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A note on bargaining power and managerial delegation in multimarket oligopolies

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Abstract

In a two-stage delegation game model with Nash bargaining between a manager and an owner, an equivalence result is found between this game and Fershtman and Judd's strategic delegation game (Fershtman and Judd, 1987). Interestingly, although both games are equivalent in terms of profits under certain conditions, managers obtain greater rewards in the bargaining game. This results in a redistribution of profits between owners and managers.

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1 Introduction

Industrial organization has enlarged the traditional economic theory view of firms as mere profit maximizers (see, for instance, Simon, 1957 and Baumol, 1958, for early critics of the pure profit-maximizing hypothesis). Nowadays, economic relationships recognize the complexity of managerial decisions and the role that separation between ownership and management plays in modern large corporations. Indeed, these reasons are found as a major obstacle to achieve the target of pure profit-maximization. To alleviate this problem, corporate governance codes have been implemented. Corporate governance is the set of processes, customs, policies, laws and institutions affecting the way in which a certain corporation is managed or controlled. Optimal corporate governance consists of designing mechanisms that alleviate, among others, the principal-agent problem between those who take decisions and the other stakeholders, mainly owner-shareholders.[1] However, the ultimate goal is to increase profits and enhance economic efficiency. Thus, the relative power of managers and shareholders is at the center of the optimal design of contracts so that profit-maximization is encouraged.

The principal-agent problem is revisited here. An early approach on the effect of strategic delegation under Cournot competition with homogeneous product was undertaken by Fershtman and Judd (1987a) (hereafter, F&J) and Sklivas (1987). They found how the optimal rewarding scheme yields a more aggressive behavior on the part of managers and, as a result, profits for managers shrink.[2] Their conclusions also hold in a more general setting of asymmetric information (F&J, 1987b). This result comes from the Bulow et al. (1985) characterization of strategic substitutes and strategic complements. According to this, quantities are strategic substitutes, thus owners offer a contract such that production is increased with respect to the game in which there is no delegation, whereas prices are strategic complements and the optimal rewarding scheme is to offer a contract in which a more cooperative behavior is encouraged to maximize profits.

Recently, in Van Witteloostuijn et al. (2007) a new approach to the study of strategic delegation is found. They analyze the choice of optimal contract design that relates

[1] The term stakeholders was first used in 1984 by R. E. Freeman in his book "Strategic Management: A Stakeholder Approach" to refer to those who can affect or are affected by the activities of a company.

[2] In F&J (1987*a*) the incentive scheme is a linear combination of profits and sales, and delegation is a dominant strategy for both firms. Thus, the case in which only one firm delegates and the rival does not, is strictly dominated.

payoffs to a combination of sales and profits. Indeed, an alternative approach to F&J (1987a) is proposed. In a model where firms' strategies are substitutes, it is assumed that bargaining exists between a manager and an owner when discussing compensation, where bargaining power is exogenously determined. Thus, optimal rewarding scheme is determined by Nash bargaining solution. Nakamura (2008) later extends the results of Van Witteloostuijn et al. (2007) with respect to the sales delegation case to those of a differentiated product duopolistic game and also to price competition.

This note analyzes which incentive scheme is better for owners in order to achieve the highest profits. To do so, the predictions of Nakamura (2008) are compared with those in F&J (1987a). Interestingly, it is found that both types of contracts are equivalent in terms of profits when managers do not have bargaining power. However Nakamura's purpose results in a bigger remuneration for managers and smaller payoffs for owners. Thus, a profit redistribution between agents is reached.

The rest of this note is organized as follows. Section 2 presents the model and finds the subgame-perfect Nash equilibrium. Section 3 compares both incentive contracts. Section 4 concludes.

2 The Model

Assume a duopoly model where products are substitutes. Substitutability is modelled by using a version of the consumer surplus function by Singh and Vives (1984) and Vives (1984). A representative consumer derives utility from the consumption of goods labelled 1 and 2 and a numeraire y. Utility is quadratic in the consumption of q_i, $i = 1, 2$, and linear in the consumption of y. Call p_i the price of product i and normalize to one the price of the numeraire. The consumer net-utility function is given by

$$U = (q_1 + q_2) - \frac{1}{2}\left(q_1^2 - 2\gamma q_1 q_2 + q_2^2\right) - p_1 q_1 - p_2 q_2. \quad (1)$$

where substitutability between products is measured by $\gamma \in [-1, 0)$. Therefore, by maximizing (1) with respect to q_i inverse demand functions are found. Setting q_i as a function of prices demand functions are

$$q_i\left(p_i, p_j\right) = \frac{1}{1-\gamma^2}\left(1+\gamma-p_i-\gamma p_j\right) \text{ for } i, j = 1, 2 \text{ and } i \neq j. \tag{2}$$

On the supply side, identical firms produce q_i with unit-cost of production $c < 1$. Firms are Bertrand competitors. Assume each owner hires a single manager and delegates the strategic decisions to him. Each manager is rewarded with a fixed salary and a bonus. Following van Witteloostuijn et al. (2007) the following contract is considered: pay to the i-th manager a proportional weighted sum of profits and quantity sold as implied by $u_i = \pi_i + w_i q_i$, where π_i are profits for firm $i = 1, 2$ and w_i is the share of the quantity sold in the product market.[3]

The owner and the prospective manager bargain over w_i, where the owner wants to maximize profits and the manager tries to get as highly paid as possible. It is assumed both managers have the same bargaining power regardless of the firm with which they are negotiating. Bargaining is modeled by means of the generalized Nash bargaining solution: for the i-th firm, the outcome of the bargaining process is the weight w_i such that maximizes the Nash product $N_i = u_i^\beta \pi_i^{1-\beta}$, where $\beta \in [0,1]$ measures the relative bargaining power of the manager.[4]

The timing of the game is as follows. At the first stage, agents (owners and managers) simultaneously decide the optimal contract as a function of the horizontal product differentiation and the exogenously given bargaining power β. At the second stage firms' managers engage in price competition.

The game is solved by backward induction (for more details see Nakamura, 2008). Optimal strategies of the firms are obtained at the market competition stage. Given weights (w_1, w_2) each manager maximizes u_i choosing a price level p_i. Using equation (2) the rewarding scheme function can be written as a function of prices $u_i(p_i, p_j)$. Any

[3] This is a version of the Vickers (1985), F&J (1987a) and Sklivas (1987) incentive contract that relates profits and revenue to manager's reward.

[4] Nash bargaining as it was initiallly proposed by Nash (1950). Economic applications can be found in Binmore et al. (1986).

equilibrium at the price competition stage must satisfy first-order conditions,

$$\frac{\partial u_i(p_i,p_j)}{\partial p_i} = 0 \Longleftrightarrow 2p_i + w_i + \gamma p_j - (1+c+\gamma) = 0,\ i = 1,2 \text{ and } i \neq j.$$

Note that p_i and p_j are strategic complements: an increase in each player's own decision p_i, raises the marginal payoff of the rival.[5] Solving the resulting equations' system optimal prices are

$$p_i\left(w_i, w_j\right) = \frac{(1+c+\gamma)}{(2+\gamma)} - \frac{2w_i - \gamma w_j}{(4-\gamma^2)},\ i = 1,2 \text{ and } i \neq j. \tag{3}$$

with the following properties. First, as $\partial p_i\left(w_i, w_j\right)/\partial w_i < 0$ the share w_i shifts inwards best response functions. Then, equilibrium prices become lower than in the absence of delegation, which yields to a more intense competition in the product market. Second, this result is reinforced with respect to the rival's shift in w_j, $\partial p_i\left(w_i, w_j\right)/\partial w_j < 0$. However, given the weighting, the magnitude of the effect is not increasing with the degree of product substitutability.[6]

The solution to the bargaining game consists of choosing w_i such that maximizes the Nash product $N_i = u_i^{\beta}\pi_i^{1-\beta}$. Using the first order condition in the price stage subgame, the objective function N_i can be expressed in terms of prices $N_i(p_i, p_j)$. First-order conditions are

$$\frac{\partial N_i}{\partial w_i} = 0 \Longrightarrow \left(2\left(p_i - c\right) + (1-\beta)\, w_i\right)\frac{\partial p_i}{\partial w_i} + (1+\beta)\left(p_i - c\right) = 0,\ i = 1,2 \text{ and } i \neq j.$$

By using (3) and assuming symmetry $w_1 = w_2 = w$, the optimal delegation weight is

$$\widehat{w} = \frac{(4\beta - \gamma^2(1+\beta))(1+\gamma)(1-c)}{4 - \gamma^2(1+\beta) + 2\gamma(1-\beta)}.$$

It depends largely on the nature of the goods as implied by $\partial\widehat{w}/\partial\gamma > 0$. Suppose goods were perfect substitutes ($\gamma = -1$); then it holds that $\widehat{w} = 0$ for every $\beta \in [0,1]$. If goods were independent ($\gamma = 0$) delegation weight would be $\widehat{w} = \beta\,(1-c)$; so the wage would be

[5] In other words, this means that the function u_i is submodular when the price decisions are strategic complements, $\frac{\partial^2 u_i}{\partial p_i \partial p_j} > 0$.

[6] The cross derivative with respect to product substitutability is $\frac{\partial^2 p_i(w_i,w_j)}{\partial w_i \partial\gamma} = \frac{-4\gamma}{(4-\gamma^2)^2} > 0$.

strictly proportional to the bargaining power of the agent. Moreover, weight is increasing with respect to the bargaining power no matter the value of γ because $\partial\widehat{w}/\partial\beta \geq 0$. In the symmetric equilibrium price, quantity and profits are as follows

$$\widehat{p}=\frac{2(1+\gamma)(1-\beta)+\left(2-\gamma^2\right)(1+\beta)c}{4-\gamma^2(1+\beta)+2\gamma(1-\beta)}, \qquad \widehat{q}=\frac{(1+\beta)(2-\gamma^2)(1-c)}{(1-\gamma)(4-\gamma^2(1+\beta)+2\gamma(1-\beta))}, \text{ and } \qquad \widehat{\pi}=\frac{2(1+\gamma)(1-c)^2\left(1-\beta^2\right)\left(2-\gamma^2\right)}{(1-\gamma)(4-\gamma^2(1+\beta)+2\gamma(1-\beta))^2}.$$

On the one hand, price decreases with respect to β $(\partial\widehat{p}/\partial\beta \leq 0)$ whereas quantity increases with the relative bargaining power of the manager $(\partial\widehat{q}/\partial\beta \geq 0)$. This encourages more intense competition. On the other hand, while price increases with γ, quantity can increase or decrease with γ because the sign of the marginal effect depends on β $(\partial\widehat{q}/\partial\gamma \lesseqgtr 0)$. Finally, profits decrease with bargaining power $(\partial\widehat{\pi}/\partial\beta \leq 0)$ and increase with the degree of substitutability $(\partial\widehat{\pi}/\partial\gamma \geq 0)$.

3 Strategic delegation versus bargaining: the comparison

In this section predictions of the above bargaining model with those in F&J (1987a) are compared. F&J assume managers do not have any power to Nash-bargain over the contract they are offered $(\beta = 0)$. Instead, owners offer a contract o_i that consists of a linear combination of profits and sales $o_i = \alpha_i\pi_i + (1-\alpha_i)\, s_i$, which can be written as $o_i = (p_i - c\alpha_i)\, q_i$. Note that, in the symmetric equilibrium, equation (24) in F&J (1987a) becomes

$$\alpha^{*}= 1+\frac{(1+\gamma)(1-c)\gamma^2}{c(4+(2-\gamma)\gamma)}.$$

where $\alpha^* \geq 1$ for every $\gamma \in [-1,0)$ and $c \in (0,1)$. Therefore, the rewarding scheme encourages less intense competition since managers are less concerned of cost minimization. Besides, α^* approaches 1 as $c \to 1$. Under a symmetric equilibrium price, quantity and profits are as follows

$$p^* = \frac{2(1+\gamma)+(2-\gamma^2)c}{4+\gamma(2-\gamma)}, \qquad q^* = \frac{(2-\gamma^2)(1-c)}{(1-\gamma)(4+\gamma(2-\gamma))}, \text{ and } \qquad \pi^* = \frac{2(1-c)^2(1+\gamma)\left(2-\gamma^2\right)}{(1-\gamma)(4+\gamma(2-\gamma))^2}.$$

Our main results are presented in Propositions 1 and 2.

Proposition 1 *If $\beta = 0$ then $\widehat{p} = p^*$ and $\widehat{u} > o^*$; that is, bargaining type of contract rewards managers better than F&J's (1987a) type of contract when managers do not have any bargaining power.*

Proof. Under Bertrand competition, in equilibrium, the manager's payment is $\widehat{u} = (\widehat{p} - c + \widehat{w})\,\widehat{q}$, whereas in F&J (1987a), under the same setup, $o^* = (p^* - \alpha^* c)\,q^*$. Hence, when $\beta = 0$ it yields $\widehat{p} = p^*$, $\widehat{q} = q^*$, and then $\widehat{\pi} = \pi^*$. Thus, under both incentive structures the manager will achieve the same payment if and only if $\widehat{w} = c(1 - \alpha^*)$. Taking the equilibrium values $\widehat{w}$, α^* evaluated at $\beta = 0$ become,

$$\widehat{w}_{\beta=0} = c(1 - \alpha^*_{\beta=0}) \Longleftrightarrow \frac{1}{4 - \gamma(\gamma + 2)} - \frac{1 + \gamma}{\gamma\,(\gamma - 2) - 4} = 0,$$

which is not feasible since, for any value of $\gamma \in [-1, 0)$ it is found that indeed $\frac{1}{4-\gamma(\gamma+2)} - \frac{1+\gamma}{\gamma(\gamma-2)-4} > 0$. This completes the proof. ■

Thus, the absence of bargaining power on the part of the managers yields to the same market outcomes as in strategic delegation. However, the payoffs to the managers are larger. As a consequence, the payoffs owners obtain are smaller, so we get a profit redistribution between managers and owners.

Finally, the implications of $\beta > 0$ for market outcomes are also analyzed. Proposition 2 summarizes the conclusions for differences in prices, profits and compensation for managers.

Proposition 2 *Bargaining type of rewarding scheme induces lower prices, larger quantities and lower profits than those under strategic delegation.*

Proof. After some simple algebraic manipulations the difference in prices, $\widehat{p} - p^*$, and quantities, $\widehat{q} - q^*$, can be expressed as

$$\widehat{p} - p^* = \frac{-4\beta(1+\gamma)\left(2-\gamma^2\right)(1-c)}{\varphi(\beta,\gamma)} \qquad \widehat{q} - q^* = \frac{(1-c)4\beta(\gamma+1)\left(2-\gamma^2\right)}{(1-\gamma)\varphi(\beta,\gamma)},$$

where $\varphi(\beta, \gamma) = (4 + (2 - \gamma)\,\gamma)\,(4 + ((2 - \gamma) - \beta\,(2 + \gamma))\,\gamma)$. Therefore, for every $\beta \in (0, 1]$, $\gamma \in (-1, 0)$ and $c \in (0, 1)$ it is straightforward to show that $\widehat{p} - p^* < 0$ and

$\widehat{q}-q^*>0$. The difference in profits is

$$\widehat{\pi}-\pi^*=\frac{-4(1+\gamma)(1-c^2)(2-\gamma^2)\beta(\gamma^4(1+\beta)-8\gamma^2(8\beta-8)+8\beta)}{(1-\gamma)(4+(2-\gamma)\gamma)^2(4-\gamma^2(1+\beta)+2\gamma(1-\beta))^2}.$$

which, given the restrictions on the parameters, is negative. This completes the proof. ■

Thus, as it has been proved, managers with bargaining power induce more intense competition in the product market than in its absence. The contract design favors greater competition between managers on the product market the lower the bargaining power of the owners of the firms is.

4 Final comments

In this note, two streams of literature on managers' compensation schemes are blended and find equivalence results. The first scheme consists of compensation equal to profits plus a fraction of sales which depends on the bargaining power of each agent. The second scheme is a linear combination of profits and sales, endogenously determined by the owners. It is found that both approaches are equivalent in terms of market results only if $\beta=0$, that is, managers do not have any bargaining power and owners choose the contract that maximizes their own payoffs. However, there is a redistribution of payoffs that favors managers in case of the first scheme. Furthermore, when managers have bargaining power ($\beta>0$), more aggressive behavior is induced than in its absence.

References

[1] Baumol, W.J., 1958. On the theory of oligopoly. Economica New Series 54, 121-138.

[2] Binmore, K., Rubinstein, A., Wolinsky, A., 1986. The Nash bargaining solution in economic modelling. RAND Journal of Economics 17(2), 176–188.

[3] Bulow, J.I., Geanakoplos, J.D., Klemperer, P.D., 1985. Multimarket oligopoly: Strategic ubstitutes and complements. Journal of Political Economy 93, 458-511.

[4] Fershtman, C., Judd, K.L., 1987a. Equilibrium incentives in oligopoly. American Economic Review 77, 927-940.

[5] Fershtman, C., Judd, K.L., 1987b. Strategic incentive manipulation in rivalrous agency. Hoover Institution Working Papers in Economics E-87-11.

[6] Freeman, R.E., 1984. Strategic management: A stakeholder approach. Pitman, Boston.

[7] Nakamura, Y., 2008. Bargaining over managerial contracts in delegation games: The differentiated goods case. Economics Bulletin 12(6), 1-8.

[8] Nash, J., 1950. The bargaining problem. Econometrica 18(2), 155-162.

[9] Simon, H. A., 1957. Models of man -social and rational. John Wiley and Sons, New York.

[10] Singh, N., Vives, X., 1984. Price and quantity competition in a differentiated duopoly. Rand Journal of Economics 15, 546-554.

[11] Sklivas, S.D., 1987. The strategic choice of managerial incentives. RAND Journal of Economics 18, 452-458.

[12] van Witteloostuijn, A., Jansen, T., van Lier, A., 2007. Bargaining over managerial contracts in delegation games: Managerial power, contract disclosure and cartel behavior. Managerial and Decision Economics 28, 897-904.

[13] Vickers, J., 1985. Delegation and the theory of the firm. The Economic Journal 95, 138-147.

[14] Vives, X., 1984. Duopoly information equilibrium: Cournot and Bertrand. Journal of Economic Theory 34, 71-94.