Non-strategic entry deterrence in monopolistic competition

Toshihiro Atsumi
Faculty of Economics, Meiji Gakuin University

Discussion Paper No.17-01
May, 2017

Non-strategic entry deterrence in monopolistic competition

Abstract

I look into the entrepreneur model of monopolistic competition that has been used in several different strands of literature. I show how the same model also speaks to entry deterrence and inequality: in the model, incumbent entrepreneurs can successfully deter entry in a non-strategic way, which results in a lower entrepreneurial participation rate and inequality among members of the economy, compared to the no entry deterrence/free entry equilibrium. Such entry deterrence can occur in industries in which firms are producing sufficiently dissimilar goods or goods with sufficiently low elasticities of substitution.

Keywords: entrepreneur, monopolistic competition, entry deterrence, inequality
JEL classification: L13, L51, D72

1. Introduction

Analysis of entry deterrence has largely focused on one-on-one situations in the industrial organization literature using game theory. According to Wilson (1992), analyses on strategic entry deterrence fall into the categories of preemption, signaling, and predation. Typical situations examined in preemption studies are those of monopolists acting to preserve their positions, that is, deterring entry, for example, by holding higher capacity than needed to supply current demand. Signaling studies proceed by assuming that incumbents convey information (such as cost) that discourage entry. Predation studies focus on incumbent firms' battles against current entrants to deter subsequent entry.

In the present paper, I examine entry deterrence using the entrepreneur formulation of monopolistic competition in general equilibrium. I show that, under certain conditions, incumbent firms have incentives to deter entry, and they can do so if there is a procedure for them to influence entry regulation. In contrast to the vast existing literature on strategic entry deterrence, the present paper shows entry deterrence by atomistic firms engaged in monopolistic competition that do not take any strategic actions. The entrepreneur formulation of monopolistic competition has been used previously in at least in two different strands of literature: entrepreneurial risk taking and new economic geography.

Attitudes toward risks and their consequences have been analyzed by Frank (1990) and Clemens (2006, 2008) using the entrepreneur formulation of monopolistic competition. Their focuses are on the impact of entrepreneurial behavior on macroeconomic fluctuations or economic growth. Frank (1990), for example, assumes risk aversion by entrepreneurs which leads to cautiousness in making employment decisions. This micro behavior explains low output, low employment, and low welfare as an equilibrium macroeconomic consequence.

In new economic geography, Forslid and Ottaviano (2003) analyzed a model of monopolistic competition in which geographically mobile skilled workers are needed to set up firms. This model is now known as the footloose entrepreneur model and it explains the relation between inter-regional trade costs and agglomeration created by the migration of skilled workers. The model is included among the core models of the new economic geography literature.[1]

[1] See Baldwin et al. (2003) that offer comprehensive introduction of the core models developed in the new economic geography literature.

In the entrepreneur model in this paper, there are neither entrepreneurial risks nor geographic mobility. Instead, unlike the above mentioned studies, I analyze both the equilibrium with a fixed share of entrepreneurs within the population and the free entry equilibrium. By comparing the two equilibria, it is shown that conflict of interest can exist between incumbent entrepreneurs and potential entrants depending on the initial share of entrepreneurs. I then show conditions under which incumbent entrepreneurs can successfully block entry by majority voting. If entry gets blocked and the free entry equilibrium is not achieved, then inequality persists within the economy.

In the next section, I derive the equilibrium with fixed share of entrepreneurs, which in general exhibits inequality between entrepreneurs and their employees. This inequality leads to entry, and the resultant free entry equilibrium is shown in section 3. In section 4, the possible conflict of interest between incumbent entrepreneurs and potential entrants is shown. I show in Section 5 conditions under which incumbent entrepreneurs can successfully block entry by majority voting. Section 6 summarizes and concludes.

2. Equilibrium for a fixed share of entrepreneurs

The population of the economy is denoted by L. Members are either entrepreneurs or workers. The share of entrepreneurs within the population is denoted by e $(0<e<1)$ and, following Forslid and Ottaviano (2003), it is assumed to be fixed. Correspondingly, the share of workers is $1-e$. The firms run by the entrepreneurs are assumed to be monopolistically competitive. Each entrepreneur employs workers to produce a particular variety. It is assumed that c units of workers are needed per unit output.

The same population also comprises the consumers. The assumption for consumer behavior is a standard one, originally developed by Dixit and Stiglitz (1977). All consumers have the same preferences, which are defined as

$$U=\left[\int_0^n m(i)^{\rho}\,di\right]^{\frac{1}{\rho}},$$

where U is the composite of all the differentiated varieties, n is the mass of varieties, $m(i)$ is the consumption of variety i, and ρ is the substitution parameter. It is assumed that $0<\rho<1$ to ensure that the varieties are imperfect substitutes. $\sigma\equiv 1/(1-\rho)>1$ represents the elasticity of

substitution between any two varieties. Higher (lower) σ means weaker (stronger) love of variety. Denoting the price of a variety as $p(i)$, a price index

$$G \equiv \left[\int_0^n p(i)^{1-\sigma} di \right]^{\frac{1}{1-\sigma}} \tag{1}$$

is introduced such that total expenditure is GU. G is an overall level of prices that each firm takes as given.

In the above setting, consumers' utility maximization leads to demand for each variety being $p(i)^{-\sigma} G^{\sigma-1} Y$, where Y is aggregate income. Demand therefore depends not only on $p(i)$ and Y but also on G. Y consists of total profits earned by the entrepreneurs and total earnings of the workers. When π is the profit of each firm and each worker's wage is set equal to 1,

$$Y = eL\pi + (1-e)L. \tag{2}$$

On the supply side, entrepreneurs of monopolistically competitive firms will set their prices so that marginal revenues equal marginal costs:

$$p(i)(1-1/\sigma) = c. \tag{3}$$

This is known as mark-up pricing in which firms always set their prices above their marginal costs, c. However, since rival firms are producing more or less substitutable varieties, the mark-up depends on σ: when the varieties are close substitutes (or consumers' love of variety is weak), i.e., when σ is high, then consumers are sensitive to prices and the prices are closer to c. By substituting Eq. (3) into Eq. (1), we find that the mark-up pricing by each firm leads to the price index being

$$G = n^{\frac{1}{1-\sigma}} \frac{\sigma c}{\sigma - 1}, \tag{4}$$

where

$$n = eL. \tag{5}$$

Further, denoting the output of each firm as $q(i)$, since the profit of each firm (π) is $p(i)q(i) - cq(i)$, using Eq. (3), we have

$$\pi = \frac{c}{\sigma - 1} q(i). \tag{6}$$

We can now consider the equilibrium. Equilibrium is defined as the goods and factor markets clearing (i.e., supply equals demand) at a given level of e. The goods market clearing condition is

$$q(i) = p(i)^{-\sigma} G^{\sigma-1} Y, \tag{7}$$

and the factor market clearing condition is

$$L = n + ncq(i), \tag{8}$$

which means that the population (L) needs to match the amount of entrepreneurs and workers; i.e., all those not entrepreneurs must be fully employed as workers.

The equilibrium for a given fixed share of entrepreneurs can be obtained by solving Eqs. (7) and (8) simultaneously, after substituting Eqs. (2) through (6). We then have

$$q(i) = \frac{1-e}{ec} \tag{9}$$

as the equilibrium output of each firm. Thus, having fewer entrepreneurs (and therefore fewer firms), implies that the output (or size) of each firm is larger. Substituting Eq. (9) into Eq. (6) gives the equilibrium profit:

$$\pi = \frac{1-e}{e(\sigma-1)}. \tag{10}$$

Result 1. When the share of entrepreneurs (e) within the population is fixed, the profit of each firm (π) can take any positive value depending on e and the elasticity of substitution between any two varieties (σ) according to the following relationship: the lower e and/or the lower σ, the higher π.

Result 1 can be interpreted intuitively as follows. Imagine that only a smaller fraction of the population is allowed to be entrepreneurs. Then, other things being equal, each firm becomes larger (as shown in Eq. 9) and correspondingly each firm's profit becomes larger (as shown in Eq. 6). Continuing this leads to considering a tiny e close to 0: as $e \to 0$, $\pi \to \infty$. Also, imagine that the consumers' love of variety becomes stronger and the firms produce less similar or less substitutable varieties. Other things being equal, as shown in Eq. (3), this implies a higher mark-up and higher prices, leading to higher profits (as shown in Eq. 6). Continuing this leads to considering a low σ very close to 1: as $\sigma \to 1$, $\pi \to \infty$.

Here, in the equilibrium for a fixed share of entrepreneurs, each entrepreneur earns π, while each worker earns 1. Since both entrepreneurs and workers face the same prices, a difference in their earnings implies a difference in their utilities. (The indirect utilities for the entrepreneurs and the workers are π/G and $1/G$, respectively.) $\pi>1$ ($\pi<1$) means that the entrepreneurs' utilities are higher (lower) than those of the workers. Since there is no upper limit on π, in theory, inequality can increase infinitely.

There is growing interest throughout the world regarding inequality. Result 1 indicates that there are both supply side and demand side reasons for inequality: Restriction to entry into business, for example, implies a lower e and increases inequality. At the same time, weaker love of variety, i.e., smaller σ, will also increase inequality.

3. Free entry equilibrium

This section considers free entry where the share of entrepreneurs (e) is no longer fixed, meaning that the population can choose occupations. Given the level of π, the workers now consider whether they also want to become entrepreneurs. Workers have incentives to do so if $\pi>1$, that is, when existing entrepreneurs earn more than what the workers do. On the other hand, if $\pi<1$, meaning that the entrepreneurs earn less than the workers, the entrepreneurs shut down their firms and become workers. In any case, entry or exit occur until $\pi=1$. (Entry means the workers becoming entrepreneurs; exit means the entrepreneurs becoming workers.) Substituting $\pi=1$ into Eq. (10) and solving for e, we have

$$e=1/\sigma. \tag{11}$$

Result 2. In the free entry equilibrium, the share of entrepreneurs within the population (e) only depends on the elasticity of substitution between any two varieties (σ), and e is the reciprocal of σ.

$1/\sigma$ is the optimal share of entrepreneurs in this model economy. σ, as defined in the outset, reflects the love of variety: stronger (weaker) love of variety implies lower (higher) σ. Result 2 can then be interpreted that when peoples' love of variety is strong (i.e., σ is low), more people in the population will become entrepreneurs, and therefore the economy will have more

firms and varieties. It is only the demand parameter σ that determines the share of entrepreneurs within the population in the free entry equilibrium.

4. Conflict of interest between incumbent entrepreneurs and potential entrants

When the economy reaches the free entry equilibrium, both the entrepreneurs and the workers earn 1, and equality is achieved. It is important to note, however, that the free entry equilibrium (compared to the initial equilibrium for a fixed share of entrepreneurs) does not necessarily raise the utility of all. Suppose that initially $\pi > 1$ and entry occurs, i.e., the workers set up new firms and start their own businesses. How will this affect the welfare of the existing entrepreneurs? Since π decreases to 1 in the free entry equilibrium, the existing entrepreneurs' utility changes from π / G_S to $1/G_L$, where G_S is the price index in the equilibrium with fixed share of entrepreneurs and G_L is the price index in the free entry equilibrium. For the existing entrepreneurs to enjoy increased utility, therefore, it is necessary that $\pi / G_S < 1/G_L$. That is, using Eqs. (4), (10), and (11),

$$\pi \left(= \frac{1-e}{e(\sigma -1)} \right) < \frac{G_S}{G_L} \left(= (e\sigma)^{\frac{1}{1-\sigma}} \right). \tag{12}$$

However, as shown below, it turns out that (12) does not always hold. Differentiating the left- and the right-hand sides of (12) with respect to e, we obtain

$$\frac{\partial \pi}{\partial e} = -\frac{1}{e(\sigma -1)} - \frac{1-e}{e^2(\sigma -1)} \tag{13}$$

and

$$\frac{\partial (G_S / G_L)}{\partial e} = -\frac{\sigma (e\sigma)^{\frac{\sigma}{1-\sigma}}}{\sigma -1}. \tag{14}$$

Inspecting Eqs. (13) and (14), recalling that by assumption $0 < e < 1$ and $\sigma > 1$, we can confirm that $\partial \pi / \partial e < 0$ and $\partial (G_S / G_L) / \partial e < 0$. These imply that both π and G_S / G_L are always decreasing in e. In addition, evaluating Eqs. (13) and (14) at $e = 1/\sigma$, we have

$$\frac{\partial \pi}{\partial e} = -\frac{\sigma^2}{\sigma -1} \text{ at } e = 1/\sigma \tag{15}$$

and

$$\frac{\partial (G_S / G_L)}{\partial e} = -\frac{\sigma}{\sigma -1} \text{ at } e = 1/\sigma. \tag{16}$$

Comparing Eqs. (15) and (16), since $\sigma > 1$,

$$\left|\frac{-\sigma^2}{\sigma-1}\right| > \left|\frac{-\sigma}{\sigma-1}\right|$$

which implies that the slope of π is steeper than that of G_S/G_L at $e = 1/\sigma$. We have, therefore, $\pi > G_S/G_L$, i.e., $\pi/G_S > 1/G_L$, at least in the neighborhood of the free entry equilibrium (i.e., $e = 1/\sigma$). These results are jointly illustrated in Figure 1.

Result 3. If $\pi > 1$, then as the economy approaches the free entry equilibrium (i.e., $\pi = 1$ and $e = 1/\sigma$), the existing entrepreneurs' utility decreases.

Result 3 can be interpreted as follows. On the one hand, entry improves the utility of all because the new firms provide new varieties, reflected as a fall in the price index, G. On the other hand, however, entry also means tougher competition for the existing entrepreneurs, so each firm's output falls and correspondingly profit falls. As the economy approaches the free entry equilibrium, in which, as I have already shown, there are an increasing number of entrepreneurs and rival firms, the latter effect outweighs the former; gains from the increase in variety cannot compensate individual entrepreneurs for their loss in profits relative to the starting situation.

Importantly, Result 3 means that a conflict of interest exists between the incumbent entrepreneurs and potential entrants. The incumbents are unlikely to accept new entry given that their economic welfare deteriorates, and therefore self-interested incumbents have an incentive to deter entry.

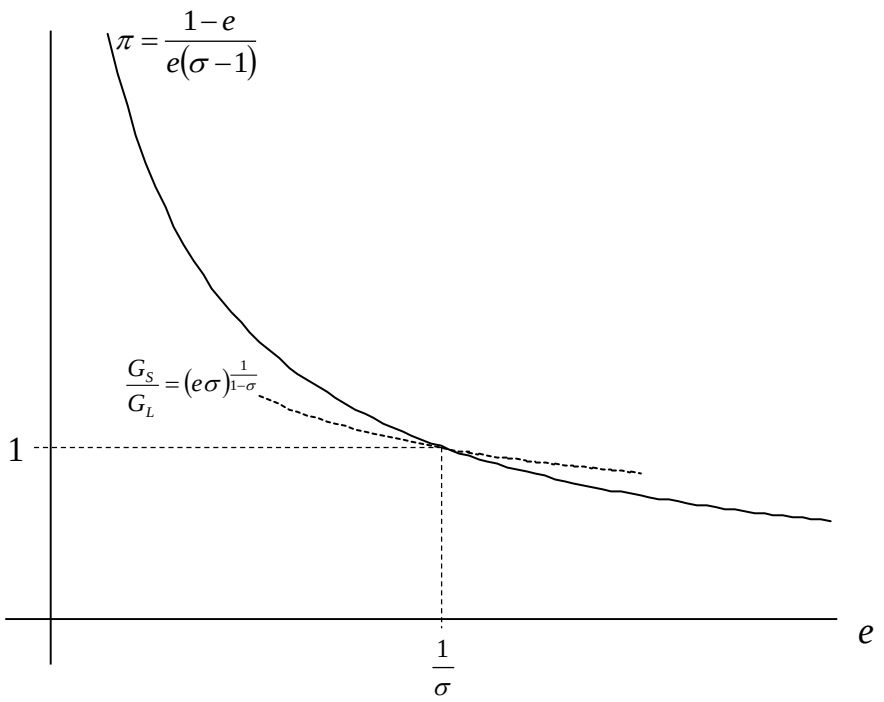

Figure 1: The free entry equilibrium

5. Entry deterrence by voting and inequality

I assume that entry regulation exists, which can be influenced by the population. The entry regulation functions in such a way that entry requires the consent of the population. Specifically, I examine a simple case in which entry is decided by majority voting, and therefore entry requires 'permission' by the majority of the population.[2] The voting is assumed to be costless.

Based on the above assumptions, given Result 2, blocking entry by majority voting can only be successful when $1/\sigma < 1/2$, i.e., $\sigma < 2$.[3] If $\sigma \geq 2$, then the incumbent entrepreneurs never constitute a majority of the population, and majority voting against entry cannot be successful.

Result 4. Entry can only be blocked in industries in which firms are producing sufficiently dissimilar goods or goods with sufficiently low elasticities of substitution, i.e., when $\sigma < 2$.

[2] I am abstracting from the real-world political process of indirect policy making.

[3] Examples of traded goods that satisfies $\sigma < 2$ from the Broda and Weinstein (2006) study are motor cars and other motor vehicles, thermionic, cold cathode, photocathode valves, etc., footwear, silver, platinum and other platinum group metals for the period 1972-1988, and thermionic, cold cathode, photocathode valves, etc., telecommunications equipment n.e.s. and parts, n.e.s. for the period 1990-2001.

The equilibrium under majority voting depends on the initial state. Suppose initially the share of entrepreneurs (e) is less than $1/2$. Then, even though entry lowers the welfare of the incumbents and they will be against entry, entry will continue because they do not yet constitute a majority of the population. However, when e reaches $1/2$, further entry now gets blocked by majority voting. The equilibrium e is therefore $1/2$ in this case. If the initial e is greater than or equal to $1/2$, then the incumbents already constitute a majority and therefore voting does not allow any further entry. That is, in this case, the equilibrium e is equal to the initial e.

Result 5. Let e_S and e_L be the initial and equilibrium shares, respectively, of entrepreneurs under majority voting. Assuming that 1) $\sigma < 2$ and 2) entry permission is subject to costless majority voting by the population, if $e_S \leq 1/2$, then $e_L = 1/2$. Otherwise, if $1/2 < e_S < 1/\sigma$, then $e_L = e_S$.

I illustrate in Figure 2 the case of $\sigma = 1.5$. For this value of σ, Result 2 gives the free entry equilibrium e as $2/3$. When $0 < e < 1/3$, there is no conflict of interest, because $\pi < G_S / G_L$, which means that entry is welfare improving for the incumbents. When $e > 1/3$, then entry reduces the welfare of the incumbents. This is when self-interested incumbents vote to block entry. However, when $1/3 < e \leq 1/2$, the incumbents do not constitute a majority of the population. Therefore, blocking entry cannot be legalized as a result of majority voting. The votes for blocking entry constitutes a majority when $e > 1/2$. Then, depending on the initial level of e, the equilibrium e will be $1/2$ or in between $1/2$ and $2/3$.

If entry deterrence occurs as presented in Result 5, inequality between the entrepreneurs and the workers is not eliminated (i.e., $\pi > 1$) and the entrepreneurial participation rate does not reach the free entry equilibrium level found in Result 2 (i.e., $e < 1/\sigma$).

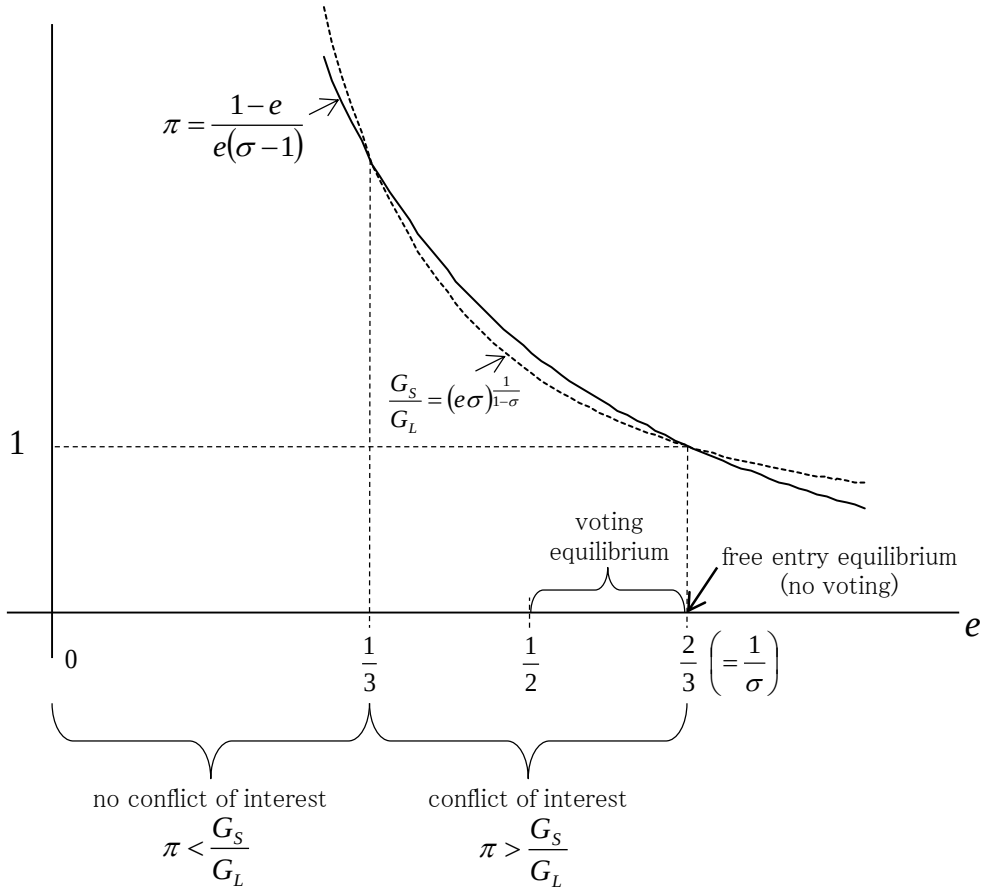

Figure 2: Example of blocked entry with $\sigma = 1.5$

6. Summary and conclusion

This paper analyzed an entrepreneurial model of monopolistic competition distinguishing between the equilibrium for a fixed share of entrepreneurs and that under free entry. When the share of entrepreneurs is fixed, inequality exists in general (Result 1), which induces new entry. Free entry leads to the share of entrepreneurs within the population being $1/\sigma$ (Result 2), at which point inequality has been eliminated. Inspecting the welfare changes of the incumbent and potential entrepreneurs, however, it is found that a conflict of interest exists because the incumbents do not necessarily gain from new entrepreneurs joining their industry. (Result 3). This implies that the incumbents may have an incentive for deterring entry. If there is a procedure such as majority voting to permit/deter entry, entry deterrence can be successful when $\sigma < 2$, that is, when the firms are producing sufficiently dissimilar goods or goods with sufficiently low elasticities of substitution (Result 4). The consequence of a successful entry deterrence will be

that the (no voting) free entry equilibrium given in Result 2 is not achieved (Result 5), and therefore a low e (i.e., low entrepreneurial participation rate) and inequality persist.

In contrast to the studies in the strategic entry deterrence literature, this paper showed that non-strategic entry deterrence can occur in a general equilibrium model of monopolistic competition in which firms are atomistic and do not conduct strategic actions. The kind of entry deterrence presented in this paper may be relevant not only to entrepreneurs in general but also to entry regulations seen in a number of professions.

Acknowledgement

I appreciate the financial support of a Grant-in-Aid for Scientific Research (16H06548) from the Japan Society for the Promotion of Science.

References

Baldwin, Richard, Rikard Forslid, Philippe Martin, Gianmarco Ottaviano and Frederic Robert-Nicoud (2003) *Economic Geography and Public Policy*, Princeton University Press: Princeton and Oxford.

Broda, Christian and David E. Weinstein (2006) "Globalization and the gains from variety" *Quarterly Journal of Economics* **121**, 541-585.

Clemens, Christiane (2006) "Monopolistic competition and entrepreneurial risk-taking" *Economics Letters* **93**, 68–74.

Clemens, Christiane (2008) "Imperfect Competition and Growth with Entrepreneurial Risk" *German Economic Review* **9**, 180–206.

Dixit, Avinash K. and Joseph E. Stiglitz (1977) "Monopolistic competition and optimum product diversity" *American Economic Review* **67**, 297-308.

Forslid, Rikard and Gianmarco I.P. Ottaviano (2003) "An analytically solvable core-periphery model" *Journal of Economic Geography* **3**, 229-240.

Frank, Jeff (1990) "Monopolistic Competition, Risk Aversion, and Equilibrium Recessions" *Quarterly Journal of Economics* **105**, 921-938.

Wilson, Robert (1992) "Strategic Models of entry Deterrence" in Robert J. Aumann and Sergiu Hart eds. *Handbook of Game Theory* Chapter 10 Amsterdam: North-Holland/Elsevier Science Publishers.