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Abstract: This paper studies the role of separation of ownership and management in determining the welfare implications of entry in oligopolistic markets. We show, in the presence of managerial incentive schemes with cost asymmetry, that entry is socially insufficient unless scale economies are very large. The policy implications emerging from the present analysis suggests that entry should be encouraged under cost asymmetry and not large scale economies.

Key words: Cost asymmetry; Incentive delegation; Insufficient entry; Excessive entry
JEL classifications: L13; L40; L50

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1. Introduction

Social efficiency of entry, which is a major concern to the antitrust authorities, has attracted significant amount of attention in recent decades. The literature examining social efficiency of entry has gained momentum with the influential work by Mankiw and Whinston (1986), which shows that entry is socially excessive in the absence of integer constraint. This result, which is often referred as the "excess-entry theorem"[1], provides a justification for anti-competitive entry regulation policies.[2] In fact, whether or not entry is socially excessive is not merely an issue of simple academic interest (Vives, 1988). In the practical dimension, governments in many countries take actions to foster or deter entry into particular industries. For example, in the post-war period, preventing excessive entry was a guiding principle in the Japanese industrial policy (see, e.g., Suzumura and Kiyono, 1987 and Suzumura, 1995).

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[1] Under excessive entry, social welfare reduces with entry. If entry is insufficient, social welfare increases with entry.

[2] See, von Weizsäcker (1980), Perry (1984), Suzumura and Kiyono (1987), Okuno-Fujiwara and Suzumura (1993), Anderson et al. (1995) and Fudenberg and Tirole (2000) for other works on excessive entry in the presence of scale economies. Ghosh and Saha (2007) suggest excessive entry without scale economies but in the presence of marginal cost differences.

While the existing literature examining social efficiency of entry has provided several important insights, they are restrictive by considering owners as the managers. Indeed, separation between ownership and management is perhaps the norm rather than exception in today's corporate world. Separation between ownership and management creates the importance of managerial objectives, as mentioned in Simon (1964), Williamson (1964) and Jensen and Meckling (1976), to name a few, and requires a proper analysis based on the owner-manager relationship, which also questions the profit maximising output choice of the firms (Fershtman and Judd, 1987). As shown by several authors, such as Vickers (1985), Fershtman and Judd (1987), Sklivas (1987) and Miller and Pazgal (2001), the incentive scheme designed by the owners affect the product market strategies by affecting their managers' objectives, which, in turn, affect the profits of the owners. Hence, while considering the social desirability of entry, a proper analysis based on the strategic owner-manager relationship deserves attention. To the best of our knowledge, there is no work addressing this issue. We take up this issue here.

Based upon a managerial incentive model *a la* Fershtman and Judd (1987), we examine social desirability of entry in a Cournot oligopoly with cost asymmetry. We show, in the presence of cost asymmetry, that entry is socially insufficient unless scale economies are large. An immediate implication of the result suggests that entry should be generally encouraged in oligopolistic market in the presence of owner-manager separation.

In stark contrast to Ghosh and Saha (2007), which shows that entry is *always* socially excessive with cost asymmetry and no scale economies, we show that entry is always socially insufficient with cost asymmetry and no scale economies when, in particular, we pay attention to the strategic owner-manager relationship. The product market competition underlying in the strategic owner-manager relationship leads to our result of insufficient entry, which is clearly distinct from the reasons considered in the literature, e.g., integer constraint (Mankiw and Whinston, 1986), timing of entry (Cabral, 2004), vertical structure (Ghosh and Morita, 2007a and b), technology licensing (Mukherjee and Mukherjee, 2008), positive externality (Mukherjee, 2010) and foreign competition (Lim, 2010 and Marjit and Mukherjee, 2010).

The remainder of the paper is organised as follows. Section 2 describes the model and derives the results. Section 3 concludes.

2. The model and the results

Assume that there is a firm (firm 0) with the marginal cost of production c_0 and there is large number of firms, each with the marginal cost c, where $c_0 < c$.[3] All

[3] The cost difference may be the outcome of technology difference between the firms.

firms decide whether to enter the market. We assume that if a firm decides to enter the market it needs to incur a fixed cost of entry, $K \geq 0$. We shall conduct our analysis separately for both cases of $K = 0$ (no scale economies) and $K > 0$ (scale economies).

The firms produce a homogeneous product and the inverse market demand function is given by $P = a - q$, where P is price of the product and q is the total output. We show in the *Appendix* the conditions required for our results under a general form of market demand function.

We assume that the owner of each producing firm delegates incentive scheme to a manager, which takes the production decision. We consider the following incentive scheme as in Fershtman and Judd (1987):

$$\alpha\pi_i + (1-\alpha)R_i, \tag{1}$$

where π_i and R_i are the profit and revenue of the *i*th firm respectively.

We consider the following game. At stage 1, the firms decide whether or not to enter the market. Although all firms decide whether to enter the market, as we will see the entry decision will be effectively for the firms with the marginal costs of production *c*, due to their cost disadvantage compared to firm 0, which will always enter the market. At stage 2, the owners of all entering firms delegate the incentive scheme (1) to the respective managers. At stage 3, all the managers determine their outputs simultaneously and the profits are realised. We solve the game through backward induction.

We will consider the following assumption in our analysis:

A1: $a > 3c$. This conditions ensures that at least one firm with the marginal cost of production c enters the market.

If a firm producing with the marginal cost of production c enters the market, we call it as entrant. If firm 0 competes with $(n-1)$ entrants, the manager of firm 0 and the manger of the jth entrant face the following problems respectively:

$$\underset{q_0}{Max}(a - q - \alpha_0 c_0)q_0 , \tag{2}$$

$$\underset{q_j}{Max}(a - q - \alpha_j c)q_j , \qquad j = 1,2,...,n-1. \tag{3}$$

It is easy to verify that the equilibrium outputs are respectively

$$q_0^* = \frac{a - n\alpha_0 c_0 + \sum_{j=1}^{n-1} \alpha_j c}{n+1}, \tag{4}$$

$$q_j^* = \frac{a - n\alpha_j c + \alpha_0 c_0 + \sum_{\substack{k=1 \\ k \neq j}}^{n-1} \alpha_k c}{n+1}, \qquad j = 1,2,...,n-1. \tag{5}$$

In the delegation stage, owners of firm 0 and the jth entrant, $j = 1,2,...,n-1$, determine the incentive schemes by solving the following expressions respectively:

$$\underset{\alpha_0}{Max}\left(\frac{a - n\alpha_0 c_0 + \sum_{j=1}^{n-1} \alpha_j c}{n+1}\right)^2 - \frac{c_0(1-\alpha_0)(a - n\alpha_0 c_0 + \sum_{j=1}^{n-1} \alpha_j c)}{n+1}, \tag{6}$$

$$\underset{\alpha_j}{Max}\left(\frac{a-n\alpha_j c+\alpha_0 c_0+\sum_{\substack{k=1\\k\neq j}}^{n-1}\alpha_k c}{n+1}\right)^2-\frac{c(1-\alpha_j)(a-n\alpha_j c+\alpha_0 c_0+\sum_{\substack{k=1\\k\neq j}}^{n-1}\alpha_k c)}{n+1}. \quad (7)$$

We obtain that

$$\alpha_0^*=\frac{-a(n-1)-n[c(n-1)^2+c_0(n-2-n^2)]}{c_0(n^2+1)}. \quad (8)$$

$$\alpha_j^*=\frac{-a(n-1)+n[2cn-c_0(n-1)]}{c(n^2+1)},\ j=1,2,...,n-1. \quad (9)$$

It is straightforward to show that the equilibrium outputs of firm 0 and the *j*th entrant are respectively

$$q_0^*=\frac{n[a+cn(n-1)+c_0(n-1-n^2)]}{(n^2+1)}. \quad (10)$$

$$q_j^*=\frac{n[a+c_0 n-c(n+1)]}{(n^2+1)},\qquad j=1,2,...,n-1. \quad (11)$$

Further, the equilibrium profits of firm 0 and the *j*th entrant net of entry costs are respectively

$$\pi_0^*=\frac{n[a+cn(n-1)+c_0(n-1-n^2)]^2}{(n^2+1)^2}-K. \quad (12)$$

$$\pi_j^*=\frac{n[a+c_0 n-c(n+1)]^2}{(n^2+1)^2}-K,\qquad j=1,2,...,n-1. \quad (13)$$

A straightforward comparison of the outputs and profits (see, (10), (11), (12) and (13)) shows that, for any number of firms, *n*, and $c>c_0$, we get $q_0^*>q_j^*$ and $\pi_0^*>\pi_j^*$, implying that the output and profit of firm 0 are higher than each entrant. Hence, the net gain from entry is higher for firm 0 than for an entrant. Clearly, the free entry equilibrium number of firms is then determined by $\pi_j^*=0$, and the profit of firm 0 is positive at the free entry equilibrium. Thus, we conclude that firm 0 will always enter the market at the free entry equilibrium, whether or not there are scale economies, and the effective entry decisions are for the firms with the marginal costs of production *c*.

2.1. The case of no scale economies ($K = 0$)

First consider the case with no scale economies, i.e., $K = 0$, which facilitates our understanding into the effects of scale economies. Under the condition of no scale economies, the free entry equilibrium number of firm is determined by the condition $q_j^* = 0$, which also implies $\pi_j^* = 0$, and is given by

$$n^e = \frac{a-c}{c-c_0}. \tag{14}$$

Now we want to determine the welfare maximising or socially optimal number of firms. Welfare is the sum of profits of all producing firms and consumer surplus. We assume that the objective of the social planner is to select the number of firms that maximises welfare, given that the owners delegate incentive schemes to the managers and the managers choose outputs like Cournot oligopolists. Even if the social planner may affect the number of firms, he cannot control the behaviours of the owners and the managers.

The social planner determines the number of firms it wants to enter the market by maximising the following expression:

$$\underset{n}{Max} W^{NSE} = \underset{n}{Max}\, \pi_0^* + (n-1)\pi_j^* + \frac{1}{2}(q_0^* + (n-1)q_j^*)^2 . \tag{15}$$

Note that the social planner will always prefer firm 0 to enter the market, since this is the more cost efficient firm. Therefore, the social planner may only restrict entry of the firms with the marginal costs of production *c*.

The welfare-maximising number of firms, n^{NSE}, is determined by the following expression:

$$\frac{\partial W^{NSE}}{\partial n} = 0 . \tag{16}$$

Evaluating $\frac{\partial W^{NSE}}{\partial n}$ at the free entry number of firms, and using **A1** and $c > c_0$, we obtain that

$$\left.\frac{\partial W^{NSE}}{\partial n}\right|_{n=n^e} = \frac{(c-c_0)^2[a(a-3c)+3c(c-c_0)+c_0(a+c_0)]}{a(a-2c)+2c(c-c_0)+c_0{}^2} > 0 . \tag{17}$$

Condition (17) implies that, if there are no scale economies, welfare is increasing at the free entry equilibrium number of firms, implying that the welfare-maximising number of firm is higher than the free entry equilibrium number of firms in the absence of scale economies.

The above discussion gives the following proposition immediately.

Proposition 1: *Consider the assumption **A1** and* $c > c_0$. *If ownership is separated from management and there are no scale economies, entry is socially insufficient in the presence of strategic incentive delegation by the owners to the managers.*

Proposition 1 is in stark contrast to Ghosh and Saha (2007), which proposes that entry is *always* socially excessive in the absence of scale economies. In contrast, we show that entry can always be insufficient in the absence of scale economies, if there is separation between ownership and management and the owners choose the incentives schemes for their managers strategically. Hence, the anti-competitive entry regulation policy suggested by Ghosh and Saha (2007) may not justifiable in the presence of cost asymmetry and no scale economies, if the ownership is separated from management, which is perhaps the norm rather than exception in today’s world.

The intuition for the above result can be provided as follows. In the absence of scale economies, welfare rises with entry, which leads the social planner to allow for as many firms as possible. However, in the presence of cost asymmetry and incentive delegation, only a finite number of firms enter the market at the free entry equilibrium. This happens because incentive delegation by the more cost efficient firm significantly reduces the profits of the more cost inefficient firms, even if all the firms can choose the incentive schemes strategically. Thus, incentive delegation creates insufficient entry by reducing the profits of the more cost inefficient firms and therefore, their incentives for entry.

2.2. The case of scale economies ($K > 0$).

Now consider the case with scale economies, i.e., $K > 0$. Under scale economies, free entry equilibrium occurs at

$$\frac{n[a + c_0 n - c(n+1)]^2}{(n^2+1)^2} = K \,. \tag{18}$$

In the presence of scale economies, the social planner maximises the following expression to determine the number of firms:

$$\underset{n}{Max}\, W^{SE} = \underset{n}{Max}\, \pi_0^* + (n-1)\pi_j^* + \frac{1}{2}(q_0^* + (n-1)q_j^*)^2 - nK = \underset{n}{Max}\, W^{NSE} - nK \,. \tag{19}$$

The welfare-maximising number of firms, n^{SE}, is determined by

$$\frac{\partial W^{SE}}{\partial n} = \frac{\partial W^{NSE}}{\partial n} - K = 0 \,. \tag{20}$$

It is intuitive that the cost of entry reduces the number of entrants into the market and also reduces social desirability of entry by imposing costs to the society. However, since entry is socially insufficient for $K = 0$ and $c > c_0$, and (20) is continuous in K, it is immediate that entry can be socially insufficient even if $K > 0$ yet very small.

It is worth noting from (17) that the difference between c and c_0 may play an important role in determining the social desirability of entry, since the possibility of insufficient entry reduces as the cost difference between firm 0 and the entrants reduces.

If the firms are symmetric, i.e., $c = c_0$, evaluating $\frac{\partial W^{NSE}}{\partial n} - K$ at the free entry equilibrium number of firms, thus satisfying $\frac{n[a + c_0 n - c(n+1)]^2}{(n^2+1)^2} = K$, we can establish that

$$\frac{\partial W^{NSE}}{\partial n} - \frac{n[a + c_0 n - c(n+1)]^2}{(n^2+1)^2} = -\frac{n(n^2-1)(a-c)^2}{(n^2+1)^3} < 0 . \qquad (21)$$

Condition (21) suggests that welfare is reducing at the free entry equilibrium number of firms, i.e., entry is socially excessive.

Clearly, whether welfare is increasing or decreasing at the free entry equilibrium number of firms in the presence of scale economies and $c > c_0$ is not immediate. In other words, the sign of the expression $(\frac{\partial W^{NSE}}{\partial n} - \frac{n[a + c_0 n - c(n+1)]^2}{(n^2+1)^2})$ cannot be neatly obtain once we move away from the symmetric case and consider $c > c_0$. Nonetheless, we can use a simple numerical example to show that entry can be socially insufficient under scale economies if $c > c_0$. Figure 1 illustrates a case of $a = 1$, $c = 0.05$, $c_0 = 0.01$ and plot the difference $(\frac{\partial W^{NSE}}{\partial n} - \frac{n[a + c_0 n - c(n+1)]^2}{(n^2+1)^2})$ for $n \in [2,10]$.

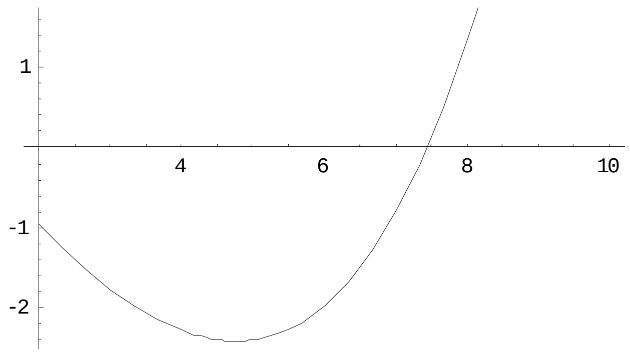

Figure 1: Excessive and insufficient entry under scale economies with $c > c_0$.

Figure 1 shows that if $c > c_0$, welfare in increasing at the free entry equilibrium number firms, suggesting entry is socially insufficient, for higher values of *n*, which occurs for relatively lower *K* (follows from (18)). Hence, as mentioned above, socially insufficient entry can occur for lower values of *K* even under scale economies and $c > c_0$. It is worth mentioning that $q_0^* > 0$ and $q_j^* > 0$, $j = 1, 2, ..., n-1$ in the above figure.

3. Conclusion

There is a vast literature showing that entry is socially excessive in oligopolistic markets. This result provides the justification for anti-competitive entry regulation policies. However, the previous works ignore an important empirical regulation, viz., separation of ownership and management. The separation of ownership and management creates the requirement for considering proper objective functions of the managers designed by the respective owners.

Using a simple model of managerial incentives with cost asymmetry, we show that endogenous managerial incentive schemes have significant implications on the social desirability of entry. In the presence of cost asymmetry, entry is socially insufficient unless scale economies are large. An immediate policy implication of our analysis suggests that entry should generally be encouraged when ownerships in firms are separated from management.

Appendix

The case of a general demand function: Now consider that the inverse market demand function is $P(q)$, with $P' < 0$ and $P'' \leq 0$.

Given the incentive schemes, the managers of firm 0 and the *j*th entrant maximise the following expressions respectively to deter the equilibrium outputs:

$$\underset{q_0}{Max}(P - \alpha_0 c_0)q_0 \tag{A1}$$

$$\underset{q_j}{Max}(P - \alpha_j c)q_j, \quad j = 1, 2, ..., n-1. \tag{A2}$$

The equilibrium outputs are given by the following expressions:

$$P - \alpha_0 c_0 + q_0^* P' = 0 \tag{A3}$$

$$P - \alpha_i c + q_i^* P' = 0, \quad j = 1, 2, ..., n-1. \tag{A4}$$

The owners of firm 0 and the *j*th entrant, $j = 1, 2, ..., n-1$, determine the incentive schemes by maximising $\underset{\alpha_0}{Max}(P - \alpha_0 c_0)q_0 - (1-\alpha_0)c_0 q_0$ and $\underset{\alpha_j}{Max}(P - \alpha_j c)q_j - (1-\alpha_j)cq_j$ respectively.

Now consider the welfare maximising number of firms. Given the symmetry of the entrants, the social planner maximises the following expression to determine the welfare maximising number of firms:

$$\underset{n}{Max}W = \underset{n}{Max}\int_0^{q^*} P(q)dq - c_0 q_0^* - (n-1)cq_j^* - (n+1)K, \tag{A5}$$

where $q^* = q_0^* + (n-1)q_j^*$.

Differentiating (A5) with respect to *n*, we get that

$$\frac{\partial W}{\partial n} = (P - c_0)\frac{\partial q_0^*}{\partial n} + (n-1)(P-c)\frac{\partial q_j^*}{\partial n} + [(P-c)q_j^* - K]. \tag{A6}$$

First consider the case of no scale economies, i.e., $K = 0$. In this situation, we get that $P = c$ at the free entry equilibrium. If we evaluate (A6) at the free entry equilibrium, it reduces to

$$\frac{\partial W}{\partial n} = (P - c_0)\frac{\partial q_0^*}{\partial n}. \tag{A7}$$

It is immediate from (A7) that, if there are no scale economies, entry is insufficient if $\frac{\partial W}{\partial n} = (P - c_0)\frac{\partial q_0^*}{\partial n} > 0$, i.e., if the equilibrium output of firm 0 increases with n at the free entry equilibrium. This condition is satisfied in our analysis in section 2.

Now consider the case of scale economies, i.e., $K > 0$. In this situation, free entry equilibrium occurs when $(P-c)q_j^* = K$, which also implies that $P > c$. If we evaluate (A6) at the free entry equilibrium, it reduces to

$$\frac{\partial W}{\partial n} = (P - c_0)\frac{\partial q_0^*}{\partial n} + (n-1)(P-c)\frac{\partial q_j^*}{\partial n}. \tag{A8}$$

In the presence of a business-stealing effect (Mankiw and Whinston, 1986) among the entrants, $\frac{\partial q_j^*}{\partial n} < 0$.[4] This is satisfied in our analysis in section 2. It then follows from (A7) and (A8) that the possibility of insufficient entry reduces with scale economies.

If $c = c_0$, it follows from (A8) that excessive entry occurs if $n\frac{\partial q_j^*}{\partial n} < 0$, since $q_0^* = q_j^*$ in this situation. The presence of the business-stealing effect confirms this,

[4] We consider the presence of a business-stealing effect even after considering the effect of the number of firms on the incentive schemes.

which implies that entry is excessive under scale economies if all firms are symmetric.

Given that (A8) is continuous in c, it implies that entry under scale economies will be excessive eve if c is greater than but close to c_0. However, as c increases from c_0, it reduces the effect of $(n-1)(P-c)\frac{\partial q_j^*}{\partial n}$ in (A8). Hence, if c is sufficiently larger than c_0, insufficient entry can occur under scale economies.

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