

COMPETTIVE AND PREDATORY MULTI-PLANT LOCATION DECISIONS*

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ABSTRACT

The decision of one of two competitors on a line to open a new plant is analysed. Three levels of interdependence -or independence- between the already existing firm and the new plant are studied: *complete independence*, *joint decision making with respect to the location of the new plant only* and *joint decision making with respect to both pricing and location of the second plant*. The latter is shown to make the already existing firm not to open the new plant. On the contrary, if the intention of the already existing firm is to drive its rival out of the market, monopolising thereafter the line, the new plant is located on the same point on which the multiplant firm's rival is located.

KEY WORDS: Predatory location, product choice.

RESUMEN

Se analiza la decisión de uno de los dos competidores en una línea de abrir una nueva planta estudiando tres niveles de interdependencia -o independencia- entre la empresa ya existente y la nueva planta: *completa independencia*, *toma de decisión conjunta únicamente respecto a la ubicación de la nueva planta* y *toma de decisión conjunta respecto tanto de la fijación de precios como de la ubicación de la segunda planta*. En este último caso la empresa ya existente decide no abrir una nueva planta. Por el contrario, si la intención de la empresa ya existente es expulsar a su rival del mercado, monopolizando después la línea, la nueva planta se ubica en el mismo punto en que se encontraba el rival de la empresa multiplanta.

PALABRAS CLAVE: Ubicación agresiva, elección de producto.

I Introduction

Competition authorities often consider price data as the easiest to have access to and therefore, the most useful when assessing firms' behaviour in terms of competition policy. In the special case of firms with more than one activity, product or plant, the decision concerning the location of a new plant, or the choice of the characteristics of a new product may be a decisive measure of predatory behaviour. We argue here that a multiproduct firm may price its products in a pro-competitive way, while with its product choice or location decisions may aim at eliminating its competitors. Nevertheless, Competition Authorities in Europe still insist on looking at prices and price-cost margins as the main measure of market performance.

We consider the recent example of the Tetra Pak case. The Tetra Pak group makes cartons for packing both fresh - or *non-aseptic* - and *aseptic* liquids. Tetra Pak is the only producer of aseptics, and it has a main competitor, Elopak, in the non-aseptic sector. While the non-aseptic products of Tetra Pak are similar to the ones produced by its rival, the aseptic sector is highly differentiated from the non-aseptic one. It is important to note that, in the Tetra Pak case, the EC Commission ([1988] and [1991]) systematically avoided any consideration of Tetra Pak's decisions concerning the characteristics of its products and the similarity between the two firms' products in the non-aseptic sector. At the same time, Tetra Pak is a monopolist in the aseptic sector in most European countries. It is argued that there might be signs of anti-competitive behaviour of the firm in the fact that its aseptic products' characteristics exhibit maximum differentiation with respect to those of non-aseptic products, while in the non-aseptic sector the firm's products are almost identical to those produced by other firms.

We present a location model and show how predation in the long run may be performed by multiproduct firms by predatory location (or product choice in the sense of positioning along the product's characteristics line)¹. The assumption of quadratic transportation

¹A firm i is intended to show a predatory behaviour when it maximises its own profit subject to the fact that the profits of all its rivals is negative.

costs yields the standard result of maximum differentiation, enabling us to model a situation in which aseptic and non-aseptic packaging correspond to the extremes of the line of product differentiation.

Location decisions are regarded in a more general context, in which the distance between firms' locations along a line may also be used to model product differentiation².

Using the equilibrium concept of subgame perfection we study the *second location decision* as the first stage decision of a game whose second stage involves price-setting decisions.

We study a number of scenarios concerning the relation between the first firm and the new plant:

First, we assume that the new plant acts independently with respect to both price and location choice. Second, we study the case in which the first firm decides on location, but the new plant acts independently thereafter. Third, we assume that the new plant makes both stages' decisions jointly with the first firm³.

Finally, we study a simple two-period extension of the game. In the second period, firms decide on prices, taking their locations of the first period's first stage as given. The fact that all consumers buy one unit of the product implies that if there is only one firm on the line, its optimal price and profits are infinite. Therefore, the first period behaviour of the first firm will change. More specifically, assuming that the second firm will exit the market in the second period if its first-period profits are zero, the first firm's first-period objective becomes to maximise profits subject to the constraint that its rival's profits are zero. Similar assumptions can be found in the literature on limit-pricing⁴.

²For the use of location models as models of product choice, see Horstmann and Slivinski [1985].

³The assumptions concerning the interdependence between the first firm and the new plant should be interpreted taking into account that location decisions are irreversible and influence the behaviour of the firms in the long run, while pricing decisions are made taking into account the irreversibility of location decisions. See Embid-Irujo (1987).

⁴For a recent contribution to the limit pricing literature with special emphasis on strategic relations of the Bulow *et al.* [1985] type, see Martin [1994].

II The Model

Consumers are uniformly distributed along the line OI of length L . The first firm is located on point O and the second firm on I ⁵. The first firm can now open a new plant, whose location M on the line OI at distance m from O is going to be chosen in the first stage of a two stage game⁶. In the second stage, prices net of production costs (which are assumed to be constant) are P_O, P_M, P_I .

A consumer at a point X on the OM part of the line, at distance x from O , will be indifferent between the first firm and the new plant if

$$P_O + tx^2 = P_M + t(m - x)^2 \quad (1)$$

and a consumer at Y on the MI part of the line at a distance y from M will be indifferent between the new plant and the second firm if

$$P_M + ty^2 = P_I + t(L - m - y)^2 \quad (2)$$

where tx^2 is the transport costs of a unit of the good to be paid by the consumer located at x from the seller.

Solving equations (1) and (2) for x and y and using the property of the uniform distribution of consumers along the line and the assumption that each consumer buys a unit of the good, we derive the demand of each firm: $D_O = x$ for the first firm,

⁵The assumption concerning the initial location of the two firms follows the result of D'Aspremont *et al.* [1979], according to which this is the locational equilibrium with two firms and quadratic transport costs. However, we take this situation as an exogenously given starting point. This could be the result of the location decision of the two firms at a time in which none of the firms could predict that at a later stage one of them would have the possibility to introduce a new product or establish a second plant. Thereafter, this first location decision of the two firms is considered irreversible.

⁶The assumption that only one of the two firms can open a new plant is due to the fact that this coincides with what we observe in the Tetra Pak case.

$D_M = m - x + y$ for the new plant and $D_I = L - m - y$ for the second firm. We can then write firms' profits as functions of the strategic variables which are prices and m , (the location of the new plant), as well as of the parameters t and L :

$$\Pi_O = P_O \left(\frac{m}{2} - \frac{P_O - P_M}{2tm} \right) \quad (3)$$

$$\Pi_M = P_M \left(\frac{m}{2} - \frac{P_M - P_O}{2tm} + \frac{L - m}{2} - \frac{P_M - P_I}{2t(L - m)} \right) \quad (4)$$

$$\Pi_I = P_I \left(\frac{L - m}{2} - \frac{P_I - P_M}{2t(L - m)} \right) \quad (5)$$

III Pro-Competitive Location and Pricing

We first assume that the two-stage game is played once and that firms' profit maximising behaviour does not have any predatory intention. However, we assume three different degrees of dependence (or independence) between the new plant and the first firm. In the first scenario, the new plant is completely independent deciding both location and price to maximise its own profits. In the second case, the first firm and the new plant choose the latter's location jointly, while the new plant decides on its second stage price independently from the first firm. In the third case, the first firm and the new plant decide both on the latter's location and their prices to maximise their joint profit.

III.1 Complete Independence of the New Plant

The Bertrand-Nash prices of the second stage of the game will satisfy:

$$\frac{\partial \Pi_O}{\partial P_O} = 0 \quad (6)$$

$$\frac{\partial \Pi_M}{\partial P_M} = 0 \quad (7)$$

$$\frac{\partial \Pi_I}{\partial P_I} = 0 \quad (8)$$

Solution of the system (6)-(8) gives equilibrium prices:

$$P_O^B = \frac{Lmt}{2} \quad (9)$$

$$P_M^B = (L - m)mt \quad (10)$$

$$P_I^B = \frac{L(L - m)t}{2} \quad (11)$$

which yield profits:

$$\Pi_O^B = \frac{L^2mt}{8} \quad (12)$$

$$\Pi_M^B = \frac{(L - m)Lmt}{2} \quad (13)$$

$$\Pi_I^B = \frac{L^2(L - m)t}{8} \quad (14)$$

Then we get:

Proposition 1 *When the new plant decides independently on both location and price, it locates at $m = L/2$.*

Proof: *Note that from (13) we get that Π_M^B has a maximum at $m = L/2$.*

Following the new plant's location in the middle of OI , equilibrium prices are:

$$P_O^* = \frac{L^2t}{4} \quad (15)$$

$$P_M^* = \frac{L^2t}{4} \quad (16)$$

$$P_I^* = \frac{L^2t}{4} \quad (17)$$

and profits:

$$\Pi_O^* = \frac{L^3 t}{16} \quad (18)$$

$$\Pi_M^* = \frac{L^3 t}{8} \quad (19)$$

$$\Pi_I^* = \frac{L^3 t}{16} \quad (20)$$

III.2 Independence of the New Plant in the Second Stage

If the first firm and the new plant decide jointly on the latter's decision to maximise joint second-stage profits, taking into account that the new plant will set second-stage prices independently from the first firm, they set m so that:

$$\frac{\partial(\Pi_O^B + \Pi_M^B)}{\partial m} = 0 \quad (21)$$

which gives us

Proposition 2 *When the first firm and the new plant decide jointly on the latter's location but they compete in prices in the second stage, the new plant will be located at $m = 5L/8$.*

Proof: *Straightforward from maximisation of (12) + (13).*

Following the new plant's location decision, equilibrium prices are:

$$P_O^{**} = \frac{5L^2 t}{16} \quad (22)$$

$$P_M^{**} = \frac{15L^2 t}{64} \quad (23)$$

$$P_I^{**} = \frac{3L^2 t}{16} \quad (24)$$

and profits:

$$\Pi_O^{**} = \frac{5L^3t}{64} \quad (25)$$

$$\Pi_M^{**} = \frac{15L^3t}{128} \quad (26)$$

$$\Pi_I^{**} = \frac{3L^3t}{64} \quad (27)$$

Comparison of the two cases studied up to now gives us that cooperation between the first firm and the new plant in the first stage results in:

Remark 1: Higher joint profits for the first firm and the new plant (Note that: $(25) + (26) = 25L^3t/128 > (18) + (19) = 3L^3t/16$).

Remark 2: Lower profits to the second firm (Note that: $(20) = 4L^3t/64 > (27) = 3L^3t/64$).

Remark 3: Larger contribution of the first firm to the joint first firm's and the new plant's profits (Note that $(18)/(19) = 1/2 < (25)/(26) = 2/3$).

Remark 4: The first firm has shifted competition further from its original location O and sets a higher price, while the new plant and the second firm are now closer and in the presence of more competition set lower prices (Note that $3/16 < 15/64 < 1/4 < 5/16$).

Remark 4 shows us that *dumping* can be the result of pro-competitive, profit-maximising behaviour of firms.

For simplicity, assume that $t = 1$ (prices and profits are expressed then in terms unit transport costs). Then we can easily derive that:

Result 1 *For $t = 1$, the shares of the first firm, the new plant and the second firm do not depend on whether the location decision concerning the new plant is made by the first firm and the new plant jointly or independently. In both cases, the first firm sells up to a distance of $z = L/4$ on its left, while the new plant's consumers are the ones located between $L/4$ and $3L/4$ on the right of O .*

This useful property of the model allows us to compare the social implications of the two cases:

Remark 5: The clients of the first firm are worse off because they pay a higher price, while those of the second firm and the new plant are better off because they pay less. However, the first firm's price increase, which affects $1/4$ of all consumers, is equal to the second firm's price decrease, which also affects $1/4$ of the consumers. Therefore, the price decrease of the new plant implies a strictly negative effect of the joint location decision on prices.

Nevertheless, considering that in the second case the new plant is not located in the middle of the line (and therefore of the segment of its own clients) there is a further social inefficiency to be taken into account. That is,

Remark 6: Total transport costs are higher in the second case.

In fact, we can calculate the total amount spent by the consumers on prices plus transportation costs in the two cases. It is easy to show that in both cases, consumers pay a total of $13L^3/48$, of which in the first case $L^3/4$ is due to prices net of transport costs, while in the second case, a smaller amount -equal to $31L^3/128$ - of total expenditure is due to prices net of transportation costs. We summarise this finding in the following result:

Result 2 *The joint decision of the first firm and the new plant concerning the latter's location, followed by price competition in the second stage, has a strictly negative effect on the part of the expenditure due to prices, and a strictly positive effect on transportation costs payed by all consumers.*

The implication of this result in terms of social efficiency is that joint profit maximisation in the new plant's location choice shifts competition away from the first firm, increasing competition in a larger part of the market. This results in lower overall expenditure due to prices. Therefore, *dumping*, in the sense of lower prices in the more competitive segment of the market, may result in lower overall prices. However, expenditure due to transportation costs increases.

III.3 Joint Location and Price-Setting Decisions

Assume now that the new plant and the first firm make both stages' decisions jointly⁷. Then, the equilibrium prices of the second stage will satisfy the system:

$$\frac{\partial(\Pi_O + \Pi_M)}{\partial P_O} = 0 \quad (28)$$

$$\frac{\partial(\Pi_O + \Pi_M)}{\partial P_M} = 0 \quad (29)$$

$$\frac{\partial \Pi_I}{\partial P_I} = 0 \quad (30)$$

whose solution gives:

$$P_O^C = \frac{(6L - m)(L - m)t}{6} \quad (31)$$

$$P_M^C = \frac{(3L + m)(L - m)t}{3} \quad (32)$$

$$P_I^C = \frac{(3L - m)(L - m)t}{3} \quad (33)$$

and profits:

$$\Pi_O^C = \frac{m(6L^2 - 4Lm + m^2)t}{24} \quad (34)$$

$$\Pi_M^C = \frac{(6L - m)(3L^2 - 2Lm - m^2)t}{36} \quad (35)$$

$$\Pi_I^C = \frac{(L - m)(3L - m)^2 t}{64} \quad (36)$$

If we now solve the equation

⁷The study of firms that open new plants is analysed by Martinez-Giralt and Neven (1988). The result obtained in this section in which firms are assumed to have asymmetric production possibilities holds in the set up of that study when firms have symmetric production possibilities.

$$\frac{\partial(\Pi_O^C + \Pi_M^C)}{\partial m} = 0 \quad (37)$$

with respect to m we find that it has two roots which correspond to points **outside** the interval $[0, L]$ and more specifically on the points defined by $m_1 = L(40 + 4\sqrt{145})/30$ and $m_2 = L(40 - 4\sqrt{145})/30$ which correspond, respectively to a *maximum*, on the side of O and a *minimum* on the side of I . This observation and the continuous behaviour of the joint profit function of the first firm and its new plant leads us to the following result:

Result 3 *The joint profit function of the first firm and its new plant is weakly decreasing with respect to m in the interval $[0, L]$.*

Therefore,

Proposition 3 *The joint profit maximisation of the first firm and its new plant's profits with respect to both prices and the new plant's location is achieved at $m = 0$.*

The implication of the last proposition is that if the first firm and the new plant behave cooperatively in both stages, the first firm will not locate on a second point on the line. The intuition is that the losses due to extra competition -even in the case that cooperation takes place in the first stage- offered by the new plant cannot be compensated by the expansion of the first firm's activities over a new location.

The equilibrium that follows implies:

$$P_O^{***} = P_I^{***} = L^2 t \quad (38)$$

and profits:

$$\Pi_O^{***} = \Pi_I^{***} = \frac{L^3 t}{2} \quad (39)$$

Simple comparison of this case with the two previous cases shows us that this configuration is the most profitable for both firms, whereas, in terms of social welfare is the

most inefficient in the sense that it results in higher prices and total transport costs for all consumers.

IV Predatory Location Decisions

We study here a simple two-period version of the last scenario in which the first firm and the new plant decide jointly the new plant's location and the second-stage prices. However, we assume that the second firm will be forced to exit the market if it earns zero profits at the end of the second stage of the first period. Therefore, the first firm would monopolise the market in the second period setting a very high price (given that consumers buy one unit of the good each) and earning very high monopoly profits.

Therefore, we use the results of the last case, assuming that the first firm and the new plant maximise their first period joint profits subject to the restriction that the second firm's profits are zero.

It is easy to observe that the second firm's profits are 0 for $m = L$. Furthermore, we have seen that the joint profit function of the first firm and the new plant is weakly monotonically decreasing in m for values from the interval $[0, L]$. Then it is straightforward that:

Proposition 4 *The joint profit of the first firm is maximised subject to the constraint that the second firm's profit is zero (Predatory Location), for $m = L$.*⁸

The importance of the last proposition for competition policy is that it shows how anti-competitive behaviour can be observed with respect to *location* instead of pricing strategies. In fact there are no anti-competitive elements in the first firm's -nor its newly established plant- pricing behaviour.

⁸To be precise, the second firm would experience losses for $m = L$ if there were any positive fixed cost. We have assumed no fixed costs in order to avoid unnecessary complications. With positive fixed costs, we would get that predation would take place for $m_o < L$.

The message is that product or location choice may be as effective, or more, as an instrument of predation in oligopolies. Competition authorities may have to abandon their perception that controlling pricing behaviour is an efficient instrument of competition policy. A low price-cost margin may have been achieved on other social costs (transportation in this case), or the survival of more competitors in the future. Pro-competitive pricing behaviour may be a compulsory fulfillment of anti-trust legislation by a firm whose anti-competitive behaviour is expressed with respect to non-price strategies (e.g. location or product choice).

V Conclusions

We have attempted an overview of some characteristics of multi-plant activity that could be of interest to competition policy-makers. Some competition policy issues of more general character have been overlooked⁹.

The location model presented here has produced some interesting results concerning the competition policy implications of non-price decisions. Embid Irujo [1987] points out that the nature of the relations among firms which belong to the same group is very important for competition policy. We have shown that some independence between the already existing firm and its new plant leads to socially preferable configurations. However, complete independence is not only difficult to implement, but also not necessarily superior in terms of consumer welfare, as compared to incomplete independence of the subsidiary. This finding relates to the fact that if the new plant is located nearer to the second firm, in order for the first firm and the new plant to maximise joint profits, acting independently with respect to price thereafter, the social loss from higher transport costs is compensated by gains due to lower prices. Nevertheless, complete lack of independence

⁹The existence -or not- of symmetric production possibilities may be an important issue which has been overlooked here. In fact, whether a firm has the possibility to enter in another firm's market is a matter of great importance and often depends on restrictions imposed by the legislation concerning patents and technological innovation. Here, such asymmetries are exogenously given.

of the new plant results in clearly inferior outcomes in terms of social welfare. In that case, if the firm that considers opening a new plant behaves in a pro-competitive way, the second plant will not be opened. Otherwise, the first firm might choose the location of the new plant in a predatory way. The survival of the second firm will become impossible. Then, the whole market will be monopolised by the first firm and its new plant.

Anti-competitive behaviour may be expressed by location or product choice decisions. In general, entries of new plants or new products and some independence of the new decision making centers improve social welfare if they do not reduce the probability of competition in the future. Deviating from actual profit maximisation aiming at reducing a firm's rivals' profits and monopolisation of the market in the future is clearly an anti-competitive practice. Concerning the Tetra Pak case, the Commission should have paid more attention to the fact that, while aseptic products - produced exclusively by Tetra Pak - exhibit a high degree of differentiation with respect to non-aseptic products, non-aseptic products of Tetra Pak are identical to those produced by the firm's rival.

Price data have always been the authorities' favorite because they are the easiest to access. However, this should not be interpreted to imply that anti-competitive behaviour can only be observed on price strategies. We suggest here location and product choice decisions as an alternative.

References

- [1] D'Aspremont, C., Gabszewicz J. J. and Thisse, F., (1979), "On Hotelling's Stability in Competition", *Econometrica*, 47, pp. 1145-1150.
- [2] Dodgson, J. S., Newton, C. R. and Katsoulacos, Y., (1992), "A Modelling Framework for the Empirical Analysis of Predatory Behaviour in the Bus Service Industry", *Regional Science and Urban Economics*, 22, pp. 51-70.
- [3] EC Commission, (1988), "Tetra Pak I", EC Commission Decision, O.J. L 272/27, 26 July.

- [4] EC Commission, (1991), "Tetra Pak II", EC Commission Decision, O.J. L 72/1, 24 July.
- [5] Embid-Irujo, J. M., (1987), "Cuestiones Básicas de la Ordenación Jurídica de los Grupos de Sociedades-Especial Consideración del Derecho de la Competencia", Octubre, ICE, pp. 100-111.
- [6] George, K. and Jacquemin, A., (1990) "Competition Policy in the European Community", in: Lesourne, J. and Sonnenschein, H. (eds), 'Competition Policy in Europe and North America: Economic Issues and Institutions', Chur: Harwood Academic Publishers.
- [7] Geroski, P.A. and Jacquemin, A., (1984), "Dominant Firms and their Alleged Decline", *International Journal of Industrial Organization*, 2, pp. 1-29.
- [8] Gyselen, L., (1990), "Abuse of Monopoly Power within the Meaning of Article 86 of the EEC Treaty: recent developments", in: Barry Hawk (ed), 'Annual Proceedings of the Fordham Corporate Law 1992 and EEC/US Competition and Trade Law Ardsley-on-Hudson', New York: Transnational Juris Publications Incorporated.
- [9] Horstmann, I. and Slivinski, A., (1985), "Location Models as Models of Product Choice", *Journal of Economic Theory*, 36, pp. 367-386.
- [10] Hotelling, H., (1929), "Stability in Competition", *Economic Journal*, 39, pp. 41-57.
- [11] Martin, S., (1994), "Oligopoly Limit Pricing: Strategic Substitutes, Strategic Complements", EUI Working Paper, ECO No. 94/15.
- [12] Martínez-Giralt, X. and Neven D.J., (1988), "Can Price Competition Dominate Market Segmentation?", *The Journal of Industrial Economics*, vol. XXXVI, No. 4.
- [13] Salop, S., (1979), "Monopolistic Competition with Outside Goods", *Bell Journal of Economics*, 10, pp. 141-156.

DOCUMENTOS PUBLICADOS

- WP-EC 90-01 "Los Determinantes de la Evolución de la Productividad en España"
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