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Strategic Delegation and Market Competitiveness

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Abstract. This paper examines the determinants of the degree of strategic delegation in a quantity setting framework. The sub-game perfect equilibrium degree of strategic delegation is derived as a function of the two key parameters that define market competitiveness in a homogeneous product set-up, i.e. the price-elasticity of market demand and the number of firms. With respect to both these parameters we find that their relationship with the degree of strategic delegation is not necessarily monotone. Indeed, for an inverse relation between strategic delegation and market competitiveness to arise, the initial value of the Lerner index must be sufficiently low.

Keywords: Strategic delegation, quantity competition, constant price-elasticity of demand
Jel Classification: D43, L13, L20

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1 Introduction

The literature on strategic delegation has shown that profit maximizing firms may strategically choose to commit to a non-profit maximizing behaviour, the latter being formalized in terms of each firm's owner delegating market decisions to a manager, to whom an objective function is assigned in terms of a combination of profits and another variable (sales, quantity, relative profits, etc.). The relative weight of this additional variable, strategically chosen by the owners, is a measure of the degree of delegation to which they commit, and defines the implicit structure of incentives which should support the underlying principal-agent relation.

In recent years the basic models by Sklivas (1987), Fershtman and Judd (1987) and Basu (1995) have been enriched to investigate the implications of extending the delegation (originally conceived for the choice of quantity or price) to decisions concerning, among others, quality (Ishibashi, 2001), R&D investments (Zhang and Zhang, 1997), vertical and horizontal product differentiation (Barros and Grilo, 2002; Bárcena-Ruiz and Casado-Izaga, 2005); moreover, a number of issues such as the profitability of horizontal mergers (Gonzalez-Maestre and Lopez-Cunat, 2001), the sustainability of collusive agreements (Lambertini and Trombetta, 2002), the competition between private and public firms (White, 2001) have been re-examined in a delegation framework. Less attention has been paid, however, to what determines the degree of delegation, i.e. the extent of the departure from profit maximization to which firms commit themselves in equilibrium.

In this paper we tackle this issue in a quantity setting framework, and by assuming that the managers' objective function is a combination of profits and sales. In particular, we concentrate on the factors underlying market competitiveness as key determinants of the degree of delegation. By developing a model with constant-elasticity market demand, we parametrize the solution for the optimal degree of delegation to the elasticity itself and the number of firms, which is treated as exogenous. Our main result is that the relation between delegation and these two parameters is not necessarily monotone, allowing for a reduction of the Lerner index of monopoly power to be associated to a higher delegation.

The paper is organized as follows. In section 2 we develop the model, discussing in section 3 the role of demand elasticity and market concentration on the delegation decisions; section 4 offers some conclusions.

2 The model

We consider a standard two-stage strategic delegation game in a quantity setting framework, with n oligopolistic firms producing a homogeneous product. Each firm has an owner and a manager. In this game, the quantity of each firm is set at the second stage by its manager who maximizes a linear combination of profits and sales (Fershtman and Judd, 1987). For each firm, the weight of sales in the objective function of the manager is the strategic decision left to the profit maximizing owner at the first stage. This decision can be thought of as the content of a delegation contract and defines the structure of the incentives to the manager.

In order to parametrize the solution of the game to both the price elasticity of demand and the number of firms, we assume a market demand function with constant price-elasticity:

$$P(Q) = Q^{-\frac{1}{\eta}}, \qquad \eta > 1$$

where $Q = \sum_{i=1}^{n} q_i$, $i = 1, ..., n$ and the restriction on η ensures that the reaction function of any firm is well defined for any possible choice of its rivals. All firms share the same technology, synthesized in a constant average and marginal cost, c.

At the quantity stage, the manager of firm i behaves consistently with the incentive structure chosen by the owner, by maximizing the following linear combination of profits π_i and sales S_i:

$$M_i = \theta_i \pi_i + (1 - \theta_i) S_i = \left(\sum_{i=1}^{n} q_i \right)^{-\frac{1}{\eta}} q_i - \theta_i c q_i \tag{1}$$

where the weight attached to sales (the distance of θ_i from 1) is an index of the degree of strategic delegation.

Maximization of (1) implies

$$\eta Q^{-\frac{1}{\eta}} - q_i Q^{-\frac{1+\eta}{\eta}} - \theta_i c \eta = 0, \qquad i = 1, ..., n. \tag{2}$$

Summing (2) over i, we obtain the total industry output and the market price:

$$Q = \frac{(n\eta - 1)^{\eta}}{\left(c\eta\left(\sum_{i=1}^{n}\theta_i\right)\right)^{\eta}}, \qquad P = \frac{c\eta\left(\sum_{i=1}^{n}\theta_i\right)}{(n\eta - 1)}.$$

Substituting Q in eqt. (2), the latter can be solved for the Nash equilibrium in quantities:

$$q_i^* = \frac{(n\eta - 1)^{\eta}}{\left(c\eta\left(\sum_{i=1}^{n}\theta_i\right)\right)^{\eta}}\left(\eta - \frac{\theta_i\,(n\eta - 1)}{\sum_{i=1}^{n}\theta_i}\right), \qquad i = 1, ..., n.$$

When $\theta_i = 1$ for all i, i.e. in the absence of strategic delegation, the above expression clearly collapses to the symmetric Cournot-Nash solution under constant elasticity of demand.

The structure of incentives - i.e. the delegation parameters - are strategically chosen by the profit-maximizing owners at the first stage of the game. By substituting P and q_i^* in the profit function $\pi_i = (P - c)\,q_i$, and maximizing the latter with respect to θ_i, we get the following implicit reaction function:

$$\eta\left(\eta - \frac{\theta_i\,(n\eta - 1)}{(\Theta + \theta_i)}\right) - (\eta\,(\Theta + \theta_i) - (n\eta - 1))\left(\frac{\eta^2\,(\Theta + \theta_i) - \eta\theta_i\,(n\eta - 1) + (n\eta - 1)\,\Theta}{(\Theta + \theta_i)^2}\right) = 0$$

where $\Theta = \sum_{j \neq i}\theta_j$. Under symmetry, $\Theta = (n-1)\,\theta_i$ and therefore the subgame perfect Nash equilibrium implies

$$\theta^*\,(\eta, n) = \frac{\eta^2 n\,(n^2 - n + 1) - (2n\eta - 1)\,(n - 1) - \eta}{\eta n\,(\eta - n + n\eta\,(n - 1))} \tag{3}$$

It can be checked that $0 < \theta^* < 1$. The constant elasticity hypothesis does not alter the basic feature of strategic substitutability at the quantity stage equilibrium, and this implies that at the delegation stage the owners are willing to induce strategically an aggressive behaviour of their managers.

3 Demand elasticity, concentration and managerial incentives

A nice feature of (3) is that the sub-game perfect equilibrium degree of strategic delegation is a function of the two key parameters that define market competitiveness in a homogeneous product set-up, i.e. the elasticity of market demand and the number of firms.

Let us consider first the role of demand elasticity. It is immediate to check that as η approaches infinity, the incentive to strategic delegation disappears for all values of n. However, the pattern of convergence to strict profit maximization is not necessarily monotone. Figure 1 shows the behaviour of $\theta^*(\eta, n)$ as a function of η, for different given values of n.

FIGURE 1

In the duopoly case the function is clearly non-monotone: for $\eta \in \left]1, 1+\frac{\sqrt{3}}{3}\right]$ the degree of strategic delegation $(1-\theta^*)$ is increasing in η, moving from zero (in the limit case $\eta \to 1$) to 0.067, while it is monotonically decreasing for $\eta > 1+\frac{\sqrt{3}}{3}$. For $n \geq 3$, however, the θ^* function is monotone: any increase in the elasticity of demand leads to a reduction in the optimal delegation.

In order to explain the non-monotonicity in the duopoly case, it is useful to concentrate upon the way in which the elasticity of demand affects the reaction function of the delegation stage of the game. In Figure 2 we draw this reaction function for some relevant values of η.

FIGURE 2

The constant elasticity hypothesis implies that both at the quantity stage and at the delegation stage the reaction functions exhibit first strategic complementarity and then strategic substitutability, the latter characterizing the equilibrium at both stages.[1] At the quantity stage this shape results from

[1] When $\eta = 1$, the symmetric equilibrium of the quantity game occurs at a point where the slope of the reaction function is zero. This strategic independence implies that there is no incentive to distort from profit maximization the manager's choice. This explains why $\lim_{\eta \to 1} \theta^*(\eta, 2) = 1$.

the interplay of two forces: as the rival firm increases its quantity, firm i experiences both a leftward shift and a flattening of its residual demand curve. While the first effect lowers the marginal revenue, the second, which dominates for high values of the firm's quantity compared to the rival's, tends to increase it. The behaviour of the reaction function directly derives from these changes in the marginal revenue function (Naish, 1998). At the delegation stage, we again observe a twofold effect on firm i of the actions of the rival firm. As the rival moves towards profit maximization, (i) the effect on the market price of a quantity reduction of firm i associated to a lower degree of delegation is magnified; (ii) the negative effect on profits of the reduction of quantities associated to a lower degree of delegation becomes stronger. The second effect is the only relevant one in the standard linear demand case and explains in that setup the negative slope of the reaction function over its entire domain. However, the first is peculiar of the convex shape of the demand curve in the constant elasticity case, and induces strategic complementarity. The standard quantity effect (and thus strategic substitutability) prevails when the price is sufficiently high, and therefore when the quantity produced by the rival is low, due to a low degree of strategic delegation.

Since higher values of the elasticity of demand imply, *ceteris paribus*, a lower market price and a lower reactiveness of price to quantity changes, as η increases (a) the reaction function flattens towards the 45° line, and (b) the dominance of strategic substitutability occurs for progressively lower values of delegation. When the elasticity is close to 1 both these movements are consistent with an inward shift of the part of the reaction function lying above the 45° line; on the contrary, when the elasticity is higher, as η increases the new reaction function crosses the previous one from below, at the left of the 45° line. In the first case the equilibrium degree of strategic delegation increases, in the second it decreases. Since the optimal delegation is monotonically decreasing in η for $n > 2$, the above argument suggests that an inverse relation occurs provided that in equilibrium the Lerner index of monopoly power is sufficiently low.

Let us now consider the role of market concentration. The fact that both the monopolistic and the competitive firm do not provide to their managers any incentive to depart from profit maximization led Fersthman and Judd (1987) to suggest that 'the relationship between market structure and managerial incentives will likely not be monotonic', since 'nonprofit-maximizing incentives will be given only in oligopolistic industries'. Indeed, our constant elasticity model allows to extend their argument within the oligopolistic mar-

kets. According to (3), for any value of η the optimal degree of delegation is not monotonically decreasing in n, but reaches its maximum (under the integer constraint) for $n = 3$. Again, in order to obtain the 'intuitive' inverse relation between delegation and market competitiveness, the degree of market competitiveness must be sufficiently high.

4 Conclusions

In this paper we investigated the determinants of the degree of strategic delegation in a quantity setting framework. The ideal setup to study how market 'fundamentals' affect strategic delegation would be one which allows to parametrize the solution with respect to the elasticity of market demand, the elasticity of costs and the number of firms. However, under generic constant elasticity of demand and generic constant elasticity of costs, the two-stage game cannot be solved. Therefore, by assuming linear costs we focussed upon the role of the two factors affecting market competitiveness: the elasticity of demand and the number of firms.

While one would expect that moving towards a more competitive environment should reduce the incentive to delegation, our main result is that the relationship between the Lerner index of monopoly power and the degree of strategic delegation is not necessarily monotone. On the one side, in a duopoly setting there is a range of demand elasticity values for which delegation increases with elasticity; on the other side, for all values of the elasticity the highest degree of strategic delegation is not observed for $n = 2$, but for $n = 3$.

Competition weakens the incentives to commit to an overaggressive behaviour, but for this to occur the initial environment must be sufficiently competitive, either in terms of demand elasticity or in terms of market concentration.

References

Bárcena-Ruiz, J.C. and F.J. Casado-Izaga, 2005, Should Shareholders Delegate Location Decisions?, Research in Economics 59: 209-222.

Barros, F. and I. Grilo, 2002, Delegation in a Vertically Differentiated Duopoly, Manchester School 70: 164-84.

Basu, K., 1995, Stackelberg Equilibrium in Oligopoly: an Explanation Based on Managerial Incentives, Economics Letters 49: 459–464.

Fershtman, C., and K.L. Judd, 1987, Equilibrium Incentives in Oligopoly, American Economic Review 77: 926-940.

Gonzalez-Maestre, M. and J. Lopez-Cunat, 2001, Delegation and Mergers in Oligopoly, International Journal of Industrial Organization 8: 1263-1279.

Ishibashi, K., 2001, Strategic Delegation under Quality Competition, Journal of Economics 73: 25-56.

Lambertini, L. and M. Trombetta, 2002, Delegation and Firms' Ability to Collude, Journal of Economic Behavior and Organization 47: 359-73.

Naish, F.H., 1998, Imperfect Competition and the Gains from Trade in a Macro Duopoly Model, Review of International Economics 6: 266-83.

Sklivas, S.D., 1987, The Strategic Choice of Managerial Incentives, RAND Journal of Economics 18: 452-458.

Zhang, J. and Zhang, Z., 1997, R&D in a Strategic Delegation Game, Managerial and Decision Economics 18: 391-8.

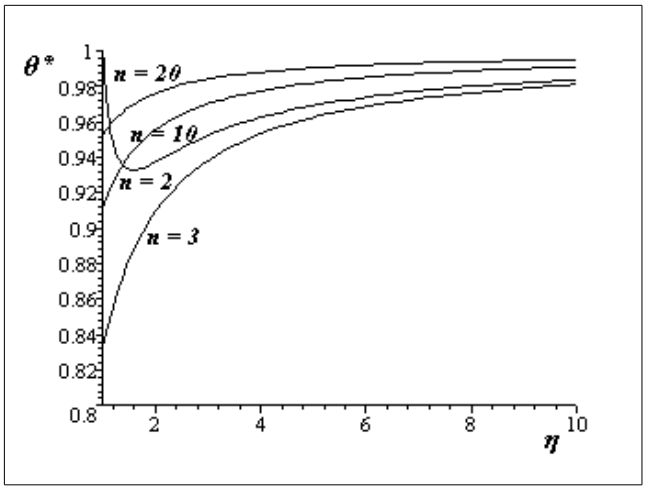

Figure 1: The pattern of delegation and demand elasticity

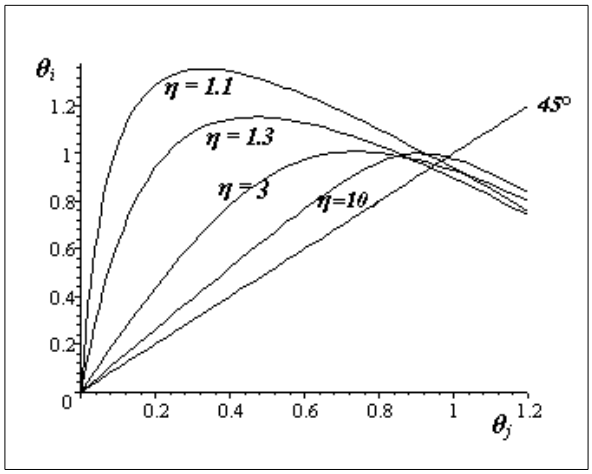

Figure 2: The reaction function at the delegation stage for different values of η