ON THE EFFECTS OF
RETARDED ENTRY

by

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Onderzoeksrapport N° 7514

November 1975

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ABSTRACT

The effects of retarded versus unimpeded entry are studied for a dominant firm industry, using a generalized Gaskins limit-pricing model. We explore under what conditions, mainly concerning scale effects, the consequences of both discouraged and free entry are the same for the competitive characteristics and stability of the stationary state of the industry, and for the direction of movement of individual firm and industry output.

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1. Introduction.

The effects of entry on industry behaviour continue to be a topic of interest to economists. For industries where structural elements and policies of established members may discourage the appearance of entrants an important question is : how, if at all, do the effects of actual entry differ when the industry is able and attempts to retard entry as compared to when entry is free or impeding efforts are considered futile? In this paper we partly explore this problem for a dominant firm industry, considering only effects of entry with regard to the competitive and stability characteristics of the stationary state and the direction of movement of industry and individual firm output (quasi-competitiveness).

The consequences of free entry in this context were synthesized by Ruffin [11] for a Cournot oligopoly, but they are in essence applicable for a dominant firm situation. With marginal revenue decreasing with entry, industry output (price) will increase (decrease) and the firm's output shrink provided marginal costs are non-decreasing. As the competitive fringe expands eventually a competitive state is reached where industry price equals marginal and minimum average cost at zero output of the dominant firm. This last result does not apply and industry output may not enlarge when scale economies are present.

In the study of established firms recognizing potential entry the major focus (of limit pricing theory) has been on how price (and other) policies would be

affected by the ability to discourage entry as related to structural elements of the industry and the individual firm. The effects of actual (retarded or forestalled) entry were either assumed, verbally argued, left unspecified or unexplored. Some exceptions require attention. Gaskins [4] envisaged a dominant firm producing with constant marginal cost and viewing the rate of entry linearly related to current industry price. He found that price will also drop as entrants appear and that the stationary state is similarly characterized by a competitive situation given that the firm has no cost advantage over prospective rivals. Kamien and Schwartz (KS) [9] - in a recent attempt to unify old and new developments on the oligopoly front - directly address our earlier question for a Cournot oligopoly viewing the appearance of new firms as uncertain and dependent on current industry price. They conclude that Ruffin's equilibrium claims continue to hold (implicitly assuming no cost disadvantage for potential entrants) but that "it appears that industry and firm output may expand or contract after entry of another firm" (p.130). Actually, their analysis confirms Gaskins' finding of decreasing industry price in the absence of scale economies, given a linear dependence of the conditional probability of entry on industry price (or on the difference between price and marginal cost).

One is left to wonder if this is the only instance in which retarding entry doesn't make a difference for the direction of movement of industry price, and if similar conclusions cannot be reached for individual firm output and stability. We confront these questions by reanalyzing Gaskins' model under the less restrictive assumptions imbedded in the KS approach. In passing some results on the competitive (and Chamberlinian) characteristics of the stationary state of the industry are clarified and refined.

In section two we present and solve the generalized model, next take up the

stationary solution, stability and quasi-competitiveness and finally summarize our findings.

2. The Model and its Solution.

A dominant firm industry is posited (Gaskins). Total industry output at a time t , $Q(t)$, is composed of the dominant firm's current production $x(t)$ while the competitive fringe supplies an amount $s(t)$, thus $Q=x+s$. The inverse demand relation between industry price and quantity is denoted by $f(Q)=p$ and is assumed to be stationary through time and twice differentiable with negative slope f' .

The firm's cost function $C(x)$ with $C(0)=0$ and average cost function $A(x)$, where $C=xA$, are assumed twice differentiable. Production x is freely variable with no adjustment costs. Current profits $\pi(x,s)=xf(x+s)-C(x)$ are strictly concave in x for any s .

Potential entrants are attracted by current industry price, an entry lag needed by new rivals to make their entries effective is negligible (see section 4 for a comment on this last aspect). We suppose that the rate of entry in the competitive fringe is directly related to the divergence between current industry price and a constant limit price $\bar{p}$ at which net entry is zero;

$$\dot{s}(t) = g(f(x(t)+s(t)) - \bar{p}) \equiv G(x(t), s(t)) \quad s(0) = 0 \quad (1)$$

with $g(0)=0$ and $g'>0$, understanding that $g'=dg/du$ with $u=f-\bar{p}$ (g'' appearing later on is similarly defined). Expression (1) is a generalization of Gaskins' linear specification, except that for simplifying reasons (without further consequences) we view the initial size of the competitive fringe to be zero.

Constancy of the limit price is also imposed by KS; we require a regularity condition $\bar{p} < f(0)$ and suppose the dominant firm has no cost disadvantage, $\bar{p} \geq \min A$.

The firm's problem can now be posed as :

$$\max_{x \geq 0} J = \int_0^{\infty} e^{-rt} \pi(x(t), s(t)) dt \quad (2)$$

subject to (1). The discount rate is r .

Gaskins' model is reobtained for $g''=0$ and $C''=0$, noting $x=f^{-1}(p)-s$.

Before solving (2) we indicate how the dominant firm situation relates to a Cournot oligopoly where industry price affects the rate of increase $\dot{n}(t)$ in the number of firms $n(t)$. Let the output of a firm be $x(t)$ and let the remaining $(n-1)$ identical firms each produce an amount $q(t)$. The Cournot firm will attempt to solve (2) with $\pi = xf(x+(n-1)q) - C(x)$ subject to $\dot{n} = g(f(x+(n-1)q) - \bar{p})$, $n(0)=1$ and $dq/dx=0$. We note that $s=(n-1)q$ and hence $\dot{s} = \dot{n}q + (n-1)\dot{q}$. The dominant firm's problem is therefore formally equivalent to that of a single firm attempting to retard the rate of entry of new rivals who continue with their initial identical policy ($q(0)$) as entrants appear ($\dot{q}(t)=0$). Consequently the firm believes new firms behave according to the classic Cournot assumption. The latter, however, is a weaker assumption since $q(t)$ could vary independently of $x(t)$ as $n(t)$ changes. Parts of our subsequent results do not change for such a pure Cournot situation, possible alterations and difficulties will be pointed out as we proceed.

Viewing (2) as an optimal control problem with x the control and s the state variable, we form the current value Hamiltonian (suppressing time arguments for expository reasons) :

$$H = e^{-rt} (\pi(x, s) + \mu G(x, s))$$

Let $\hat{x}$ be an optimal policy and $\hat{s}$ the corresponding state, then

$$\hat{\pi}_x + \mu \hat{G}_x + z = 0 \quad \hat{x} \geq 0 \quad z \geq 0 \quad z \hat{x} = 0 \quad (3)$$

$$\dot{\mu} = r\mu - (\hat{\pi}_s + \mu \hat{G}_s) \quad \lim_{t \rightarrow \infty} e^{-rt} \mu(t) = 0 \quad (4)$$

where $\hat{x}$ and $\hat{s}$ satisfy (1) and $\pi_x = f(x+s) + xf'(x+s) - C'(x)$, $G_x = G_s = g'(f(x+s) - \bar{p})f'(x+s)$, $\pi_s = xf'(x+s)$. Subscripts (when used) denote the arguments to which we differentiate partially; the hat notation indicates evaluation at $\hat{x}$ and $\hat{s}$. We assumed it is appropriate to take the limit of the finite planning horizon transversality condition.

To fulfill the second-order condition for $\hat{x}$ to maximize H we assume the sufficient requirement that

$$\Delta \equiv \hat{\pi}_{xx} + \mu \hat{G}_{xx} < 0 \quad (5)$$

with $\pi_{xx} = [2f'(x+s) + xf''(x+s) - C''(x)] < 0$ by assumption and $G_{xx} = g''(f(x+s) - \bar{p})f'^2(x+s) + g'(f(x+s) - \bar{p})f''(x+s)$. So far no claims are made that the previous conditions are also sufficient for $\hat{x}$ and $\hat{s}$ to maximize J, on this aspect see section 4. Later on it is argued that μ is negative (or at infinity possibly zero), hence convexity of G in x will ensure (5) to hold. A similar consideration applies for a next assumption introduced for later use

$$\hat{f}' + \hat{x}\hat{f}'' + \mu \hat{G}_{ss} < 0 \quad (6)$$

provided $f' + xf'' < 0$ and noting $G_{xx} = G_{ss}$. The last inequality is Ruffin's supposition that short-run marginal revenue is steeper than the demand curve or that this marginal revenue decreases with entrants appearing. Finally we note that analog convexity arguments can be made for the KS Cournot analysis.

Given existing insights [4, 7, 9] we can be brief in interpreting the optimality conditions. The adjoint variable μ equals the current value that the firm imputes to a unitary change in the competitive fringe since with $V = \int_{t_0}^{\infty} e^{-rt} \pi dt$ and $\partial V / \partial s$ a variational derivative, one verifies that $\mu(t_0) = e^{rt_0} (\partial \hat{V} / \partial \hat{s})_{t=t_0}$. It can be shown that $\mu < 0$ for $t < \infty$, for instance using the method of proof spelled out by Jacquemin and Thisse [6]. Substituting (3) in (4) and integrating one

obtains $\mu(t) = - \int_t^{\infty} e^{-r(v-t)} [f(\hat{x}(v) + \hat{s}(v)) - C'(x(\hat{v})) + z(v)] dv$. The greater future monopoly power the more additional entry is valued negatively.

Condition (3) reflects that for $\hat{x} > 0$ the firm equates long-run marginal revenue $\hat{f} + \hat{x}\hat{f}' + \mu\hat{g}'\hat{f}'$ to marginal production cost $\hat{C}'$. With $g'=0$ the firm believes its impending efforts to be futile and the short-run optimality condition is found. It attempts to retard entry for $g' > 0$ and $t < \infty$, since in view of $\mu < 0$ and $\pi_{xx} < 0$ one finds easily that individual and industry output will be larger (industry price lower) than the short-run profit maximizing output (price).

3. Competitive and Chamberlinian Characteristics of the Stationary State.

Stationary values for the dominant firm industry, denoted by x^0, s^0 , and μ^0 , solve besides (3)

$$r\mu^0 - f'(x^0 + s^0)(x^0 + \mu^0 g'(0)) = 0 \quad (7)$$

$$f(x^0 + s^0) - \bar{p} = 0 \quad (8)$$

since in equilibrium $\dot{s}^0 = \dot{\mu}^0 = 0$.

To prove our main results two lemma's are relevant. The notation f^0, f'^0 and C'^0 indicates evaluation at the stationary values.

Lemma 1 : (i) $\mu^0 \leq 0$ as $x^0 \geq 0$, (ii) $f^0 - C'^0 = 0 \Rightarrow \mu^0 = 0$, (iii) $\mu^0 = 0 \Rightarrow f^0 - C'^0 \leq 0$.

Proof : (i) Compute from (7) $\mu^0 = x^0 f'^0 / (r - g'(0)f'^0)$ and note $g'(0) > 0$ and $f'^0 < 0$.

(ii) Let $f^0 - C'^0 = 0$, then either $x^0 > 0$ or $x^0 = 0$. Given $x^0 > 0$ and recalling (3) and (7) we see that $x^0 + \mu^0 g'(0) = 0$ and $\mu^0 = 0$ would have to hold simultaneously which is impossible. Therefore $x^0 = 0$ and also $\mu^0 = 0$ from (i). (iii) Immediate observing (i) and (3)

Lemma 2 : (i) $x^0 > 0 \Rightarrow f^0 - C'^0 > 0$, (ii) $f^0 - C'^0 \leq 0 \Rightarrow x^0 = 0$.

Proof : (i) Let $x^0 > 0$ and suppose to the contrary that $f^0 - C'^0 = 0$ or $f^0 - C'^0 < 0$. The for-

mer possibility is excluded by combining (i) and (ii) from lemma 1. With $f^0 - C'^0 < 0$ and $x^0 > 0$, substitute $f'^0(x^0 + \mu^0 g'(0)) = -(f^0 - C'^0)$ from (3) in (7) to obtain that $\mu^0 = -(f^0 - C'^0)/r > 0$. But $x^0 > 0$ implies $\mu^0 < 0$ according to lemma 1 (i). (ii) Is an obvious consequence of (i).

Defining an equilibrium competitive if and only if $f^0 = C'^0 = \min A^0$ (Ruffin), two theorems are proved which are the long-run editions for a dominant firm industry of Ruffin's short-run theorems.

Theorem 1 : If $A(x)$ is non-decreasing and $C'(0) = \min A$, then : (1) for $\bar{p} = \min A$ the equilibrium is competitive and $x^0 = 0$, (2) for $\bar{p} > \min A$ the equilibrium is non-competitive and $x^0 > 0$.

Proof : (1) Let $\bar{p} = C'(0) = A(0)$, $A'(x) = 0$ for $0 < x < a$ and $A'(x) > 0$ for $x > a$ with $0 < a < \infty$. It is sufficient to show that $x^0 = 0$. Envisage that $x^0 > 0$, then $C'^0 > \bar{p} = f^0$ contradicting lemma 2 (ii). (2) We only need to argue that $x^0 > 0$. With $x^0 = 0$ we have from (8) and lemma 1 that $\bar{p} = f^0 < C'(0) = \min A$, but $\bar{p} > \min A$ by supposition.

This result generalizes Gaskins' conclusions limited to constant average cost. The dominant firm with a cost advantage over potential entrants and non-decreasing average cost ($\bar{p} > \min A = C'(0)$) will in the stationary state produce a positive supply with price above marginal cost (recall lemma 2 (i)). For the equilibrium to be competitive with retarded entry and these production cost circumstances it is necessary, in contrast with unimpeded entry, that the limit price equals the free entry competitive price. This point does not emerge clearly from the KS analysis because they suppose that new entrants upon entry become indistinguishable from the earlier established Cournot firms [9, p.126]. Given an implicit assumption of perfect foresight on the side of prospective rivals it then only makes sense to treat established firms and potential entrants as identical,

and only the limiting case $x \rightarrow 0$ needs to be considered.

At this stage we may recall Jacquemin and Thisse's argument [6] that even with no cost advantage (and constant average cost) the competitive situation need not be reached when the firm can manipulate the size of rival output by buying established firms. Within this altered framework, however, it is unclear why with no cost disadvantages existing firms would be willing to yield their operations.

Our next theorem duplicates the unimpeded entry result, in accordance with KS' claim for a Cournot oligopoly discouraging entry.

Theorem 2 : If $A(x)$ is U-shaped so that $C'(0) > \min A$, then the equilibrium is non-competitive.

Proof : A competitive stationary state requires $\bar{p} = f^0 = \min A^0 = C'^0$, but this would mean that $x^0 > 0$ and therefore by lemma 2 (ii) that $f^0 > C'^0$ which is contradictory.

In the stationary state the dominant firm is operating with excess capacity ($A^0 > \min A$) even with a Harrod-type limit price (Harrod [5]) equal to the minimum of the U-shaped average cost curve ($\bar{p} = \min A$). In this last situation of no cost advantage over potential rivals the firm would be minimizing losses and given the assumed absence of fixed costs would be better off leaving the industry. Adding a non-negative profit constraint one can similarly infer that with a cost advantage the earlier corresponding conclusion of positive output and price above marginal cost still applies when economies of scale are present.

KS claim that for their model the stationary state with zero profits and a positive output displays the additional Chamberlinian characteristic of tangency between the (residual) demand curve and the average cost curve [2]. In the generalized Gaskins model this feature follows only for $g'(0) = 0$. Indeed for $\pi^0 = 0$ and $x^0 > 0$ we have from (3) and $C = xA$ that $x^0(f'^0 - A'^0) + \mu^0 g'(0)f'^0 = 0$ with $\mu^0 < 0$ by

lemma 1 (i) and $f'^0 < 0$ by assumption.

In the KS model a condition comparable to $g'(0)=0$ is satisfied (because at the stationary state $h(\bar{p})=0$ and by continuity of the first derivative of the hazard function h also $h'(\bar{p})=0$). We posited and proceed with $g'(0)>0$ for the following reasons. First, for both models neither of the boundary specifications seem to reveal further economic significance while $g'(0)=0$ (or $h'(\bar{p})=0$) excludes a linear specification of g (or h) unless the limit price equals zero. Second, this hair-splitting problem appears to have its origin in the assumption that price is the signal for prospective entrants rather than profit, since in the latter instance a pure Chamberlinian stationary state follows with either of the conditions. Indeed the equilibrium solution for model (2) with state equation $\dot{s}=g(\pi)$ (Pyatt [10]) is : $(1+\gamma g'(0))(f-A+x(f'-A'))=0$, $r\gamma - xf'(1+\gamma g'(0))=0$ and $\pi=x(f-A)=0$ with γ a current value adjoint variable. We only need to show that $(1+\gamma g'(0)) \neq 0$ and in fact $(1+\gamma g'(0))=0$ would require $\gamma=0$ with $x>0$ which is impossible regardless of the magnitude of $g'(0)$. It is unclear how, if at all, one can exclude current profit maximization in this modified situation so further discussion serves no purpose here. Moreover, as pointed out by Baron [1] and Kamien and Schwartz [8] there are objections against the profit- and arguments for the price-signal supposition.

Finally a comment on the relevance of the results obtained so far for a Cournot oligopoly. No conclusions are changed as long as n^0 stays finite (n^0 defined) but this is of course a problem for a stationary state with $x^0=0$ and symmetry of all Cournot firms (which is needed in any case for further analysis).

4. Stability and Quasi-Competitiveness.

In this section we seek conditions for which the equilibrium x^0 , μ^0 , s^0 is

stable and under which industry output will rise and the firm's output will shrink with an increase in the competitive fringe. Technically our task is to analyze the system of differential equations in μ and s , defined through (1) and (4) and observing (3) which implicitly defines a function $x=x(\mu,s)$ (recall (5)) with properties,

$$x_{\mu} = -g'f'/\Delta < 0 \quad (9)$$

$$x_s = -(f' + xf'' + \mu G_{ss})/\Delta < 0 \quad (10)$$

noting (5) and (6).

Constructing foundations for further analysis, let in accordance with (3) and (4) $\dot{\mu} = r\mu + f(x(\mu,s)+s) - C'(x(\mu,s)) + z\bar{1}(\mu,s)$ and $\dot{s} = g[f(x(\mu,s)+s) - \bar{p}] \equiv k(\mu,s)$. Compute using (9) and (10),

$$l_{\mu} = r + (f' - C'')x_{\mu} = (r\Delta - g'f'(f' - C''))/\Delta \quad (11)$$

$$l_s = f'(x_s + 1) - C''x_s = [f'^2 + C''(xf'' + \mu(g''f'^2 + g'f''))]/\Delta \quad (12)$$

$$k_{\mu} = g'f'x_{\mu} = -(g'f')^2/\Delta > 0 \quad (13)$$

$$k_s = g'f'(x_s + 1) = g'f'(f' - C'')/\Delta \quad (14)$$

Addressing the stability question first, we linearize the system $\dot{\mu}, \dot{s}$ around the equilibrium μ^0, s^0 ; $\dot{\mu} = l_{\mu}^0(\mu - \mu^0) + l_s^0(s - s^0)$ and $\dot{s} = k_{\mu}^0(\mu - \mu^0) + k_s^0(s - s^0)$. The corresponding characteristic roots are $\lambda_1 = r/2 - ((r/2)^2 + \theta^0)^{1/2}$ and $\lambda_2 = r/2 + ((r/2)^2 + \theta^0)^{1/2}$ where,

$$\theta = -(l_{\mu}k_s - k_{\mu}l_s) = g'f'(r(C'' - f') - C''g'f')/\Delta \quad (15)$$

With $\theta^0 > 0$, λ_1 and λ_2 are real and opposite of sign, hence non-decreasing marginal costs are sufficient for local stability of the stationary state. On the other hand stability ($\lim_{t \rightarrow \infty} \mu(t) = \mu^0, \lim_{t \rightarrow \infty} s(t) = s^0$) can be shown to imply $\lambda_1 < 0 < \lambda_2$ and thus $\theta^0 > 0$ (by a straightforward adaptation of similar formal arguments made by

Treadway [12, pp.338-340]). We thus find that in equilibrium the entry-retarding dominant firm must be operating with $(f' - C'') < 0$, a condition sufficient for short-run Cournot stability (Ruffin, pp.408-409). For our subsequent analysis to be meaningful we proceed under the stability postulate.

Turning to the quasi-competitiveness problem we first characterize the optimal solutions to μ and s with the aid of a phase diagram. Provided $f' - C'' < 0$ and $[f'^2 + C''(xf'' + \mu(g''f'^2 + g'f''))] > 0$ we obtain, noting earlier assumptions, (11) through (15) and stability, that : $d\mu/ds|_{\dot{\mu}=0} = -l_s/l_\mu > 0$, $\partial\dot{\mu}/\partial\mu|_{\dot{\mu}=0} > 0$, $d\mu/ds|_{\dot{s}=0} = -k_s/k_\mu > 0$, $\partial\dot{s}/\partial s|_{\dot{s}=0} = k_s < 0$ and $(d\mu/ds|_{\dot{\mu}=0} - d\mu/ds|_{\dot{s}=0})|_{\mu=\mu^0, s=s^0} = -\theta^0/l_\mu^0 k_\mu^0 < 0$. The following diagram (Fig 1) can now be constructed for $\mu^0 < 0$ ($x^0 > 0$), the relevant structure is unaltered for $\mu^0 = 0$ ($x^0 = 0$). Observe that in view of the inequalities found above $\dot{\mu}=0$ must cut $\dot{s}=0$ from above and only once and that the changes in slopes are not claimed (nor used subsequently).

Figure 1

sufficient but also necessary. Industry output increases with both free and discouraged entry when 1°) $C''=0$ and $g''=0$ (Gaskins, KS), 2°) $C''\geq 0$ and $f''=g''=0$. In these situations industry price drops towards the limit price as the competitive fringe grows.

Indeed, for $s < s^0$ we have $\mu_s = 1/g$ and from (18) that $\text{sign}(dQ/ds) = -\text{sign}(f'(g - lg') - C'')$. Along the optimal trajectory $\hat{\mu} = \mu(\hat{s})$ we envisage $(g - lg')$ as a function of s alone with the property that $(g - lg')|_{s=s^0} = 0$ by definition of the stationary state. But $d(g - lg')/ds = (-rg'\mu_s + g'C''(dx/ds)) < 0$ for $s = \hat{s} < s^0$ since given the suppositions $\hat{\mu}_s > 0$ and $(d\hat{x}/d\hat{s}) < 0$ by (16) and (17). Hence $(g - lg') > 0$ and also $(dQ/ds) > 0$ for $s = \hat{s} < s^0$. We did not succeed in showing the validity of this prediction for $C''=0$ and $g'' \neq 0$. This could be argued when $d^2\hat{\mu}/d\hat{s}^2$ were not to change sign (because the sign of (dQ/ds) depends on the difference of the slopes of $\hat{\mu}_s$ and $d\mu/ds|_{\hat{s}=0}$, while $d^2\mu/ds^2|_{\hat{s}=0} = C'''/g'f'$) or when $(f' + xf'' + \mu(g''f'^2 + g'f'')) > 0$ noting (17) and $Q = x + s$.

The analysis of this section can also be conducted for a Cournot oligopoly with independent identical output decisions of a finite number of firms at each moment in time, since then the corresponding system of differential equations is autonomous and defined. We hinted already earlier that a possible infinite number of firms in the stationary state constitutes a technical problem. Apart from this, the phase diagram arguments become a different story anyway and also on this basis it is not clear whether our conclusions still apply for such a Cournot situation.

The limited results of KS' quasi-competitive analysis originate in another reason. In their approach the post-entry behaviour of entrants and established firms is unspecified and consequently it is applicable to both a Cournot and a dominant firm industry. It should therefore be possible to duplicate our results by exploring the dynamic programming part of their analysis. One can view loosely

our control theoretic work as one way of achieving this with each moment in time in the (generalized) Gaskins model corresponding to a pre-entry period in the KS model. While this view is unprecise because of the uncertainty in this last model, we doubt whether this aspect would alter any of our inferences.

Of more interest perhaps is the question as to whether any changes occur for industries where there is an entry lag between a rival's decision to enter and its appearance as an entrant, due to the time needed to plan and prepare new operations. The absence of such a lag is implicit in the assumption that entry is attracted by current industry price, though entry is not immediate because of other non-price barriers to entry. We have argued elsewhere [3] that predictions (of KS [7], Gaskins [4] and others) on the effects of these barriers on industry price at a given time may be reversed in the presence of an entry lag. An exploration of the consequences of such a lag for the effects of entry falls outside the scope of this paper and can be expected to enhance serious technical problems with the application of optimal control theory. Still it seems worthwhile to report that one can show, with the aid of an adapted KS limit pricing model (formulated in my earlier paper), that also in the presence of a positive finite entry lag industry price will drop with retarded entry when there are no scale economies and the conditional probability of entry is linearly dependent on constant industry price (or on the divergence between this price and marginal cost).

5. Summary.

We focused on the effects of retarded versus unimpeded entry for a dominant firm industry using a generalized Gaskins model to allow for scale effects and nonlinear dependence of the rate of entry on the difference between current in-

dustry price and a constant limit price.

With regard to the stationary state we found that entry retarding modifies free entry conclusions only if the firm has a cost advantage over potential entrants. The industry will eventually converge to a competitive situation if and only if there are no scale economies and the dominant firm - ultimately leaving the market - has no cost advantage over prospective rivals. With a cost advantage the firm produces in equilibrium a positive output at excess capacity with price above marginal cost (given non-negative profits in the presence of economies of scale). It was argued that a Chamberlinian equilibrium is only attained with a seemingly uninteresting corner condition which becomes irrelevant in this regard with entry dependent on current profits rather than price.

Stability of the stationary state was argued to be assured with non-decreasing marginal cost and to require the condition $(f' - C'') < 0$. Finally we identified a number of situations, limited to circumstances with no scale economies, for which individual firm and industry output respectively decreases and expands with both unimpeded and retarded entry.

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