

CHAPTER 11

ORGANIZATIONAL CHOICE AND ENTRY DETERRENCE

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Abstract

A centralized structure will set prices higher and locate products closer together than a decentralized structure. A decentralized organizational structure is chosen because the entry-detering effect of such an organizational structure outweighs the monopoly effects of a centralized structure for sufficiently low levels of the entry fee.

1. Introduction

Industrial Organization has traditionally been concerned with the competition between firms at the market level of analysis. Economists do have a "theory of the firm", but this theory is rather silent about the internal functioning of firms. This is a rather unsatisfactory state of affairs because a significant part of the allocation of resources of a society occurs within firms. This chapter analyzes the relationship between the choice of organization structure and the location and pricing decisions of products of these organizations.

An organizational structure formulates some broad rules with respect to the division of labor into distinct tasks. We will consider only two well known organization structures. A functional structure has departments organized around functions like finance, sales and manufacturing, whereas a divisional structure is organized around products. A feature of a divisional structure is that the departments are usually inde-

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pendent profit centers, whereas this is not possible in a functional structure due to the interdependency of departments regarding the final product(s). The departments of a divisional structure act independently of each other, which implies that they are competitors on the market. The decisions of a functional structure regarding the market are taken centrally. We will focus on this issue.

The entry-detering effect of organizational choice is modelled as a four stage game. A decision in an early stage reflects a choice which is costly to change and has therefore a long term effect. The cost involved can not be completely recovered and are called sunk cost. Such a decision is therefore made only once in many years and provides a commitment to certain competitive strategies in subsequent periods. Examples are choices regarding capacity, research and development, product line and organizational structure. Decisions in later stages of the game reflect choices which are made on a monthly or weekly basis and are not expensive to change, e.g. prices. Such decisions serve in general not a strategic role in the market because they lack the credibility of being executed when faced with actual competition. The ex ante optimality of a strategy of low prices may not be ex post optimal when entry has actually occurred because profits will be higher when there is not a price war. Smiley (1988) offers empirical evidence on the contents of these ideas and supports the claim that certain irreversible aspects of an investment are required in order to be able to serve a strategic role in markets.

An organizational structure can not be sold to a third party and casual empiricism suggests that there are considerable costs involved in changing it. The costs associated with an organization structure change are therefore sunk and the subsequent choices regarding the market are commitments. These features are captured in this chapter's model. The first stage consists of a choice between a functional or divisional structure. The second stage considers the positioning of products. The third stage analyzes entry and the fourth stage the choice of the prices. It is found that a functional structure will set prices higher and locate products closer together than a divisional structure. A divisional structure is chosen from merely an industrial organization point of view because the entry deterring effect of such an organization structure outweighs the monopoly effects of a functional structure for sufficiently low levels of the entry fee. It pays therefore to adopt a divisional organization structure from a strategic point of view when internal organization considerations favor a functional structure not too much.

There have been a few other papers linking the internal and industrial organization of firms. We mention Willig (1986), who analyzes management performance as a function of exogenously given market conditions, Fershtman and Judd (1987) and Vickers (1985), who study the effects of delegation on market rivalry, Nalebuff and Stiglitz (1983) and Hart (1983), who focus on the use of market competition as a mechanism for assessing management performance and mitigating moral hazard problems, and Bull and Ordover (1987), who investigate the relationship between the decision rule for rejecting projects, the degree of competition and the size of the organization. Brander and Lewis (1986) and Maksimovic (1988) look at oligopoly

and financial structure, Bonanno and Vickers (1988) and Coughlan and Wernerfelt (1989) analyse oligopoly and vertical separation. The last two authors show also the importance of the observability of decisions in the first stage for the results. Schwarz and Thompson (1986) consider the use of divisions in order to preempt entry in a homogeneous product world. Our analysis deals with centralization and decentralization in a product differentiation model. We don't assume that managerial diseconomies rule out a centralized structure and it will be shown that such a structure might actually be chosen in equilibrium. We will explicitly analyze the claim made by Caves (1980, p. 77) that "... strategies facilitated by the multidivisional corporation may have their drawbacks in that they raise entry barriers to new competitors - an issue not dealt with in this chapter - ..." and a similar claim by Vickers (1985, p. 139) that "... the horizontal organization of a firm (e.g. into separate divisions) can be seen as a form of delegation that may have strategic advantages in relation to other firms".

The chapter is organized as follows. Section two formulates the model and the following section presents the results. The final section offers some conclusions.

2. Locations and prices

A divisionalized structure allocates the decision power regarding products and prices to the divisional departments, whereas these decisions are executed at a more centralized level in a functional structure. The implication is that an organization adopting a functional structure will act as one entity on the market, whereas the departments of a divisional structure will compete with each other. This is in a spirit similar to Stiglitz: "If the monopolist could delegate the responsibility for the management of each store to a different individual, and could pre-commit himself not to intervene to coordinate their actions, then it would pay for him to do so" (1986, p. 64). We will analyse the outcome of the organizational structure choice for the market and consider the entry decision of other firms in a standard location model.

These considerations are modelled by a multistage game. The commitment effect of various decisions is reflected in the sequencing of the stages. A decision in a particular stage will structure (or channel) all subsequent decisions, i.e. firms anticipate that decisions in early stages affect decisions in subsequent stages. We assume that firms maximize profits. The first stage consists of a choice between a divisional or functional structure. The subsequent decisions regarding product specifications and prices are taken independently by each department of a divisional structure, i.e. the organization has decentralized all its product and pricing decisions. A functional structure has centralized these decisions. The incumbent decides which product to produce in the second stage, given the organization structure choice of the first stage. The positioning of products will be analyzed in a location model of product differentiation. The decisions regarding the introduction of new products by potential

entrants are dealt with in the third stage, given the decisions in the first and second stages. Finally, firms compete in prices in the fourth stage while taking the prices of the other firms as given, i.e. the firms behave as Bertrand competitors.

This four stage game is solved for its subgame perfect Nash equilibrium by using the method of backward induction. First, the profit maximizing prices of the fourth stage are calculated, given the choices of the three previous stages. Second, the profit maximizing entry decisions of the third stage are analyzed, given the choices of the previous two stages and taking into account the subsequent profit maximizing prices in the fourth stage. Third, the profit maximizing positioning of products by the incumbent is considered, given the choice of the first stage and taking into account the profit maximizing responses in the third and fourth stage. Finally, the profit maximizing organizational structure is calculated, taking into account the profit maximizing choices in the next three stages.

One way of modelling product differentiation is the so-called location or spatial differentiation model, in which different consumers are located at different places. This model can also be interpreted as consumers having heterogeneous tastes; each location represents a different taste. The distance that consumers have to travel to the location of a firm is interpreted as a utility loss from not consuming their preferred commodity. We adopt a circular city model of product differentiation in order to circumvent problem regarding the existence of equilibrium and the boundary issues of the linear city model (Tirole, 1988). However, the results are not sensitive to this specification.

Consumers are uniformly distributed along a circle with unit circumference. Each consumer buys either zero or one unit of the product. A consumer buying one unit of a product produced at x has a surplus of

$$C - d_x - p_x,$$

where C is the reservation price common to all consumers, d_x is the distance between the consumer and the location where x is sold and p_x is the price of product x . Each consumer buys one unit, provided that this leaves her with a non-negative surplus.

The incumbent firm is assumed to produce two products, whereas (potential) entrants produce only one. This simplifying assumption is not influencing the results. The marginal costs are set equal to zero.

Figure 1 shows the incumbent two-product firm and one entrant. The incumbent offers products at a and b and the entrant at c . The prices are p_a , p_b and p_c , respectively. We assume that the whole market is served by taking C high enough. We will take $a = 0$.

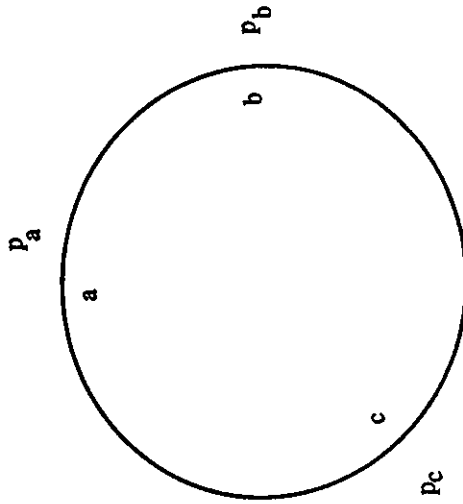


Figure 1:

Location of firms and consumers on a circle.

A firm with a functional organization structure will maximize the joint profits of his products sold at a and b , whereas a firm with a divisional organizational structure will maximize the profits of the two products independently. The results with respect to the pricing decision are shown in Table 1. The fourth location is labelled d and profits associated with location i by p_i . The case of functional organizational structure with two entrants, one on $[0,b]$ and one on $[b,1]$ is identical to a divisional organizational structure with two entrants. The appendix derives these results for the case of one entrant on the segment $[b,1]$.

The results presented in Table 1 show the solution to the fourth stage of the game, i.e. the profit maximizing prices, given any entry pattern, location and organizational choice in the three previous stages. Notice that the first three stages are indeed treated as parameters in table 1. They are represented in the horizontal and vertical entries of this table and the location parameters a , b , c and d . It is now easy to determine the profit maximizing choices in the third, second and first stage of the game. This is done in the next section.

Organizational choice	F-structure	D-structure
number of entrants		
no entrants	$p^*_a = p^*_b = C-1/4$ $\pi_a + \pi_b = C-1/4$	$p^*_a = p^*_b = 1/2$ $\pi_a + \pi_b = 1/2$
one entrant	$p^*_a = 7a+3b-2c$ 12	$p^*_a = \frac{2+b-c}{5}$
on [b,1]	$p^*_b = 5+b+2c$ 12	$p^*_b = \frac{1+c}{5}$
	$p^*_c = 3b$ 6	$p^*_c = 2b$ 5
	$\pi_a + \pi_b = 30b+12c+39+7b^2-6bc+12c^2$ 144	$\pi_1 = (p^*_1)^2$
	$\pi_c = (3b)^2$ (6)	
two entrants	$p^*_a = \frac{44(b-d)+14c+73}{145}$	$p^*_a = \frac{1+2(1-d+b)}{8}$
on [b,1]	$p^*_b = \frac{14(b-d)+44c+43}{145}$	$p^*_b = \frac{1+2c}{8}$
	$p^*_c = \frac{3c-32(b-d)+26}{145}$	$p^*_c = \frac{1+2(d+b)}{8}$
	$p^*_d = \frac{3(b-d)-32c+61}{145}$	$p^*_d = \frac{1+2(1-c)}{8}$
	$\pi_a + \pi_b = \frac{1516(b-d)^2+332c(b-d)+1516c^2+2014c+4714(b-d)+4039}{145 \cdot 145}$	$\pi_1 = (p^*_1)^2$
	$\pi_c = (p^*_c)^2$	
	$\pi_d = (p^*_d)^2$	

Table 1:

The optimal prices and profits, given locations and organizational structure.

3. Results

This section will establish results regarding the relationship between the choice of organizational structure and the industrial organization of firms. Choices regarding organizational structure, locations, entry and prices are made by firms in order to maximize profits of the whole game.

Table one enables us to calculate the entry fee E for which entry of the first or second potential entrant is deterred for each organization structure. We will now present a specific example to illustrate our main results. Suppose that $E = 1/8$. The profits of the incumbent with a functional structure are $7/12 \cdot 7/12$ and the profits of the entrant are $(5/12 \cdot 5/12 - 1/8)$. A second entrant will not make positive profits. The profits of the incumbent with a divisional organizational structure are $1/2$ and there is no entry because the profits of the first entrant would be negative $(1/3 \cdot 1/3 - 1/8)$.

This example illustrates several results. First, if a functional organizational structure is adopted instead of a divisional one, then at least as much product variety will be offered and prices will be higher, given a certain level of the entry fee E . This is the effect described by Stiglitz (1986, p. 37). He writes: "A monopolist, controlling all stores, simply chooses the price at each store optimally. He knows that lowering the price at one location lowers profits at adjacent locations and takes this into account. This induces him not to lower his prices as much in response to entry; thus to make entry less attractive, he must place his stores closer together".

Second, the above model shows that a divisional organizational structure will be adopted from merely an industrial organization point of view when the entry fee is below a certain level (i.e. $E \leq 25/144$). The reason for the higher profits of a divisional structure is that the entry-detering effect of the commitment to a more competitive profile by the divisional structure outweighs the monopoly effects of a functional structure. A functional structure is chosen when $E > 25/144$.

Third, it is clear that internal organizational considerations might result in adopting a different organizational structure than from a merely industrial organization point of view would be expected. The scale disadvantages of a divisional structure might be more important than the profit-decreasing effect of entry and therefore result in a functional organizational structure. If the entry fee is sufficiently low then there will be entry and mill price dispersion. The mill price dispersion is due to two forces. A higher price charged by the incumbent increases his profits in the area between his two stores, but decreases them in the areas where he is facing a rival. The profit-maximizing price choices result in higher mill prices of the incumbent than the entrant.

On the other hand, it might also be that industrial organization considerations may change the internal organization choice. If the entry deterring effect of a divisional structure dominates the monopoly effect of a functional structure, then this implies

and scope of the firm and remuneration schemes have not been treated, therefore we have not considered many aspects of the richness of internal organizations. Similar comments can be made regarding the industrial organization of firms. All these issues are interesting in themselves, but we have to limit ourselves in the scope of the analysis and don't imply some judgment about the importance of other issues. However, the main contribution of this chapter lies in providing a relationship between organizational choice and the industrial organization of firms.

Appendix

This appendix will derive the expressions of Table 1 for the case of one entrant on [b,1]. The other cases are obtained in a similar way.

Profits are equal to the price times the length of the segment of consumers being served. These segments will now be calculated. We have assumed that the whole market is served. A consumer located at x on the interval $[0,b]$ is indifferent between buying at location $a(=0)$ or b when

$$C - x - p_a = C - (b-x) - p_b$$

$$\Leftrightarrow x = \frac{b + p_b - p_a}{2}$$

Similarly, a consumer located at y on the interval $[b,c]$ is indifferent between buying at b or c when

$$y = \frac{b + c + p_c - p_b}{2}$$

and a consumer located at z on the interval $[c,1]$ is indifferent between buying at c or a when

$$z = \frac{1 + c + p_a - p_c}{2}$$

The profit functions are therefore

$$\pi_a(p_a) = p_a (1 - z + x)$$

$$\pi_b(p_b) = p_b (b - x + y - b)$$

$$\pi_c(p_c) = p_c (c - y + z - c)$$

The profits of a D-structure are determined by maximizing $\pi_i(p_i)$ with respect to p_i , where $i = a, b$ or c . The solution to this system of three equations with three

that strategic considerations will to some extent influence the choice of organizational structure. So a divisional organization structure might be adopted even when on merely internal organization grounds a F-structure would be preferred. This establishes the entry deterring effect of organizational choice.

Finally, the strategic adoption of a divisional organizational structure improves welfare from merely an industrial organization point of view. We have assumed that the market is covered and consumers are characterized by inelastic demand. The sum of consumer and producer is therefore insensitive to changes in organizational structure. It is therefore sufficient to compare the decrease in transportation costs of consumers due to the adoption of a functional organization structure with the cost of entry. If $E = 1/8$, then the transportation costs of consumers are equal to $1/8$ when a divisional organizational structure is chosen by the incumbent. A welfare loss is therefore associated with a functional organization structure because the transportation costs have still to be added to the entry fee.

A classic example of entry deterrence by choosing an appropriate organizational structure is the General Motors company (Chandler, 1962). General Motors offers many different types and sizes of cars. It could have decided to organize the productions around wheels, bodies and engines and to allow each salesperson to sell every product. However, it was decided to organize the activities around products in separate divisions. These divisions compete independently and no attempts were made by the general office to limit the operating authority of each division.

4. Conclusions and further research

We have analyzed the relationship between the internal and industrial organization of firms in a model focussing on the effect of the choice of internal (de)centralization on market behavior and have established a link between the internal and industrial organization of firms. It was shown that a centralized organization structure (i.e. a functional organization) will charge higher prices and locate products closer together than a decentralized structure (i.e. a divisional structure), given certain entry fee levels. The entry deterring effect of organizational choice was shown by choosing a divisional structure, although this might not be optimal from merely an internal organization point of view.

There are many extensions possible of the current analysis. We have limited ourselves to the delegation aspect of two well known organization structures. Other aspects of these structures are left out, like the relative advantage of a divisional structure regarding co-ordination and incentive problems, whereas a functional structure is relatively good at reaping the benefits of economies of scale. Other organization structures (e.g. a matrix structure, i.e. a hybrid of a divisional and functional structure) have not been considered. Issues like decisions regarding authority and responsibility relationships, the number of hierarchical levels, the size

unknowns yields the profit maximizing prices and the associated profits. The profits of the F-structure are determined by maximizing $\pi_a(p_a) + \pi_b(p_b)$ with respect to p_a and p_b . The results are presented in table 1.

Notice that the assumption regarding the whole market being served is satisfied when $C \geq 3/4$.

References

- Bonanno, G., and J. Vickers, 1988, Vertical Separation, *The Journal of Industrial Economics*, 36: 3, 257-265.
- Brander, J.A., and J. Eaton, 1984, Product Line Rivalry, *American Economic Review*, 74: 3, 323-334.
- Brander, J.A., and T.R. Lewis, 1986, Oligopoly and Financial Structure: the Limited Liability Effect, *American Economic Review*, 76: 5, 956-970.
- Bull, C., and J.A. Ordover, 1987, Market Structure and Optimal Management Organizations, *Rand Journal of Economics*, 18: 4, 480-491.
- Caves, R.E., 1980, Corporate Strategy and Structure, *Journal of Economic Literature*, 18: 1, 64-92.
- Coughlan, A.T., and B. Wernerfelt, 1989, On Credible Delegation by Oligopolists: a Discussion of Distribution Channel Management, *Management Science*, 35: 2, 226-239.
- Chandler, A.D., 1962, *Strategy and Structure: Chapters in the History of the Industrial Enterprise*, (Cambridge, Mass., The MIT Press).
- Fershtman C., and K.L. Judd, 1987, Equilibrium Incentives in Oligopoly, *American Economic Review*, 77: 5, 927-940.
- Hart, O., 1983, The Market Mechanism as an Incentive Scheme, *Bell Journal of Economics*, 74, 366-382.
- Maksimovic, V., 1988, Capital Structure in Repeated Oligopolies, *The Rand Journal of Economics*, 19: 3, 389-407.
- Nalebuff, B.J., and J.E. Stiglitz, 1983, Information, Competition and Markets, *American Economic Review*, 73, 278-283.

Schwartz, M., and E.A. Thompson, 1986, Divisionalization and Entry Deterrence, *Quarterly Journal of Economics*, 101, 307-321.

Smiley, R., 1988, Empirical Evidence on Strategic Entry Deterrence, *International Journal of Industrial Organization*, 6, 167-180.

Stiglitz, J.E., 1986, Towards a More General Theory of Monopolistic Competition, in Peston, M.H. and R.E. Quandt (Eds.), *Prices Competition & Equilibrium*, (New York, Philip Allan / Barnes & Noble Books).

Tirole, J., 1988, *The Theory of Industrial Organization*, (Cambridge, Mass., The MIT Press).

Vickers, J., 1985, Delegation and the Theory of the Firm, *Conference Papers, Supplement to the Economic Journal*, 95, 138-147.

Willig, R.D., 1986, Corporate Governance and Product Market Structure, in Razin A. and E. Sadka (Eds.), *Economic Policy in Theory and Practice*, (New York, Mac Millan).