The Contestability Paradigm in the Presence of Vertical Differentiation. Efficiency Evaluation of a Natural Oligopoly.*

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Abstract

This paper addresses the link between Contestable Markets and Natural Oligopolies, both considered as a reinterpretation of Bertrand's Competition. A market with ex ante uncertainty as regards to technology is outlined. Technological uncertainty is solved by a pioneer entering the market with a high quality product. The high quality choice is a precommitment that affects market's ex post contestability degree, which becomes endogenous; moreover, interacting with consumers' preferences about quality, this choice creates a barrier to entry. Thus, in a pure vertical differentiation case, and assumed that the cost curve is flat enough, the number of firms enjoying positive market shares and positive profits turns out to be limited. This outcome seems to hold in the presence of experience goods as well, although here consumers may prefer to buy from entrants if good's desirability is high.

The model also suggests the possibility of an efficiency evaluation of an oligopoly with vertically differentiated products, in terms of a tradeoff between price and quality or variety.

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1. Introduction

The Contestability Theory may be considered as a rediscovery of the classic concept of competition, revisited under a perspective *à la Bertrand.*[1]

The distinctive feature of the contestability approach is to be identified in the fact that potential freedom of entry is flanked by specific conditions (no sunk costs and possible supernormal profits) that render such entry attractive and, thus, effective. This leads the market to reach an efficient configuration.

Thus, Contestability looks like a reference paradigm as regards to efficiency and welfare, and this holds for oligopolistic and monopolistic outcomes as well.

When natural oligopolies are taken into consideration, the Bertrand strategy in prices is coupled to competition in quality, which radically modifies the outcome reached by such a model.[2]

In this sense, the Natural Oligopoly Theory might be seen as a possible solution to the Bertrand paradox.[3]

Thus, both approaches may be seen as a reinterpretation of Bertrand's competition; yet, while the first gravitates around the pole of perfect competition, the latter reaches the monopolistic outcomes implicitly brought about by a price strategy *à la Bertrand.*

The aim of this paper is to integrate these perspectives. This amounts to saying that we must put into question the robustness of contestability as against a particular class of oligopolies and, at the same time, the reliability of the criteria usually adopted to assess the efficiency and

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1. Baumol (1982); Baumol, Panzar and Willig (1982).

2. Shaked and Sutton (1982, 1983, 1987); Sutton (1986).

3. For an assessment of Bertrand's oligopoly, see Friedman (1977, ch.3).

the social welfare (i.e., the desirability) of a specific market configuration.

We may first ask ourselves if the contestability concept can resist to structural changes that may be extremely far from any technological consideration. In other words, technological contestability is a **necessary** condition to effective contestability; the question now is: is it also (and always) a **sufficient** condition? And, if not, how does the market look like?

Within the Contestability Theory, the existence of entry barriers is linked to the presence of capital specificity and sunk costs; moreover, possible scope economies induce firms to enter contiguous industries, leaving completely out of consideration these industries' structure.

Thus, we have to investigate the changes induced in this framework by the introduction of the following elements:

(a) uncertainty (ex ante, about market's contestability);

(b) vertical (i.e., quality) differentiation;[4]

(c) first mover advantage.

We will try to show that market's actual contestability cannot be assured by cost considerations alone. The observed outcome, in terms of market form, depends heavily on qualitative as well as informational issues we just mentioned, combined with demand conditions - that is, the preference structure and the income distribution assumed for consumers.

The basic idea we will refer to, firstly developed by Shaked and Sutton (1982, 1983, 1987) and Sutton (1986), is that if we quit the horizontal differentiation model to adopt a vertical differentiation one, the 'atomistic' or fragmented outcome reached by Hotelling (1929) may be

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4. The concept of 'quality' has been widely discussed. In a pure horizontal differentiation context, if we conceive a particular good as a bundle of characteristics, that good will be preferred because of a specific feature that the others haven't (Lancaster, 1979). This meaning of 'quality' is linked to the heterogeneity of consumers' preferences, while in case of vertical differentiation preferences are homogeneous (cfr. assumption 1 below).

invalidated.

On the contrary, vertical differentiation would yield a natural oligopoly in which a very small number of firms (possibly two) make positive profits by selling a superior quality good,[5] even though they don't necessarily control a large market share.

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5. By this, we mean that, *ceteris paribus*, a personal computer with the very same functions of any PC, is better if it works faster; the quality of a camera is higher if its lenses are manufactured with superior glasses, etc., even if it 'does the same things' that any other camera can do.

2. The model

Let's consider an 'empty' market, roughly speaking, a market that is only 'potential'. In activating it, firms are nonetheless conditioned by ex ante uncertainty on the cost side, while they know what the behaviour of demand is (i.e., consumers' preferences and income distribution are known).

Thus, we have to imagine a firm acting as a 'pioneer' to identify such technological (cost) conditions. Let us assume that the market shows ex post perfect contestability, which means that other producers may enter the market with positive (expected) profit.

At time t_1, we can describe this market as follows:

$$X_T \gg x_i \geq 0 \qquad (1$$

$$x_i = f^{-1}(p_i) \qquad (2$$

$$p_i x_i - c(x_i) \geq 0 \qquad (3$$

$$\exists \quad p_e \leq p_i \quad \wedge \quad x_e \leq X_T - x_i \quad \ni \quad x_e p_e - c(x_e) \geq 0 \qquad (4$$

$$t_i > \tau_e. \qquad (5$$

Subscripts i and e are respectively referred to the pioneer, which actually becomes incumbent, and to a potential entrant; X_T is the whole supply for the industry in perfect competition; t_i is the time the incumbent takes to react to new entries by lowering his/her price;

τ_e is the time period during which the entrant's costs are sunk.

Condition (1) shows the quantity supplied by the pioneer; condition (2) says that this supply is totally sold. By (3), we know that incumbent's profits are non negative. Condition (4) states that there exists a pair (q_e, p_e) such to yield non negative profits to an entrant. At last, condition (5) states that the entrant can get these profits adopting a hit-and-run strategy, and quit the market before the incumbent's reaction.[6]

Let's now assume that product quality, q, is defined over the closed interval $[L, H]$, $L > 0$, and that consumers' preferences are synthesized by a parameter θ_q - defined over the closed interval $[\theta_L, \theta_H]$ - increasing in income and uniformly distributed across the population between $\theta_L > 0$ and $\theta_H = \theta_L + 1$.[7] The expression $\theta_q q$ turns consumers' preferences into money values.

For reasons that will be clear later on, we shall now make the following basic assumptions:

ASSUMPTION 1: every individual ranks the existing goods in the same order, that is: $q_H > q_{H-\delta} > \ldots q_{L+\delta} > q_L$. This amounts to saying that preferences are homogeneous across consumers: prices and income being equal, every consumer would buy the same product, i.e., the top one.

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6. Labelled the sunk costs as σ, we could assume $\sigma = 0$. We prefer, however, the formulation given in the text, since the definition itself of 'sunk costs' implies a temporal dimension.

7. This is the same morphology assumed by Gabszewicz and Thisse (1979, 1980) and subsequently by Shaked and Sutton (1982, 1983). The assumptions made about parameter θ hide an analogous assumption about income distribution: income y is defined over the interval $0 < a \leq y \leq b$, with total density equal to 1, and is uniformly increasing over the population of consumers.

ASSUMPTION 2: let $F(q)$ be the level of fixed costs. For $q \in [L,H]$, we have $F(q)>0$, $F'(q)>0$ and $F''(q)<0$. This states that there exists an upper bound to fixed costs.[8]

ASSUMPTION 3: every increase in product quality will turn into increased sales. Formally:

$$\theta_q q = c_q + \varepsilon, \quad \forall q \neq L, \quad \varepsilon > 0, \tag{6}$$

while for $q = L$, we have $\theta_L L = c_L$. This is the crucial hypothesis: the increase in unit variable costs due to an increase in quality is strictly less than the marginal evaluation, i.e., the marginal willingness to pay for quality by the richest consumer. This seems to provide the strongest incentive to produce a high-quality good.

Thus, although in a preliminary way, we stress the interaction between cost conditions on the supply side and willingness to pay by the public on the demand side; this leads to think that there should be a 'move' by which a firm could achieve a permanent market share and positive profits of monopolistic flavour, without paying any attention to competitors' prices.

Let us finally assume that the pioneer chooses to enter on a small scale (condition (1)), selling a high-quality product,[9] indeed, the highest: $q_i = H$. This choice relies on q's **immediate observability** by consumers; thus, it testifies pioneer's honesty, since it signals

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8. Or that they are 'short-tailed' (Sutton, 1986).

9. This implicitly means to assume that a) vertical differentiation deals strictly with the intensity of a certain characteristic (that is, the product at stake remains horizontally homogeneous with the others); and b) any quality increase doesn't involve sunk costs (even though it involves an increase in fixed costs - cfr. assumption 2 above).

his/her intention to stay in the market for long. The quality choice is assumed to be fixed.[10]

Let U be the consumer's utility function; assume he can choose between a) buying a single unit of product from the seller or b) not buying. His utility will be, respectively: $U = \theta_q q - p, \quad U = 0.$

Being q immediately observable, the consumer will buy if the price yields him/her a positive net surplus:

$$U = \theta_q q - p_i > 0. \tag{7}$$

The above condition is satisfied by (6); thus we obtain the following:

$$U = \theta_H H - p_i = \varepsilon/2 > 0, \tag{8}$$

and:

$$p_i = \theta_H H - \varepsilon/2. \tag{9}$$

Pioneer's profit amounts to:

$$\pi_i = \theta_H H - \varepsilon/2 - c_H \tag{10}$$

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10. This is the *extrapolability hypothesis* introduced by von Weizsäcker (1980), which states that the quality chosen in the first period is a signal of the quality to be supplied in the future. Since the definition of q involves an immediate positive fixed cost, there is no incentive to riduce it later on; on the other hand, if there is a reputation-effect and if this effect relies on the first period performance, there isn't either incentive to increase quality in the subsequent periods. The meaning of this latter statement will become clearer in section 4.

and, since:

$$c_H = \theta_H H - \varepsilon, \qquad (11$$

we have:

$$\pi_i = \varepsilon/2. \qquad (12$$

This means that the pioneer, producing $x_i = X_T/n, \quad n > 2,$ and selling at $p_i = c_H + \varepsilon/2$, will make a profit $\pi_i = \varepsilon/2$.

At the end of the first period, potential competitors face the perspective of an 'unfulfilled demand' equal to $X_T - X_T/n$, or $\left(\frac{n-1}{n}\right)X_T$, to be satisfied at a price that seemingly allows positive profits. However, the heart of the matter is the choice of q; the entrant faces three alternatives:

1) a contestable stragegy: he/she can sell a good of quality $q_e = L$, on a large scale: $x_e = mx_i, \quad 1 \ll m < (n-1)$, at a price $c_L < p_e < p_i$.

Unfortunately, this is not a feasible strategy, given consumers' preferences and the immediate observability of q. Consumers, rationally suspicious about the likely adoption of a hit-and-run strategy by the entrant, won't buy a good of quality L if its price is higher than $p_e = \theta_L L = c_L$. Thus, there won't even be a war of attrition,[11] avoided by the entry barrier consisting in the interaction between preferences and quality choice.

2) a pure strategy *à la Sutton*: from period t_2 we won't talk about contestability any longer.

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11. Cfr. Fudenberg and Tirole (1986, 1987).

3) a perfectly competitive strategy: the entrant can sell a standard-quality product (L), at the price $p_e = c_L$. But, since he/she has the chance (2) above, he/she won't behave this way.

3. From Contestability to Natural Oligopolies

In this section, we will investigate the market outcome implied by alternative (2) mentioned above. That is, we assume that the entrant engages a competition in quality and prices with the entrant.

At the turn of the second period, instant t_2, the entrant supplies a good of quality $q_e = h = H - \delta, \quad 0 < \delta < H - L$. The reason is quite simple: should he/she choose quality H, we wuold observe a case of competition with homogeneous products, which would finally yield zero profit for both competitors.[12]

Let us assume, for the sake of simplicity, that the difference between c_L and c_H is small enough, so that we can consider the same value of c for both suppliers.[13]

The final configuration of the market is the outcome of a competition we can describe as a multistage non cooperative game, each stage to be solved looking for the Nash Equilibrium in the relevant variable. In the first stage, firms have to choose whether or not to enter the market. At the second, once they have checked the number of firms actually present, they face the option regarding the kind of good to be supplied, that is, the quality choice. Then, having observed its rivals' qualities, at the third stage each firm has to choose its own price. The solution of a sequence like this, if it exists, is a Perfect Equilibrium for the game.[14] Here, we

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12. The least-differentiation choice would then turn out in a 'Bertrand paradox'. Moreover, given the incumbent's choice, the entrant is compelled to reply 'from below'. This, in our simple model, is a consequence of the hypothesis that q is bounded above. For the general case in which $q \in [0, \infty)$, see the Appendix.

13. If the cost curve is effectively 'short-tailed', this last assumption doesn't look unreasonable.

14. More formally, we say that an n-tuple of strategies is a Perfect Equilibrium in the game if, after any stage, the part of the firms' strategies pertaining to the game consisting of the remaining stages, forms a Nash Equilibrium for that game (cfr. Selten, 1975).

will proceed as usual by backward induction.

Consumers will be indifferent between the two products (the incumbent's and the entrant's) if and only if the following condition is verified:[15]

$$\theta_H H - p_i = \theta_h h - p_e. \qquad (13$$

Market demands for the two goods will be respectively:[16]

$$x_i(\hat{p}) = \theta_H - \left(\frac{\Delta p}{\delta}\right), \qquad (14$$

$$x_e(\hat{p}) = \left(\frac{\Delta p}{\delta}\right) - \theta_L. \qquad (15$$

In order to reach the Nash Equilibrium, each firm is required to:

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15. Cfr. Tirole (1988, p.296).

16. If a good of quality q is supplied at a price p, demand will consist of the consumers whose preferences are such that $\theta_q q \geq p$. If N is the total number of consumers, we have:

$$x(p) = N[1 - F(p/q)].$$

With several differentiated goods, every consumer shall decide not only **whether or not** to buy, but also **which** good to buy. Our case shows the most interesting situation, in which there is no *dominant* good. In fact, given $p_1 > p_2 \wedge q_1 > q_2$, the consumers whose preferences are such that $\tilde{\theta} \geq (p_1 - p_2)/(q_1 - q_2)$ will buy good 1, while those consumers whose preferences are such that $p_2/q_2 < \theta < \tilde{\theta}$ will buy good 2. The remaining consumers won't buy at all. Thus, the demanded quantities will be:

$$x_1(\hat{p}) = N[1 - F((p_1 - p_2)/(q_1 - q_2))],$$

$$x_2(\hat{p}) = N[F((p_1 - p_2)/(q_1 - q_2)) - F(p_2/q_2)].$$

$$\max_{p_j} \quad (p_j - c)x_j, \quad j = i, e. \tag{16}$$

Thus, the incumbent's objective function is:

$$\max_{p_i} \quad (p_i - c)\left[\theta_H - \frac{p_i - p_e}{\delta}\right]; \tag{17}$$

and the entrant's:

$$\max_{p_e} \quad (p_e - c)\left[\frac{p_i - p_e}{\delta} - \theta_L\right]. \tag{18}$$

The first order conditions are:

$$\delta\theta_H - 2p_i + p_e + c = 0; \tag{19}$$

$$p_i - 2p_e - \delta\theta_L + c = 0. \tag{20}$$

And the respective reaction functions will be:

$$p_i = R_i(p_e) = (p_e + c + \delta\theta_H)/2; \tag{21}$$

$$p_e = R_e(p_i) = (p_i + c - \delta\theta_L)/2. \tag{22}$$

The Nash Equilibrium in prices requires:

$$p_e^e = c + (\theta_H - 2\theta_L)\frac{\delta}{3} \qquad (23$$

and:

$$p_i^e = c + (2\theta_H - \theta_L)\frac{\delta}{3} > p_e^e, \qquad (24$$

where the apex 'e' denotes the equilibrium values. The quantities sold at equilibrium will be:

$$x_e^e = \frac{\theta_H - 2\theta_L}{3} \qquad (25$$

and:

$$x_i^e = \frac{2\theta_H - \theta_L}{3}; \qquad (26$$

and the profits:

$$\pi_i = (2\theta_H - \theta_L)^2\delta/9; \qquad (27$$

$$\pi_e = (\theta_H - 2\theta_L)^2\delta/9; \quad (28$$

$$\pi_i > \pi_e > 0. \quad (29$$

Let's summarize the results: the higher-quality supplier is allowed to set a higher price, this way making higher profits. This is not, however, the end of the story: since $\pi = \pi(\delta)$, both firms will gain from differentiation, as in the horizontal model *à la Hotelling*. Hence, the logical consequence is that the entrant will locate himself as close to the lower bound of the quality range as possible, even though, by virtue of the hypotheses adopted, he/she cannot reach the value L.[17]

Moreover, given the structure of the model, two is the largest number of firms enjoying positive profits by selling differentiated goods. This is the so-called ***finiteness property***.[18] New entrants would be compelled to behave as perfect competitors, selling a homogeneous good of standard quality L, at a price equal to marginal cost.

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17. "This suggests the possibility, in real time, of both firms trying to be first. To describe such a preemptition game, one wuold introduce a (possibly time-decreasing) cost of introducing each quality, and possibly a rate of growth of demand (formalized, for instance, by the rate of growth of the density of consumers). The firms then would face a tradeoff between obtaining a leadership position (i.e., occupying the most profitable niche) and introducing the good too early" (Tirole, 1988, p.297). The cost which Tirole refers to, in the present model, may be identified in the initial uncertainty that the pioneer must solve.

18. Shaked and Sutton (1982, 1983).

4. Experience goods

Let's now take into consideration the case of *experience goods*, in the sense introduced by Nelson (1970): by experience good we denote a good whose quality is unobservable at the time of purchase, though observable after the buyer has used it for a while.

This assumption is in itself far from the contestability domain. Nevertheless, and although it may seem a paradox, we are now going to show that in such a case contestability may work, if some specific conditions are satisfied.

Let's first investigate the position of the pioneer, and let's suppose he/she sets a 'fair' price, according to the above surplus-rule. At the time of entry, he/she faces the only barrier represented by consumers' rational distrust: quality being unobservable, the public can't assess the surplus supplied by the firm. One could think however that at least a part of the public (possibly, but not necessarily, the richest) chooses to buy, acting as a pioneer on the demand side. It is also reasonable to think that the quantity actually sold isn't enough to cover the costs[19] (strictly speaking, we may say that the uncovered cost share is provisionally sunk). Assuming that the time period needed to verify the quality of x_i is less than t, and that informations spread instantaneously across consumers, at the end of the first period **every** consumer will be aware of the quality supplied by the incumbent. In other words, the first-round buyers exert a positive externality over the remaining consumers.[20]

Furthermore, as the pioneer has borne the burden of creating the market, it seems reasonable to assume that he/she is determined to stay in the market for more than one period. This represents an incentive to honesty, i.e., to supply $q_i = H$. This choice allows him/her to enjoy

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19. This is a patent violation of condition (2), which states that 'the quantity supplied by the pioneer is completely and immediately sold'.

20. Salop (1977), Salop and Stiglitz (1977).

a positive market share and positive profits at least starting from the second period, and yields him/her an indirect weapon against possible 'contestable entry'.[21]

Indeed, even assuming that $t > \tau$, what really matters is that the reaction by the public takes place with a lag shorter than t, so that, although the incombent is unable to react quickly to entry, the reputation he/she has gained among the public will become a barrier to entry (so to speak, reputation yields him/her a rent). If every consumer waits for the events and doesn't buy from entrants, the hit-and-run strategy is doomed to failure, even in the absence of switching costs.

In that case, one could assume that an entrant adopting a contestable strategy would produce on large scale a standardized good at a price slightly lower than the incumbent's. But, if the public infers quality from quantity, then a large scale production will be associated to low quality. Furthermore, consumers' rationality will induce them to suspect that the relationship between quality and price associated to the entrant's good isn't such to yield a 'fair' surplus. Hence, we observe a problem of **moral hazard** on the supply side.[22]

If the quality choosen by the incumbent is high, this very fact builds up a barrier to entry such that market's contestability disappears. As for him/her, the entrant faces a paradoxical situation. Assume he/she can choose between:

(a) entering the market on a small scale, selling a good of quality $h_1 = H - \delta$, δ arbitrarily small, or

(b) exploiting possible economies of scale, selling a good whose quality is $h_2 \ll H$.

The latter can be so small that no consumer is willing to buy at a price higher than unit cost;

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21. We could also adopt the opposite perspective: during the first period, the pioneer is actually a monopolist; hence, he/she will supply a high-quality good **if and only if** he/she can set a price high enough. This is because a high price will signal high quality to uninformed consumers, given the impossibility of quality discrimination by the producer.

22. For a deeper analysis, see Farrell (1986). The analogy with the market for lemons described by Akerlof (1970) is striking, but nevertheless incomplete: if the idea of 'lemon' refers to the quality-price ratio of a good, it is also true that, in the present context, low quality doesn't necessarily mean 'lemon'.

thus, if this is indeed the entrant's strategy, he/she is forced to quit the market before the start of the second period, in which his/her profit would be zero anyway.

This leads to conclude that honesty isn't necessarily an optimal strategy for the entrant, if he/she is determined to 'hit-and-run'; if, in other words, he/she doesn't expect to make any profit in the subsequent periods (since he/she will quit at the end of the first, to avoid the incumbent's reaction). As a consequence, if consumers are rationally suspicious - as they are, given that the product is an experience good - entry is blocked.

The entrant can't make any profit out of quality, because it isn't immediately observable; and he/she won't stay in the market for more than one period. Thus, since he/she bears the cost of producing a high-quality good without drawing any gain, he/she won't produce it at all.

In other words, the hit-and-run strategy doesn't get along with the only feasible solution, which consists in sacrifying current profits to acquire a market share.

On the other hand, an honest incumbent faces a less severe problem of moral hazard, and the intrinsic reluctance showed by the public yields him/her concrete long-term advantages in term of reputation and barriers to entry.

As a consequence, it seems reasonable to state that the technological contestability of a market can be eliminated by the interaction between preferences and cost structure, or by simple (and neglected) considerations about consumer's tastes, non-technological characteristics of the supplied good and producer's reputation.

We want now to suggest a situation in which contestability works, i.e., the hit-and-run strategy may be successful. This is the case if the use the good is conceived for is such that the purchase seems unavoidable, no matter what the surplus is, with the only condition that the price must be so low to appeal to those consumers with a low value of parameter θ. Thus, although unable to understand whether the terms offered by the producer are fair or not (i.e., whether $U_e > 0$), the consumers 'desire' that good to such an extent that, observing $p_e < p_i$,

they are induced to buy x_e simply because they can't afford to buy x_i.

They could also be induced to make the (wrong) conjecture that a low price signals a high quality, or that it represents an introductory offer. Without any specific information, the entrant can make them believe that he/she is determined to stay in the market for a long time, selling a high-quality good, and that he/she is willing to set a low initial price to testify his/her intention. The (conjectured) price strategy becomes fundamental, to the extent that consumers now take no longer into account quantity but price as a signal of quality.

5. Conclusions

Vertical Differentiation and Efficiency in an Oligopolistic Market

The aim of the paper was to point out the link between the market configuration associated to Contestability Theory and what we know under the heading of Natural Oligopoly, which can be characterized as the result of the vertical differentiation hypothesis. And this without questioning the technological (cost) conditions which the contestability of a market relies on.

The model proposed describes the market outcome observed under the assumption of ex ante technological uncertainty. The latter is eliminated by a pioneer, the first producer that enters the market with a high-quality good. This represents a precommitment which endogenizes market's contestability degree, affecting the choices made by later entrants.[23]

Assuming pure vertical differentiation, and a cost curve flat enough, we observe that the number of firms enjoying positive profits at equilibrium turns out to be limited. The only feasible alternative to differentiation is standardization in both quality (low) and strategy (permanent and perfectly competitive).

This certainly amounts to a market failure, but the analogy with the market failure observed in the case of lemons is impossible, since the perspective is reversed. In the model suggested in this paper, the lemons disappear from the market, because of the same problem of moral hazard outlined by Akerlof (1970). We may also say that the market works; in fact, contestability is the only one to fail.

These conclusions seem to hold in presence of experience goods as well. In this case, indeed, we can obtain even stronger results because, given a strong distrust of entrants by the public,

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23. For an analysis of the possible precommitments affecting market's contestability on the technological side, see Appelbaum and Lim (1985).

the only feasible way to overcome entry barriers is to adopt the same honest strategy chosen by the pioneer, but for a lower quality. There is, however, a possible exception: the entrant may cheat consumers, given that their rationality is bounded and that the good's desirability is high.

Another relevant matter emphasized by the model is the assessment of an oligopolistic market with vertical differentiated products in terms of efficiency.

The existing literature on the subject often stresses the inefficiency of both monopolistic competition and oligopoly, but this stand neglects the benefits for consumers resulting from differentiation.

In doing so, indeed, it is omitted the fact that consumers won't simply be better off purchasing larger quantities of a homogeneous product at a lower price, since this means that they must give up a wider variety. As a result, the net effect on welfare is undeterminate.

Hence, given that the conditions regarding costs and preferences are satisfied, it seems reasonable to argue that consumers are better off in the presence of vertical differentiation rather than in a 'pure' contestable configuration, and this without causing firms to be worse off.

In this sense, the kernel of this model lies in the tradeoff between cost and quality or variety, because variety allows consumers to obtain a good which is closer to their desires, and this against a reasonably limited increase in cost and price.

Furthermore, the inefficiency of a monopolistic market involves the qualitative side, since the monopolist has to give up a (socially preferred) higher quality to reach the optimum, because the marginal willingness to pay for quality by the marginal consumer is lower than the one associated to consumers with a higher θ. Hence, from the point of view of the latter, and given the impossibility of quality discrimination, the quality supplied by the monopolist is **suboptimal**. Yet, it is not clear whether or not this quality is actually lower than that observed in a social planning (competitive) case. This is because, since the monopoly price is higher, a

monopolist is able to reach consumers with a higher θ.

The oligopolistic configuration suggested by our model seems to provide new insights. The idea that the outcome of the competition between incumbent and entrants is the supply of vertically differentiated goods at prices linked to both cost structure and consumers' preferences and income is quite appealing and still widely unexplored.

APPENDIX: the finiteness property

It is reasonable to assume[24] that:

a) for any pair $(h_i > h_j)$, $R(h_i, h_j) > R(h_j, h_i)$;

b) the revenues of both firms increase as the quality of the better good increases: $R_{h_i} > 0$.

Let's now assume that firm 1 chooses quality h_1. Then, in the range $[L, h_1]$, firm 2 chooses that level of quality which maximizes its revenues, $R(h_2, h_1)$. Since this function is coninuous in h_2, it follows that for any h_1 it takes a maximum over h_2 in the closed interval $[L, h_1]$. Furthermore, this will be attained for $L < h_2 < h_1$, because $h_2 = h_1 \Rightarrow R(h_2, h_1) = R(h_1, h_2) = 0$.

Thus, we can define the set of optimal replies from below as follows:

$$\rho(h_1) = \{h_2 \quad \ni \quad R(h_2, h_1) = \max R(h_j, h_1); \quad L \leq h_j \leq h_1\}.$$

We have now to show that h_1 is optimal for firm 1, given that firm 2 has already choosen h_2. Hence, let's assume that firm 1 chooses h^1, $L \leq h^1 \leq h_2$. This yields:

$$R(h^1, h_2) \leq R(h^1, h_1),$$

by assumption (b); but:

$$R(h^1, h_1) \leq R(h_2, h_1),$$

since $h_2 \in \rho(h_1)$; and:

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24. For a formal proof, see Shaked and Sutton (1982).

$$R(h_2, h_1) \leq R(h_1, h_2),$$

by assumption (a). Hence:

$$R(h^1, h_2) \leq R(h_1, h_2), \qquad Q.E.D.$$

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