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Why do Owners let their Managers Pay too much for their Acquisitions? *

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Abstract

Empirical works show that mergers are very often unprofitable. We suggest that unprofitability of mergers may be a consequence of the managerial incentives of the type used by Fershtman and Judd (1987), whose model we extend to consider the possibility of takeovers. To make the manager more aggressive in the marketplace, the owner gives her an incentive to increase the firm's sales. However, as a side-effect of this contract, the manager takes more rivals over than it would be profitable.

We also find incentive schemes which can avoid unprofitable mergers while keeping the strategic features of the managerial contract.

1. Introduction.

Salant, Switzer and Reynolds (1983) found that, in a theoretical model with a Cournot setting, horizontal mergers are profitable only under extreme conditions. This contribution was very controversial, because it seemed to deny a rational explanation for the existence of mergers. It also stimulated other theoretical work on the issue of merger profitability. In particular, Deneckere and Davidson (1985) and Perry and Porter (1985) reversed the results obtained by Salant, Switzer and Reynolds (1983), by introducing respectively the hypothesis of price competition with differentiated products and that of tangible assets which allow the merged firms to produce at lower costs than a single firm.

Empirical evidence does not fully support either of the theoretical views just summarized. On the one hand, takeovers do occur. On the other hand, empirical research as well as documentary evidence seem to indicate that takeovers are often unprofitable. The existing studies in the applied industrial organization literature tend to confirm the idea that a (slight) 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)). Mueller (1985) explains the lack of takeover profitability with a decline in efficiency which offsets the benefits of higher market power.

In the financial literature, empirical evidence seems more optimistic about the profitability of mergers (Caves (1989)). Whereas takeovers appear to benefit in a significant way the shareholders of the target companies, it is not clear whether they also benefit those of the acquiring firm. By summarizing previous findings, Jensen (1988) concludes that "(A)cquiring-firm shareholders on average earn about 4 per cent in hostile takeovers and roughly zero in mergers, although these returns seem to have declined from past levels" (Jensen, p.23). Jarrell and Poulsen's (1987, as reported in Jarrell, Bricley and Netter (1988)) find evidence of a

decline in the gains of successful bidders after the 60's and also of (statistically insignificant) losses to bidders in the 80's. Franks, Harris and Titman (1991) find instead a positive post-merger share-price performance of acquiring firms.

Overall, it seems fair to conclude, at least, that a considerable proportion of mergers results in unprofitable operations. This leaves us with the question of why such unprofitable mergers occur at all. A first 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)). We suggest here that unprofitable mergers may occur not because managers are not rational or because they pursue objectives other than profit maximization, but because of the incentives that they receive from the owners. In other words, our purpose is to show that unprofitable takeovers may be due to the strategic choice of managerial incentives.

In the economic literature, some non-profit maximizing behaviour of managers can be rationalized as a way to obtain strategic advantages. In Vickers (1985), Fershtman and Judd (1987) and Sklivas (1987) managerial incentives are distorted away from profit maximization to include size considerations. In the present paper, we extend Fershtman and Judd's model to consider the case where the manager takes not only quantity but also takeover decisions. We consider a market with three firms, but for simplicity only in one of them is ownership separated from management. Then (as in Fershtman and Judd (1987) with Cournot competition), to obtain strategic advantages over the rivals, market size is included in the incentive that the principal gives to his manager. However, as a side-effect of making the

manager more aggressive in the market, this incentive induces her to take rival firms over even when it is not profitable for the owner.

The structure of the paper is as follows. In the second section, the model is presented and in the third a simple example fully analyzed. The fourth focusses on unprofitable takeovers and the fifth deals with the sensitivity of the results obtained with respect to different contracts. Short comments in the sixth section bring the paper to the end.

2. The model.

We assume that there are three firms (A, B and C) competing in a homogeneous product market. Firms B and C are standard profit-maximizing firms (from now on *entrepreneurial* firms). Firm A will be able to lay tender offers to buy competitors.[1] In firm A (from now on *managerial* firm), decisions relating to output and takeovers are taken by a professional manager. The manager has an informational advantage vis-à-vis the owner: the former knows the production costs of all the firms whereas the latter only knows their probability distribution. This assumption is very important, because it assures that delegation of decisions yields more profits than in the case where the manager simply executes the decisions taken by the owner beforehand. The owner can influence the choices taken by the manager through setting the incentive scheme he judges appropriate. The situation is modelled as a five-stage game involving the actions described below:

Stage 1: The owner of firm A chooses the parameter α which determines the payment $G = \alpha P_A + (1-\alpha) S_A$ offered to his would-be manager, where P_A and S_A stand for gross profits and

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[1]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.

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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.

Stage 2: Potential competitive managers bid to get the job.

Stage 3: The manager of firm A can make offers to buy firm B and C. Purchases of competitors are financed by the manager, so that to get her actual remuneration (I) one should deduct takeover expenses (M) from the payment (G).

Stage 4: The firms that have received an offer decide simultaneously whether to accept it or not.

Stage 5: The remaining independent firms compete à la Cournot.

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, 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. In our model, α lower than one has the additional effect of making takeover activities 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 takeover more valuable to the manager than to the owner, because it biases managerial incentives to size and takeovers always increase sales as competition is reduced. Therefore, as it reduces the cost of takeovers and increases its benefits, decreases in α makes managers more prone to take competitors over.[2]

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[2] 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.

Our main purpose is then to show the conditions under which unprofitable takeovers can occur. Takeovers are unprofitable if, given the incentives and the value of c, they reduce the profits of the firm. Therefore, the owner would be better off if takeovers were forbidden at the beginning of Stage 2, once incentives have been already set. It should be emphasized that unprofitable takeovers are driven by the strategic gains obtained by distorting output decisions. If the entrepreneurial firms were committed to sell a fixed amount of output and not to accept any offer below a certain critical level, no unprofitable takeover would occur because owners would set $\alpha=1$. Therefore, the overbidding of managers comes as a result of the strategic use of managerial incentives.

Takeover expenditures are supposed not to be contractible. The manager bargains directly with owners of entrepreneurial firms, so that the cost of takeovers is private information.[3] This assumption will be relaxed later on to assess its importance.

3.The solution of the model: an example.

To illustrate our ideas in a simple way, we solve the model for the case in which the following simplifying assumptions are made:

The demand takes the following linear form: $P = 1 - X$, where X are total sales and P stands for price.

All firms have identical unit costs c.

All players know the actual value of c, except the owner of firm A that only knows that it is uniformly distributed in the support (0,1). We use the subgame perfect equilibrium as a solution concept. We proceed by backward induction.

In **Stage 5**, given the number of active firms i, the value of α and c, we can compute the Cournot equilibrium. Then we can deduce the payoff of players. We denote by $\Pi_i(\alpha,c)$ the

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[3]Prices of transactions are commonly manipulated in other cases, for instance, for tax-avoidance reasons.

profits of <u>entrepreneurial</u> firms if i > 1 firms are active. Similarly we denote by $P_i(\alpha,c)$ the gross profits of the <u>managerial</u> firm and by $G_i(\alpha,c)$ the payment received by the manager from the owner. It is straightforward to check that these functions have the following form.

$$\Pi_i(\alpha,c)=\begin{cases} [\dfrac{1-2c+\alpha c}{1+i}]^2 & \text{if } c < \dfrac{1}{2-\alpha} \\ 0 & \text{otherwise.} \end{cases} \quad \text{for } i = 2, 3.$$

$$P_i(\alpha,c)=\begin{cases} \dfrac{(1-2c+\alpha c)(1+(i-1)c-\alpha c i)}{(1+i)^2} & \text{if } c < \dfrac{1}{2-\alpha} \\ \dfrac{(1-2c+\alpha c)(1-\alpha c)}{4} & \text{otherwise.} \end{cases} \quad \text{for } i = 1, 2, 3.$$

$$G_i(\alpha,c)=\begin{cases} [\dfrac{1+(i-1)c-\alpha c i}{1+i}]^2 & \text{if } c < \dfrac{1}{2-\alpha} \\ [\dfrac{1-\alpha c}{2}]^2 & \text{otherwise.} \end{cases} \quad \text{for } i = 1, 2, 3.$$

In Stage 4, given the offers received by the firms, we can determine the number of firms that are going to be sold. As bids cannot be renegotiated, entrepreneurial firms will accept any offer assuring them, at least, their opportunity cost, that is the profits 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 $\Pi_2(\alpha,c)$. No takeover occurs if each of them is offered less than $\Pi_3(\alpha,c)$. One takeover will occur otherwise.

In Stage 3, given the incentive chosen in the first stage, one can compute the bids. As the manager finances takeovers with her own resources, she is going to pay the minimum necessary to achieve a desired market structure. Therefore, if both firms are bought, they will

receive $\Pi_2(\alpha,c)$ each and if only one firm is bought, it is going to be paid $\Pi_3(\alpha,c)$. If takeover decisions are not delegated, the manager just executes the orders received. If they are delegated, her remuneration as a function of the number i of active firms in the last stage can be written as:

$$I(\alpha,c,i) = G_i(\alpha,c) - (3 - i) \Pi_{i+1}(\alpha,c) \quad (i = 1,2,3)$$

Then, if $0 < c < \dfrac{5}{82-77\alpha}$, the manager chooses i=3, because $I(\alpha,c,3) > I(\alpha,c,i)$ (i=1,2) and if $\dfrac{5}{82-77\alpha} \leq c \leq 1$, the manager chooses i=1, because $I(\alpha,c,1) \geq I(\alpha,c,i)$ (i=2,3).[4,5] (See Appendix 1).

In **Stage 2**, given α, the price paid by the manager getting the job is equal to her remuneration in equilibrium minus her opportunity cost. This implies that to maximize his income, the owner should set α in Stage 1 so as to maximize expected profits.

In **Stage 1**, the owner of the managerial firm has to take two different decisions: (i) whether to delegate takeover decisions or to fix the number of firms the manager has to take over and (ii) to determine the value of α. The latter parameter affects three things: (1) the profits obtained by managerial firms in stage five once market structure is fixed, (2) the profits of entrepreneurial firms and hence their reservation price in stage four and (3) the gains of takeovers in stage three. To analyse the sign of the effect of α is convenient to rewrite managerial incentives in the following way: $I = S_A - \alpha c Q_A$, where Q_A is the quantity sold, so that we explicitly show that

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[4] If $\dfrac{1}{2-\alpha} < c < 1$, $I(\alpha,c,1)=I(\alpha,c,2)=I(\alpha,c,3)$ because entrepreneurial firms do not produce in any market configuration.

[5] If we increased the number of entrepreneurial firms, then less-than-industry-wide takeovers would occur for some values of α. Instead, it can be shown that with only one entrepreneurial firm takeovers would always be profitable.

α determines the marginal cost faced by the manager.[6] Hence, by reducing α the production of the managerial firm in the last stage is stimulated.

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, to soften competition in the last stage, the owner should induce the manager to produce over the profit-maximization level by setting α lower than one.[7] 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 four. Finally (third effect), lowering α increases the gains obtained by the manager in taking firms over. Acquiring firms increase their output after a takeover, which increases sales more than profits because costs also increase. Therefore the greater the weight given to sales (lower α) the wider the interval for which the manager will take firms over.

Scrutiny of the expected profits of managerial firms given by expression (1) below when takeover decisions are delegated illustrates the three effects just mentioned. As the maximizer of each of these effects taken separately is not greater that one, we do not need to worry about the functional form of expected profits for α > 1.

$$B(\alpha) = \int_{0}^{\frac{5}{82-77\alpha}} P_3(\alpha,c)\,dc + \int_{\frac{5}{82-77\alpha}}^{1} [P_1(\alpha,c) - 2\,\Pi_2(\alpha,c)]\,dc. \qquad (1)$$

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[6] With this reinterpretation of incentives is easier to understand the result of Stage 3. Increases in c affect the cost differential between entrepreneurial and managerial firms [$(1-\alpha)c$]. This makes takeovers cheaper by reducing the profitability of the former.

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

The first effect corresponds to the terms $P_3(\alpha,c)$ and $P_1(\alpha,c)$, where $\dfrac{\partial P_1}{\partial \alpha} \geq 0$ for $\alpha \leq 1$. The second effect can be seen through the term $\Pi_2(\alpha,c)$ and the extreme of integration $\dfrac{5}{82-77\alpha}$ which indicates the values starting from which the entrepreneurial firm will sell. The third effect also corresponds to the mentioned extreme of integration.

The optimal α depends on the takeover policy decided by the owner, because the intensity of the effects varies with it. The optimal incentive is $\alpha^*=0.784$ if takeovers are delegated, $\alpha_0=0.856$ if the owner specifies in the contract he does not want takeovers, $\alpha_1=0.798$ and $\alpha_2=0.726$ if respectively one and two takeovers are stipulated in the contract. Comparison of these values sheds some light on the intensity of the different effects. 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.[8] Comparison of expected profits given a takeover policy evaluated at the respective maximizers leads to the conclusion that delegation of takeover decisions is optimal (see Appendix 2).

4. Unprofitable takeovers.

We have seen that in equilibrium managerial incentives depart from profit maximization to include considerations of size. It has been suggested that this type of objectives induces unprofitable takeovers (Shleifer and Vishny (1988)). To check this point in our model, we look for the values of c satisfying the condition that, given the incentives chosen in Stage 1, taking two firms over is more profitable than not taking them over. Therefore, profitability in our model amounts to saying that $L = P_1(\alpha,c) - 2 \Pi_2(\alpha,c) - P_3(\alpha,c) > 0$. It can be checked that

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[8]Observe that $\Pi_3(\alpha,c)$ is concave and $\Pi_2(\alpha,c)$ always decreasing on α.

function L(α,c) is positive for $\dfrac{5}{46-41\alpha} < c < \dfrac{1}{2-\alpha}$ (Appendix 3). Profitability at the optimal

value of $\alpha=\alpha^*$ is therefore ensured when $0.36 < c < 0.82$. From the results of stage 3, we

know that the manager is going to buy both entrepreneurial firms whenever c > 0.23.

Therefore, for c $\in$ [0.23,0.36), the manager is going to pay more for the target firms than the

increase in profits induced by the takeovers. In these cases, the manager engages in

unprofitable takeovers.

In order to avoid the overbidding of managers, the owner could forbid takeovers. In other

words, the owner could avoid unprofitable takeovers from occurring by specifying it in the

contract. However, this policy is not profit-maximizing (as we have shown at the end of section

3) because it would not only prevent unprofitable takeovers from occurring but it would also

prevent the profitable ones.

Note that unprofitable takeovers occurred in our model because two different types of decisions

- which would require two different incentives - are taken by the same agent [see Holmstrom

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

One straightforward solution to this 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 from 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. In other words, the

assumption of nonseparability of decisions made here can be understood as the result of a dynamic process in which the informational asymmetry is endogenously determined by the assignment of tasks.

In the next section we study incentive schemes other than the simple ones treated so far, to try to replicate the same outcome as with separation of tasks.

5. Do unprofitable takeovers occur under alternative incentive schemes?

The purpose of the previous sections was to show that unprofitable takeovers may occur because of the incentives given by the principal to his agent. We found it natural to use a simple and well-known incentive scheme in the tradition of Vickers (1985), Fershtman and Judd (1987) and Sklivas (1987) to prove our result. However, we should now turn to the analysis of alternative incentive schemes, to see the sensitivity of our results to different contracts.

We consider two different extensions of the original incentives that progressively strengthen the informational (verifiability) requirements. In the first one, information about whether the manager engages in takeover activity or not is used. The owner may then decide to impose a fine when the manager buys other firms, in the attempt of discouraging unprofitable mergers. We will show that at equilibrium unprofitable takeovers may still occur despite the existence of the fine.

In the second extension, we relax the assumption that the cost of the takeovers is not contractible. We assume that these costs are perfectly observable, and that the owner can include them in the contract offered to the manager. In this more sophisticated case, the optimal contract avoids unprofitable takeovers.

5.1. Fines for engaging in takeover activity.

We consider an incentive scheme where fines contingent on the existence or not of takeover activity are allowed. For the sake of simplicity, we do not make fines contingent on the number of firms the manager takes over.[9]

As the fine punishes in the same way the decisions of taking one or two firms over we still find that - like in the previous section - in Stage 3 the manager will never take only one firm over. Therefore, we can limit ourselves to study how the fine affects the decision of the manager between merging two firms or none.

In Figure 1, we plot the function $L(\alpha,c,F) = G_1(\alpha,c) - 2\Pi_2(\alpha,c) - F - G_3(\alpha,c)$ to illustrate our argument. This function is the manager's net payoff if she takes two rivals over *minus* her remuneration if no takeover occurs, given α and a fine F. The fine pushes this function downwards by the constant amount F such that it reduces the values of c by which a takeover occurs. The interval of values for which the manager would like to buy rivals corresponds to positive values of function L (in the figure between points v and y). As takeovers are *profitable* only if $c \geq \dfrac{5}{46-41\alpha}$ (point x in Figure 1), the fine reduces the zone of unprofitable takeovers <u>at the cost</u> of reducing the zone of profitable takeovers as well. As a consequence of this trade-off the optimal fine falls short of preventing unprofitable takeovers from occurring. It is possible to check that the actual optimal fine is 0.007 and the optimal incentive is $\alpha = 0.78$ (see Appendix 4). Then, for $c \in (0.3, 0.36)$ takeovers occur and are unprofitable.

The optimal α is very close to α^* because two counterbalancing forces are at stake. As the perverse effect on takeover decisions of reductions of α is partly corrected by the fine, the owner is more inclined to lower α. However, as the fine reduces the likelihood of takeovers,

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[9] It can be shown that the results obtained would not change under this alternative assumption.

the owner prefers to raise α, because we know that incentives are more distorted to reduce the costs of takeovers than to affect competition in the last stage.

5.2. Making incentives contingent on the costs of takeovers.

Maintaining the assumption of linear contracts, we consider contracts which can be made contingent on the costs of takeovers (M). The payment offered to the manager would then be: G $= \alpha\ P_A + (1-\alpha)\ S_A - \chi\ M$. With such a contract, unprofitable takeovers do not occur in equilibrium. This point is illustrated by figure 2, where we plot the function $L(\alpha,c,\chi)=G_1(\alpha,c) - 2\ \chi\ \Pi_2(\alpha,c) - G_3(\alpha,c)$ which determines the choice of the manager.

Increases in χ pushes this function downwards but one root is left unchanged. To understand this, recall that the cost of takeovers is decreasing in the cost parameter c. Then the owner can reduce the zone of unprofitable takeovers without reducing the area of profitable takeovers. Therefore the optimal χ would prevent any unprofitable takeover from occurring. In other words, through the appropriate choice of the contract, the owner pushes the manager to make the same takeover decisions as the owner himself would make were he perfectly informed, because he can deduce the value of c through the observation of takeover expenditures. It can be checked that the optimal contract offered to the manager is such that $\alpha = 0.78$ and $\chi = \frac{37}{32}$ (see Appendix 5). In other words, to correct the perverse effect of α in takeover decisions, the owner taxes takeover expenditures.[10]

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[10] We have also checked that taking only one firm over is never convenient for the manager under the optimal contract.

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6. <u>Discussion and Conclusion.</u>

In a Cournot setting, we have analysed a model where the owner of a firm delegates output and takeover decisions to a professional manager. We have limited ourselves to the analysis of simple linear contracts, since our main purpose has been to show that very well-known incentive schemes like those proposed by Fershtman and Judd (1987) may lead to unprofitable mergers.[11]

We have also shown that the existence of a fine aimed at discouraging takeovers is not enough to guarantee merger profitability. However, losses from mergers might be avoided were the owner able to observe the amount paid by the manager in the takeover <u>and</u> to stipulate an incentive scheme dependent on it. Managerial contracts made dependent on takeover expenditures are not commonly observed and may be thought as unrealistic and too sophisticated. An alternative approach to avoid merger losses should then be found.

The results are derived using a simple model. Further research should be aimed at verifying that the basic result still holds good with more sophisticated environments.

An empirically testable hypothesis which can be derived from the present work is that merger unprofitability is due to managerial incentives which do not include only the company's profits. In this sense, one should find that the higher the company's own stock held by managers (i.e., the higher the profit component in their remuneration), the higher the expected profitability from mergers. The only empirical study of this type we are aware of is the work by Lewellen et al. (1985) which gives some support to our hypothesis.

We believe it would be interesting to explore further the empirical validity of such a hypothesis.

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[11]It may also be worth of notice that because of the strategic use of managerial incentives, mergers do occur although the firms choose quantities.

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L(α,c,F)

$$u = \frac{5}{82-77\alpha} \; , \;\; x = \frac{5}{46-41\alpha} \;\; \text{and} \;\; z = \frac{1}{2-\alpha} \; .$$
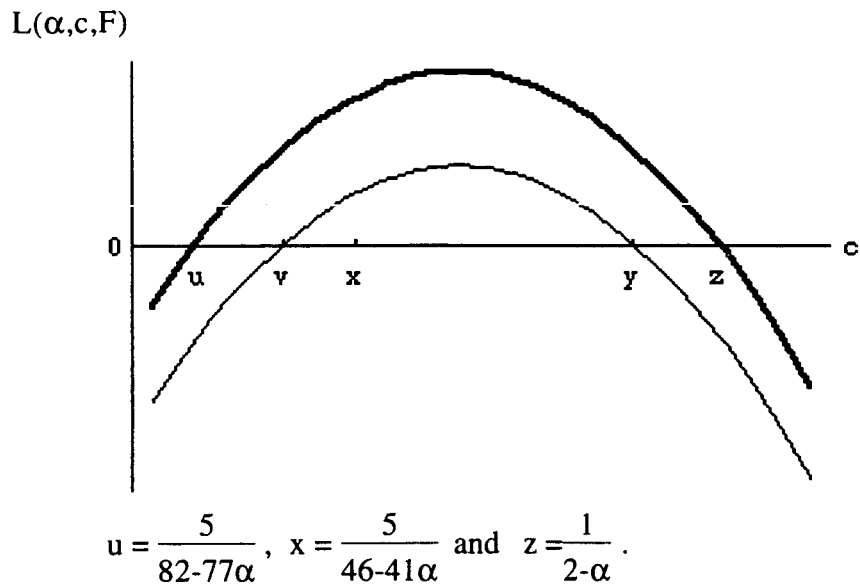
Figure 1. Function L(α,c,F), depicted for F=0 (bold line) and F>0.

L(α,c,χ)

$$x = \frac{5}{82-77\alpha} \; , \;\; y = \frac{5}{46-41\alpha} \;\; \text{and} \;\; z = \frac{1}{2-\alpha}$$
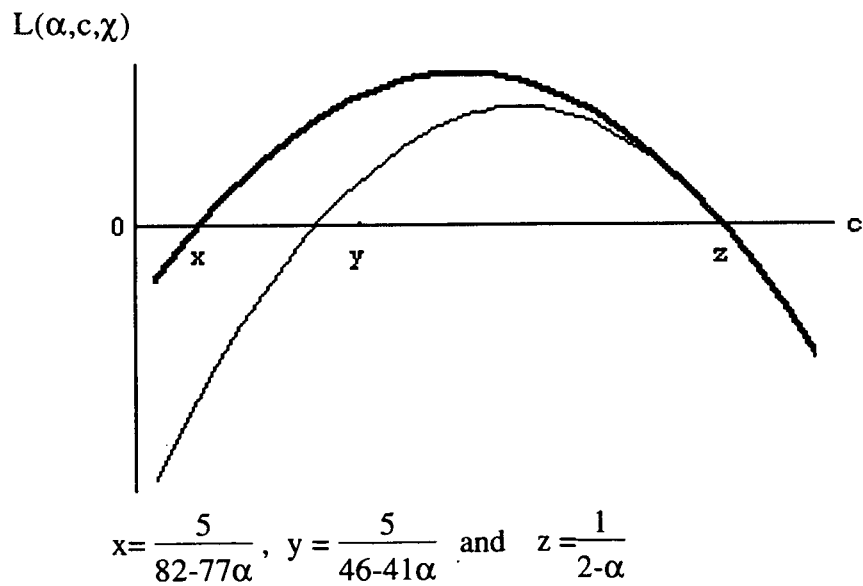
Figure 2. Function L(α,c,χ), depicted for χ=1 (bold line) and χ >1.

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Appendix 1:

The following functions are the difference in manager's remuneration given two different takeover decisions.

$$\Delta 32 = I(\alpha,c,3) - I(\alpha,c,2) = \frac{1 - 16\,c + 14\,\alpha\,c + 28\,c^2 - 40\,\alpha\,c^2 + 13\,\alpha^2\,c^2}{72} \ .$$

$$\Delta 31 = I(\alpha,c,3) - I(\alpha,c,1) = \frac{5 - 92\,c + 82\,\alpha\,c + 164\,c^2 - 236\,\alpha\,c^2 + 77\,\alpha^2\,c^2}{144} \ .$$

$$\Delta 21 = I(\alpha,c,2) - I(\alpha,c,1) = \frac{1 - 20\,c + 18\,\alpha\,c + 36\,c^2 - 52\,\alpha\,c^2 + 17\,\alpha^2\,c^2}{48} \ .$$

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

$$\Delta 32 > 0 \text{ iff } 0 \le c < \frac{1}{14 - 13\alpha} \text{ and } \Delta 32 < 0 \text{ iff } \frac{1}{14 - 13\alpha} < c < \frac{1}{2-\alpha} \ .$$

$$\Delta 31 > 0 \text{ iff } 0 \le c < \frac{5}{82 - 77\alpha} \text{ and } \Delta 31 < 0 \text{ iff } \frac{5}{82 - 77\alpha} < c < \frac{1}{2-\alpha} \ .$$

$$\Delta 21 > 0 \text{ iff } 0 \le c < \frac{1}{18 - 17\alpha} \text{ and } \Delta 21 < 0 \text{ iff } \frac{1}{18 - 17\alpha} < c < \frac{1}{2-\alpha} \ .$$

Recall that if $\frac{1}{2-\alpha} \le c \le 1$, $I(\alpha,c,1) = I(\alpha,c,2) = I(\alpha,c,3)$ because entrepreneurial firms do not produce in any market configuration.

Given that $\alpha < 1$, we have: $\frac{1}{18 - 17\alpha} < \frac{5}{82 - 77\alpha} < \frac{1}{14 - 13\alpha}$. 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 only focus on the sign of $\Delta 31$ to derive the actions taken by the manager. This leads to the result stated in the text.

Appendix 2:

We study the optimal value of α given a takeover policy:

a.- Delegation of takeover decisions.

Expected profits are given by:

$$B(\alpha) = \int_{0}^{\frac{5}{82-77\alpha}} P_3(\alpha,c)\,dc + \int_{\frac{5}{82-77\alpha}}^{\frac{1}{2-\alpha}} [P_1(\alpha,c) - 2\,\Pi_2(\alpha,c)]\,dc + \int_{\frac{1}{2-\alpha}}^{1} P_1(\alpha,c)\,dc =$$

$$= \frac{25\,(-13744 + 26398\,\alpha - 12679\,\alpha^2)}{432\,(-82 + 77\,\alpha)^3} + \frac{8 - 36\,\alpha + 36\,\alpha^2 - 9\,\alpha^3}{108\,(-2 + \alpha)}$$

$$\frac{\partial B(\alpha)}{\partial \alpha} = \frac{25\,(1010228 - 1985936\,\alpha + 976283\,\alpha^2)}{432\,(-82 + 77\,\alpha)^4} + \frac{32 - 72\,\alpha + 45\,\alpha^2 - 9\,\alpha^3}{54\,(-2 + \alpha)^2} = 0$$

The only meaningful solution to the first order condition is $\alpha^*=0.784$. It can be checked that the second order condition is satisfied. Expected profits at the correspondent maximizer is $B(0.784) = 0.0233$.

b.- Forbidding takeovers.

Expected profits are given by:

$$C(\alpha) = \int_{0}^{\frac{1}{2-\alpha}} P_3(\alpha,c)\,dc + \int_{\frac{1}{2-\alpha}}^{1} P_1(\alpha,c)\,dc = \frac{-8 + 37\,\alpha - 48\,\alpha^2 + 24\,\alpha^3 - 4\,\alpha^4}{48\,(-2 + \alpha)^2}.$$

It is possible to derive the FOC and see it is solved for $\alpha_o = 0.856$. The value of expected profits at this point is $C(0.856) = 0.022$.

c.- <u>Imposing one takeover</u>.

$$D(\alpha) = \int_0^{\frac{1}{2-\alpha}} [P_2(\alpha,c) - \Pi_3(\alpha,c)]\, dc + \int_{\frac{1}{2-\alpha}}^1 P_1(\alpha,c)\, dc =$$

$$= \frac{-70 + 329\,\alpha - 432\,\alpha^2 + 216\,\alpha^3 - 36\,\alpha^4}{432\,(-2 + \alpha)^2}.$$

It is possible to derive the FOC and see it is solved for $\alpha_1 = 0.798$. The value of expected profits at this point is $C(0.8) = 0.02$.

d.- <u>Imposing two takeovers</u>.

$$E(\alpha) = \int_0^{\frac{1}{2-\alpha}} [P_1(\alpha,c) - 2\,\Pi_2(\alpha,c)]\, dc + \int_{\frac{1}{2-\alpha}}^1 P_1(\alpha,c)\, dc = \frac{8 - 36\,\alpha + 36\,\alpha^2 - 9\,\alpha^3}{108\,(-2 + \alpha)}.$$

It is possible to derive the FOC and see it is solved for $\alpha_2 = 0.726$. The value of expected profits at this point is $C(0.8) = 0.019$.

Comparison of expected profits given a takeover policy evaluated at the respective maximizers leads to the conclusion that delegation of takeover decisions is optimal.

<u>Appendix 3.</u>

$$P_1(\alpha,c) - 2\Pi_2(\alpha,c) - P_3(\alpha,c) = -\left(\frac{5 - 56\,c + 46\,\alpha\,c + 92\,c^2 - 128\,\alpha\,c^2 + 41\,\alpha^2\,c^2}{144}\right).$$

This function is concave in c and therefore it is positive between its two roots: \f(5;46-41α) and $\frac{1}{2-\alpha}$. Recall that if $\frac{1}{2-\alpha} \le c \le 1$, the previous function is zero, because entrepreneurial firms do not produce in any market configuration.

<u>Appendix 4.</u>

We prove here that a fixed fine does not eliminate unprofitable mergers. First of all, we should notice that by introducing a fine (F), the owner affects the interval of values of c for which the manager takes rivals over. If with a fine F=0, the minimum value of c for which the manager makes the acquisitions is given by $u = \dfrac{5}{82-77\alpha}$, with the fine this point is given by v = u+dist(F). In the same way, with a positive fine the point after which no rivals are taken over is given by y=z - dist(F). [See Figure 1 for a representation of these points.] We proceed to derive dist(F). To do so, we first find the points v and y. These points are those where there is a switch in the manager's decision from takeovers to no-takeovers. Therefore, they are the roots of I(α,c,1) - I(α,c,3)-F (see appendix 1) i.e. the manager's payoff if she takes two rivals over minus her remuneration if no takeover occurs. Their expression is given by:

$$v = \frac{46 - 41\,\alpha - 12\,\sqrt{9 - 18\,\alpha + 9\,\alpha^2 - 164\,F + 236\,\alpha\,F - 77\,\alpha^2\,F}}{164 - 236\,\alpha + 77\,\alpha^2}.$$

$$y = \frac{46 - 41\,\alpha + 12\,\sqrt{9 - 18\,\alpha + 9\,\alpha^2 - 164\,F + 236\,\alpha\,F - 77\,\alpha^2\,F}}{164 - 236\,\alpha + 77\,\alpha^2}.$$

dist(F) is obtained as the difference between point v and point u. Inverting this function we can write the fine as a function of the variable dist.

$$F = \frac{dist\,(72\,(1-\alpha) - 164\,dist + 236\,\alpha\,dist - 77\,\alpha^2\,dist)}{144} \qquad (2)$$

We now define the function f(c,α,i) as the profits obtained by the owner of firm A given that i firms are active in the last stage.

$$f(\alpha,c,i) = P_i(\alpha,c,i) - (3-i)\,\Pi_{i+1}(\alpha,c).$$

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The fine does not appear in this expression because competition between managers in stage 2 reduces the remuneration of the manager getting the job to her opportunity cost. Therefore, a fine (F) paid by the manager in the last stage means a reduction by F in the payment she makes in Stage 2.

Define delta as the difference in profits between not taking any rival over and monopolizing the industry. This function denotes the gain obtained by the owner by forcing his manager with a fine to switch from mergers to non-mergers.

$$\text{delta}(\alpha,c) = f(\alpha,c,3) - f(\alpha,c,1) =$$

$$= \frac{5 - 56\,c + 46\,\alpha\,c + 92\,c^2 - 128\,\alpha\,c^2 + 41\,\alpha^2\,c^2}{144} .$$

We proceed to derive the optimal decisions of the owner in two stages. In the first, we derive the optimal fine given α. With this result, we are able to write the expected profits as a function only of α and then we pick its optimal value. For the sake of simplicity, first stage calculations are done considering that the owner chooses the variable dist. Expression (2) will allow us to know what value of the fine this choice implies.

A positive dist enlarges the zone for which takeovers do not occur. To compute its optimal value given α, we have to take into account only the change in expected profits due to this enlargement:

$$T(\text{dist}) = \int_{\frac{5}{88-77\alpha}}^{\frac{5}{88-77\alpha} + \text{dist}} \text{delta}(\alpha,c)\, dc + \int_{\frac{1}{2-\alpha} - \text{dist}}^{\frac{1}{2-\alpha}} \text{delta}(\alpha,c)\, dc$$

The only meaningful solution to $\dfrac{\partial T(\text{dist})}{\partial \text{dist}} = 0$ is

$\text{dist}(\alpha) =$

$$\frac{36\,(3772 - 10676\,\alpha + 10061\,\alpha^2 - 3157\,\alpha^3 - 6\,\sqrt{(-1+\alpha)^3(-46+41\,\alpha)(-82+77\,\alpha)^2}\,)}{(-82+77\,\alpha)^2\,(92 - 128\,\alpha + 41\,\alpha^2)}$$

It can be checked that the second order condition is satisfied.

Now, we write the expected profits as a function of α only.

$$S(\alpha) = \int_{0}^{\frac{5}{82-77\alpha}+\text{dist}(\alpha)} P_3(\alpha,c)\,dc + \int_{\frac{5}{82-77\alpha}+\text{dist}(\alpha)}^{\frac{1}{2-\alpha}-\text{dist}(\alpha)} [P_1(\alpha,c) - 2\,\Pi_2(\alpha,c)]\,dc +$$

$$+ \int_{\frac{1}{2-\alpha}-\text{dist}(\alpha)}^{\frac{1}{2-\alpha}} P_3(\alpha,c)\,dc + \int_{\frac{1}{2-\alpha}}^{1} P_1(\alpha,c)\,dc$$

The only meaningful solution to $\dfrac{\partial S(\alpha)}{\partial \alpha} = 0$ is $\alpha = 0.784$. It can be checked that the second

order condition is satisfied. The optimal fine is then: $F(\text{dist}(0.784))=0.007$.

Appendix 5.

We show here that a contract which is contingent on the costs of takeovers avoids unprofitable

mergers. To do so, we first find the profit-maximizing takeover decision for given c. This

would give the optimal policy were the owner able to observe costs. We then show that by

taxing takeovers the owner can replicate this outcome. We define the function f(c,α) as the

profits obtained by the owner of firm A given that i firms are active in the last stage.

$$f(\alpha,c,i) = P_i(\alpha,c,i) - (3-i)\,\Pi_{i+1}(\alpha,c).$$

The following functions are the difference in profits given two different takeover decisions.

$$\delta 32 = f(\alpha,c,3) - f(\alpha,c,2) = \frac{1 - 10\,c + 8\,\alpha\,c + 16\,c^2 - 22\,\alpha\,c^2 + 7\,\alpha^2\,c^2}{72}.$$

$$\delta 31 = f(\alpha,c,3) - f(\alpha,c,1) = \frac{5 - 56\,c + 46\,\alpha\,c + 92\,c^2 - 128\,\alpha\,c^2 + 41\,\alpha^2\,c^2}{144}.$$

$$\delta 21 = f(\alpha,c,2) - f(\alpha,c,1) = \frac{1 - 12\,c + 10\,\alpha\,c + 20\,c^2 - 28\,\alpha\,c^2 + 9\,\alpha^2\,c^2}{48}.$$

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

$$\delta 32 > 0 \text{ iff } 0 \le c < \frac{1}{8 - 7\alpha} \text{ and } \delta 32 < 0 \text{ iff } \frac{1}{8 - 7\alpha} < c < \frac{1}{2 - \alpha}.$$

$$\delta 31 > 0 \text{ iff } 0 \le c < \frac{5}{46 - 41\alpha} \text{ and } \delta 31 < 0 \text{ iff } \frac{5}{46 - 41\alpha} < c < \frac{1}{2 - \alpha}.$$

$$\delta 21 > 0 \text{ iff } 0 \le c < \frac{1}{10 - 9\alpha} \text{ and } \delta 21 < 0 \text{ iff } \frac{1}{10 - 9\alpha} < c < \frac{1}{2 - \alpha}.$$

Recall that if $\frac{1}{2 - \alpha} \le c \le 1$, $f(\alpha,c,1) = f(\alpha,c,2) = f(\alpha,c,3)$ since for this interval of costs entrepreneurial firms do not produce in any market configuration (takeover decisions do not play any role).

As (for $\alpha < 1$) $\frac{1}{10 - 9\alpha} < \frac{5}{46 - 41\alpha} < \frac{1}{8 - 7\alpha}$, we have that $f(\alpha,c,2)$ is either lower than $f(\alpha,c,3)$ or lower than $f(\alpha,c,1)$, so that taking only one firm over is never profit-maximizing. Therefore, we should only look at the sign of $\delta 31$ to derive the profit-maximizing takeover decisions. The optimal decisions would be to make no takeovers if $0 \le c < \frac{5}{46 - 41\alpha}$ and to monopolize if $\frac{5}{46 - 41\alpha} < c < \frac{1}{2 - \alpha}$. If costs were contractible, the owner would stipulate the previous conditions in the contract. In this case, expected profits would be:

$$Z(\alpha) = \int_0^{\frac{5}{46-41\alpha}} P_3(\alpha,c)\, dc + \int_{\frac{5}{46-41\alpha}}^{\frac{1}{2-\alpha}} [P_1(\alpha,c) - 2\,\Pi_2(\alpha,c)]\, dc + \int_{\frac{1}{2-\alpha}}^{1} P_1(\alpha,c)\, dc.$$

The only meaningful solution to $\dfrac{\partial Z(\alpha)}{\partial\alpha} = 0$ is $\alpha=0.783$. It can be checked that the second order condition is satisfied.

We are now going to show that by taxing takeover expenditures, the owner can obtain the same expected profits as if costs were contractible. First of all, we study the takeover decisions of a manager who has to pay χ times the cost of takeovers. We define the function $I_\chi(c,\alpha,i)$ as manager's remuneration given that i firms are active in the last stage.

$$I_\chi(c,\alpha,i) = G_i(\alpha,c) - (3 - i)\,\Pi_{i+1}(\alpha,c) \quad (i = 1,2,3)$$

The following functions are the difference in manager's remuneration given two different takeover decisions.

$$\Delta\chi 32 = I_\chi(\alpha,c,3) - I_\chi(\alpha,c,2) =$$

$$= \frac{(1 - 2c + \alpha c)\,(-7 + 9\chi + 2c + 5\alpha c - 18\chi c + 9\alpha\chi c)}{144}$$

$$\Delta\chi 31 = I_\chi(\alpha,c,3) - I_\chi(\alpha,c,1) =$$
$$= \frac{(1 - 2c + \alpha c)\,(-27 + 32\chi + 18c + 9\alpha c - 64\chi c + 32\alpha\chi c)}{144}$$

$$\Delta\chi 21 = I_\chi(\alpha,c,2) - I_\chi(\alpha,c,1) =$$
$$= \frac{(1 - 2c + \alpha c)\,(-20 + 23\chi + 16c + 4\alpha c - 46\chi c + 23\alpha\chi c)}{144}$$

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

$\Delta\chi 32 > 0$ iff $0 \le c < c32(\alpha,\chi)$ and $\Delta\chi 32 < 0$ iff $c32(\alpha,\chi) < c < \dfrac{1}{2-\alpha}$.

$\Delta\chi 31 > 0$ iff $0 \le c < c31(\alpha,\chi)$ and $\Delta\chi 31 < 0$ iff $c31(\alpha,\chi) < c < \dfrac{1}{2-\alpha}$.

$\Delta\chi 21 > 0$ iff $0 \le c < c21(\alpha,\chi)$ and $\Delta\chi 21 < 0$ iff $c21(\alpha,\chi) < c < \dfrac{1}{2-\alpha}$.

where, $c32(\alpha,\chi) = \dfrac{-7 + 9\chi}{10 - 17\alpha + 18\chi - 9\alpha\chi}$,

$c31(\alpha,\chi) = \dfrac{-27 + 32\chi}{18 - 45\alpha + 64\chi - 23\alpha\chi}$ and

$c21(\alpha,\chi) = \dfrac{-20 + 23\chi}{8 - 28\alpha + 46\chi - 23\alpha\chi}$.

Recall that if $\dfrac{1}{2-\alpha} \le c \le 1$, $I_\chi(\alpha,c,1)=I_\chi(\alpha,c,2)=I_\chi(\alpha,c,3)$ because entrepreneurial firms do not produce in any market configuration.

The manager could be led to take the profit-maximizing decision if $\chi = \dfrac{37}{32}$ because then $c31(\alpha,\dfrac{37}{32}) = \dfrac{5}{46-41\alpha}$. Of course, we have to check that for this value of the takeover tax, the manager would not like to take only one firm over. This is done by checking that: $c12(0.783,\dfrac{37}{32}) < c13(0.783,\dfrac{37}{32}) < c23(0.783,\dfrac{37}{32})$. Therefore, by taxing takeover expenditures the owner can attain the same expected profits as if costs were contractible, thus avoiding unprofitable mergers.

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