competitive and if the behaviour can be detected given the present tools of investigation; in section 4.0. Finally in section 5.0 policy suggestions is made.

2.0 Literature review

A great deal of research has been made on entry and incumbent behaviour and in general, the theoretical contributions can be divided into two kinds of models: limit pricing and predation. Limit pricing models, emphasize that entry can be deterred pre-entry and predation models, that deterrence can also happen post-entry.

Limit pricing models, such as Bain (1956), Modigliani (1958) and Sylos-Labini (1962), explain how an incumbent firm by setting its pre-entry price low enough can make entry look unprofitable

or even impossible. As incumbents in this way foregoes pre-entry profit by deterring entry by pricing below marginal cost, the strategy is only credible, if the incumbents has deep-pockets or can reasonably expect to have deterred entry in the long run (Geroski, 1995). A different case of "deep-pockets" is that of incumbents with multi-market contact that is a firm producing in two or more markets, where it at least in a subset or subsets of markets is dominant. The dominance can then be used to support predatory or entry-deterring strategies in one or more of the other markets and in this way is credible for new entry (Bernheim and Whinston, 1990). But as far as limit pricing strategies is considered, Simon (2005) notes that there is little empirical evidence to support limit pricing strategies.

Game-theoretic models show that rational potential entrants does not have to take low pre-entry seriously, as they are not a good prediction of post-entry profitability and thus incumbents would just spend too much effort on deterrence through prices, with little effect on entry (Milgrom and Roberts, 1982).

A number of other strategies and conditions may also be entry deterring, such as incumbents investing in excess capacity (Spence, 1977, Dixit, 1980). Empirical studies like Smiley (1988) do not find support for investment in excess capacity as deterring entry.

Empirical research is much less conclusive than theoretical research when it comes to entry and incumbent pricing (Geroski, 1995), in fact empirical studies seem to point in all directions with regard to the pricing behaviour of incumbents, both in relation to potential, as well as real entry and with regard to pre- as well as post-entry pricing behaviour.

In addition to the theories of entry deterrence, Baumol et al's (1988) theory of contestable markets emphasize that both actual, as well as potential entry will affect the pricing behaviour of incumbent firms. The theory has been examined in relation to air transport, but has not found much support for the point of view, that air transport markets should be contestable.

Turning to the studies of specific markets, then the existing body of empirical studies on incumbent airline's pricing behaviour when entry, generally find mixed results with regard to the effect on incumbents' pricing. Some studies find that incumbents cut prices post entry (Joskow, et al, 1994 and Windle and Desner, 1995), while others find that incumbents accommodate entry by leaving prices unchanged or even raise prices (Borenstein, 1989 and 1990).

In the light of Klemperer (1987) and Perloff and Salop (1985) the mixed empirical results can be understood by seeing markets, as characterised by heterogeneous goods targeted different market segments, such as business and non-business customers or as a brand-loyal and a price-sensitive

segment. Entry in such markets can have two effects on the incumbents' pricing strategy: a competitive effect and a displacement effect.

The competitive effect is when, as a response to entry, the incumbent decrease prices in order to keep customers. The displacement effect occur as a result of the loss of price sensitive customers to an entrant focussed on price competition, leaving an incumbent, focussed on providing brand quality, to concentrate even more on the brand-loyal segment, as the segment will continue to purchase from the incumbent, even if the price of the entrant is lower, see Rosenthal (1980) and Hollander (1987). If the competitive and displacement effects can occur simultaneously, the net effect on prices depends on which effect is more prominent. Which is to ask to what extent is the incumbent able to build a profitable business on the brand-loyal segment alone? Since brand loyalty for a large part is created by for example marketing efforts, the profitability depends on the airline's ability to keep customers loyal.

In Klemperer (1987), Cairns and Galbraith (1990) and Larsen and Storm (2001) the issue to what extent frequent flyer programmes (FFP), or for that matter any other artificially created brand loyalty, is able to lock in markets is examined. It is found that it crucially depend on the customer's subjective valuation of the benefits of being loyal, in relation to the firm's cost of providing the customer the benefits. As long as the customer's valuation is higher than the cost of providing the benefits, programme owners will be able to price above the price of a low cost airline without a FFP. All airlines engaged in loyalty inducing business strategies tend to offset the competitive effects, as minor changes in a firm's business strategy are enough to mitigate any economies of scope effects, such as brand loyalty. This is in line with the view of competition in monopolistic markets with heterogeneous goods. In the short run it is possible to earn rents, but impossible in the long run, as the prospect of rents attract new firms targeting their products for previously untargeted or existing segments. Thus, although different market segments can be identified, the effect of non-price competition on observed price changes may not be significant.

Simon (2005), using an empirical model of magazine markets, finds that incumbents vary in their incentives to cut prices; in that incumbents with greater incentives are more likely to respond aggressively to entry. It is then concluded, that incumbents' pricing strategies in general depend on their incentives to compete.

This paper is in line with the study by Simon, but in addition it is proposed that the mixed results should be understood, as the incumbent taking the physical restraint on the number of firms in a market or a facility into account, when making its pricing decisions.

3.0 A Game Theoretic Approach to Pricing Behaviour at Capacity Constrained Facilities

Imagine two markets: a market with constrained or limited access, called the local market, and a surrounding market, called a global market. The global market consists of firms ready to enter the local market, as soon as space becomes available and that there is no significant sunk costs, entry or exit barriers. Space becomes available only if an existing firm exits the local market. The global market could be perceived, as having many subsets of local markets or simply as a pool of potential entrants to the local market.

Assume that incumbent firms are not able to capture the entire market for different reasons. It could be that the freed space at the local market is reserved or is easier to access for new entrants at the local market. This would for example be the case, if the incumbent airline is dominant at an airport and is thus subject to competition authority scrutiny and objections, if it attempts to occupy the freed space and thus increase its dominance locally. It could also be problems relating to coordination problems between existing and new capacity.

Firms in the two markets produce similar products, but markets are assumed to be separate, as the product cannot be imported or exported to the local or the global market when produced in either place. An example of such a product would be airline point to point routes, such as Berlin – Paris and Hamburg – Paris, although both are air travel to the same end-destination and in that sense homogenous, the trips cannot be produced in one place, exported and consumed at another. Alternatively it could be, that consumer transaction costs effectively separate markets. In both circumstances only local market consumers will benefit from the production of the service at the local or global market.

Although it is not a necessary condition, it is assumed that the number of local market firms is two and that the number of global market firms is limited, but sufficiently high to ensure a wide variety of firm cost types, that would enter the local market.

Demand conditions at the local market are characterised by n consumers, where $n \in R$. For ease of assessment, consumers are assumed to buy one unit at the offered price, and from the airline offering the lowest price. In the case where firms offer the same price, there is an equal probability of consumers choosing to consume at any of the local market firms.

The global firm bound to enter the local market, is picked randomly and independently (by nature) from the pool of global market firms, to illustrate that the decision to enter a market is private information to the firm. This implies that local market firms do not know exactly, what firm type

will enter the local market. What they do know is the probability distribution of potential entrants, or in other words, the composition of cost types of the global market pool of firms. As a consequence of this, payoffs to local market firms will depend on the random move and the actions of entrant firms, as well as the actions of other local market firms. The available information to the firms is assumed to be market dependent, in the sense that local market firms have information about local market specific information and information about global market firms, whereas global market firms have global market specific information only. This could be interpreted as local firms having a first mover advantage, such as superior knowledge about the local market demand conditions.

Local market firms have full information about local firm costs, but do not have information about the global market firm's cost other than the distribution of cost types. This is to reflect that existing firms do not know if entry is new firms or existing firms entering the market. It also means that local firms assign no other probability on entrants, other than that given by the distribution of cost types. The true cost type of a global firm is revealed to the local market firm, when the global firm enters the local market and the local market firm's cost is revealed to the global firm, when it enters the local market. Thus, entry implies complete information about local market firm costs, prior to firms simultaneously choosing prices. This also implies that there is asymmetric information between local and global market firms. The game is also characterised by incomplete information, since firms do not have complete information about the realization of the entrant firm's costs.

Used either as subscripts or stand-alone letters: i and j refer to firms of the initial game, e to entrant firms, g to global market firms, L to the local market, and G to the global market. Subscript g and l refer to global or local market specific occurrences and t to game period. The number of firms (N) is defined, as $N_L, N_G \subset N \in R$ and $N_L \times N_G = N$, where $N_L = \{i, j\}_t$, if prices are $p_i = p_j$ at $t = 0$, or $N_L = \{i, j\}_{t=0}$ and $N_L = \{i, e\}_t$, whenever firms undercut, that is at any period after information about the firms is revealed to the local market firms, that is at $t > 0$.

In any sub-game the number of firms is assumed to be the maximum numbers of firms in the local market, which are assumed to be limited to two. The set of available actions are denoted a, and defined as $a \in A$, where $A_L, A_G \subset A$ and $A_L \notin A_G$. Further, $A_L = \left\{ \begin{matrix} > \\ p_i = p_{j,e} \\ < \end{matrix} \right\}$ and $A_G = \{entry, no\ entry\}$, where $a \in A_G$ is chosen by nature.

Payoffs in the model are denoted π and firms are assumed to maximize profit. To make the global market a homogeneous or generic market, it is assumed that global market firms earn zero profit in every period they stay in the global market.

The costs of the local market firms, entrant firms and global market firms are defined respectively as $c_i, c_j, c_e, c_g \in C$, where $C = [\underline{c_g}, \overline{c_g}]$. That is, the marginal cost of the firms in the local market is at least as high, as the lowest marginal cost among the global market firms. It is assumed that $c_i < c_j$, to illustrate that only real cost advantages can force firms to exit markets, and that $c_i = c_e$. The distribution function of C is F(C) and assuming that C is continuous over the interval $C = [\underline{c_g}, \overline{c_g}]$, the probability function $P(c_e)$ can be written, as $F(x) = P(c_e \le x) = \int_{\underline{c_e}}^{x} P(c_e \le x)dx$, where $P(c_e)$ is the derivative of the distribution function.

In this setting, price competition in one period will also affect proceeding periods, in that if a high cost local market firm is forced to exit, it may be replaced by a more competitive opponent. This entrant firm may in turn decide to force the incumbent firm to exit, that is if $c_e \le c_i$. This imply that space is not only a scarce asset to firms, but also a factor to take account of, when determining their optimal price.

Proposition: Whenever space becomes available entry occurs.

Proof: If space becomes available, it must imply that one of the local market firms has forced the other to exit. Given its information, a global market firm will assess, whether it is better to stay or leave the global market. The payoff to global market firms of non-entry is assumed to be $(\pi_g)_t = 0 \forall t \ge 0$, that is to be zero as long as they stay in the global market. The payoff to global market firms of entry depend on the action chosen by the remaining local market firm, to that of the entrant firm, that is whether the price is $p_i \gtrless p_e$. The best response of the incumbent and the entrant firm, depends on how the entrant firm's costs compares to the local market firm's that is whether

$c_e = c_i$. Under these assumptions we can write the global market firms' profit as, $E\Pi_G = \sum_{0}^{t'} (\pi_g = 0)_t + \sum_{t'}^{n} (E\pi_e)_t,\ \forall c_e \in C \text{ and } \forall c_i \in C$ for all actions $p_i = p_e \Rightarrow E\Pi_G \geq 0$. The number of periods without entry is t' and $(n - t') \geq 1$ is the number of periods with successful entry.

As $c \in C$ where $C = \left[\underline{c}_g, \overline{c}_g \right]$, the global firm can expect that its costs is less than the incumbent firm with probability $P(c_e) \geq 0$, and greater than the incumbent's cost with a probability of $\left(1 - P(c_e)\right)$. The expected payoff of a global firm from entry can then be written as, $E\pi_e = P\left(c_e\right)\pi\left(c_e < c_i\right) + \left(1 - P\left(c_e\right)\right)\pi\left(c_e \geq c_i\right) = P\left(c_e\right)\pi\left(c_e < c_i\right) \geq 0$ implying that $E\pi_e \geq \pi_G$. Thus, entry of a global market firm will occur, whenever space become available, as the incentives of doing so are greater than staying at the global market.

Denote the set of possible outcomes of entry Ω, and allow $c_e \in \Omega \Rightarrow \Omega \subset C$. Assume that entrant firms are drawn independently from Ω and that the probability of entry of a firm with costs c_e is $\rho(c_e)$. Further, assume that local market firms have the same conjecture about $\rho(c_e)$.

The initial information of the local market firms about global market firms are Ω, the composition of the global pool is $C = [\underline{c_g}, \overline{c_g}]$ where $c_i, c_j, c_e, c_g \in C$ and the probability distribution of the possible outcomes of the random move is $\rho \in \Delta(\Omega)$.

Impose the following rules of the game: that entry occurs in the period just after exit has occurred in the local market, but prior to the proceeding sub-game; that at the moment of entry, entrant cost is revealed to the local market firm and the local market firm cost is revealed to the entrant; that every sub-game is characterised by Bertrand competition with simultaneous price setting; that firms prefer to earn zero profits and produce, than not producing at all; that firms are assumed to be risk neutral; and that exit of a firm occurs whenever its individual period profit is negative, that is if $\left(\pi_i, \pi_{j,e}\right)_t < 0 \forall t$.

To play the game, all firms plan in advance what kind of strategy they will use for every piece of information revealed and for every possible action. For local firms in particular, they will use the revealed information by the random move to update their beliefs using Bayes' rule about the composition of global market firms and the possible entrant firm's costs. Under these assumptions

payoffs will not only depend on the random move, but also on the actions chosen by the firms, that is $\pi : \Omega \times A \to R$. This means that not only the history of actions, but also the outcome of the chance movement will determine the payoff of the sub-game and the expected pay-off of the entire history of sub-games of the game.

The game described so far constitutes a game with asymmetric information and incomplete information with observable actions, see Harsanyi (1967-68) and Osborne and Rubinstein (1998). The equilibrium of the game is a Bayesian equilibrium (BE) and constitute a behavioural rule specifying how the firm will play the game for all possible combinations of the revealed information, that is for all possible outcomes of the random move. The Bayesian equilibrium of the game is then a vector $\beta = (\beta_1, \beta_2, ..., \beta_n)$ s.t. $\forall i$, $\forall \theta_i$ and $\forall s_i$, for which $\pi_i^{\beta}(\beta_i(\theta_i), \theta_i) \geq \pi_i^{\beta}(s_i, \theta_i)$, where θ_i is beliefs of firm i, s is the strategy and β the behavioural rule $\beta_i(\theta) \in s$. The BE of the game is: for all firms, whatever they know, there are no profitable deviations from the behavioural rule that is to the way to play the game. To find a proper candidate for the solution to the game, consider the standard Bertrand competition game of one period, and the assumption about the local and global market firms' cost. In games of Bertrand competition with two players, i and j, the dominant strategies are respectively $p_i \leq p_j$ and $\mathrm{p_j} \leq \mathrm{p_i}$ for $c_i = c_j$. If on the other hand $c_i < c_j$, the dominant strategy for the respective firms is $p_i < p_j$, which imply exit of the inefficient firm. If we introduce the possibility of entry, the firms have to take account of entrant firms' costs as well, when determining optimal strategies.

This suggests that the composition of the global pool of cost types is important, as it will affect the formation of strategies of the local market firms. To simplify the analysis, assume that the pool of global market firms is reduced by the number of firms entering the local market, and that exiting local market firms do not re-enter the global pool. When this is the case, then if a local firm decide to undercut its competitor, entry will occur and the global pool will become smaller. One consequence of this is that, if undercutting is not attractive, the game reduces to the infinitely repeated Bertrand game.

We can ignore firm j and focus on the strategic choices of firm i, since if $c_j > c_i$ then $BR_j(p_i) = p_j = c_j \ \forall p_i$. Consider the case where the beliefs for the period just after the initial period of the game, is that the entrant's costs are higher than the cost of the present competitor to firm i in the local market, that is $\hat{\theta}_i = \left(\theta_i((c_e)_{t+1} > (c_{j,e})_t\right)_t > \left(\theta_i((c_e)_{t+1} \le (c_{j,e})_t)\right)_t = \theta_i' \Rightarrow Ec_e > (c_{j,e})_t$. In this case the best response of firm i is to undercut, or $BR_i = p_i < (c_{j,e})_t$, since $E\pi_i(p_i < (c_{j,e})_t) > \pi_i(p_i = (c_{j,e})_t)$. The result is then, that the inefficient firm at the local market exit and is replaced by a firm from the global market.

Now consider what happens if the realised entrant cost is $c_i < \overline{c}_e = (c_e)_{t+1} < (c_{j,e})_t$, then $\pi_i(p_i = \overline{c_e}) < \pi_i(p_i = (c_{j,e})_t)$ and $\pi_i(p_i = \overline{c}_e) > \pi_i(p_i = (Ec_e)_{t+1})$. Thus, local market firms will update their beliefs about global firms, since $\overline{c}_e < (Ec_e)_{t+1}$ or that $\hat{\theta}_i > \theta_i'$ is not what was expected. Thus, drawing a firm from the global market pool, with lower than expected costs from the global pool, imply an increase in the probability, that the next entrant will have high costs.

In the proceeding period firm i will still have the choice of undercutting to find a better price or refrain to do so and stay at the lower price. If firm i continue the search for a high cost opponent, firm i would expect a higher payoff in the proceeding period to make up for any incurred period loss or series of losses. If the firm should for some reason choose not to undercut, then it would incur a unit loss in every proceeding period, consisting of the difference in costs of the weak opponents and a single shot benefit from undercutting in total of $\Delta_L = (c_{j,e})_t - (c_{j,e})_{t+1} + \frac{2(c_{j,e})_t}{n-t} > 0$. Thus, the firm would expect entrant costs of at least $(c_{j,e})_t + \Delta_L$ before choosing to undercut again. This means that a local market firm will only undercut, if it provide increasing incentives.

On the other hand, if $(Ec_e)_{t+1} < (c_e)_{t+1}$ that is if $(\overline{c}_e)_{t+2} > (Ec_e)_{t+1}$, firms' will update their beliefs such that $\theta_i(c_e)_{t+1} > \theta_i(c_e)_{t+2}$. Thus, drawing a higher than expected cost type from the global pool, implies reducing expectations about entrant's cost in proceeding periods. As the global pool is finite, undercutting cannot be a continuous activity of the local firm, as undercutting will stop when $\sum_{t'}^{n} \pi_i(p_i = p_{j,e})_t \ge \sum_{t'}^{n} E\pi_i(p_i < p_{j,e})_t$ or if $\overline{c_e} < c_i$. Thus, the investigation of the formation of beliefs and best responses so far suggest the following solution to the game.

Proposition: Given the assumptions and conditions of the game, then for the game to have a BE, then at each sub-game the firms:

a) Update beliefs using Bayes' rule whenever possible.

b) Choose not to undercut, that is to play $p_i = p_{j,e} = c_{j,e}$ whenever $\sum_{t'}^{n} \pi(p_i = p_{j,e})_t \geq \sum_{t'}^{n} E\pi(p_i < p_{j,e})_t$. This is so when $c_i = (c_{j,e})_{t'} \geq (Ec_e)_{t'+1}$.

c) In every sub-game choose to undercut, that is to play $p_i < p_{j,e} = c_{j,e}$ whenever $\sum_{t'}^{n} \pi(p_i = p_{j,e})_t < \sum_{t'}^{n} E\pi(p_i < p_{j,e})_t$ .This is so when $c_i < (c_{j,e})_{t'} < (Ec_e)_{t'+1}, c_i < c_j$ and $c_i < c_e$.

Where t' indicate the sub-game proceeding entry and revelation of firm specific cost to local market firms or in the case of the initial sub-game, the revelation of the cost of firm i and j to both the firms. The consequence of the rule for firm j is that, following the assumption about costs, that is $c_i < c_j$, risk neutrality and the condition for game participation that $\pi \geq 0$ or otherwise exit, the best response of firm j is $p_j = c_j \forall \theta_j(c_e)$. This will also apply for entrants that have entered the local market for which $c_e \geq c_i$, but if $c_e < c_i$, entrants become the "new" incumbents, and follow the behavioural rule specified above.

Proof: Ad. a) If the firm does not update its information, its beliefs about entrant firms' costs will be wrong. The consequence will be that the firm is no longer having consistent beliefs and that the probability of being right about entrant firm's costs is independent on the revealed information. Thus, using Bayes' rule to update beliefs ensures that expected beliefs are consistent with the revealed information, and that the firm is able to correctly assess the game.

Ad. b) Assume that, $(p_i)_{t'} = (c_{j,e})_{t'} < (Ec_e)_{t'+1}, c_i < (Ec_e)_{t'+1}$ and firm i do not choose to undercut, in that case the profit of the firm i is $\sum_{t'}^{n} \pi_i(p_i = p_{j,e} = c_{j,e})_t < \pi_i(p_i < c_{j,e}) + \sum_{t'+1}^{n} E\pi_i(p_i = Ec_e)_t$. Thus, firm i would be able to increase its payoff by undercutting, as long as $c_{j,e} < Ec_e$ at time t'.

Ad. c) The proof follows from ad. b).

The intuition behind the BE should be straight forward. Based on firms' beliefs about just how efficient global market firms might be, firms evaluate their strategic position relative to each other and in comparison to what they might get from undercutting and not undercutting. Thus, from the

perspective of the firm, whenever entrant's expected costs are lower than or equal to the present competitor's cost, the firm's present competitive position provide greater benefits in the long run, than you can achieve by competing with your present competitor in the local market and from global market entry. Thus, the pricing behaviour implies price stickiness and upward pricing, as well as competition only taking place, if the right incentives are there.

Notice that an increase in local market firms with many different cost types would not change the BE, as the dominant strategy of the most efficient local market firm would be to set prices equal to the lowest possible cost type, that is $p \leq c^{\min}$. Thus, adding more local firms to the game would not change the fundamental strategies of the game and thus, the way to play the game.

The next section examines the possible consequence of the behavioural rule for EU competition policy.

4.0 The Behavioural Rule and EU Competition Policy and Regulatory Approaches

In those circumstances where the most efficient incumbent is also dominant, the pricing behaviour of the incumbent is subject to competition authority (CA) scrutiny. The question is, if CAs would classify such behaviour as anti-competitive, or is able to detect it by using the tools CAs normally apply in competition law cases, from the point of view of a European competition authority. These issues will in turn be examined in this section.

The EU competition rules of article 102 in the EU Treaty of Lisbon protect small firms from abusive market behaviour of dominant firms. Dominance is a market share greater than 40 pct. or below 40 pct., if market shares of competitors are comparatively lower. Abusive market behaviour can be many things. Among those that are most similar to the pricing behaviour found in the previous section is predatory pricing. Predatory pricing is defined *"..as the practice where a dominant company lowers its price and thereby deliberately incurs losses or foregoes profits in the short run so as to enable it to eliminate or discipline one or more rivals or to prevent entry by one or more potential rivals thereby hindering the maintenance of competition still existing in the market or the growth of that competition*, Commission (2005)." The pricing behaviour found in the previous section fulfils this definition, as it presumes that an efficient incumbent will only compete with a less efficient firm, if it provides a higher profit than otherwise. This imply that the pricing behaviour in effect prevent entry and the growth of competition.

In assessing whether or not a dominant firm has used predatory pricing, competition authorities (CA) will assess whether the dominant firm has priced below its own costs, by using the so called

form-based approach, see Commission (2005). The form-based approach implies, that cost benchmarks are calculated, such as the "average avoidable cost (AAC)," which is the average cost that the firm could have avoided by not producing the extra amount, as a consequence of the alleged abusive behaviour, and the "long run average incremental cost (LRAIC)," which is the average of the variable and fixed cost of the firm by producing the particular product. If the firm produces only one product, LRAIC is the average total cost (ATC), while LRAIC is below the ATC for firms producing more than one product. When using a form-based approach, CAs do not take effects of the anti-competitive behaviour into consideration, but assume that the observed behaviour have had market and anti-competitive effects, (AKZO, 1991; Commission, 2005). Effects of the anti-competitive behaviour could be, would be to assess if the behaviour have had any damaging effects on competition.

Pricing below AAC is interpreted by CAs as an indication that a firm, at least as efficient as the firm with the alleged abusive behaviour, would not be able to compete with this firm without incurring a loss. Pricing below LRAIC indicates that an at least as efficient firm is shielded from the market.

The pricing behaviour of the previous section would fall short of any CA analysis, since the behavioural rule imply, that incumbents would price $p_i > AAC > LRAIC$, but the anticompetitive behaviour lies not in the most efficient firm undercutting the least efficient firm in the local market, but in the effect of undercutting on market efficiency that is on social welfare. In other words, the incumbent have allowed a less efficient competitor to enter the local market by eliminating a more efficient competitor.

For competition authorities to be able to discover that the pricing behaviour is predatory, CAs would have to assess the effects on pricing of the incumbent dominant firm and make an assessment of the efficiency of potential entry, to that of the incumbent or the existing firm. In addition, CAs would also have to assess, whether or not entry is likely to occur. This suggests, that CA's should determine whether the behaviour does have an effect, and thus use an effect-based approach, rather than a form-based approach to verify competitive harm in all cases, where market access is constrained.

5.0. Conclusion and Policy Suggestions

As shown incumbent pricing behaviour can be seen from the point of view of locational space being a physical restraint on entry, in this setting, pricing behaviour should be understood by considering

firm specific variables, as well as incumbent incentives of competing locally relative to that of potential entry.

The resulting pricing behaviour suggest, that market power could be exercised much more subtle, than through direct aggressive competitive practices and beyond what the use of any bright-line test by competition authorities can detect, such as assessing whether P<AAC or P<LRAIC. As the pricing behaviour found in this article depends on the assumptions of restrained access to a facility, initiatives designed to increase capacity will have real welfare improving consequences. Other relevant initiatives should be aimed at increasing social welfare, by finding ways to limit the possibility of exercising the behaviour. This could for example be done by using auctions and public tenders, as a screening mechanism for allocating competition to capacity constrained facilities.

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