Should owners of firms delegate location decisions?

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Abstract

This paper analyzes whether owners of firms have incentives to delegate firms' location decisions to managers or not. The result arising from our analysis shows that owners do have incentives to keep their long-run decisions (the location of the firms) to themselves. In this context we show that the delegation of short-run decisions (prices) to the managers leads to an increase in the degree of product differentiation with regard to the case in which firms do not hire managers.

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1. Introduction

Firms have usually got to make two kinds of decisions: short-run and long-run decisions. A well known result in the literature on strategic delegation states that owners have incentives to delegate short-run decisions, such as those on prices or quantities, to their managers (see, for example, Vickers, 1985; Fershtman and Judd, 1987; and Sklivas, 1987). Nevertheless, it seems that the real world shows that some firms' owners do not have incentives to delegate their long-run decisions. Thus, this paper will analyze the strategic reasons why owners of firms do not have incentives to delegate firms' location decisions to their managers.

There are different examples that are useful to illustrate the preceding situation. The case of the BMW (Bavarian Motor Works) company is one of them. In this company, in 1984, between 50 and 75% of the property of the firm was in the hands of the Quandt family who also held a very active position in the supervisory board of BMW; the remainder of the firm was owned by a group of European banks and employees of the firm. The owners of BMW were very much involved in the management of the firm (in their long-run decisions) but, at the same time, they delegate short run decisions such as marketing plans to the subsidiaries. As Jenster *et al.* (1990, p. 142) point out: "*Although the parent company, BMW in Munich, established broad guidelines, the subsidiaries are responsible for developing their own strategic objectives and marketing plans within their regions.*" Another example is given by the firm Benneton, in which the owners are also very involved in the long-run decisions. In this firm, as Jarillo and Martínez (1990, p. 72) explain: "*Benneton approved location of the shops and Luciano (the owner) personally oversaw the more strategic sites.*" Additional evidence is given by Microsoft; in this firm Bill Gates, the main owner, plays a dominant role in the strategic decisions of the firm. As The Economist (July 10th 1999, p. 88) read: "*Could any manager be more firmly entrenched at the head of his company than Bill Gates?*"

The preceding examples reveal that, in many firms, the long-run decisions are taken or are personally supervised by the owners. In accordance with this situation, this paper shows that it is in the interest of the owners to keep the long-run decision (the location of the firm) to themselves.

The literature on strategic delegation, which started with Vickers (1985), Fershtman and Judd (1987) and Sklivas (1987), points out that it is in the interest of the owners of firms to delegate price or output decisions (short-run decisions) to managers. These authors analyze

the strategic value that firms' owners can derive from incentive contracts, which are publicly observed, based on the profits and sales. In this framework, they show that in equilibrium firms' owners will use incentive schemes to make their managers change the firm's strategic position in the market.[1] Therefore, managers are hired to compete in the product market and the owners can then manipulate their incentive schemes to get a strategic advantage.

In order to study whether the owners of the firms delegate long-run decisions to managers or not, we shall consider a specific decision: the location of the firm. As the literature on spatial competition points out, the location of the firm can also be interpreted as product variety. This literature (see, for example, D'Aspremont et *al*., 1979) usually considers that firms ought to be located within the city limits. Lambertini (1994) and Tabuchi and Thisse (1995) relax this assumption when analyzing the firms' location decisions in a linear city in which consumers have quadratic transportation costs. They state that if firms are able to locate themselves outside the city limits, firms have incentives to do so. These authors do not take into account that firms are usually managed by managers who have different objectives to those of the owners. Therefore, in this paper we extend the analysis of Lambertini (1994) and Tabuchi and Thisse (1995), that is, we consider the unconstrained Hotelling model, and assume that in each firm there is an owner and a manager. Thus, ignoring informational asymmetries, we focus on the owners' incentives to delegate to managers long-run decisions (firms' locations) in addition to short-run decisions (prices).

We consider that each firm has only one owner and one manager. Each owner can delegate both location and price decisions, or only price decisions. The main result of this paper is that the owners have incentives to keep the location decisions to themselves. The intuition of this result is the following. Each owner can either choose the location of the firm by himself or delegate this decision to his manager. By taking location decisions on his own, an owner can avoid becoming a leader in incentives and thus be granted a better location in the

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[1] Product market competition has an important impact on managerial incentives. It may, on the one hand, exert pressure on internal incentives and affect the optimal contracts within the firm (see, for example, Hart, 1983; and Scharfstein, 1988). And the agency contracts within a firm may, on the other hand, affect its position in the marketplace and be one of the strategic variables which shape product market competition (see Holmström and Tirole, 1989).

market and a lower competition in the product market. On the other hand, if an owner delegates the location decision to his manager, he risks becoming a leader in incentives and thus having to choose a worse location in the market. Thus, the owners prefer to keep the location decision to themselves.

Given that owners have incentives to delegate their price decisions to managers, the owners' choice of product variety can be affected. For this reason, we analyze the incentive contracts that the owners choose for their managers focusing on how owners may strategically manipulate these incentive contracts and its effect on the degree of product differentiation. We show that the delegation of price decisions to managers increases the degree of product differentiation with respect to the case in which firms do not hire managers.

The remainder of the paper is organized as follows. Section two presents the model. Section three states the results. Finally, conclusions are drawn in section four.

2. The model

The consumers are distributed uniformly with unitary density along a linear city the length of which is equal to one. Consumers transport their purchase home at a cost td^2, where t is a positive constant and d is the distance between the consumer and the firm. Consumers buy one unit of the good at the lowest delivered price, considered as the mill price plus transportation cost, if it does not exceed their gross surplus. Let us assume that this surplus is high enough to guarantee that the market be covered (all consumers buy the good).

There are two firms indexed by i ($i=1, 2$) competing in a market for a differentiated product. They can decide on locating outside the city boundaries. The firms cannot change their locations in the future. Marginal costs of production (c) are assumed to be constant and identical for both firms. As the literature on strategic delegation shows, it is in the interest of the owners to delegate price decisions to the managers. Therefore, to simplify the model and the exposition of the results, we consider that the owners of firms will always delegate price decisions to their managers.[2] The owners must also decide whether to delegate the firms' location decisions to managers or whether to keep this decision to themselves. Thus, we will

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[2] In our model is straightforward to show that once the locations have been decided (it does not matter if this decision has been taken by the owners, by the managers or by one owner and one manager) it is in the interest of the owners to delegate price decisions to managers because this strategy dominates non delegation.

denote by delegation the case in which the manager of a firm takes the location decision; on the contrary, if the owner of a firm takes the location decision, we will consider that there is no delegation.

As in Fershtman and Judd (1987), we assume that the owners offer "take it or leave it" linear incentive schemes to their managers. The manager of firm i (i=1, 2) receives a payoff: $A_i + B_iO_i$, where A_i and B_i are constant, $B_i > 0$, and O_i is a linear combination of profits and sales. The owner selects A_i so that the manager only gets his opportunity cost which is normalized to zero. Managers are risk neutral and maximize: $O_i = a_ip_i + (1 - a_i)S_i$, where p_i and S_i are profits and sales, respectively, and α_i is the incentive parameter chosen by the owner of firm i. We assume that firms can commit themselves to incentive schemes.

The timing of the game is as follows. In the first stage, the owner of each firm chooses whether to delegate the location decision to his manager or to keep this decision to himself. In the case of delegation, the owner chooses the incentive parameter of his manager before the manager takes the location decision; if the owner does not delegate this decision, the incentive parameter is selected after having chosen the location of the firm. Therefore, in stage two only the owner of a firm who delegates location decision chooses the incentive scheme of his manager. In stage three, location decisions are taken simultaneously. In stage four, only the owner who did not delegate chooses the incentive scheme of his manager. The contracts (incentive schemes) cannot be renegotiated and they become common knowledge once they are signed. Finally, in stage five, the managers simultaneously make price decisions. We solve the game by backward induction from the last stage of the game to obtain a subgame perfect Nash equilibrium.

The preceding timing considers, as it seems reasonable, that location decisions are chosen simultaneously and that prices are also chosen simultaneously. The incentive parameters are the variables which can be chosen sequentially; this only happens in the case in which one owner delegates location decisions whereas the other one does not delegate.

The assumption that incentive contracts become common knowledge when the contract is signed is crucial to our results, as well as to most of the delegation literature. If this assumption is not considered, the contracts cannot act as commitment devices (see Katz, 1991). Fershtman and Judd (1987) argue that incentive contracts are costlier variables to

change than price, and therefore remain unaltered for a substantial amount of time (while price decisions are being changed), and they are likely to be observed by rivals.

3. Results

The game has four different subgames: the first is that in which the two owners take location decisions by themselves; the second refers to the case in which the two owners delegate location decisions; and the third and fourth are those in which one owner delegates location decision while the other owner takes it by himself. We analyze these four subgames before solving stage one. We shall first analyze the last stage of the game, the stage in which firms compete in prices.

Let a denote the location of firm 1 and $1- b$ denote the location of firm 2. As pointed out before, these locations can lie outside the city boundaries. When a is equal to 0, firm 1 is located at the [0,1] city's left boundary. If $a > 0$, firm 1 is located to the right of this point. If $a < 0$, firm 1 is located to the left of the [0,1] city. From the point of view of firm 2, if $b = 0$, firm 2 is located on the right border of the [0,1] city. If $b > 0$, firm 2 is located to the left of this point, and finally, if $b < 0$, firm 2 is to the right of this point. For the sake of simplicity, we assume that firm 1 is located on the left or on the same point as firm 2: $1 - a - b \geq 0$.

Let p_i denote the price of firm i (i=1, 2). We can determine the consumer who is indifferent between the two firms and who locates at a point x such that:

$$p_1 + t\,(x - a)^2 = p_2 + t\,(1 - x - b)^2.$$

Then, the respective demands of firms 1 and 2, when both firms do not locate at the same point $(1 - a - b \quad 0)$, [3] are given by q_1 and q_2:

$$q_1\left(p_1,\ p_2\right) = \frac{p_2 - p_1}{2t(1 - a - b)} + \frac{1 - a - b}{2} + a, \ \ if \ \ 0 \leq \frac{p_2 - p_1}{2t(1 - a - b)} + \frac{1 - a - b}{2} + a \leq 1$$

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[3] If $1 - a - b = 0$, the product is homogeneous and profits are nil because of the Bertrand Paradox.

$$= 1, \qquad\qquad if \quad \frac{p_2 - p_1}{2t(1-a-b)} + \frac{1-a-b}{2} + a > 1$$

$$= 0, \qquad\qquad if \quad \frac{p_2 - p_1}{2t(1-a-b)} + \frac{1-a-b}{2} + a < 0$$

$$q_2(p_1, p_2) = \frac{p_1 - p_2}{2t(1-a-b)} + \frac{1-a-b}{2} + b, \quad if \quad 0 \leq \frac{p_1 - p_2}{2t(1-a-b)} + \frac{1-a-b}{2} + b \leq 1$$

$$= 1, \qquad\qquad if \quad \frac{p_1 - p_2}{2t(1-a-b)} + \frac{1-a-b}{2} + b > 1$$

$$= 0, \qquad\qquad if \quad \frac{p_1 - p_2}{2t(1-a-b)} + \frac{1-a-b}{2} + b < 0$$

In stage five, the manager of firm i will choose prices so as to maximize his objective function and this depends on his incentive parameter: $O_i = (p_i - a_i c)q_i$, $i = 1, 2$. From the first order conditions of the managers' problem, when both firms have a positive *quota*, we obtain the fifth stage prices as a function of the incentive parameters and firms' locations:

$$p_1^*(a, b, a_1, a_2) = \frac{t(1-a-b)(3+a-b) + 2a_1 c + a_2 c}{3} \ ,$$

$$\tag{1}$$

$$p_2^*(a, b, a_1, a_2) = \frac{t(1-a-b)(3-a+b) + 2a_2 c + a_1 c}{3} \ .$$

As usual, given that firms compete in prices, the price set by firm i, p_i^* ($i=1, 2$), increases with the incentive parameters α_1 and α_2.[4]

3.1. The owners choose the firms' locations simultaneously

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[4] Fershtman and Judd (1987) and Sklivas (1987) show that if firms sell differentiated products and compete in prices, each owner will incentive his manager to set a high price, thereby encouraging competing managers to also raise their prices. Therefore, under price competition owners will pay managers to keep sales low.

In this subgame both owners choose first the location of the firms. Thus, in stage three, the owners simultaneously decide on the location of the firms, while in stage four, the owners simultaneously decide on incentive parameters.[5]

In the fourth stage, the owner of firm i chooses incentive scheme parameter α_i so as to maximize his profits:

$$p_i(a, b, \mathbf{a}_i, \mathbf{a}_j) = \left(p_i^*(a, b, \mathbf{a}_i, \mathbf{a}_j) - c \right) q_i^*(a, b, \mathbf{a}_i, \mathbf{a}_j); \; i \neq j; \; i, j = 1, 2.$$

The profit function of firm i can be expressed as $\pi_i\left(a, b, p_i^*(a, b, \mathbf{a}_1, \mathbf{a}_2), p_j^*(a, b, \mathbf{a}_1, \mathbf{a}_2)\right)$, and the first order condition can be written as:

$$\frac{d p_i\left(a, b, p_i^*(a, b, \mathbf{a}_1, \mathbf{a}_2), p_j^*(a, b, \mathbf{a}_1, \mathbf{a}_2)\right)}{d \mathbf{a}_i} = \frac{\partial p_i}{\partial p_i} \frac{\partial p_i^*}{\partial \mathbf{a}_i} + \frac{\partial p_i}{\partial p_j} \frac{\partial p_j^*}{\partial \mathbf{a}_i} = 0; \; i \neq j; \; i, j = 1, 2. \quad (2)$$

From (2) we get:[6]

$$\mathbf{a}_1 = \frac{t(1 - a - b)(3 + a - b) + 3c + \mathbf{a}_2 c}{4c} \; ,$$

$$\quad (3)$$

$$\mathbf{a}_2 = \frac{t(1 - a - b)(3 - a + b) + 3c + \mathbf{a}_1 c}{4c} \; .$$

Solving (3) we obtain:

$$\mathbf{a}_1^*(a, b) = 1 + \frac{t(1 - a - b)(5 + a - b)}{5c} \; ,$$

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[5] A similar timing is considered by Bárcena-Ruiz and Espinosa (1999) who assume that owners of firms choose the organizational form of the firm and the incentive parameters of the managers, while managers choose prices or quantities.

[6] It is easy to see that incentives parameters are strategic complements.

$$a_2^*(a, b) = 1 + \frac{t(1 - a - b)(5 - a + b)}{5c} \; .$$

In the third stage of the game, firms' owners choose the locations of the firms so as to maximize profits as a function of locations. The profit of firm 1 can be expressed as:

$$\boldsymbol{p}_1(a, b) = \boldsymbol{p}_1(a, b, \; \hat{p}_1^*(a, b, \mathbf{a}_1^*(a, b), \mathbf{a}_2^*(a, b)), \; \hat{p}_2^*(a, b, \mathbf{a}_1^*(a, b), \mathbf{a}_2^*(a, b))).$$

Differentiating $\boldsymbol{p}_1(\cdot)$ with respect to a, we obtain:

$$\frac{d\boldsymbol{p}_1}{da} = \frac{\partial \boldsymbol{p}_1}{\partial a} + \frac{\partial \boldsymbol{p}_1}{\partial \hat{p}_1} \left[\frac{\partial \hat{p}_1^*}{\partial a} + \frac{\partial \hat{p}_1^*}{\partial \mathbf{a}_1} \frac{d\mathbf{a}_1^*}{da} + \frac{\partial \hat{p}_1^*}{\partial \mathbf{a}_2} \frac{d\mathbf{a}_2^*}{da} \right] + \frac{\partial \boldsymbol{p}_1}{\partial \hat{p}_2} \left[\frac{\partial \hat{p}_2^*}{\partial a} + \frac{\partial \hat{p}_2^*}{\partial \mathbf{a}_1} \frac{d\mathbf{a}_1^*}{da} + \frac{\partial \hat{p}_2^*}{\partial \mathbf{a}_2} \frac{d\mathbf{a}_2^*}{da} \right].$$

We must take into account that because of the first order condition in the fourth stage of the game (see (2)): $\dfrac{\partial \pi_1}{\partial p_1} \dfrac{\partial p_1^*}{\partial \alpha_1} + \dfrac{\partial \pi_1}{\partial p_2} \dfrac{\partial p_2^*}{\partial \alpha_1} = 0$. Then, by the envelope theorem, we do not need to analyze the effects which act through the own firm's incentive parameter.[7] As a result:

$$\frac{d\boldsymbol{p}_1}{da} = \frac{\partial \boldsymbol{p}_1}{\partial a} + \frac{\partial \boldsymbol{p}_1}{\partial \hat{p}_1} \left[\frac{\partial \hat{p}_1^*}{\partial a} + \frac{\partial \hat{p}_1^*}{\partial \mathbf{a}_2} \frac{d\mathbf{a}_2^*}{da} \right] + \frac{\partial \boldsymbol{p}_1}{\partial \hat{p}_2} \left[\frac{\partial \hat{p}_2^*}{\partial a} + \frac{\partial \hat{p}_2^*}{\partial \mathbf{a}_2} \frac{d\mathbf{a}_2^*}{da} \right]. \tag{4}$$

Solving (4) we have:

$$\frac{\partial \boldsymbol{p}_1}{\partial a} = \frac{t(5 + a - b)(5 - 9a - b)}{25},$$

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[7] In standard models of spatial competition $\dfrac{\partial \boldsymbol{p}_1}{\partial p_1}$ is zero by the envelope theorem. In our model it is not the case because firm 1's manager chooses the price that maximizes his objective function, O_1, which is different from the profit function, $\boldsymbol{p}_1$.

$$\frac{\partial \boldsymbol{p}_1}{\partial p_1}\left[\frac{\partial p_1^*}{\partial a} + \frac{\partial p_1^*}{\partial \boldsymbol{a}_2}\frac{d\boldsymbol{a}_2^*}{da}\right] = -\frac{5+a-b}{10}\left[-\frac{2t(1+a)}{3} - \frac{c}{3}\frac{2t(3-a)}{5c}\right] = \frac{4t(5+a-b)(2+a)}{75},$$

$$\frac{\partial \boldsymbol{p}_1}{\partial p_2}\left[\frac{\partial p_2^*}{\partial a} + \frac{\partial p_2^*}{\partial \boldsymbol{a}_2}\frac{d\boldsymbol{a}_2^*}{da}\right] = \frac{5+a-b}{5}\left[-\frac{2t(2-a)}{3} - \frac{2c}{3}\frac{2t(3-a)}{5c}\right] = -\frac{2t(5+a-b)(16-7a)}{75}.$$

Taking into account the preceding results, we obtain the following lemma:

Lemma 1: When firms' owners choose firms' locations simultaneously the optimal locations and the profits of firms 1 and 2 are such that: $a^* = b^* = -\frac{3}{4}$ and $\boldsymbol{p}_1 = \boldsymbol{p}_2 = \frac{5t}{2}$.[8]

Proof. Substituting the preceding computations in (4) we have that firm 1 chooses a location such that:

$$\frac{d\boldsymbol{p}_1}{da} = -\frac{t(5+a-b)(3+3a+b)}{25} = 0.$$

Similarly, we have that firm 2 chooses a location such that:

$$\frac{d\boldsymbol{p}_2}{db} = -\frac{t(5-a+b)(3+a+3b)}{25} = 0.$$

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[8] If the owner of firm 1 chooses his location before the owner of firm 2 does (but the two owners choose their managers' incentive parameters simultaneously), the optimal locations are: $a^* = \frac{1}{2}$, $b^* = -\frac{7}{6}$. If one firm acts as a Stackelberg leader in the location stage, the leader locates at the center of the city while the follower locates outside the city limits. There is to note that the leader, firm 1, fixes a higher price and obtains higher profits than the follower, firm 2 ($\boldsymbol{p}_1 = \frac{80t}{27} > \boldsymbol{p}_2 = \frac{20t}{27}$).

Thus, the optimal solution is given by: $a^* = b^* = -\frac{3}{4}$. In equilibrium, the prices and incentives parameters of firms 1 and 2 are, respectively: $p_1^* = p_2^* = c + 5t$ and $\mathbf{a}_1^* = \mathbf{a}_2^* = 1 + \frac{5t}{2c}$. Then, $\mathbf{p}_1 = \mathbf{p}_2 = \frac{5t}{2}$.

Since incentive variables are strategic complements, we obtain the usual result, that is, that the incentive parameters are higher than one: $\mathbf{a}_1 = \mathbf{a}_2 > 1$.

Lemma 1 shows that the strategic delegation of price decisions to managers increases the incentives of one firm to locate farther from the rival, this is so with respect to the case in which firms do not hire managers. By means of this firms are able to charge higher prices, thus relaxing product market competition and obtaining higher profits.

If firms do not hire managers we face the case analyzed by Lambertini (1994), according to who $a^* = b^* = -\frac{1}{4}$, and each firm has a profit of $\frac{3t}{4}$. Then, in the unconstrained Hotelling game the distance between the two rivals is $\frac{3}{2}$ while in our model it is $\frac{5}{2}$. Therefore, when firms are able to establish themselves outside the city limits, the possibility of contracting managers increases the degree of product differentiation. The owners want to locate the firms farther from the rival because this encourages the other firm to incentive his manager to charge higher prices.

The preceding results rely on three different effects which can be measured when $1 - a - b > 0$ for reasonable values of a, that is, $a \in (-2, 0.5)$. First, we have a demand effect that pushes firm 1 towards firm 2: $\frac{\partial \mathbf{p}_1}{\partial a} > 0$. Second, we find an effect that operates in the same direction as the first one: $\frac{\partial \mathbf{p}_1}{\partial p_1}\left[\frac{\partial p_1^*}{\partial a} + \frac{\partial p_1^*}{\partial \mathbf{a}_2}\frac{d\mathbf{a}_2^*}{da}\right] > 0$; this effect is due to the fact that firms hire managers who are incentivated to relax competition and this implies that they choose high prices. Third, we get a strategic effect that works in the opposite direction, $\frac{\partial \mathbf{p}_1}{\partial p_2}\left[\frac{\partial p_2^*}{\partial a} + \frac{\partial p_2^*}{\partial \mathbf{a}_2}\frac{d\mathbf{a}_2^*}{da}\right] < 0$, because firm 1 can benefit from an increase in firm 2's price by locating itself farther from the rival. By means of this the rival's price increases because the distance is greater and the manager hired by the rival is encouraged to charge higher prices.

The preceding effects are balanced when locations of firms 1 and 2 are such that:
$a^* = b^* = -\frac{3}{4}$.

3.2. Managers choose the firms' locations

In this subgame, the owner of each firm delegates to his manager the location decision in addition to prices.[9] Thus, in stage two the owners simultaneously decide on the incentive parameters, while in stage three the managers simultaneously choose the firms' locations.[10]

In the third stage of the game, managers decide on the location of the firms so as to maximize their objective function: $O_i(a, b, \mathbf{a}_1, \mathbf{a}_2)$, $i = 1, 2$. By solving this problem we get:

$$a(\mathbf{a}_1, \mathbf{a}_2) = \frac{4c\,(\mathbf{a}_2 - \mathbf{a}_1) - 3t}{12t} \, ,$$

(5)

$$b(\mathbf{a}_1, \mathbf{a}_2) = \frac{4c\,(\mathbf{a}_1 - \mathbf{a}_2) - 3t}{12t} \, .$$

In the second stage, firms' owners choose the incentives parameters so as to maximize profits. Thus, the reaction functions in incentives are:

$$\mathbf{a}_i = \frac{12c - 9t}{8c} - \frac{\mathbf{a}_j}{2}; i \circ j; i, j = 1, 2.$$

(6)

Equation (6) shows that the incentive parameters are strategic substitutes and, thus, managers will be aggressive in the product market. By solving (6) and then (5) we have the following result:

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[9] In some big firms top managers take long-run decisions. For example, this is the case of Kraft, one of America's best-known brand names in food products (see Boyd, 1990).

[10] A similar game is considered by Szymanski (1994). He assumes that managers choose the level of sales and negotiate costs with input suppliers, while the owners choose the incentive parameters.

Lemma 2: When managers simultaneously choose the firms' locations, the optimal locations and profits are such that: $a^* = b^* = -\dfrac{1}{4}$ and $\boldsymbol{p}_1 = \boldsymbol{p}_2 = \dfrac{3t}{8}$.

The prices and incentives parameters of firm 1 and 2 are, respectively: $p_1^* = p_2^* = c + \dfrac{3t}{4}$

and $\boldsymbol{a}_1^* = \boldsymbol{a}_2^* = 1 - \dfrac{3t}{4c}$.

The result according to which incentive parameters are lower than 1 is in contrast with previous work on incentive contracts for managers (in models where managers only decide on prices) such as, for example, Fershtman and Judd (1987), Sklivas (1987) and Bárcena-Ruiz and Espinosa (1996).[11] These authors show that firms' owners encourage their managers to underproduct (incentive parameters are higher than 1) when short-run variables are strategic complements, since they also come to the conclusion that incentive parameters are strategic complements too. However, when the owners of firms delegate location decisions to managers, an additional effect is introduced into the standard game. The fact that managers decide on the location in stage three, once the owners of the firms have chosen the incentive parameters, makes incentive parameters become strategic substitutes. As equation (5) shows, the proximity of one firm to the centre of the market increases if the incentive parameter of its manager decreases (i. e., the manager is more aggressive) or if the incentive parameter of the manager of the other firm increases. This effect explains why the owners will encourage their managers to be aggressive.

From the point of view of the location result, we have that once the owners have chosen their managers incentives, the location chosen by the managers is the same as that resulting in the game in which managers are not hired (Lambertini, 1994). The reason is that, in equilibrium, managers are given the same incentive parameters, and, as a result, they consider the same cost $(\boldsymbol{a}_i^* c = c - \dfrac{3t}{4})$ when maximizing their objective function $O_i = (p_i - \boldsymbol{a}_i c)q_i$, i=1, 2. Given that equilibrium locations do not depend on the marginal cost

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[11] Faulí-Oller and Motta (1996), assuming a game in which managers choose product market strategies and make takeover decisions, also obtain that the optimal incentive parameter is lower than 1.

when managers are given the same incentive parameters, see (5), we reach the standard result according to which managers choose the locations of the unconstrained Hotelling model.

3.3. Only one owner delegates the location decision

In this subgame, the owner of firm 1 decides the location of his firm on his own, while the owner of firm 2 delegates the firm's location decision to his manager. Thus, in the second stage of the game, the owner of firm 2 chooses the incentive scheme of his manager. In the third stage of the game, the owner of firm 1 and the manager of firm 2 take location decisions simultaneously. In the fourth stage of the game, the owner of firm 1 chooses his manager's incentives.[12]

In the fourth stage of the game the owner of firm 1 chooses the $\boldsymbol{a}_1$ that maximizes:

$$\boldsymbol{p}_1(a, b, \boldsymbol{a}_i, \boldsymbol{a}_j) = [\ p_1^*(a, b, \boldsymbol{a}_i, \boldsymbol{a}_j) - c]\ q_1^*(a, b, \boldsymbol{a}_i, \boldsymbol{a}_j);\ i \neq j$$

Solving the preceding problem we get that:

$$\alpha_1^*(a, b, \alpha_2) = \frac{(3 + a - b)(1 - a - b)\ t + c\ (3 + \alpha_2)}{4c}. \tag{7}$$

In the third stage of the game, locations are chosen by the owner of firm 1 and the manager of firm 2 simultaneously. Firm 2's manager chooses the value of b that maximizes his objective function:

$$O_2 = [p_2^*(a, b, \boldsymbol{a}_1^*(a, b, \boldsymbol{a}_2), \boldsymbol{a}_2) - \boldsymbol{a}_2 c]\ q_2^*(a, b, \boldsymbol{a}_1^*(a, b, \boldsymbol{a}_2), \boldsymbol{a}_2).$$

The owner of firm 1 chooses the value of a that maximizes his profits:

$$\boldsymbol{p}_1(\cdot) = [p_1^*(a, b, \boldsymbol{a}_1^*(a, b, \boldsymbol{a}_2), \boldsymbol{a}_2) - c]\, q_1^*(a, b, \boldsymbol{a}_1^*(a, b, \boldsymbol{a}_2), \boldsymbol{a}_2).$$

From the first order conditions of the preceding problems we get that:

$$a^*(\boldsymbol{a}_2) = \frac{c\boldsymbol{a}_2 - c}{4\,t},$$

$$b^*(\boldsymbol{a}_2) = \frac{c - 4t - c\boldsymbol{a}_2}{4\,t}.$$

(8)

In the second stage of the game, the owner of firm 2 chooses his manager's incentives $\boldsymbol{a}_2$ such as to maximize:

$$\boldsymbol{p}_2(\cdot) = [p_2^*(a^*(\boldsymbol{a}_2), b^*(\boldsymbol{a}_2), \boldsymbol{a}_1^*(\boldsymbol{a}_2), \boldsymbol{a}_2) - c]\, q_2^*(a^*(\boldsymbol{a}_2), b^*(\boldsymbol{a}_2), \boldsymbol{a}_1^*(\boldsymbol{a}_2), \boldsymbol{a}_2).$$

It is straightforward to verify that the solution of the game is the following:

Lemma 3: When the owner of firm 1 decides the location of the firm by himself, while the owner of the firm 2 delegates the firm´s location decision to his manager, the optimal locations and profits are such that: $a^*=0$, $b^*=-1$, $\boldsymbol{p}_1 = 2\,t$ and $\boldsymbol{p}_2 = t$.

In equilibrium, the prices and incentives parameters of the firms are: $p_1 = c + 4\,t$, $p_2 = c + 2\,t$, $\alpha_1 = 1 + \dfrac{2\,t}{c}$ and $\alpha_2 = 1$.[13]

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[13] The main result obtained in this section also holds if we consider that location decisions are chosen sequentially. Thus, we could assume that, in the second stage, the owner of firm 1 chooses the location of his firm and the owner of firm 2 chooses his manager's incentives; in the third stage, the owner of firm 1 chooses his manager's incentives and the manager of firm 2 chooses firm 2's location. With this timing, we get that the owner of firm 1, who does not delegate location decision, gets higher profits than the owner of firm 2, who does delegate location decision ($\boldsymbol{p}_1 = 2.1526t > \boldsymbol{p}_2 = 0.6779t$, $a^* = 0.5$ and $b^* = -0.5658$).

This lemma shows that the owner who does not delegate the location decision (the owner of firm 1) gets higher profits than the owner who delegates this decision (the owner of firm 2). Firm 1 is located at the city's left boundary ($a^*=0$) while firm 2 locates outside the city limits, at $b^*=-1$.

We must note, in order to explain this result, that the distance between the two rivals, $1 - a - b$, does not depend on the value of a_2 (see (8)); the distance between the two rivals is always 2. This result is owed to the fact that the incentive parameter a_2 (see (8)) has the same effect, but with opposed sign, on a^* ($\dfrac{d\,a^*}{d\,a_2} = \dfrac{c}{4t}$) as on b^* ($\dfrac{d\,b^*}{d\,a_2} = -\dfrac{c}{4t}$).

When the leader in incentive decisions, the owner of firm 2, chooses the incentive scheme of his manager, a_2, he takes into account the following tradeoff. On the one hand, if the incentive parameter a_2 increases, given that incentive parameters are strategic complements (see (7)), the incentive parameter chosen by the follower, a_1, also increases; by setting $a_2>1$ the owner of firm 2 manages to get the other owner to choose $a_1>1$, which relaxes competition in the product market by increasing prices (substituting (8) in (7) we get that: $\alpha_1^*(\alpha_2) = \dfrac{c + 4\,t + c\,\alpha_2}{2c}$). On the other hand, if the incentive parameter a_2 increases, this pushes firm 1 towards the middle of the market but pushes firm 2 far from firm 1 (see (8)), which is harmful for firm 2.

If $a_2>1$, the second effect is stronger than the first effect; thus, although the prices of both firms increase, the reduction in the market share of firm 2 has a greater weight. The owner of firm 2 will not choose $a_2<1$ since, in this case, competition in the product market would be strong (as $p_1(\alpha_2) = 4\,t + c\,\alpha_2$ and $p_2(\alpha_2) = (4\,t + c + c\,\alpha_2)/2$, $p_i(\alpha_2)$ increases with a_2, and both managers would be incentived to increase prices); in this case, the owner of firm 2 raises its market share, but the fact that price competition is stronger is harmful for him. As a result, the owner of firm 2 chooses $a_2=1$, and this encourages his manager to maximize profits, and firm 1 gets higher profits than firm 2.

Substituting (7) and (8) in the profit function of firm 2 we have that the profit of firm 2, as a function of a_2, is: $\pi_2(\alpha_2) = t - \dfrac{c^2}{16t}(1 - \alpha_2)^2$. Thus, the fact that the owner of firm 2 delegates the location decision, while the owner of firm 1 does not delegate it, makes the

owner of firm 2 the leader in incentive parameters, therefore implying that we have a maximum for a_2=1. As a result, the owner of firm 2 encourages his manager to maximize profits, and both the owner and the manager have the same objective function.

4.4. To delegate or not to delegate location decisions

Let us now analyze if it is in the interest of the owners to delegate product variety decisions to their managers. As we have argued before, there are four different subgames: the first is that in which the owners of both firms simultaneously choose the product variety; the second is that in which both owners delegate the decisions on product differentiation to their managers; the third and fourth are those in which the owner of one firm chooses the location, and the rival chooses the incentives of his manager and delegates the location decision to him. The four subgames have already been looked into before and the firms' profits are shown in figure 1; these profits depend on whether it is the owner or the manager who takes the location decision.

[INSERT FIGURE 1]

Then, we can establish the following proposition:

Proposition 1: The game in which firms' owners choose whether to delegate the location decision to a manager or whether to choose it by themselves has a unique subgame perfect Nash equilibrium in which both owners choose the location of the firm by themselves.

Proof. It is straightforward to verify that not delegating the location decision dominates delegating it. Then, both owners choose the firms' product variety.

The reason why we come to the preceding result is the following. When one owner chooses to delegate the location decision, the other owner by not delegating the location decision can guarantee a better location in the market and less competition in the future (less aggressive managers). As a result, when one owner delegates the location decision, the other owner will not delegate it. Looking at the case in which one owner does not delegate, the best response the other owner can give is not to delegate either. Thus, the firm avoids becoming a

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leader in incentive parameters and can guarantee less competition in the product market in the future. As a result, each owner will prefer not to delegate the location decision because when delegating it the firm could become a leader in the choice of incentives and this would not do the firm any good.

4. Concluding remarks

The existence of owners who hire managers in order to delegate their short-run decisions allows the firms competing in a market to increase the degree of product differentiation. Firms offer their managers contracts in which sales are penalized (the incentive parameters are higher than 1). Firms' owners due to the relaxation of competition locate the firm farther from the rival and, as a result, the degree of product differentiation increases. Therefore, strategic delegation ought to be seen as a source of distortion different from others proposed in the literature, as for example the uncertainty about consumer tastes (see Casado-Izaga, 1999) meaning to explain the increase in the degree of product differentiation.

When owners delegate both location and price decisions to managers, the results of product differentiation, with simultaneous decisions on location, are the same as those without strategic delegation; this is so owing to the linear structure of the incentives in the managers' objective function. In this case the owners encourage their managers to sell more than what corresponds to the level in which the profits are maximized. Then, each manager will locate the firm closer to his rival if compared with the case in which the locations are chosen by the owners.

Finally, if we look into the question of whether the owners want to delegate the choice of product variety or not, we find that firms' owners do have incentives to choose product variety on their own and delegate later price decisions to their managers. Therefore, the owners have an incentive to keep the most important decisions to themselves and to delegate the operative decisions to their managers.

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Firm 2

	Owner	Manager
Owner	*2.5t , 2.5t*	*2t , t*
Manager	*t , 2t*	*0.375t , 0.375t*

Firm 1

Figure 1. Summary of the results