**Consumers and Competition**


Michael Waterson


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# Consumers and Competition[1]

## Michael Waterson

### University of Warwick

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### Abstract

This paper shows that even if all consumers face search costs, if these are below a certain level dependent upon the firm numbers and demand elasticity, the Diamond-type equilibrium with all prices at the monopoly level fails to exist.

Correspondence to

Professor Michael Waterson
Department of Economics
University of Warwick
Coventry
CV4 7AL
UK
Telephone +44 2476 523427
Fax +44 2476 523032
Email: michael.waterson@warwick.ac.uk

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**Consumers and Competition**


**Introduction**


The purpose of this paper is to demonstrate in the simplest terms possible, how consumer behaviour has a vitally important role to play in the competitiveness of a market. We first note (Proposition 1) that if every consumer searches only once, the optimal price is at monopoly level. We then show a novel proposition (Proposition 2) that relates to a significant body of existing work. It is that once search costs are below a certain level, then *even if all consumers face positive search costs*, it will be worthwhile those consumers searching and as a consequence, there will be no equilibrium with price at the monopoly level. A larger number of firms, and a more elastic industry demand, make this outcome more likely. Thus consumer beliefs are important; if consumers believe it is not worthwhile searching, it will not be worthwhile, whereas if they consider searching to be worthwhile, it may well be so. This relates to what is commonly called the Diamond Paradox, and the paper shows that the paradox is sometimes overstated.


The next section contains the basic analysis, the propositions and a corollary. Following that, short sections contain some discussion of the result and a brief illustrative example.


**Analysis**


Consider a market in which there is a continuum of risk-neutral potential consumers, indexed i, with mass N, each of whom has a different reservation price $p_i$ for the product, such that their demand is:

$q_i = 1, \ p \ \pounds \ p_i$

$q_i = 0, \ p > p_i$

This gives rise to an aggregate demand curve $Q = f(p), \quad f \pounds < 0$. Consumers have a constant cost per search[2], $s$.

There are $n$-1 (>2) firms, with constant marginal costs, $c$. Firms maximise profit ($\Pi_i$) and are risk neutral. Consumers allocate themselves randomly to one firm. More formally,

**A1**: Each new consumer searches only once for a price and purchases the product if the price is below his/ her reservation value.

Then we have

**Proposition 1**: In a market with zero/ one demand by individual consumers and constant marginal cost of production, if each consumer searches only one firm prior to the purchase decision, the pricing outcome is at the monopoly level, regardless of the number of firms in the market.

**Proof:**

Obvious since $\max_p \Pi_i(p)$ and $\max_p \Pi_i(p)/(n-1)$ have the same solution, namely that the optimal price $p^*$ is given by

$$p^* = p_m = c/(1\text{-}1/\varepsilon) \tag{1}$$

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[2] Since a consumer clearly must search at least once, we adopt the convention that the first search is absorbed into the price of the product.

where ε is the own price elasticity of demand (written as a positive number), so $p_m$ is the monopoly price.

This is the normal monopoly margin equation. Clearly, no firm has an incentive to raise price above the monopoly level. Nor has it an incentive to lower price, since it will not attract additional consumers from other firms, under A1. The result is a simplified version of Diamond (1971) and also a limiting case of the "sluggish consumer" in Hehenkamp (2002). There is an interesting implication, namely that if everyone believes that search is not worthwhile because the competitive process works[3], then it does not work.

The assumption that each consumer searches only once is of course a significant limitation. Therefore we now extend the game, to three periods, in the following manner. Firms set price in each period, prior to demand being revealed. The first period is identical to the game above. In the second period, a new firm (E) enters and decides its pricing policy, based upon the fact that consumers may indulge in further search as in A2 below. In period 3, based upon their experience in period 2, existing firms may react to the new firm's price; price-cutting is punished by retaliatory price-matching (the grim strategy). Consumers make their purchases from the lowest- priced supplier they have encountered; if two or more prices are identical, they select their supplier randomly.

We now state:

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[3] That is, everyone believes other people have done the searching for them.

**A2**: In stage 2, consumers of existing firms believe there is a firm that sets a price below $p_m$ but they do not know the identity of the low-price firm. Given this assumption, they will search for the low-priced firm if it is optimal to do so.

And for completeness:

**A3**: The entrant firm will be willing to set a price lower than $p_m$ if it increases profit thereby.

We first show:

**Lemma**: If it is optimal for firm E to set a price below $p_m$ in period 2, that price is given by:

$$p_e = p_m - (n-1).s/2 \tag{2}$$

**Proof:** Given assumption A2, the representative consumer will only rationally engage in additional search, at a cost $s$ per company searched (beyond the first), if the expected benefit is greater than the cost. Therefore, E needs to make $p_e$ low enough to encourage search. Under assumption A2, the optimal consumer search strategy is to search until the low price is found, or not at all. There are $n-1$ additional firms to search, so on average, $(n-1)/2$ extra searches must be carried out. The expected benefits to an existing consumer are $(p_m - p_e)$. Thus if $p_e$ is given by a value less than or equal to that in (2), search by consumers who purchased in period 1 is worthwhile, otherwise it is not worthwhile them searching. It is not optimal for E to reduce price in period 2 below the value given by (2); additional consumers with reservation prices below $p_m$ are attracted to E, but this is equivalent to a monopolist reducing its price when it is already below the monopoly level.

We now state our main result:

**Proposition 2:** If consumer search costs are below a certain level (but strictly greater than zero), it will be worthwhile in expected value terms for consumers to engage in search for a lower price than $p_m$ and it will be worthwhile for entrant E to price strictly lower than $p_m$. This is more likely, the smaller the number of firms in the market.

**Proof:**

It remains to be shown that the strategy of E setting a price $p_e$ may be optimal, and that this is affected as stated by the number of firms in the market.

The first question is whether the firm captures enough additional consumers by this policy to make net additional profits, compared with the alternative of setting $p_m$. In considering this, E must take into account net profits in periods 2 and 3. Let $N_m$ ($N_e$) be the mass of consumers who have a reservation price no lower than $p_m$ ($p_e$). The expected net benefit to firm E of lowering price is

$$EB = (p_e - c)N_m + (p_e - c)(N_e - N_m)/n + (p_e - c)N_e \boldsymbol{d}/n - (p_m - c)N_m(1 + \boldsymbol{d})/n \qquad (3)$$

Here the first term is the revenue in period 2 from customers with reservation prices above $p_m$ switching from other suppliers, the second term is the revenue in period 2 from generated customers who made their first search at firm E who have reservation values $p_e < p < p_m$, the third term is revenue from E's share of customers in period 3 (discounted at the rate $\boldsymbol{d}$)[4]. The

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[4] This third term assumes all firms set price $p_e$ in period 3 and that consumers search again for a supplier, choosing one randomly; this assumption, along with the grim strategy, are the least conducive to price-cutting by E in period 2.

final term represents E's revenue under the alternative scenario where it sets price $p_m$ in periods 2 and 3. Substituting in (2) and rearranging slightly yields

$$EB = (p_m - c)[N_m(n-2-d) + N_e(1+d)]/n - (n-1).s[N_m(n-1) + N_e(1+d)]/n \qquad (4)$$

The firm will benefit from price-cutting if (4) is positive. After some rearrangement, using (1), it can be shown that a sufficient condition for search costs to be low enough to make price cutting worthwhile is the following

$$s/p_m < 2/[(n-2-d).e] \qquad (5)$$

Given that firm E benefits by undercutting the existing players when this condition holds, an equilibrium where all firms set $p_m$ cannot exist. Thus consumer beliefs regarding the existence of a low price firm are justified.

QED

**Corollary:** In markets where consumers' search costs are significant, the monopoly price can be the Nash equilibrium outcome. This is the more likely, the *larger* the number of firms in the industry.

**Proof**: A sufficient condition for (4) to be negative, under which it is in no firm's interest to price below $p_m$, is given by (6) below. In these circumstances, there is a Nash equilibrium at the monopoly price.

$$s/p_m > 2/[(n-1).e] \qquad (6)$$

To gain some idea of magnitude, if n is 20 and ε is 1.7, search costs greater than around 6% of monopoly price will render price-cutting undesirable from the viewpoint of any particular firm.

**Discussion**

Proposition 2 looks superficially like Stahl's (1989) proposition 4(a), but the mechanism involved is completely different. In Stahl, a proportion of the consumers are "shoppers" and have zero search costs, so they seek out the cheapest store, whilst the others do have positive search costs. As the proportion varies, the price distribution changes. By contrast in the present model, all consumers have search costs. Also, the main point is not to identify an equilibrium, in either pure or mixed strategies, but rather to show that the Diamond (1971) equilibrium need not exist, where it is commonly viewed as doing so. This point deserves amplification.

The intuition underlying Diamond's (1971) result is deceptively simple. Consider for example the following exposition in Anderson and Renault (1999, pp. 719-20) "Suppose there were an equilibrium at which some firm set a price below the monopoly price and (weakly) below those set by all other firms. Then all consumers who go to the low-price firm would still buy there even if the firm raised its price by an amount less than the cost of searching another firm, since a consumer who searched again could not expect to gain enough to offset the search cost. This incentive to raise price means that *all firms must charge the monopoly price in equilibrium*." (emphasis added). Our point is that under

certain circumstances, this equilibrium does not exist and that these circumstances are well-characterised by (5) in terms of search costs, demand elasticity and firm numbers[5].

The analysis above is reminiscent of discussions of tacit collusion, in which a collusive agreement may be maintained if there is a punishment that can be inflicted on the price-cutting firm that is credible and makes collusion sustainable (see e.g. Rees, 1993). The example above assumes such a punishment may be imposed. However, the difficulty in this line of argument is that simply matching the price-cutter's price may not be sufficient as a punishment, given consumers' limited information. If it does not lead to firms deserting the price-cutter, there would appear to be no credible punishment. In these circumstances, the argument above would be modified somewhat, but proposition 2 would remain valid. It is also worth noting that collusion is generally viewed as being easier to maintain if firm numbers are small. In the model above, the result is the opposite.

## A Brief Illustration

Finally, there is a question of whether this model bears a resemblance to reality. The market for many professional services, prior to around 1980, provides an illustration. For example, around much of the world, legal services were provided by a large number of relatively small firms that were organised as partnerships. These were commonly prevented by their professional bodies from advertising except in the most trivial of ways. In particular they

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[5] In this sense it makes rigorous the intuitive discussion in Carlton and Perloff (1999, p 433). Note that their discussion captures the importance of firm numbers but not of search costs or demand elasticity.

were not allowed to advertise the price of their services[6].  In these circumstances, it is clear that the Corollary is likely to hold, with high prices being maintained.

The case of Bates (Supreme Court, 1976) provides an interesting example.  Bates and O'Steen were attorneys licensed to practice law in Arizona.  They started a "legal clinic" in Phoenix, providing straightforward services (uncontested divorces and the like) at low prices.  However, "After conducting their practice in this manner for two years, appellants concluded that their practice and clinical concept could not survive unless the availability of legal services at low cost was advertised and, in particular, fees were advertised." (Supreme Court, 1976, p. 354).  It was at this stage, when they advertised "very reasonable fees", that they came into conflict with the Bar and the legal proceedings commenced.  Here we see that an attempt to cut price did not create sufficient business to enable the lower price to be sustained, in the absence of active information provided to consumers.

An interesting contrast is provided by the example of solicitors' house conveyancing services in the England and Wales.  As Domberger and Sherr (1989) recount, a "Private Member's Bill" was introduced into the House of Commons in 1984, proposing to end the solicitors' monopoly on conveyancing (legal transfer of title in real estate).  This was withdrawn, following an undertaking by the Government to introduce its own legislation, and indeed the first (non-solicitor) licensed conveyancers came into practice in 1987.  However, the interesting thing is that "Reports of reductions in conveyancing charges first appeared in 1984." (Domberger and Sherr, 1989, p. 41), that is much before the competition from

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[6] Monopolies and Mergers Commission (1976) contains surveys of restrictions coming from solicitors and similar professional bodies from most of the major North American, West European and Australasian jurisdictions.  All severely restricted advertising (as of 1974/5) or banned it outright.

licensed conveyancers appeared, and indeed before the Law Society's restrictions on advertising by lawyers had been relaxed, or advertisements had appeared. Thus it appears that consumers had been sensitised to the possibility of finding cheaper provision of this standardised service through search, and that as a result some firms of solicitors had responded by reducing charges in order to generate extra business for themselves, as suggested by Proposition 2.

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