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Managerial Incentives for Mergers*

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Abstract

We study managerial incentives in a model where managers take not only product market but also takeover decisions. We show that the optimal contract includes an incentive to increase the firm's sales, under both quantity and price competition. This result is in contrast to the previous literature and hinges on the fact that with a more aggressive manager rival firms earn lower profits and are willing to sell out at a lower price.

However, as a side-effect of such a contract, the manager might take over more rivals than would be profitable.

1. Introduction.

Recent work has shown that the owner of a firm can manipulate the contract offered to his manager to obtain strategic advantages with respect to rivals (see Vickers (1985), Fershtman and Judd (1987) and Sklivas (1987)). In particular, when products are strategic substitutes the owner distorts managerial incentives away from profit maximization to include size considerations, to make the manager more aggressive in the product market. Instead, when products are strategic complements, the contract offered to the manager discourages her from increasing output, to stimulate a soft behavior and higher market prices.

In this paper we analyze managerial incentives in a context where a manager can take decisions not only on quantity (or price), but also on possible mergers with other firms operating in the industry. We show that the type of incentives offered to the manager does not depend on the nature of competition in the product market. Indeed, a new effect comes into play when managers can make takeover decisions. When the owner chooses a contract which makes the manager more aggressive the rival entrepreneurs will earn lower profits and hence will accept to sell their firms at a lower price. This mechanism works independently of the mode of competition in the market and explains why equilibrium incentives include size considerations under both price and quantity competition. This result is in contrast to the aforementioned literature on managerial incentives.

However, the choice of a managerial incentive which includes market size and makes the manager more aggressive in the market might have the side-effect of inducing her to take rival firms over even when it is not profitable for the owner. Therefore, the strategic manipulation of the managerial contracts might lead to unprofitable mergers. The result that mergers might be unprofitable is consistent with empirical and anecdotal evidence. The empirical studies in the applied industrial organization literature support the idea that a decrease in profits is the most

likely effect of takeovers both in Europe and the United States (see e.g. Jacquemin and Slade (1989), De Jong (1990) and Ravenscraft and Scherer (1987)).¹

The specialized press has often reported cases of unsuccessful mergers. For instance, in the computer software industry Novell's acquisitions of Digital Research (1991), Unix System Laboratories (1993) and WordPerfect (1994), made in the attempt of matching Microsoft's market power, have been widely judged as failures and have possibly contributed to the downward trend of Novell's market share.² The banking sector has also been involved in a recent wave of mergers, some of which (like BankAmerica's \$4.2 billion acquisition of Security Pacific) have been unsuccessful (see *Business Week*, October 30, 1995).

A less well-known merger is the \$2 billion purchase of Banesto by Banco Santander (April 1994), which has allowed the latter to become the first Spanish banking group. The deal reduced the share price of Banco Santander by 7% in the days following the purchase (*La Vanguardia*, 27 April 1994), and caused Santander's long-term debt to be downgraded (*American Banker*, August 26, 1994, page 2). In September 1995 Banco Santander's share price was even lower, as a result of the market's poor evaluation of the deal with Banesto and of the subsequent share purchases of the US First Fidelity Bank. Santander's takeovers have been part of a growth strategy which its Chairman, Emilio Botin, had openly pursued.³ The objective of increasing the firm's size might explain why, as many analysts said, Santander paid too much for its purchase (*International Management*, July 1994, page 36).

¹In the financial literature results are less clear-cut. See Caves (1989) for a comparison between the two strands of literature. For more optimistic findings about the profitability of mergers, see Franks, Harris and Titman (1991). Note however that we are concerned only with horizontal mergers while empirical studies in finance often consider mergers between firms operating in different sectors as well.

² See e.g. *Business Week*, "The case against mergers", October 30, 1995, a Special Report containing statistical results and discussions of several unprofitable merger cases. On failed mergers in the software industry, see in particular page 62.

³ See for instance his "Letter to the Shareholders", in Banco Santander's Annual Report, 1993.

A number of reasons have been proposed to explain unprofitable mergers. Mueller (1985) explains the lack of takeover profitability with a decline in efficiency which offsets the benefits of higher market power. A different explanation is given by Roll (1986), according to whom "managers of bidding firms infected by hubris simply pay too much for their targets". Managers tend to overestimate their ability to run other companies, and this makes them overpay for their targets. Another possible explanation is that managers have objectives which differ from those of the shareholders: While the latter care only for profits, the former may be more interested in size, growth or risk diversification of the company they run (Morck, Shleifer and Vishny (1990)). Our model suggests instead that unprofitable mergers may occur not because managers are irrational or because they pursue objectives other than profit maximization, but because of the incentives that they receive from the owners.

The structure of the paper is as follows. In section 2 we present the model and we analyze the case where firms compete in quantities. In section 3 we study the case of price competition. Short comments in section 4 bring the paper to the end.

2. The model, with quantity competition.

In this section we introduce the model and solve it for the case where firms compete in quantities on the product market (section 2.1). Next, we show that unprofitable mergers might occur at equilibrium, and we indicate alternative incentive schemes which avoid unprofitability of mergers (section 2.2).

2.1 Presentation of the model and solution.

We assume that there are three firms competing in a homogeneous product market. In firm A (from now on *managerial* firm) decisions relating to output and takeovers are taken by a

professional manager. Firms B and C are standard profit-maximizing firms (from now on *entrepreneurial* firms) where ownership is not separated from control.

We analyze the following three-stage game. In the first stage the owner of firm A chooses the non-negative parameter α which determines the payment $G = \alpha \Pi_A + (1-\alpha) S_A$ offered to his would-be manager, where Π_A and S_A stand respectively for profits and sales of firm A. He also decides whether to delegate decisions on takeovers to the manager or to fix the number of firms the manager has to take over. When takeovers occur, to get the actual remuneration I of the manager one should deduct takeover expenses from the payment G . The contract offered is publicly announced (competitors observe it) and potential managers bid for the position in firm A. Because of competitive bidding, the appointed manager will just receive her opportunity cost. In the second stage the manager of firm A can make offers to buy the other firms. We assume that only firm A is able to lay tender offers to buy competitors, while the other firms are not.⁴ The firms that have received an offer decide simultaneously whether to accept it or not. In the third and last stage of the game the remaining independent firms compete à la Cournot (we study the case of Bertrand competition in section 3). Owners receive the resulting profits and the manager is paid according to her contract.

Demand is given by $p = a - Q/s$, where Q are total sales and p stands for price. The parameters a and s are positive, and s can be interpreted as the size of the market, since the demand above can be seen as the inverse of the demand function $Q = s(a - p)$.

We also assume that all firms have the same identical unit costs c . All players know the actual value of c except the owner of firm A who only knows that it is uniformly distributed in the support $(0, a/2)$. We set $c < a/2$ to guarantee that all the firms have a positive output independently of the incentive $\alpha \geq 0$ chosen by the owner of the managerial firm and of the number of independent firms selling in the market.

⁴ For simplicity, we do not consider the possibility that the entrepreneurial firms can make a takeover. See Kamien and Zang (1991) for a treatment of multi-side biddings.

We use the sub-game perfect equilibrium as a solution concept and proceed by backward induction. In the last stage of the game we compute the Cournot equilibrium given the number of active firms i and the values of α and c . We denote by $\Pi_j(\alpha, c, i)$ the profits of entrepreneurial firms $j=B,C$ if $i > 1$ firms are active. Similarly we denote by $\Pi_A(\alpha, c, i)$ the gross profits of the managerial firm A and by $G(\alpha, c, i)$ the payment received by the manager from the owner (for $i=1,2,3$). To solve for the equilibrium for any number i of active firms recall that the output of the managerial firm is chosen to maximize $G(\alpha, c, i)$, and the output of the entrepreneurial firms is chosen to maximize $\Pi_j(\alpha, c, i)$. It is straightforward to show that equilibrium quantities are:

$$q_A(\alpha, c, i) = \frac{(a - c + (1 - \alpha)ci)s}{(i + 1)}, \quad i = 1, 2, 3; \quad q_j(\alpha, c, i) = \frac{(a - 2c + \alpha c)s}{i + 1}, \quad i = 2, 3; j = B, C.$$

One can then check that equilibrium payoffs are given by:

$$\Pi_j(\alpha, c, i) = \frac{(a - 2c + \alpha c)^2 s}{(1 + i)^2}, \quad i = 2, 3; \quad j = B, C$$

$$\Pi_A(\alpha, c, i) = \frac{(a - 2c + \alpha c)(a - c + (1 - \alpha)ci)s}{(1 + i)^2}, \quad i = 1, 2, 3;$$

$$G(\alpha, c, i) = \frac{(a - c + (1 - \alpha)ci)^2 s}{(1 + i)^2}, \quad i = 1, 2, 3.$$

In the second stage of the game we determine the number of firms that are bought by the managerial firm. As bids cannot be renegotiated, entrepreneurial firms will accept any offer assuring them, at least, their opportunity cost, that is the profit they would make if they stayed in the market. The opportunity cost depends on whether by not selling the firm would be a duopolist or a triopolist. Hence, two takeovers occur if both firms receive an offer not lower than $\Pi_j(\alpha, c, 2)$. No takeover occurs if each of them is offered less than $\Pi_j(\alpha, c, 3)$. One takeover will occur otherwise.

Given the incentive chosen in the first stage, one can compute the bids. The manager is going to pay the minimum necessary to achieve a desired market structure. Therefore, if both firms are bought, they will receive $\Pi_j(\alpha, c, 2)$ each and if only one firm is bought, it is going to be paid $\Pi_j(\alpha, c, 3)$. The net remuneration of the manager as a function of the number i of active firms in the last stage can be written as:

$$I(\alpha, c, i) = G_i(\alpha, c, i) - (3 - i) \Pi_j(\alpha, c, i+1) \quad , i = 1, 2, 3.$$

It is then easy to show the following:

Remark 1.⁵

For $\alpha < 72/77$, the manager takes over both entrepreneurial firms if $(5a)/(82-77\alpha) < c < a/2$, and no takeovers occur if $0 < c \leq (5a)/(82-77\alpha)$. For $\alpha \geq 72/77$, the manager never does any takeover.

Proof.

The problem of the manager is to choose the number of firms i she takes over in order to maximize her net remuneration $I(\alpha, c, i)$. The following functions are the difference in manager's remuneration given two different takeover decisions.

$$\Delta_{32} = I(\alpha, c, 3) - I(\alpha, c, 2) = (a^2 - 16ac + 14a\alpha c + 28c^2 - 40\alpha c^2 + 13\alpha^2 c^2) (s/72) .$$

$$\Delta_{31} = I(\alpha, c, 3) - I(\alpha, c, 1) = (5a^2 - 92ac + 82a\alpha c + 164c^2 - 236\alpha c^2 + 77\alpha^2 c^2) (s/144).$$

$$\Delta_{21} = I(\alpha, c, 2) - I(\alpha, c, 1) = (a^2 - 20ac + 18a\alpha c + 36c^2 - 52\alpha c^2 + 17\alpha^2 c^2) (s/48) .$$

The previous functions are convex in c . Knowing their roots allows us to determine their sign given the value of c :

⁵ If we increased the number of entrepreneurial firms, then less-than-industry-wide takeovers would occur for some values of α . The same is true if we considered two (or more) entrepreneurial firms but adopted the hypothesis of differentiated goods. In this case, less-than-industry-wide takeovers would occur for some values of α as long as goods are not close substitutes (and mergers might be unprofitable). Instead, it can be shown that with only one entrepreneurial firm the takeover would always occur independently of the incentive set by the owner (and of the degree of substitution between the products), and that the resulting merger would be profitable.

$\Delta_{32} \geq 0$ iff $0 < c \leq a/(14 - 13\alpha)$ and $\Delta_{32} < 0$ iff $a/(14 - 13\alpha) < c < a/2$.

$\Delta_{31} \geq 0$ iff $0 < c \leq (5a)/(82 - 77\alpha)$ and $\Delta_{31} < 0$ iff $(5a)/(82 - 77\alpha) < c < a/2$.

$\Delta_{21} \geq 0$ iff $0 < c \leq a/(18 - 17\alpha)$ and $\Delta_{21} < 0$ iff $a/(18 - 17\alpha) < c < a/2$.

Given that $\alpha \leq 1$, we have: $a/(18 - 17\alpha) < (5a)/(82 - 77\alpha) < a/(14 - 13\alpha)$. Therefore, $I(\alpha, c, 2)$ is either lower than $I(\alpha, c, 3)$ or lower than $I(\alpha, c, 1)$, so that taking only one firm over is never optimal by the manager. Therefore, we should focus on the sign of Δ_{31} to derive the actions taken for the manager. Note that $(5a)/(82 - 77\alpha) < c < a/2$ only for $\alpha < 72/77$. For values of α such that $\alpha \geq 72/77$, then Δ_{31} is always positive. This leads to the result stated in the text. •

Remark 1 determines the takeover decision as a function of both the marginal costs c and the incentive parameter α . This is done for expositional convenience, but the result can be better interpreted by thinking in terms of the incentive parameter α only. Indeed, remark 1 amounts to saying that for any given c , the lower the value of α and the more likely that the takeovers occur. This is because a lower α pushes the manager to be more aggressive in the marketplace and therefore decreases the profits obtained by the entrepreneurial firms in the last stage of the game. This makes takeovers cheaper since it lowers the price at which the entrepreneurs are willing to sell their firms.

In the first stage of the game the owner of the managerial firm maximizes his expected profit by (i) deciding whether to delegate takeover decisions or to fix the number of firms the manager has to take over and (ii) determining the value of α . The latter parameter affects: (1) the profits obtained by the managerial firm at the last stage once market structure is fixed; (2) the profits of the entrepreneurial firms and hence their reservation price in the second stage; and (3) the manager's gains from takeovers.

As for the first effect, the optimal value of α is conditional on the number of firms in the industry. If there is more than one firm, the owner should induce the manager to produce over the profit-maximization level by setting α lower than one to soften competition in the last

stage.⁶ However, if the industry is monopolized, absent any strategic effect, profit-maximization behavior is optimal and the correct α should be one. As for the second effect, it also calls for α lower than one: the more the managerial firm produces in the last stage the lower the profits of the entrepreneurial firms and therefore the lower their reservation price in stage two. Finally (third effect), a lower α increases the gains obtained by the manager in taking firms over. Since the manager increases its output after a takeover, the greater the weight given to sales (lower α) and the wider the interval for which the manager will take firms over.

The expected profit for the owner of the managerial firm is given by expression (1) below when takeover decisions are delegated. As the maximizer of each of these effects taken separately is not greater than one, we do not need to worry about the functional form of expected profits for $\alpha > 1$.

$$= \int_0^{\frac{5a}{82-77\alpha}} \Pi_A(\alpha, c, 3) dc + \int_{\frac{5a}{82-77\alpha}}^{\frac{a}{2}} (\Pi_A(\alpha, c, 1) - 2\Pi_j(\alpha, c, 2)) dc, \quad \text{for } 0 \leq \alpha < \frac{72}{77}$$

$$B(\alpha) = \tag{1}$$

$$= \int_0^{\frac{a}{2}} \Pi_A(\alpha, c, 3) dc \quad \text{for } \alpha \leq \frac{72}{77} \leq 1$$

Scrutiny of this expression illustrates the three effects mentioned above. Let us consider first the case where $\alpha < 72/77$. The first effect corresponds to the terms $\Pi_A(\alpha, c, 3)$ and $\Pi_A(\alpha, c, 1)$. The second effect can be seen through the term $\Pi_j(\alpha, c, 2)$ and the extreme of integration $(5a)/(82-77\alpha)$ which indicates the values starting from which the entrepreneurial firm will sell. The third effect also corresponds to the mentioned extreme of integration.

When $\alpha \geq 72/77$ takeovers never occur. The second and third effects disappear and only the first effect comes into play. A lower value of α increases the profit of the managerial firm to the detriment of the rivals, for the usual strategic reasons.

⁶This is the standard effect found in the literature of strategic choice of managerial incentives (Vickers (1985), Fershtman and Judd (1987) and Sklivas (1987)).

Proposition 1.

1a) If the owner delegates merger decisions to his manager, the optimal incentive α^* is lower than one. 1b) The owner finds it optimal to delegate takeovers to the manager.

Proof.

1a) Let us start with the first part of the Proposition and compute the expected profits given by expression (1) for $\alpha < 72/77$ as:

$$B(\alpha) = \frac{a^3 s}{72} \left(\frac{22 + 2\alpha - 17\alpha^2}{12} \right) + \frac{25a^3 s}{144(82 - 77\alpha)} - \frac{25a^3 s}{(82 - 77\alpha)^2} \left(\frac{28 - 23\alpha}{144} \right) + \frac{125a^3 s}{(82 - 77\alpha)^3} \left(\frac{20 + 16\alpha - 13\alpha^2}{432} \right)$$

The first order condition is:

$$\frac{\partial B}{\partial \alpha} = \frac{a^3 s(1 - 17\alpha)}{432} + \frac{625a^3 s}{36(82 - 77\alpha)^2} - \frac{25a^3 s(3394 - 2759\alpha)}{108(82 - 77\alpha)^3} + \frac{9625a^3 s(92 - 128\alpha + 41\alpha^2)}{144(82 - 77\alpha)^4} = 0$$

This is an equation of the fifth order in α , since a and s enter the expression above in a multiplicative way. Numerical solutions show that there are two roots in the real numbers and lower than $72/77$. The maximum of the function is attained for $\alpha^* = .0983297$. At this value the function $B(\alpha^*) = .027 a^3 s$.

When $\alpha \geq 72/77$, $B(\alpha) = a^3 (s/384) (8 + 2\alpha - 3\alpha^2)$. Since the function has a maximum at $\alpha = 1/3$ and then decreases, the maximum value attained in the function over the domain is $B(72/77) = .019 a^3 s < B(\alpha^*)$. Therefore, the owner will choose $\alpha = \alpha^*$.

(1b) The optimal α depends on the takeover policy decided by the owner because the intensity of the effects varies with it. If the owner decided to set an explicit prohibition in the contract so as to prevent the manager from doing any merger, his expected profit would be:

$$C(\alpha) = \int_0^{a/2} \Pi_A(\alpha, c, 3) dc = \frac{a^3 s(2 - \alpha)}{64} - \frac{a^3 s(4 - 8\alpha + 3\alpha^2)}{384}$$

By computing the first derivative with respect to α and equating to zero, one can check that the optimal value of α is given by $\alpha_0=1/3$. At this value $C(\alpha)=.022 a^3 s$, which is lower than the benefit obtained when there exists delegation.

If instead the owner decided to specify in the contract that he wants two takeovers, then his expected value would be:

$$D(\alpha) = \int_0^{\frac{a}{2}} (\Pi_A(\alpha, c, 1) - 2\Pi_j(\alpha, c, 2)) dc = \frac{a^3 s(22 + 2\alpha - 17\alpha^2)}{864}$$

By solving the FOCs one can then compute the optimal value $\alpha_2=1/17=.0588$. At this value $D(\alpha)=.025 a^3 s$. Again, this is lower than the profit under delegation.

Finally, if the owner wanted only one takeover, his expected value would be:

$$E(\alpha) = \int_0^{\frac{a}{2}} (\Pi_A(\alpha, c, 2) - \Pi_j(\alpha, c, 3)) dc = \frac{a^3 s(22 + 2\alpha - 17\alpha^2)}{864}$$

The optimal value is $\alpha_1=7/41$. At this value $E(\alpha)=.022 a^3 s$. Again, this is lower than the profit under delegation. We have therefore completed the proof of Proposition 1. •

Note that the optimal incentive when takeovers are delegated (α^*) is lower than the incentive given when the owner specifies in the contract he wants one takeover (α_1) or no takeovers (α_0) but higher than the incentive given when two takeovers are stipulated in the contract (α_2). Comparison of these values sheds some light on the intensity of the different effects described above. Recall that if takeovers are forbidden, the second effect is absent and if the owner asks his manager to monopolize the industry, the first effect calls for $\alpha=1$. Therefore, $\alpha_0 > \alpha_2$ means that the second effect is stronger than the first, i.e. incentives are more distorted to reduce the cost of takeovers than to soften competition in the last stage.

2.2. Unprofitable takeovers.

We have seen that in equilibrium managerial incentives depart from profit maximization to include considerations of size ($\alpha^* < 1$). It has been suggested that this type of objective induces unprofitable takeovers (Shleifer and Vishny (1988)). To check this claim in our model, we say that mergers are unprofitable when there exist values of costs such that *given the incentives chosen in the first stage*, taking two firms over is less profitable than not taking them over. One can then check the following proposition.

Proposition 2.

Given the optimal incentive α^ chosen by the owner at the first stage, there exist values of the costs for which mergers occur and are unprofitable.*

Proof.

Profitability of mergers in our model amounts to saying that the owner attains a higher payoff when the rivals are taken over than when they are not. This is equivalent to requiring that:

$$L(\alpha, c) = \Pi_A(\alpha, c, 1) - 2\Pi_j(\alpha, c, 2) - \Pi_A(\alpha, c, 3) = \frac{(-5a + 46c - 41\alpha c)(a - 2c + \alpha c)s}{144} > 0.$$

It can be checked that the function $L(\alpha, c)$ is positive for $(5a)/(46-41\alpha) < c < a/2$. Profitability at the optimal value of $\alpha = \alpha^*$ is therefore ensured when $c > .119a$. However, we know that the manager is going to buy both entrepreneurial firms whenever $c > (5a)/(82-77\alpha)$, that is for $c > .067a$ when $\alpha = \alpha^*$. Therefore, for $c \in [.067a, .119a)$, the manager is going to pay more for the target firms than the increase in profits induced by the takeovers. In this interval the manager engages in unprofitable takeovers. •

To avoid the overbidding of managers, the owner could forbid takeovers. In other words, the owner could avoid unprofitable takeovers from occurring by specifying he does not want any takeover in the contract. However, this policy is not profit-maximizing (as we have shown in

proposition 1) because it would not only prevent unprofitable takeovers from occurring but it would also prevent profitable ones.

Unprofitable takeovers occur in our model because two different types of decisions - which would require two different incentives - are taken by the same agent.⁷ One straightforward solution to this problem would be to hire two managers: One should be in charge of takeover decisions and the other should choose the level of output. The former would be asked to maximize profits and the latter a convex combination of profits and sales. However, this solution presents at least two problems. First, it would imply the duplication of managerial costs. Second, it may work under the assumptions of our model because they suppose that a great number of managers know a priori the value of c . In fact, one is more inclined to believe that knowledge is related to daily experience. Then, more realistically, one may think that the value of c is learned by daily dealing with the productive process and hence it is private information of the agent managing it. Therefore, we would be back to the informational asymmetry we assumed exogenously in our model which, as we have seen, implies that allowing the informed part to take the takeover decisions is more profitable.

To replicate the same outcome as with separation of tasks, one might also resort to slightly more sophisticated incentive schemes where the owner possesses two instruments. One instrument (corresponding to the parameter α) would affect output decisions, and the other instrument would affect takeover decisions. The latter instrument can be represented by a "tax" which increases the cost of takeovers for the manager. In other words, to obtain the manager's net remuneration one has to subtract from the payment G the price of takeovers multiplied by $(1+\tau)$. Note that in the contract analyzed above we had $\tau=0$.

It is then possible to show (see Appendix) that the optimal contract the owner would choose is given by: $\alpha=.105$, $\tau=5/32$. By taxing takeover expenditures, the owner avoids unprofitable takeovers which result from setting $\alpha<1$.

⁷See Holmstrom and Milgrom (1989) for a treatment of multitask agency problems in a non-strategic setting.

There exists a similarity between our analysis and the "free cash-flow hypothesis". According to the latter, managers endowed with free cash flow might engage in projects, such as takeovers, which have negative net present value (Jensen (1986), Lang, Stulz and Walkling (1991)). In the same way that we suggest that a tax on takeover activity might be optimal, this literature suggests increasing the cost of the projects by making the managers resort to external debt instead of using internal funds, whose usage is less costly for them.

3. Price competition.

We now turn to the case where there exists price competition in the product market. To analyze this case, we assume that goods are differentiated. From a standard quadratic utility function the following linear demand can be derived:⁸

$$p_k = a - q_k - g \sum_{j \neq k} q_j \quad a > 0, \quad g < 1, \quad k, j = 1, \dots, n$$

The direct demand functions can then be obtained as:

$$q_k = \frac{a(1-g) - p_k(1+(n-2)g) + g \sum_{j \neq k} p_j}{(1-g)(1+g(n-1))} \quad k, j = 1, \dots, n$$

Apart from the hypothesis that goods are differentiated, all other features of the model remain unchanged.^{9 10}

⁸ For similar demand functions see for instance Shubik and Levitan (1980) or Shaked and Sutton (1990).

⁹ The hypothesis of differentiation is introduced here to analyze the different mode of competition. As we said in footnote 5 above, the results obtained under Cournot competition and product differentiation are similar to those obtained under Cournot competition and homogeneous goods.

¹⁰ Note a difference with the case of homogeneous goods. In that case, a firm taken over "disappears" from the market. With differentiated goods the product to which it is associated still exists and enters the portfolio of the goods that the merged firm can offer.

As in the case of Cournot competition, one can compute the equilibrium prices and payoffs at the last stage of the game and obtain the solutions of the game by backward induction.

For the sake of simplicity, we focus here on the case where there exist only two firms in the industry, one managerial and the other entrepreneurial. We now show that the owner finds it optimal to set an incentive $\alpha < 1$ even when there exists price competition.¹¹

Proposition 3.

With price competition the optimal incentive α^ is lower than one.*

Proof.

At the last stage of the game, if there is no takeover and therefore the two firms are independent, the payoffs are given by:

$$\begin{aligned}\Pi_A(\alpha, c, 2) &= \frac{(2a - 4c + 2\alpha c - ag + cg - ag^2 + cg^2)(2a - 2\alpha c - ag + cg - ag^2 + \alpha cg^2)}{16 - 24g^2 + 9g^4 - g^6} \\ \Pi_B(\alpha, c, 2) &= \frac{(2a - 2c + \alpha cg - ag - ag^2 + cg^2)^2}{16 - 24g^2 + 9g^4 - g^6} \\ G(\alpha, c, 2) &= \frac{(2a - 2\alpha c - ag + cg - ag^2 + \alpha cg^2)^2}{16 - 24g^2 + 9g^4 - g^6}\end{aligned}$$

The equilibrium payoffs in the case where the independent firm is bought over by the manager are given by:

$$\begin{aligned}\Pi_A(\alpha, c, 1) &= \frac{(a - \alpha c)(a - 2c + \alpha c)}{2(1 + g)} \\ G(\alpha, c, 1) &= \frac{(a - \alpha c)^2}{2(1 + g)}\end{aligned}$$

¹¹ We have chosen $n=2$ for simplicity but similar results carry over for $2 < n < 6$. With 6 or more firms in the industry it is no longer true that the manager wants to monopolize the industry for any $0 < \alpha < 1$. As a result, the choice of α influences the takeover decisions in a way similar to the case of quantity competition, and mergers might be unprofitable.

We can now study the decision of the manager about whether to take over the entrepreneurial firm or not. This is done by studying the sign of:

$$\Delta I = I(\alpha, c, 1) - I(\alpha, c, 2) = G(\alpha, c, 1) - \Pi_B(\alpha, c, 2) - G(\alpha, c, 2),$$

subject to $0 \leq g < 1$, $0 \leq \alpha \leq 1$, $a > 0$ and $c < a(1-g)/(2-g)$, the last condition being made to guarantee that the output produced at the duopoly equilibrium by the firms is always positive. By using the Kuhn-Tucker conditions, it can be checked that the function ΔI attains a minimum when $g=0$ and $\alpha=1$. At the minimum $\Delta I=0$ which implies that the function is always non-negative and which ensures that the manager always finds it optimal to monopolize the industry.

At the first stage of the game the owner chooses α to maximize:

$$B = \int_0^{a(1-g)/(2-g)} (\Pi_A(\alpha, c, 1) - \Pi_B(\alpha, c, 2)) dc = \frac{a^3(1-g)(6+2\alpha-\alpha^2-3g-4\alpha g+2\alpha^2 g+2\alpha g^2-\alpha^2 g^2)}{6(2-g)^3(1+g)} +$$

$$-\frac{a^3(1-g)^2(28+8\alpha g-10g^2+\alpha^2 g^2-\alpha g^3+g^4)}{3(2-g)^5(1+g)(2+g)^2}$$

Whence:

$$\frac{dB}{d\alpha} = \frac{a^3(1-g)^2(16-16\alpha-24g+16\alpha g-8g^2+6\alpha g^2+9g^3-8\alpha g^3+g^4-\alpha g^4-g^5+\alpha g^5)}{3(2-g)^5(1+g)(2+g)^2}$$

The optimal value is therefore: $\alpha^* = \frac{16-24g-8g^2+9g^3+g^4-g^5}{16-16g-6g^2+8g^3+g^4-g^5} \leq 1$. Note that this function

is equal to one for $g=0$ and is decreasing in the domain $0 \leq g < 1$. Since the function is negative for $g > .6306$, and since we have assumed α to be non-negative, we have:

$$B(\alpha = \alpha^*) = \frac{a^3(56-152g+141g^2-22g^3-50g^4+29g^5+2g^6-5g^7+g^8)}{6(2-g)^3(1+g)(16-16g-6g^2+8g^3+g^4-g^5)}, \quad 0 \leq g \leq .6306$$

$$B(\alpha = 0) = \frac{a^3(40-32g-36g^2+32g^3-5g^5+g^6)}{6(2-g)^5(1+g)(2+g)^2}, \quad .6306 < g \leq 1$$

So far we have looked at the choice of the owner for $0 \leq \alpha \leq 1$. We still have to check that it is better for the owner to set $\alpha < 1$ in order to pay less for the takeover, rather than to set $\alpha > 1$ to soften competition in the marketplace.

Obviously, were the owner trying to give the manager the incentive to be less aggressive to implement a more cooperative solution ($\alpha > 1$), he would also forbid the manager to do any takeover activity.¹² The problem of the owner would therefore be to choose α to maximize:

$$R = \int_0^{\frac{a(1-g)}{2-g}} (\Pi_A(\alpha, c, 2)) dc = \frac{a^3(1-g)^2(48 + 16\alpha - 8\alpha^2 + 16g - 22g^2 + 2\alpha^2g^2 - 4g^3 + 2\alpha g^3 + 3g^4 - \alpha g^4)}{6(2-g)^5(1+g)(2+g)^2}$$

By computing the first derivative with respect to α and equating it to zero, it is then possible to check that the maximum of the function R is given by: $\alpha^{**} = \frac{16 + 2g^3 - g^4}{16 - 8g^2} \geq 1$. We then have:

$$R(\alpha = \alpha^{**}) = \frac{a^3(1-g)^2(112 + 32g - 36g^2 - 4g^3 + g^4)}{96(2-g)^3(1+g)(2-g^2)}, \quad 0 \leq g < 1.$$

It is then easy to check that $B(\alpha = \alpha^*) > R(\alpha = \alpha^{**})$ in the interval $0 \leq g \leq .6306$ and that $B(\alpha = 0) > R(\alpha = \alpha^{**})$ in the interval $.6306 < g < 1$. This completes the proof that the owner sets $\alpha < 1$ in the equilibrium. •

This result is in contrast to previous work on incentive contracts for managers (in models where takeovers are not allowed). Whereas Fershtman and Judd (1987) and Sklivas (1987) have proved that the managers are offered a contract which gives them an incentive to overproduce when goods are strategic substitutes and to underproduce when goods are strategic complements, here such a different prediction does not arise. When the possibility of takeovers exists, an additional effect is introduced in the usual game. An aggressive manager decreases the profits of the other firms and makes them willing to sell at a lower price. This effect works

¹² It could never be optimal for the owner to set $\alpha > 1$ and allow takeovers. Indeed, $\alpha > 1$ would have the effect of making the rivals' profits higher, with the result that the cost of takeover would also increase.

both under price and under quantity competition, and explains why a manager is given the incentive to expand sales even when firms compete in prices in the product market.

3.2 Merger profitability under price competition.

In the previous example with two firms in the industry the manager always wants to take the rival over for any value of α such that $0 \leq \alpha \leq 1$. Hence, the issue of profitability of the merger does not arise since the choice of α does not modify the interval of parameters under which the merger occurs. The same feature arises for up to five firms in the industry. However, when the number of firms is equal or higher than six, it is no longer true that the manager always monopolizes the industry. As a result, unprofitable mergers might occur. Indeed, it is possible to show that mergers can be unprofitable for certain values of the parameters even when competition is on prices.¹³

4. Discussion and Conclusion.

The main difference between the present model and Fershtman and Judd's (1987) is that we enlarge the strategy set of managers by allowing for the possibility of takeovers. This introduces new considerations in the choice of the managerial incentives (α) since the value of α will also affect the desirability and the cost of a takeover. In Fershtman and Judd (1987) principals set α lower than one to obtain a softer reaction from competitors when competition is on quantities (but they set α larger than one when competition is on prices).

In our model α lower than one has the additional effect of making takeover activities less costly and more likely. Indeed, the lower the value of α the more aggressive the manager in the output market and the lower the profits obtained by entrepreneurial firms; hence, the lower the value of the minimum offer they should receive to sell the firm. Besides, reductions in α make the

¹³ Details can be obtained from the authors upon request.

takeover more valuable to the manager than to the owner because they bias managerial incentives towards size.¹⁴

This additional effect explains why owners want managers to be aggressive in the market place both under price and under quantity competition when managers take not only product market decisions but also takeover decisions.

Unprofitable takeovers might result as a side effect of this type of contract which includes the incentive to increase the size of the firm. Such contracts make takeovers cheaper but might also encourage the manager to take rivals over even when it is not profitable.

We have presented here an extremely simple model. In future research we plan to relax the hypothesis that only one firm can make takeover bids and to study formation of mergers in a context similar to that analyzed by Kamien and Zang (1991). Nevertheless, we feel that the basic insights of the present model still hold with more sophisticated environments.

Our analysis also suggests that the well-known difference of instruments (taxes or subsidies) which should be used in strategic trade policy according to whether firms compete in prices or quantities may be blurred if the firms engage in takeover activities. We would expect that governments might decide to subsidize national firms even when they play à la Bertrand in the international markets. By doing so, these firms would be encouraged to take rivals over and would increase the market shares in international markets. Applications to international trade issues seem therefore worthy of interest.

¹⁴ Larcker (1983) suggests that managers who own less stock in their own company are more likely to make bids. Shleifer and Vishny (1988) push this idea further by suggesting that compensating the board of directors with stock will decrease the occurrence of unprofitable mergers. We can associate *reductions* in the share holdings of managers with reductions in α because both facts distort the incentive of managers away from profit-maximization.

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Appendix.

In the presence of a tax τ on the cost of takeovers the manager prefers to take two firms over rather than making no takeovers if:

$$G(\alpha, c, 1) - 2(1 + \tau)\Pi_j(\alpha, c, 2) - G(\alpha, c, 3) = \\ = s \frac{-5a^2 + ac(92 - 82\alpha) + c^2(-164 + 236\alpha - 77\alpha^2) + 128c\tau(a - \frac{a\alpha}{2} - c + \alpha c - \frac{\alpha^2 c}{4})}{144} \geq 0$$

Therefore, takeovers occur if the following condition holds:

$$\hat{c}(\alpha, \tau) \equiv \frac{a(5 + 32\tau)}{82 - 77\alpha + 64\tau - 32\alpha\tau} \leq c < \frac{a}{2}.$$

We can now turn to the decision that the owner takes at the first stage where it now possesses two instruments, α and τ . The objective of the owner is to maximize:

$$B(\alpha, \tau) = \int_0^{\hat{c}(\alpha, \tau)} \Pi_A(\alpha, c, 3) dc + \int_{\hat{c}(\alpha, \tau)}^{\frac{a}{2}} (\Pi_A(\alpha, c, 1) - 2\Pi_j(\alpha, c, 2)) dc = \\ = a^3 s \left(\frac{22 + 2\alpha - 17\alpha^2}{864} + \frac{343600 + \alpha(316975\alpha - 659950) + k(1896960 - 3443520\alpha)}{432(82 - 77\alpha + 64\tau - 32\alpha\tau)^3} + \right. \\ \left. + \frac{1558560k\alpha^2 + k^2(5167104\alpha - 2015232 - 3075072\alpha^2) + k^3(1114112\alpha - 524288 - 425984\alpha^2)}{432(82 - 77\alpha + 64\tau - 32\alpha\tau)^3} \right)$$

Taking the derivative and equating the first order conditions to zero, one can show that the function $B(\alpha, \tau)$ reaches a maximum when $\alpha = .105$ and $\tau = 5/32$. By substituting these values, we have that takeovers occur for $c > .1199a$. Recall that the condition for the profitability of takeovers is given by $c > (5a)/(46 - 41\alpha)$. For $\alpha = .105$, this means $c > .1199a$. All takeovers are profitable.

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