ANNALES D'ÉCONOMIE ET DE STATISTIQUE. – N° 33 — 1994

Employee Control and Oligopoly in a Free Market Economy

Helmuth CREMER, Jacques CRÉMER*

ABSTRACT. – We study duopolistic markets where a profit-maximizing firm competes with an employee-controlled firm that maximizes value-added per employee. We first study an industry with Cournot competition. We show that the presence of an employee-controlled firm does not affect the equilibrium number of firms, lowers aggregate output, increases price and reduces social welfare. The employee-controlled firm has a smaller equilibrium output than its competitor.

For Hotelling type competition in a market with diversified products, we show that equilibrium locations are not affected by employee control, that prices increase and that social welfare decreases. The market share of the employee-controlled firm is lower than that of its competitor. Surprisingly, the profits of *both* firms can increase when control is transferred from stockholders to employees in one of them.

Finally, we show that employees would not want to buy a firm from its owners.

Coopératives et oligopoles dans une économie de marché

RÉSUMÉ. – Nous étudions des duopoles où une firme qui cherche à maximiser ses profits est en concurrence avec une entreprise autogérée qui cherche à maximiser la valeur ajoutée par employé. En se plaçant tout d'abord dans le cadre d'un oligopole de Cournot, nous montrons que la présence d'une entreprise autogérée n'affecte pas le nombre de firmes à l'équilibre, fait diminuer la production agrégée de l'industrie et augmenter le prix, et réduit le bien-être social. La firme autogérée produit moins que son concurrent.

Dans le cadre d'un oligopole à la Hotelling, nous montrons que le choix des produits n'est pas affecté par la présence d'une entreprise autogérée, que les prix augmentent et que le bien-être social diminue. La part de marché de la firme autogérée est plus faible que celle de son concurrent. De façon plus surprenante, les profits des deux entreprises peuvent augmenter quand le contrôle passe des actionnaires aux employés dans l'une d'entre elles.

Finalement, nous montrons que les employés ne seront jamais prêts à acheter une entreprise à des actionnaires.

---

* H. CREMER : Université des Sciences Sociales de Toulouse and Virginia Polytechnic Institute & State University; J. CRÉMER : CNRS, GREMAQ, and IDEI. Jacques Crémer's work was supported by the NSF, grant #SES 8722014

We thank Catherine Eckel, Allan Mandelstamm, Myrna Wooders, and the participants at seminars at the Virginia Polytechnic Institute & State University, Queen's University, the University of Virginia, the 1990 Southeastern Economic Theory Conference in Gainesville, Florida, the 1990 « Journées de microéconomie appliquée » in Montreal, Canada, and the conference on « Non profit maximizing firms and the cooperative sector » in Aix-en-Provence, 1991, for useful comments.

1 Introduction

JENSEN [1989] might be overshooting when he predicts the demise of the limited liability firm within the next few years, but we have certainly witnessed in recent years numerous experiments with new organizational forms. Quite often, in order to avoid the moral hazard problems associated with the separation of ownership and management, employees or subgroups of employees buy out the stockholders and run firms on their own account. In this paper, we study the strategic interactions in an industry where one firm has taken this path while the other is still owned by shareholders.

In the US, employees are majority owners in an estimated 1 500 companies (Joseph R. BLASI, quoted in VALENTE and SMITH [1990], and the development of ESOP's could increase this number. Furthermore a number of organizational forms prevalent in Western countries may give substantial power to employees. This is true of state ownership, and there are important oligopolistic markets where state-owned companies compete with private enterprises. Prominent examples are the European automobile, aircraft and oil industries as well as the banking sector. Employees also have substantial power in non-profit organizations. In the United States, non-profit organizations compete with for-profit organizations in a number of sectors where local oligopolies are prevalent; the health care industry is a primary example. While state-owned and not-for-profit organizations are not allowed to explicitly distribute their profits to their employees, they may choose an equivalent route by paying above-market wages or by providing high employee benefits. Our analysis might throw some light on these industries. In some countries important politicians, while supporting free market economies [1], propose reforms to favor the gradual growth of cooperative firms (ROCARD [1990]). A careful analysis is needed to determine the probability of success of such reforms.

The in again and out again buy-out of United Airlines (UAL) by its pilots provides an interesting example for our study. After UAL run into financial difficulties and became a target for raiders attracted by the important fixed assets it owned–its planes–a group of investors in which the pilots' union had a majority stake offered to buy out the airline in September 1989. This group offered a very high price, $ 300 for shares that traded at less than $ 100 less than three years before, and at less than $ 150 six months later. Yet the deal could not be consumed. It failed, to the best of our understanding, because the partners of the pilots, mostly British Airways, required more guarantees about the safety of their investment than could be provided. [2]

1. To be precise, ROCARD, in the article quoted below, differentiates between free market and capitalist economies.

2. As of January 1994 a new Buy-out is being discussed at $ 174 per stare (*Aviation week and Space Technology*), 3 Jan 1994).

This episode raises a number of questions of general importance. Is the failure of this deal a sign that employee-control is impossible in a free market economy? Or was it due to specific features of this buy-out, maybe the extremely high price? Are some industries more favorable to the viability of employee-controlled firms? Which ones? Are productivity gains due to the change in control necessary to induce takeovers by employees?

As organization theorists we would address these questions by studying the implications of the transfer of control for the efficiency of firms. We set these phenomena aside in order to study the strategic behavior of a firm that is owned by a substantial component, or the totality, of its workforce–for instance the pilots of UAL. Assuming away any changes in the production capabilities of the firm we study the consequences of such experiments on price, output, and social welfare, and we attempt to identify the industries in which they are more likely to succeed.

Our main results are presented in sections 2 and especially in 3. We study duopolies where one firm maximizes its profits while the other is employee-controlled. In section 2 we consider Cournot competition in an industry that produces undifferentiated products. Although Cournot competition between employee-controlled and profit-maximizing firm has not been explored in the literature, some of the results have a familiar flavor, as the behavior of employee-controlled firms with market power has been extensively studied. It nevertheless appears that the strategic interaction is a crucial ingredient, and that some phenomena can not be properly understood by considering the employee-controlled firm alone. In section 3 we use a Hotelling-type model to study an industry with horizontal product differentiation and endogenous product selection. As far as we know, the literature contains no study of product choice by employee-controlled firms. It appears that the impact of employee-control on a Hotelling-type industry is very different from its impact on a Cournot-type industry. And, it turns out that this differential impact is not an issue of homogenous vs. differentiated products, but results from the different types of strategic interaction.

We have found only one direct predecessor to the analysis of sections 2 and 3. LAW and STEWART [1983] study a Stackelberg duopoly where a profit-maximizing and an employee-controlled firm coexist. They focus their attention on the incentives to play the role of leader or follower, and they show that there could be agreement: In some cases, the profit-maximizing firm will prefer to be the leader and the employee-controlled firm will prefer to be the follower.

Section 2 will have shown that entry and exit are not modified by the legal status of the firm. In section 4 we ask a different question: Would a profit minded entrepreneur find it profitable to buy an already functioning employee-controlled firm? A positive answer would indicate that managed firms should not last very long. And the answer is indeed positive in many, but not all, cases. We also show that the answer to the converse question–will employees ever buy a profit-maximizing firm from its owners?–is always negative.

While writing this paper, we faced one important and interesting modeling issue. Employee-controlled firms maximize profits per employee, but if the total remuneration becomes smaller than the market wage, the employees will quit. This will not happen at equilibrium, but we still need to describe the behavior of the firm in this case in order to compute its reaction function [3]. Our solution, explained in detail in section 5 is to assume that when the compensation of employees fall below the market wage, the firm tries to maximize its profit, or rather minimize its loss, maybe because it has been taken over by the bank that helped it raise capital (we will show that such a solution is consistent). The failure of the UAL buy-out proves that these considerations play a role in practice.

Finally, a few words about terminology and our modeling choices. We draw heavily on the insights developed by the labor management literature, and our model of employee-control is exactly similar to its modeling of labor management. However, most of this literature studies economies where all firms are labor managed. We use the term employee-control to stress the applicability of our analysis to contemporary market economies.

For the most part we assume that the labor force is homogeneous, and that the firm maximizes the value-added per employee. In reality employee-controlled firms face difficult problems of allocation of tasks among their employees, and special difficulties in the design of compensation packages (see MacLeold [1987] and [1988]). We also assume that the constitution of the employee-controlled firm forbids it to discriminate between new and old employees. In particular, it cannot charge an entry fee to new employees. This possibility would substantially change the results (see Sertel [1990]).

In a companion paper Cremer and Crémer [1992], we study a similar model. Because we assume much more general forms in that paper we are not able to study a number of interesting issues. In particular, in the present paper entry in the Cournot-Nash model, and location in the Hotelling model are endogeneous whereas the number of firms and the characteristics of their products are considered as given in the other paper, which, furthermore, does not consider at all the issues addressed in sections 4 and 5 [4].

2 The Employee-Controlled Firm in a Cournot-Nash Oligopoly

Consider n firms that are potential competitors in the market we consider. They play a two stage game:

• In the first stage they (simultaneously) decide whether or not to enter.

• In the second stage the firms that have entered play a Cournot-Nash oligopoly.

3. Modern applications of game theory to economics have shown that it is crucial to identify the behavior of an agent for *all* possible actions of his rivals.
4. At a more technical level, with general functional forms we are only able to obtain local results, when profits are close to 0, whereas in the present paper, we can derive results whatever the value of profits.

If a firm enters, it incurs an entry cost F which is irreversible. Having incurred this cost, firms produce according to an identical Leontief technology

$$q_i = \min\left\{\frac{l_i}{\alpha}, \frac{k_i}{\beta}\right\},$$

where q_i is production, l_i is labor and k_i is some other input, which we call capital for simplicity. Our results would not be modified if there were several inputs other than l [5]. Some of the results of this section can be generalized to other technologies; see CREMER and CRÉMER [1992].

We had to assume that the technology showed some degree of increasing returns to scale: An employee-controlled firm always chooses a vector of inputs such that returns to scale are locally increasing, hence, if its production function is concave there is no optimum. (See PESTIEAU and THISSE [1980], LANDSBURGER and SUBOTNIK [1981], LAFFONT and MOREAUX [1985], and BONIN and PUTTERMAN [1987] for a survey) [6].

With the Leontief technology, if firm i produces $q_i > 0$ units of output, it will use $l_i = \alpha\, q_i$ units of labor and $k_i = \beta\, q_i$ units of capital. Let w be the market wage and r be the rental rate of capital, and write

$$c = \alpha\, w + \beta\, r.$$

The cost function of a profit-maximizing firm is

$$\mathrm{C}(q_i) = \begin{cases} 0 & \text{if} \quad q_i = 0, \\ cq_i + \mathrm{F} & \text{if} \quad q_i > 0. \end{cases}$$

To be more precise this is the pre-entry cost function. After entry, the cost F is sunk, and the cost is $cq_i + \mathrm{F}$ even if $q_i = 0$.

5. More precisely, none of the results change if k_i is a vector of inputs and there exists a linear homogeneous function f such that

$$q_i = \min\left\{\frac{l_i}{\alpha}, f\,(k_i)\right\}.$$

This might be not too unrealistic a model for UAL. It is difficult to substitute pilots and other inputs! If several categories of employees are potential owners of the firm and their wages are always proportional to their market wages, we can reinterpret l as an aggregate quantity of labor.

6. This is easily proved by contradiction. Consider a labor managed firm that produces at its optimum output q^* using l^* units of labor and a vector of other inputs x^*; the price of output is p_q^* and the price of inputs is p_x^*. Let $l' = \eta\, l'$ and $x' = \eta\, x^*$ for some $\eta \in (0, 1)$. If the technology does not show increasing returns to scale the corresponding output q' belongs to $(\eta\, q^*, q^*)$. The new prices are $p'_q \geq p_q^*$ and $p'_x \leq p_x^*$. The value added per worker is

$$\frac{p'_q\, q' - p'_x\, x'}{l'} = \frac{p'_q\, q' - p'_x\,(\eta\, x^*)}{\eta\, l'} \geq \frac{p'_q\, q^* - p'_x\, x^*}{l^*} \geq \frac{p_q^*\, q^* - p_x^*\, x^*}{l^*}$$

and one of the inequalities is strict either if there is market power or strictly decreasing returns to scale. This establishes the contradiction.

We assume that the inverse demand function is linear:

$$p(q) = a - bq \tag{1}$$

with $a > c > 0$ and $b > 0$.

We consider only cases were exactly two firms would enter the market if all potential entrants were profit-maximizing firms. In such a situation, both firms are making a profit, but if a third firm entered all three firms would make a loss. To determine the relevant range of parameters, we first reexamine the competition between profit-maximizing firms. It is easy to check that their reaction function is

$$q_i = \frac{a - b\mathrm{T} - c}{2b} \tag{2}$$

where T is the aggregate production of the competitors. Table 1 describes the equilibrium under duopoly and "triopoly" [7]. Exactly two firms enter if F belongs to the interval $(\underline{\mathrm{F}}, \overline{\mathrm{F}})$ where $\underline{\mathrm{F}} = (a-c)^2/16\,b$ and $\overline{\mathrm{F}} = (a-c)^2/9\,b$; see VICKERS [1989].

We now turn to our main theme, the competition between an employee-controlled and a profit-maximizing firm. Firm 1 is employee-controlled, whereas firm 2 maximizes its profits. The employees of firm 1 share the value added of the firm, $pq_1 - rk_1 - \mathrm{F}$, and choose an output that maximizes the ratio of this quantity to l_1. The firm enters **if and only if** it can realize a value-added per worker greater than the market wage and therefore this condition will always be met in equilibrium.

Because of the Leontief technology once firm 1 has chosen its production, q_1, the quantity of each input is also determined [8]. It value added per worker is

$$w_1(q_1, q_2) = \frac{(a - b(q_1 + q_2))\,q_1 - r\,\beta\,q_1 - \mathrm{F}}{\alpha\,q_1}, \tag{3}$$

TABLE 1

Cournot-Nash Competition between Profit-Maximizing Firms

	Duopoly	Triopoly
Output per firm	$\frac{a-c}{3\,b}$	$\frac{a-c}{4\,b}$
Price	$\frac{a+2\,c}{3}$	$\frac{a+3\,c}{4}$
Profit per firm	$\frac{(a-c)^3}{9\,b} - \mathrm{F}$	$\frac{(a-c)^2}{16\,b} - \mathrm{F}$

7. To check the "triopoly" computations, for instance, substitute $2\,q_i$ for T in equation (2) and solve to obtain $q_i = (a-c)/4\,b$.
8. In general, an employee-controlled firm will distort the choice of inputs, see CREMER and CRÉMER [1992], but this is not the case with a Leontief technology.

and its profit at market wages is

$$\Pi_1(q_1, q_2) = (a - b(q_1 + q_2))\, q_1 - w\,\alpha\, q_1 - r\,\beta\, q_1 - \mathrm{F} \tag{4}$$

$$= \alpha\, q_1\, (w_1(q_1, q_2) - w). \tag{5}$$

The value added per worker is greater than w if and only if the profit at market wages is positive.

We have

$$\frac{\partial w_1(q_1, q_2)}{\partial q_1} = -\frac{b}{\alpha} + \frac{\mathrm{F}}{\alpha\, q_1^2}, \tag{6}$$

and

$$\frac{\partial^2 w_1(q_1, q_2)}{\partial q_1^2} = -\frac{2\,\mathrm{F}}{\alpha\, q_1^3}\,. \tag{7}$$

The function $w_1(q_1, q_2)$ is strictly concave in q_1.

We use a superscript $^{\mathrm{P}}$ to denote the quantities associated with the equilibrium when *both* firms maximize their profits, and the superscript $^{\mathrm{E}}$ to denote the quantities associated with the equilibrium when firm 1 is controlled by its employees, while firm 2 continues to maximize profits. To compute $(q_1^{\mathrm{E}}, q_2^{\mathrm{E}})$, we set (6) equal to zero and obtain

$$q_1^{\mathrm{E}} = \frac{\sqrt{\mathrm{F}}}{\sqrt{b}}. \tag{8}$$

Per equation (2), the production of firm 2, which maximizes profits, is

$$q_2^{\mathrm{E}} = \frac{a - c}{2\,b} - \frac{\sqrt{\mathrm{F}}}{2\sqrt{b}}, \tag{9}$$

and, from equation (1) the equilibrium price, p^{E}, is

$$p^{\mathrm{E}} = \frac{a + c}{2} - \frac{\sqrt{b}\,\sqrt{\mathrm{F}}}{2}. \tag{10}$$

Equation (8) is not only the equilibrium production of firm 1, it is also its reaction function. It shows that in our setting the optimal output of an employee-controlled firm is independent of the other firm's output. Figure 1 depicts the reaction functions and the equilibrium.

Using equations (8) and (9) and Table 1, it is easy to show that when the entry cost is equal to $\overline{\mathrm{F}}$, the market structure has no influence: the equilibria are identical whether firm 1 is employee-controlled or profit-maximizing. In this case, the employee-controlled firm must choose the same output as a profit-maximizing firm. For any other output, the compensation paid to its workers would drop below the market wage.

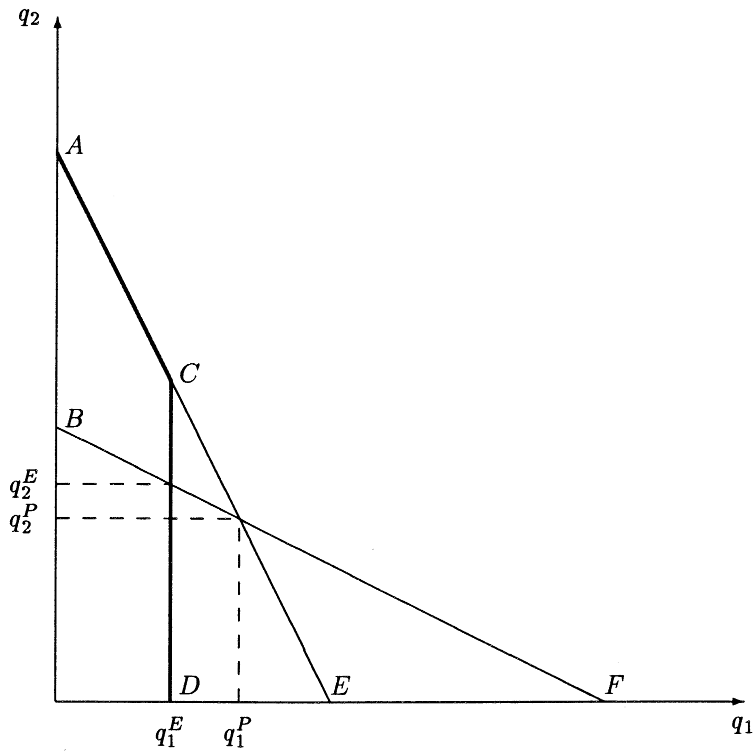

FIGURE 1

This figure represents the equilibrium in the Cournot-Nash case. BF ***represents the reaction function of firm 2,*** AE ***the reaction function of firm 1 when it maximizes profits, and*** DCA ***its reaction function when it is employee-controlled. The two equilibria are represented.***

The following proposition compares the two equilibria for $F \neq \overline{F}$. Write Π_i^P, for $\Pi_i\,(q_i^P, q_2^P)$ and Π_i^E for $\Pi_i\,(q_1^E, q_2^E)$.

PROPOSITION 1: For all $F \in (\underline{F}, \overline{F})$ we have

(11a) $$q_1^E < q_1^P = q_2^P < q_2^E,$$

(11b) $$q_1^E + q_2^E < q_1^P + q_2^P,$$

(11c) $$p^E > p^P,$$

(11d) $$0 < \Pi_1^E < \Pi_1^P = \Pi_2^P < \Pi_2^E.$$

Simple algebra proves these relations, and figure 1 provides some geometric intuition. Equation (11a) shows that, as we would expect, an employee-controlled firm produces less than a profit-maximizing firm in order to share profits among a smaller group of employees. This effect is strong enough to decrease aggregate output [equation (11b)] and, hence, to raise the price [equation (11c)]. The introduction of an employee-controlled firm lowers social surplus: the price increases from an already too high level. Equation (11d) also shows that firm 2 benefits from the change of objectives of its competitor. Finally, proposition 1 implies that for $\mathrm{F} < \overline{\mathrm{F}}$ the employee-controlled firm achieves a positive **equilibrium** profit and, hence, a compensation per employee higher than the market wage. It follows that when there is room for two profit-maximizing firms in the market, an employee-controlled firm can coexist with a profit-maximizing competitor.

The following somewhat surprising proposition is easily proved:

PROPOSITION 2: The equilibrium value-added per worker of firm 1 is greater when it maximizes profits than when it is employee-controlled:

$$w_1\,(q_1^{\mathrm{E}},\, q_2^{\mathrm{E}}) < w_1\,(q_1^{\mathrm{P}},\, q_2^{\mathrm{P}}).$$

Intuitively this result can easily be understood. Consider the profit-maximizing equilibrium $(q_1^{\mathrm{P}},\, q_2^{\mathrm{P}})$. If firm 2 produces q_2^{P}, the employees of firm 1 can increase their compensation by reducing output from q_1^{P} to q_1^{E} (see Figure 1). However, because the reaction function of firm 2 is downwards sloping, the reduction in q_1 leads to an increase in q_2 to q_2^{E} and this has a negative impact on the compensation that can be achieved. This second effect is stronger than the first, hence the result.

As a consequence of proposition 2, the employees would be better off turning over management to a third party who would be publicly instructed to maximize profits. This solution is beneficial only if its profit-maximizing competitor indeed believes that the employees will not intervene in the determination of output. (See FERSHTMAN and JUDD [1987] and SLIVAK [1987] for extensive discussions of similar phenomena).

De FRAJA and DELBONO [1989] and CREMER *et al.* [1991] find similar results when studying public enterprises in oligopolistic industries. They show that if the managers of a public enterprise try to maximize social welfare, equilibrium social welfare may be lower than when the firm tries to maximize its profits.

As discussed above, is $\mathrm{F} \leq \overline{\mathrm{F}}$ an employee-controlled firm enters if there is a single profit maximizing firm in the market. The equilibrium number of firms will thus not decrease if one of the potential firms is employee-controlled. To see if it can increase we have to study the equilibrium of a market with two profit-maximizing and one employee-controlled firm. The results are given in Table 2 [9]. It is immediate that with $\mathrm{F} > \underline{\mathrm{F}}$ no additional

9. To check the computations, substitute in equation (2) $\sqrt{(\mathrm{F}/b)} + v$ with $v = (a-c)/3\,b - \dfrac{\sqrt{\mathrm{F}}}{3\sqrt{b}}$ for T and verify that one obtains $q_i = v$.

profit-maximizing firm will enter. It follows that **the equilibrium number of firms is not affected by the presence of an employee-controlled firm.**

TABLE 2

Cournot-Nash Equilibrium with One Employee-Controlled and Two Profit-Maximizing Firms

	Employed-controlled firm	Profit-maximizing firms
Output	$\frac{\sqrt{F}}{\sqrt{b}}$	$\frac{a-c}{3\,b} - \frac{\sqrt{F}}{3\sqrt{b}}$
Price	$\frac{a+2\,c}{3} - \frac{\sqrt{b}\sqrt{F}}{3}$	
Profit	$\frac{(a-c)\sqrt{F}}{3\sqrt{b}} - \frac{4}{3}F$	$\frac{[(a-c)+2\sqrt{F})\sqrt{b}]\,[(a-c)-4\sqrt{F})\sqrt{b}]}{9\,b}$

3 Product Differentiation

In this section, we study competition between an employee-controlled and a profit-maximizing firm in a differentiated industry. We use the same technology as in the previous section but modify the demand side. Each consumer buys one unit of the good, whatever its price. If firm i, $i = 1, 2$, charges price p_i and is situated at a distance d_i of a consumer, this consumer will buy from firm 1 if $p_1 + (d_1)^2$ is smaller than $p_2 + (d_2)^2$ [10]. There is a continuum of consumers, uniformly distributed on the interval $[0, 1]$. This type of models has two possible interpretations. The distance can represent physical distance, and we have a location model in the literal sense. The interval $[0, 1]$ can also be interpreted as the space of possible variants of a product, and we have a model of horizontal product differentiation.

To keep computations within reasonable limits we assume that there are only two potential entrants [11]. The firms who have entered take two decisions: where to locate, and which price to charge. We assume that the location decision is made first, so that the game has three stages:

1. The firms decide whether to enter;

10. There would be no gain in generality in introducing a parameter δ such that transportation costs would be $\delta\,(d_i)^2$.
11. We believe that in the framework of this section the number of firms would be affected by the presence of an employee-controlled firm if there were more than two potential entrants. The problem becomes quite complicated because the influence of that firm will presumably depend on its location relative to the others. For instance in a model with three firms it can either be between them or on the side. A complete study would require an exhaustive and exhausting study of all these possibilities.

2. The firms choose their locations;

3. The firms choose their prices.

Stages 2 and 3 are those that one would find in a Hotelling model with quadratic transportation cost; see d'ASPREMONT *et al.* [1979], and KATS and NEVEN [1979]. The only difference lies in the objective of firm 1 which is defined as in section 2.

We concentrate on stages 2 and 3, and assume that both firms have already chosen to enter. We begin by reviewing well known results when both firms are profit-maximizing.

3.1. **Two Profit-Maximizing Firms**

Let x_i be the location chosen by firm i. Without loss of generality we assume that firm 1 is situated to the left of firm 2, that is $x_1 < x_2$. Then, when both firms sell strictly positive amounts, there exist a cutoff location, $t\,(p_1,\, p_2;\; x_1,\, x_2)$, such that consumers to its left buy from firm 1 and consumers to its right buy from firm 2. This location satisfies

$$p_1 + (t(p_1,\, p_2;\; x_1,\, x_2) - x_1)^2 = p_2 + (x_2 - t\,(p_1,\, p_2;\; x_1,\, x_2))^2,$$

which implies

$$t\,(p_1,\, p_2;\; x_1,\, x_2) = \frac{x_2 + x_1}{2} + \frac{p_2 - p_1}{2\,(x_2 - x_1)}. \tag{12}$$

If $p_1 = p_2$ the cutoff point is at the middle of the interval $[x_1,\, x_2]$, and when the price are different it moves closer to the firm with the highest price [12].

The profits of firm 1, net of entry cost, are

$$\Pi_1\,(p_1,\, p_2;\; x_1,\, x_2) = (p_1 - c)\, t\,(p_1,\, p_2;\; x_1,\, x_2) - \mathrm{F}, \tag{13}$$

and the profits of firm 2 are

$$\Pi_2\,(p_1,\, p_2;\; x_1,\, x_2) = (p_2 - c)\;(1 - t\,(p_1,\, p_2;\; x_1,\, x_2)) - \mathrm{F}. \tag{14}$$

Substituting from equation (12), and setting the drivatives with respect to the prices equal to zero, we obtain the best-reply functions for given locations x_1 and x_2:

$$\overline{p}_1^{\mathrm{P}}\,(p_2;\; x_1,\, x_2) = \frac{p_2}{2} + \frac{x_2^2 - x_1^2}{2} + \frac{c}{2}\,; \tag{15}$$

12. If p_1 is very large, t can be to the left of x_1, even if firm 1 sells a positive amount. A complete description of the reaction functions would also require a discussion of the choices of prices that move t to the extremities of the interval $[0,\, 1]$. In this case, one of the firms has zero sales. We will spare the reader the uniformative details.

$$(16) \qquad \overline{p}_2^{\mathrm{P}}(p_1;\, x_1,\, x_2) = \frac{p_1}{2} - \frac{x_2^2 - x_1^2}{2} + (x_2 - x_1) + \frac{c}{2}\,.$$

Then the equilibrium prices, again for given locations $(x_1,\, x_2)$, can easily be computed. Substituting these prices into (13) and (14) one obtains the firms equilibrium profits for given locations. As shown by d'ASPREMONT *et al.* [1979] the profit of firm 1 is a decreasing function of x_1, while the profit of firm 2 increases in x_2. Therefore the equilibrium locations are $(0,\, 1)$ and the equilibrium is described by the following equations:

$$(17a) \qquad x_1^{\mathrm{P}} = 0, \qquad x_2^{\mathrm{P}} = 1,$$

$$(17b) \qquad p_1^{\mathrm{P}} = p_2^{\mathrm{P}} = 1 + c,$$

$$(17c) \qquad t^{\mathrm{P}} = 1/2,$$

$$(17d) \qquad \Pi_1^{\mathrm{P}} = \Pi_2^{\mathrm{P}} = 1/2 - F.$$

We make sure that both firms will choose to enter by assuming $\mathrm{F} \leq 1/2$. If F is close enough to 1/2, there would not be enough demand to support three firms, and the presence of two firms in the market could be obtained endogenously, even if there were more than two potential entrants.

3.2. **One Employee-Controlled and One Profit-Maximizing Firm**

Let us now compute the equilibrium when firm 1 is employee-controlled and firm 2 maximizes its profit. As in section 2, we use a simplified objective function for firm 1, a more sophisticated treatment is sketched in the next section 5.

The best-reply function of firm 2 does not depend on the objective of firm 1:

$$(18) \qquad \overline{p}_2^{\mathrm{E}}(p_1; x_1,\, x_2) = \overline{p}_2^{\mathrm{P}}(p_1; x_1,\, x_2) = \frac{p_1}{2} - \frac{x_2^2 - x_1^2}{2} + (x_2 - x_1) + \frac{c}{2}\,.$$

For any vector of locations $(x_1,\, x_2)$, firm 1 will be able to generate a value added per worker greater than w as long as p_2 is large enough. In these cases, we have

$$w_1(p_1,\, p_2;\, x_1,\, x_2) = \frac{(p_1 - \beta\, r)\, t\,(p_1,\, p_2;\, x_1,\, x_2) - \mathrm{F}}{\alpha\, t\,(p_1,\, p_2;\, x_1,\, x_2)} = \frac{p_1 - \beta\, r}{\alpha} - \frac{\mathrm{F}}{\alpha\, t\,(p_1,\, p_2;\, x_1,\, x_2)}\,.$$

Substituting the value of $t\,(p_1,\, p_2;\; x_1,\, x_2)$ from equation (12) and differentiating, we obtain the best-reply function of firm 1 for high values of p_2:

$$(19) \qquad \overline{p}_1^{\mathrm{E}}(p_2;\, x_1,\, x_2) = p_2 + (x_2^2 - x_1^2) - \sqrt{2\,\mathrm{F}}\,\sqrt{x_2 - x_1}.$$

The slope of the reaction function would create major difficulties if both firms were employee-controlled. Either there would exist no equilibrium, or there would exist a continuum of equilibria.

Easy computations show that the reaction functions of the two firms intersect at only one point (see Figure 2) and we have

(20) $$p_1^{\mathrm{E}}(x_1, x_2) = 2(x_2 - x_1) + (x_2^2 - x_1^2) + c - 2\sqrt{2\,\mathrm{F}\,(x_2 - x_1)}$$

(21) $$p_2^{\mathrm{E}}(x_1, x_2) = 2\,(x_2 - x_1) - \sqrt{2\,\mathrm{F}\,(x_2 - x_1)} + c$$

when

(22) $$\sqrt{\mathrm{F}} \leq \frac{\sqrt{2\,(x_2 - x_1)}}{3}\left[1 + \frac{x_1 + x_2}{2}\right].$$

In this case firm 1 makes positive profits at equilibrium and pays its employees above the market wage.

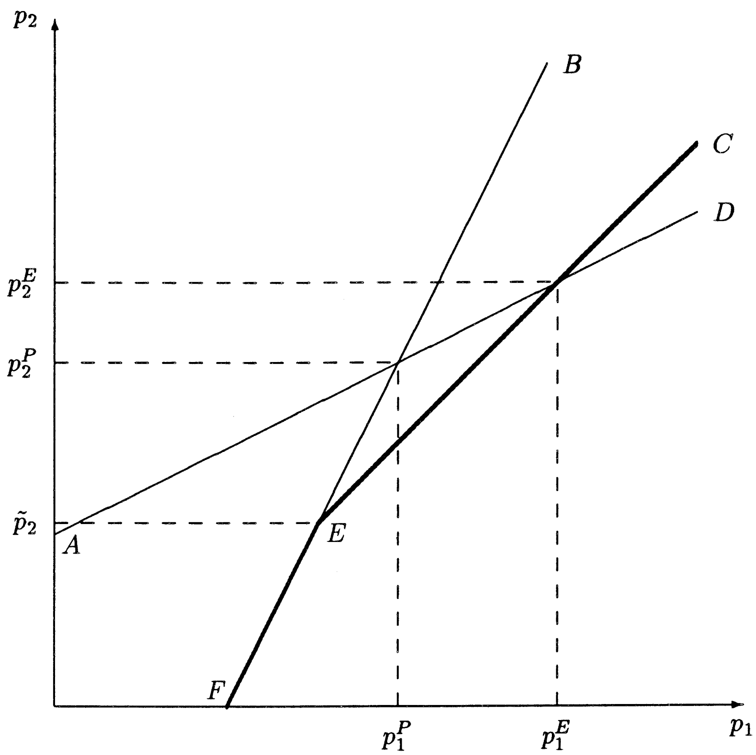

FIGURE 2

This figure illustrates the computation of equilibrium prices at given locations, when the firms are far enough that firm 1 is making positive profits. FB ***is the reaction function of firm 1 when it maximizes profits,*** FEC ***its reaction function when it is employee-controlled, and*** AD ***is the reaction function of firm 2. See equation (30) for the definition of*** $\tilde{p}_2$. ***When the firms are close to each other, the point*** E ***is above*** AD, ***and the competitive and employee-controlled equilibria coincide.***

It is now an easy task to compute the profits of firm 2 given a vector of locations (x_1, x_2):

$$\Pi_2^{\mathrm{E}}(x_1, x_2) = 2(x_2 - x_1)\left[1 - \frac{\sqrt{\mathrm{F}}}{\sqrt{2(x_2 - x_1)}}\right]^2 - \mathrm{F}. \tag{23}$$

This function is increasing in x_2, and therefore firm 2 will locate at point 1.

To find the equilibrium, it is therefore sufficient to find firm 1's best response to $x_2 = 1$ in the location game of stage 1. The relevant objective function is the value added per worker which is equal to

$$\phi(x_1) = w + \frac{1}{\alpha}\left[3 - 2x_1 - x_1^2 - 3\sqrt{2\mathrm{F}(1 - x_1)}\right].$$

We can prove

$$\alpha\phi'(x_1) = -\alpha\frac{\phi(x_1) - w}{\sqrt{2}(1 - x_1)} - .5 - 1.5x_1,$$

which in the relevant range implies

$$\alpha\phi'(x_1) < -.5 - 1.5x_1.$$

Therefore firm 1 will choose to locate at 0, and we have proved the first part of following proposition:

PROPOSITION 3: The equilibrium locations will be the same whether firm 1 is employee-controlled or maximizes its profits. The equilibrium prices and quantities under the two institutional assumptions compare as follows

$$p_1^{\mathrm{E}} > p_2^{\mathrm{E}} > p_1^{\mathrm{P}} = p_2^{\mathrm{P}}, \tag{24}$$

$$t^{\mathrm{E}} < 1/2, \tag{25}$$

$$q_1^{\mathrm{E}} < q_1^{\mathrm{P}} = q_2^{\mathrm{P}} < q_2^{\mathrm{E}},$$

The second part of the proposition is proved by substituting $x_1 = 0$ and $x_2 = 1$ in equations (20) and (21) and comparing with equation (17d). Figure 2 provides the geometric intuition.

Proposition 3 shows that prices are higher when firm 1 is employee-controlled than when it maximizes profits. Consumer surplus is therefore smaller. Because the cost of transportation is convex in distance, aggregate transportation costs are minimized when the cutoff location is situated at 1/2. By equations (17c) and (25) aggregate transportation costs are smaller when firm 1 maximizes profits. Because demand is perfectly inelastic, lowering transportation costs and increasing total surplus are equivalent [13], and we have proved the following proposition:

---

13. In order to compute the surplus of the consumers, we must know their reservation prices. We assume that they are high enough to ensure that demand is inelastic at all relevant prices. Then total surplus, that is consumer surplus plus aggregate profits, is equal to the sum of these reservation prices minus aggregate transportation costs.

PROPOSITION 4: Both consumer and total surplus are smaller when firm 1 is employee-controlled than when it maximizes profits.

The following proposition is proved by straightforward algebra. Its second part is rather surprising.

PROPOSITION 5: For $\mathrm{F} < 1/2$ the equilibrium value added of firm is greater when it is employee-controlled than when it maximizes profits, and is greater than the market wage in both cases.
For $\mathrm{F} \in (1/8,\ 1/2)$ the profits of firm 1 are greater when it is employee-controlled than when it maximizes profits. They are smaller when F belongs to $(0,\ 1/8)$, and equal when $\mathrm{F} = 1/8$. The profits of firm 2 are always greater when firm 1 is employee-controlled.

For given p_2, firm 1 will charge a higher price when it is employee-controlled than when it is profit-maximizing. From equation (18) firm 2 will react to this increase in price by increasing its own price, and successive rounds of price increases will lead to the situation depicted in equation (24). These increases in price can be sufficient to increase the profits of both firms, and in any case they are sufficient to ensure that the value added per worker in firm 1 increases.

4 Buying and Selling Employee-Controlled Firms

Our analysis so far applies to existing employee-controlled firms and to employee-controlled entrants. We now consider two related issues: The take-over of a profit-maximizing firm by its employees and, conversely, the buy-out of an employee-controlled firm by a profit-minded entrepreneur.

Some take-overs of firms by their employees occur when the firm has run into financial difficulties, for instance because of expensive union contracts [14]. In this case the change of control seems to be closely linked to the bargaining over a reduction of wages. Outside of these special circumstances, would it ever be possible for employees to buy a firm from its owners and, as a result, to be better off? The following argument suggests that the answer is negative.

The lowest price at which employees can purchase a firm is, in our static model, equal to its profit. This is the amount that will just compensate the owner. If this price is paid, the objective function of the firm after the employees take control is given by equation (27) or (28) with F replaced by

14. However, this does not seem to be the case in the French sample used by BANON [1990]: none of the 18 firms taken over by the employees was in a difficult financial situation, and only one out of 30 taken over by management was.

Π_1^{P}. Under these conditions $(q_1^{\mathrm{P}}, q_2^{\mathrm{P}})$ or $(p_1^{\mathrm{P}}, p_2^{\mathrm{P}}; x_1^{\mathrm{P}}, x_2^{\mathrm{P}})$ is an employee-controlled equilibrium. Take for instance the case of Cournot competition. If firm 1 produces q_1^{P}, firm 2 can do no better than produce q_2^{P}. If firm 2 produces q_2^{P}, firm 1 is making zero profits, measured with the new fixed cost, when it produces q_1^{P}, and it clearly can do no better as any other production would result in smaller profits. Hence, the value-added per employee can never be above the market wage, and the result is proved.

This argument shows that employee-control will not emerge through the buy-out of well-functioning profit-maximizing firms, except if employee-control improves the efficiency of the organization. Barring such an improvement, employee-controlled firms will either be created or will emerge after the re-organization of profit-maximizing firms in difficulty.

On the other hand, our results suggest that there are many circumstances under which entrepreneurs can buy employee-controlled firms from their employees. Proposition 1 shows that the employee-controlled firm makes lower profits than it would under profit-maximization. An entrepreneur could pay each of the present employees $\Pi_1^{\mathrm{E}}/l_1^{\mathrm{E}}$, which would compensate them for their loss of property rights, and make a positive profit.

There is one case in which entrepreneurs would not able to buy out an employee-controlled firm. Proposition 5 shows that in Hotelling competition, when the fixed costs are high enough, *i.e.* when the firms have limited profit opportunities, it would be impossible to compensate the current employees and generate a positive profit.

Overall, wa can expect little buying of well-functioning profit- maximizing firms by their employees. If employees take control for some reason or the other, we can expect them to resell the firm except in markets for differentiated products when profit opportunities are not too high.

5 On the Objective Function of an Employee-Controlled Firm

The results derived in the preceding sections are correct, but the reasoning is not watertight. In this section, we patch the hole. The problem has some theoretical interest, and has important implications for models where uncertainty is taken explicitly into account. However, the reader can skip this development without loss of continuity.

5.1. Cournot-Nash Equilibrium

Equation (8) states that firm 1 will produce $\sqrt{\mathrm{F}/b}$ whatever the production of firm 2. Assume, as sounds reasonable, that employees cannot be made personally liable for the fixed cost. If the output of firm 2 is so large that the value added per employee of firm 1, w_1, is less than the market wage

w, the employees will leave the firm to find another job and the fixed cost will be lost. It is possible to use this intuition to build examples where the second stage of the game has two equilibria, one similar to that described above, and one in which firm 2 behaves as a monopolist [15]. Rather than use equilibrium selection arguments, we prefer to think more deeply about the objective of firm 1.

We make the following, not too unrealistic, institutional assumption, already discussed in the introduction. The cost of entry is lent to the firm by an outside agency, let us say a bank who reserves the right to take over the control of the firm when the profits, net of labor cost measured at market wage, are too small to cover the amount which it is due, F. In this case, the bank will want the firm to maximize its profit, or rather minimize its loss [16].

Institutionally, we can imagine that the bank controls a majority of the board of directors of the firm, with representatives of the employees holding the remaining seats (the group led by the United Airlines pilots were to have a minority of votes on the board of directors, although they owned 75% of the shares). The total payments that the bank can receive are limited to F. If profits are too small to cover this amount, the directors it named try to maximize profits in order to recover as much as possible. If the profits net of F are positive, they do not care about the policy that is chosen, and the representatives of the employees become the key decision makers.

Alternatively, we obtain exactly the same behavior if the employees are guaranteed a remuneration at least equal to the market wage and that their representatives control the board [17]. When profits are large the employees would try to maximize value added per worker. When they become too small to cover this remuneration, the employees loose interest in the financial well being of the firm, and the representatives of the bank are allowed to try to limit their losses.

The value added per worker is greater than *w* if and only if the profit at market wage is positive. Therefore the following objective function for firm 1 is well defined:

$$(26) \quad y_1(q_1, q_2) = \begin{cases} w_1(q_1, q_2) - w & \text{if and only if } w_1(q_1, q_2) \geq w, \\ \Pi_1(q_1, q_2) & \text{if and only if } \Pi_1(q_1, q_2) \leq 0. \end{cases}$$

This objective function can also be written

$$(27) \quad y_1(q_1, q_2) = \min[0, \Pi_1(q_1, q_2)] + \max[0, w_1(q_1, q_2) - w].$$

For any (q_1, q_2) at most one of the terms of this sum will be positive.

15. A Derive file with the appropriate computations is available from the authors.
16. Ownership of stocks by the employees would not alleviate the problem of the previous paragraph: whether through stock ownership, loans, or a combination of both, the firm needs to raise working capital.
17. The French law on LBO's requires employees to control the board of directors, see Banon [1990].

LEMMA 1: For any q_2, the problem

$$\max_{q_1} y_1(q_1, q_2)$$

has only one local maximum.

Proof: Fix q_2, and note first that the function Π_1 is quadratic concave in q_1, negative for $q_1 = 0$, and converges to $-\infty$ when q_1 becomes very large. We must distinguish two cases:

• $y_1(q_1, q_2) = \Pi_1(q_1, q_2)$ for all q_1 because $\Pi_1(q_1, q_2) \leq 0$ for all q_1. The lemma is a direct consequence of the strict concavity of Π_1.

• There exists $\underline{q}_1(q_2)$ and $\overline{q}_1(q_2)$ such that

$$y_1(q_1, q_2) = \begin{cases} w_1(q_1, q_2) - w & \text{if} \quad q_1 \in [\underline{q}_1(q_2), \overline{q}_1(q_2)], \\ \Pi_1(q_1, q_2) & \text{if} \quad q_1 \in [0, \underline{q}_1(q_2)] \cup [\overline{q}_1(q_2), \infty). \end{cases}$$

The maximum of $y_1(q_1, q_2) = w_1(q_1, q_2) - w$ must be in the interval $[\underline{q}_1(q_2), \overline{q}_1(q_2)]$, and the lemma is a consequence of the strict concavity of the function $w_1(q)$. $\square$

We only have to prove now that the equilibrium with this corrected objective function is indeed the equilibrium that we computed in section 2. Let $(q_1^{\mathrm{E}}, q_2^{\mathrm{E}})$ be the equilibrium outputs when firm 1 is employee-controlled. We prove that $y_1(q_1^{\mathrm{E}}, q_2^{\mathrm{E}})$ is equal to $w_1(q_1^{\mathrm{E}}, q_2^{\mathrm{E}})$, not to $\Pi_1(q_1^{\mathrm{E}}, q_2^{\mathrm{E}})$. Indeed, if it were equal to $\Pi_1(q_1^{\mathrm{E}}, q_2^{\mathrm{E}})$, firm 1 would be acting like a profit-maximizing firm and these equilibrium outputs would have to be equal to $(q_1^{\mathrm{P}}, q_2^{\mathrm{P}})$. But in this case, the profits are strictly positive, per our restrictions on F, and $y_1(q_1^{\mathrm{E}}, q_2^{\mathrm{E}})$ would not be equal to $\Pi_1(q_1^{\mathrm{E}}, q_2^{\mathrm{E}})$, which establishes the contradiction.

5.2. **Product Differentiation**

Section 3 shows the same weaknesses than section 2: there are some strategies of firm 2 for which the reaction of an employee-controlled firm 1 is not well defined. For small enough p_2 it would not be able to offer its employees a remuneration above market wage. Furthermore, if the two firms locate close enough to each other, there might be no equilibrium at given location that guarantees the employees of firm 1 a remuneration above the market wage.

To solve this difficulty, by analogy with equations (26) and (27), we rewrite the objective function of firm 1:

$$y_1(p_1, p_2; x_1, x_2) = \begin{cases} w_1(p_1, p_2; x_1, x_2) - w \\ \quad \text{iff} \quad w_1(p_1, p_2; x_1, x_2) \geq w \\ \Pi_1(p_1, p_2; x_1, x_2) \\ \quad \text{iff} \quad \Pi_1(p_1, p_2; x_1, x_2) \leq 0. \end{cases}$$

or equivalently:

$$y_1(p_1, p_2; x_1, x_2) = \min[0, \Pi_1(p_1, p_2; x_1, x_2)] + \max[0, w_1(p_1, p_2; x_1, x_2) - w], \tag{28}$$

with only one of the terms of this sum positive.

As a consequence of this modification in the objective function, we must change equation (19) for low values of p_2:

$$\overline{p}_1^{\mathrm{E}}(p_2; x_1, x_2) = \begin{cases} (p_2 + (x_2^2 - x_1^2) + c)/2 & \text{if} \quad p_2 \leq \tilde{p}_2 \\ p_2 + (x_2^2 - x_1^2) - \sqrt{2\,\mathrm{F}}\sqrt{(x_2 - x_1)} \\ \quad \text{if} \quad p_2 \geq \tilde{p}_2 \end{cases} \tag{29}$$

where

$$\tilde{p}_2 = \sqrt{8\,\mathrm{F}\,(x_2 - x_1)} - (x_2^2 - x_1^2) + c. \tag{30}$$

This reaction function is continuous, convex and piece-wise linear.

Equations (20) and (21) still describe the equilibrium in prices when inequality (22) holds. On the other hand, when it does not hold the equilibrum will be identical to that given by equations (15) and (16). It is straightforward to show that the equilibrium prices, and therefore profits, are continuous in locations.

We modify equation (23) as follows:

$$\Pi_2^{\mathrm{E}}(x_1, x_2) = \begin{cases} 2(x_2 - x_1)\left[1 - \dfrac{\sqrt{\mathrm{F}}}{\sqrt{2\,(x_2 - x_1)}}\right]^2 - \mathrm{F} \ \text{ when } \ \Pi_1^{\mathrm{E}} \geq 0, \\ \Pi_2^{\mathrm{P}}(x_1, x_2) \quad \text{otherwise.} \end{cases}$$

This function also is increasing in x_2, and therefore firm 2 will indeed locate at point 1 as we had computed earlier.

If $x_2 = 1$ it is easy to show that inequality (22) holds for all x_1 [18], and therefore the rest of the reasoning of subsection 3.2 goes through.

6 Conclusion

In summary, the creation of an employee-controlled firm and the buy-out of an existing firm raise very different questions. A new employee-controlled

18. Setting $x_2 = 1$, the derivative of the righ hand side of (22) with respect to x_1

$$-\sqrt{2}\,(3(x+1)/(12\sqrt{(1-x)})$$

is negative, and the right hand side is equal to $\sqrt{1/2}$ for $x_1 = 0$.

firm is viable whenever a profit-maximizing firm would realize positive profits. However, in the homogeneous product case this observation must be qualified. First, the employee-controlled firm would have an incentive to commit itself to behave like a profit-maximizing firm. Second, if it does not, buy-out offers by entrepreneurs would be acceptable to the current employees. When products are differentiated, the first phenomenon never arises while the second arises only when the entry cost is small. The survival of an employee-controlled firm is more likely in this second case.

Our model predicts that a well functioning capitalist firm will never be bought out by its employees. Control will be transferred only if the transfer yields efficiency gains.

Many of these results extend to more general demand and production forms (see CREMER and CRÉMER [1992]). It would be interesting to know how they are affected by changes in the objective of employee-controlled firms. In particular, we would like to know whether these are viable under decreasing returns to scale if they do not share profits equally among employees.

We have not touched on one important issue, uncertainty. The airline industry is very cyclical, and the uncertainty about the response of UAL controlled by its pilots seems to have been a major stumbling block in the negotiation of a acceptable financial package. The reaction functions of employee-controlled firms is very different from those of profit-maximizing firms. Under Cournot competition, the quantity they produce is independent of the quantity produced by their competitors–see equation (8). Under Hotelling competition, they react much more than profit-maximizing firms to changes in the prices charged by their competitors–see equation (19). This last property seems to indicate that prices in a differentiated industry with a substantial number of employee-controlled firms could be subject to large fluctuations.

A more complete analysis of the effect of uncertainty on employee-controlled firms would require careful modelling of their policy when demand contracts. Do they restrict production in order to increase compensation? (See STEINHERR and THISSE [1979]). The answer would depend on the model of internal decision making within the firm which one adopts and on the degree of risk aversion of the employees.

• References

D'ASPREMONT, C., JASKOLD-GABSZEWICZ, J., THISSE, J. F. (1979). – On Hotellings "Stability in Competition", *Econometrica*, 47, pp. 1138-1150.

BANON, C. (1990). – "Les opérations de RES et de LMBO : le profil économique et financier d'une entreprise-cible d'un RES ou LMBO", *Cahiers économiques et monétaires de la Banque de France*, n° 35, pp. 97-119.

BONIN, J. P. and PUTTERMAN, L. (1987). – *Economics and Cooperation and the Labor-Managed Economy.* New York : Harwood Academic Publishers.

Cremer, H. and Crémer, J. (1992). – "Duopoly with Employee-Controlled and Profit-Maximizing Firms : Cournot vs. Bertrand Competition", *Journal of Comparative Economics*, 16, 2, pp. 241-258.

Cremer, H., Marchand M. and Thisse, J. F. (1990). – "Mixed Oligopoly with Differentiated Products", *International Journal of International Organization*, 9, 1, pp. 43-53.

De Fraja, G. and Delbono, F. (1989). – "Alternative Strategies of a Public Enterprise in Oligopoly", *Oxford Economic Papers*, 41, pp. 302-311.

Fershtman, C. and Judd, K. L. (1987). – "Equilibrium Incentives in Oligopoly", *American Economic Review*, 77, 5, pp. 927-940.

Ireland, N. and Law, P. J. (1982). – *The Economics of Labor-Managed Enterprises*. New York: St. Martin's Press.

Jensen, M. C. (1989). – "Eclipse of the Public Corporation", *Harvard Business Review*, September-October, pp. 61-74.

Kats, A. and Neven D. (1989). – "Oligopolistic Equilibrium in Hotelling's Model", *Mimeo*, Department of Economics, Virginia Polytechnic Institute & State University.

Laffont, J. J. and Moreaux, M. (1985). – "Large-Market Cournot Equibria in Labour-Managed Economies", *Economica*, 52, pp. 153-165.

Landsberger, M. and Subotnik A. (1981). – "Some Anomalies in the Production Strategy of a Labour-Managed Firm", *Economica*, 48, pp. 195-197.

Law, P. J. and Stewart G. (1983). – "Stackelberg Duopoly with an Illyrian and Profit-Maximizing Firm", *Recherches Economiques de Louvain*, 49, 2, pp. 207-212.

MacLeod, W. B. (1987). – "Behavior and the Organization of the Firm", *Journal of Comparative Economics*, 11, pp. 207-220.

MacLeod, W. B. (1988). – "Equity, Efficiency, and Incentives in Cooperative Teams", *Advances in the Economic Analysis of Participatory and Labor Managed Firms*, 3, pp. 5-23.

Mai, C. C. and H. Hwang. (1989). – "Export Subsidies and Oligopolistic Rivalry Between Labor-Managed and Capitalist Economies", *Journal of Comparative Economics*, 13, 3, pp. 473-480.

Pestieau, P. and Thisse J. F. (1980). – "On Market Imperfections and Labor Management", *Economic Letters*, 3, pp. 353-356.

Rocard, M. (1991). – "Crime contre l'Europe", *Le Nouvel Observateur* du 10 au 16 octobre 1991, 1405, pp. 68-71.

Sertel, Murat, R. (1990). – "Workers Enterprises in Imperfect Competition", *CARESS Working Paper #90-10*, University of Pennsylvania.

Slivak, S. D. (1987). – "The Strategic Choice of Managerial Incentives", *Rand Journal of Economics*, 18, pp. 452-458.

Steinherr, A. and Thisse, J. F. (1982). – "Are Labor-Managers Really Perverse ?", *Economic Letters*, 2, pp. 137-142.

Valente, J. and Smith, R. (1990). – "United Effort : Unions' Bid for UAL Requires Less Debt but Carries New Perils", *Wall Street Journal*, April 9, page A1.

Vickers, J ; (1989). – "The Nature of Costs and the Number of Firms at Cournot Equilibrium", *International Journal of Industrial Organization*, 7, pp. 503-509.