Price Deception, Market Power
and Consumer Policy

by

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Abstract: This paper presents a model in which a firm attempts to gain market power by pricing above the competitive market price and simply trying to persuade ill-informed consumers not to search for other lower priced firms. Fictitious price comparisons, or false sale signs could be used in this way to deceptively and profitably deter consumer search. A simplified model shows how this mechanism could exist when combined with moderately enforced consumer regulatory policy.
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[1]This work shows some preliminary results from the author's unfinished PhD thesis. The paper was presented at EARIE (2004).

1. Introduction

Competition policy and industrial economics has largely focussed on the behaviour of firms, while often neglecting the explicit role of consumers (see Vickers 2003, Waterson 2003). Those authors and others have suggested that there has been an over-emphasis on 'seller-seller' sources of market power that act through seller concentration, while 'seller-consumer' sources might be equivalent alternatives (Edlin 1997, Ireland 2002). A significant source of seller-consumer market power may arise from search deterrence, whereby a (high priced) firm aims to prevent consumers searching and trading with other (lower priced) firms. It is a familiar argument that firms face incentives to increase search and switching costs to deter beneficial search, but in an equivalent fashion, firms can reduce consumers' incentives to search by reducing the consumers' perceptions of the benefits of search and switching.

This prompts the possibility of an extremely simple source of market power. A firm could incrementally increase its price, while aiming to induce immediate consumer purchases by artificially deflating the consumers' perceived benefits of searching elsewhere. The mechanism is very primal – raise your price and lie to deter the consumer buying from elsewhere. In particular, this paper focuses on a specific sort of lying by firms in the form of (in-store) price advertising, which I loosely refer to as 'relative price communications'. There are two main sorts of these communications. Firstly, implicit communications advertise prices with an accompanying marketing cue such as "Low Price 5.99", "Sale 5.99", or "Only 5.99". Alternatively some explicit communications

actually make specific comparisons to alternative prices e.g. "Elsewhere 9.99 Here 5.99".

If used untruthfully, these communications have the potential to provide market power to high priced firms by deterring beneficial consumer search that would otherwise allow consumers to trade efficiently with lower priced firms. As a consequence, *price deception* can directly reduce potential consumer welfare, but may more importantly, seriously impede the efficient market mechanism, by providing a source of market power. I term price deception as the situation where a consumer mistakenly believes a false relative price communication and uses the false information to make a purchase that would not have been made had the consumer had full information[2].

For a moment, let us think what conditions are needed for a firm to deter a consumer from searching with the use of a false communication. Firstly the consumer must have been willing and able to search before observing the communication. This will occur if there is sufficient price dispersion within the market. Secondly, the consumer must be ill informed of the market price distribution. If the price distribution were known then the quoted price alone would be sufficient for the consumer to perfectly evaluate the (expected) benefits from further search. It is only when the possible alternative prices are unknown and the consumer is ignorant of the benefits of further search, that the consumer becomes, in principle, willing to listen to communications[3]. Thirdly, the firm must in principle have a better knowledge of alternative prices, than the consumer. This would

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[2] Darby and Karni's (1973, p.67) definition of more general (quality) deception is "…the provision by a firm of false information to a consumer so as to induce purchases which would not be made if the consumer possessed full information about the qualities of his purchase."

[3] Evidence shows that it is likely that consumers lack a correct knowledge of the price distribution, even in familiar markets where prices are stable, due to informational and cognitive costs. Dickson and Sawyer (1990) found only 55.6% of buyers could even recall the price of a product within a 5% confidence interval, 30 seconds after picking it, let alone recall relative prices. Rothschild (1974) is a rare case where ignorance of the price distribution is modelled explicitly.

imply an important information asymmetry between firm and consumer. At this point three out of the four conditions seem very likely in most market situations. However the fourth condition, credibility, seems far less likely, as the model presented here will show. The possible deceptive power of price communications to deter search and increase the firm's profits would seemingly make any communication by the firm itself, totally incredible. If so, any rational consumer should not believe or be influenced by communications, making search deterrence and price deception impossible. However this intuition seems counter to the huge amount of time and money that firms spend on price communications, and more worryingly seems counter to a large amount of experimental and field evidence within the marketing literature, that supports the notion of search deterrence effects[4].

This paper makes a start into analysing the possible anti-competitive nature of false price communications. In this paper, a simplified model is developed to act as a platform to begin the analysis of these issues, which seems previously absent within the literature. The situation is modelled as a cheap talk game, where price communications are essentially costless in a one shot game. As suggested above, without further sources of credibility, relative price communications are shown to be unable to act as a source of market power. However, a very simplified model shows that if consumer authorities inappropriately regulate the use of false price communications, price deception can act as

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[4] There are many experimental studies in a similar vein to an early study by Blair and Landon (1981), while Urbany et al (1988) use a more interesting methodology. A related literature uses the term 'promotion signalling', and conforms to the ideas of search deterrence, see Inman et al (1990) and Inman and McAlister (1993). Grewal and Compeau (1992) and Compeau and Grewal (1998), give nice reviews of the general issues, the evidence, and the US regulatory stance.

an equilibrium source of market power. This result additionally gives a formalisation of Nelson's (1974) ideas of how poor regulation may facilitate quality deception.

Section 2 briefly reviews the existing and related literatures, while section 3 presents the base model. Section 4 analyses some simplified, but interesting effects of consumer policy within the model, before we conclude.

2: Related Literatures

The economic analysis of search deterrence in the form of strategies to reduce the perceived benefits from search seems quite undeveloped and contains no specific work on the role of false price communications. However one can view some of the literature on price matching guarantees, as a special case of the wider issues of communications and search deterrence. PMG's are guarantees made by firms alongside relative price communications. A firm may declare "low price 5.99" and then promise not to be beaten on price, by refunding any difference relative to a lower rival firm's price found by a consumer. PMG's may be interpreted as a credibility mechanism, allowing rational agents to use price communications to educate their search decisions. This interpretation is increasingly being used in the literature (e.g. Moorthy and Winter, 2002), as empirical studies (e.g. Arbatskaya, 2004) cautiously reject the traditional economic interpretation of PMG's as facilitating devices for collusion, originally proposed by Hay (1982). In this paper we take a step backwards by analysing the credibility of price communication in general and allowing mechanisms such as PMG's to become a special case of the proposed model.

Elsewhere in the economics literature, Ireland (2002) presents another search deterrence strategy that has no role for price communications. In a model of price dispersion, the paper shows that if firms can trade under different names unknown to the consumer, search can be deterred and undermined as further search may simply check the same firm's prices, under a different store name. Expected profits and average prices can be shown to rise as a result.

To find any specific work on the role of relative price communications in search deterrence, one must turn to marketing and business research, where a wealth of largely informal ideas about relative price communications can be found. Two notable papers by Andersen and Simester (1998, 2001) make rigorous in-roads into the issues of this paper. The 1998 paper provides a very complicated theoretical model, showing that a multi-product retailer optimally uses a sale sign on all truthful promotions, and on a fraction of false promotions. (This strategy is supported by interviews of department store managers.) Using Bayesian updating, the consumer can assess the credibility of a sale sign by assessing the total number of signs used by the firm. Excessive signs would indicate that the accuracy of any one sign is weakened, and less likely to be correct. This loss in accuracy prevents the firm signing all products, providing the credibility needed for the consumer to rationally believe a sale sign in equilibrium. Price deception can therefore exist for the fraction of false signs. The extra credibility gained gives the firm market power, as the firm can charge a slightly higher promotional price for a signed good, rather than an unsigned good, and yet still prevent the consumer from searching

elsewhere. A+S (2001) provide sophisticated tests of these effects by analysing scanner and catalogue data. They also conduct a \$20000 experiment by manipulating a company catalogue's sale sign strategy to support their 1998 paper's findings. A+S's studies provide a real jump in the technical methodology employed in the literature, but unfortunately provide a very opaque theoretical model, which is unnecessarily complicated. Further, A+S (1998) is a marketing model, asking questions relevant to marketing, without addressing any issues of economic welfare or policy.

A full, rigorous, yet simplified, base economic analysis of the effects of relative price communications upon search behaviour and market power would seem highly appropriate within the literature. Here, I take a first step towards that aim. I stress that the model is deliberately stripped down with some highly simplifying assumptions to act as an initial platform for analysing some of the complex issues involved. Future work can aim to relax many of the assumptions.

3. The Model

Let there be two firms, Firm 1 and Firm 2, who 'compete' for a mass of consumers, normalised to one. Marginal costs are zero, with no fixed costs and each firm is assumed to sell a single good, of known, constant quality. The consumer has a once and for all unit demand for the product with a reservation price of V. All agents are risk neutral. The game has two stages but is strictly one shot to prevent any dynamic interactions. The consumer either buys from one of the firms, or exits the market.

Stage 1

In stage 1, the firms' prices are set, but in line with the introduction we need to ensure price dispersion. The simplest way to generate this is to make the firms' prices exogenous[5]. Intuitively, assume there are only two prices available and both firms have sales, by dropping their price to P_H from P_H with independent probabilities $(1-\gamma)$ and $(1-\theta)$ respectively. Formally, Nature selects $\mathbf{P} = P_1$, P_2 from $P_1 \in \{P_L, P_H\}$ with independent common priors $((1-\gamma), \gamma)$ and from $P_2 \in \{P_L, P_H\}$ with independent common priors $((1-\theta), \theta)$. Let $P_H > P_L > 0$. Further, let the higher price be equal to the consumer's reservation value, $P_H = V$.

Stage 2

In stage 2 the role of relative price communications can be analysed. To do this, we need consumer ignorance and the information asymmetry. Consequently assume that the prices drawn by Nature are known to the firms, but not the consumer. Specifically the consumer's information acquisition technology is assumed to be the following. The consumer is assumed to be costlessly able to visit a first store, let this arbitrarily be Firm 1, to discover P_1. However, the consumer must sink a search cost of d>0 to discover the price of the second store, P_2. Without searching, the consumer, can only assess P_2 as $E(P_2)$ using the common prior distribution. Consequently, the consumer does not know

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[5] If one were to endogenise prices, one would usually assume heterogeneous search costs (e.g. Varian (1980)) or heterogeneous reservation prices (e.g. Sobel (1984)). Either of these stories suggest that periodically firms will drop their price, by having a sale. The requirements of price dispersion and an information asymmetry between firm and consumer actually create a significant theoretical problem. Most stories of price dispersion mixed strategy equilibria require a discontinuity created by subsets of consumers responding to marginal changes in prices. With an information asymmetry, consumers may only respond to changes in average prices and so initial modelling would suggest that the increased complexity of the model is significant, contrary to my initial aims of simplicity and tractability. Current work is making attempts to endogenise prices.

the drawn market price distribution, only its expected characteristics. To allow the model to be at all interesting, assume that the expected benefits of further search given a high price at firm 1 to be positive, otherwise search is an entirely dominated strategy and communications are always irrelevant. Substituting for $E(P_2)$ we require

$$E(P_2) + d < P_H$$
$$(\theta P_H + (1-\theta)P_L) + d < P_H \qquad \text{(A1)}$$

A1 is ensured if d is small enough. The role of relative price communications can now be fully analysed by assessing the interaction purely between Firm 1 and the consumer. Firm 2 is effectively an exogenous player.

Informally the situation in stage 2 may be explained as follows. The single consumer enters the market and visits a first store, Firm 1, and observes the good available for purchase and Firm 1's price. Firm 1 knows the alternative price at Firm 2, while the consumer does not. At this point, Firm 1 has a chance to communicate to the consumer, through a costless in-store message[6]. As previously discussed, such a communication may be used to try to influence the consumer's estimate of P_2 in an attempt to deter search, and induce a purchase from Firm 1. The communication could be *explicit* or *implicit* as defined in the introduction. It will become clear that the two types of communications are equivalent here because there are only 2 prices in equilibrium. This simplification allows us to define M, the message space, simply equal to {Sale Sign, No Sign}, rather than allowing a continuum of possible reference prices. After observing P_1 and any message, the consumer can either buy immediately from Firm 1 or search. By

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[6] It is easier to think of the message as an in-store message, although general advertising out of store could apply too. Either way initially assume communications are approximately costless, and could be thought of as verbal messages.

searching, the consumer is free to trade with Firm 1 or Firm 2, knowing both prices. Firm 2 is crucially assumed not to be able to communicate to the consumer. This is to simplify analysis but could apply to the case where consumers 'miss' Firm 2's advertising.

Formally, Stage 2 can be described by a sender-receiver game, between Firm 1 and the consumer. P_2 is private information for Firm 1. Firm 1 chooses an in-store message, $m \in M = \{Sign, NoSign\}$. The consumer visits his local store, Firm 1, and observes P_1, m, and chooses an action $a \in \{Buy, Search\}$. If a=search then d is spent, P_2 is revealed and the consumer is free to buy from either firm. Payoffs are awarded, $\pi_1(a, P_1, P_2)$ for Firm 1 and u(a, P_1, P_2,) for the consumer.

Before formally solving the game, we can gain some intuition and simplification by splitting the outcomes of the game into two cases, dependent on the revelation of Firm 1's price. Case i) occurs when $P_1=P_L$ and Case ii) when $P_1=P_H$.

Case i). If $P_1=P_L$ the outcome is straightforward. Search is a dominated strategy, as Firm 1's price is the lowest possibly available. The consumer always buys from Firm 1, and so payoffs can be described as $\pi_1 = P_1$ for Firm 1 and u=V-P_L >0 for the consumer. The quoted price alone is sufficient to make the optimal search decision and so any communications will be made redundant.

Case ii) This is the interesting, strategic case, reminiscent of the ideas discussed in the introduction. If $P_1=P_H$ the price alone is not sufficient to conclusively make the search

decision. The consumer would optimally search only if he knew $P_2 = P_L$ to earn $(V-P_L-d) > 0$, rather than buying from firm 1 earning $(V-P_H) = 0$. Unfortunately, as P_2 is unknown, the decision to search will have to be dependent on the consumer's beliefs, and crucially may have some dependence on Firm 1's message. If the consumer searches and fortunately finds $P_2 = P_L$ then he will optimally buy from Firm 2. If the consumer searches and finds that $P_2 = P_H$ then there is a price tie. Non-trivially it is assumed that if this is the case then the consumer buys from the store visited most recently, Firm 2. Consequently, if the consumer chooses to search, the consumer will buy from Firm 2, as P_2 will be found to be either lower or equal to P_1. Payoffs in case ii) are $\pi_1 = P_1$ and $u(.) = (V - P_H) = 0$ if the consumer buys, and $\pi_1 = 0$, $u(.) = V - P_2 - d$ if the consumer searches, buying from Firm 2.

In beginning to solve the game, the clarification of these two cases makes the game and its solution surprisingly simple. Due to stage 1 being exogenous, the game is a standard two type, two action sender receiver game split into two simplifying cases, i) and ii). Case i) is trivial as the consumer always buys from Firm 1, ignoring any possible message and therefore we only need to concentrate on the solution of case ii). Case ii) is actually a cheap talk (sub) game[7]. Cheap talk games are a special subset of sender-receiver games where the message is costless in the sense that the message itself does not affect any player's payoffs. More formally, a sender observes some variable $t \in T$, and sends an unverifiable message $m \in M$ to the receiver who observes m and chooses an action $a \in A$. Payoffs are allocated, dependent upon a and t, but not m, as in our game

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[7] Crawford and Sobel (1982) is the seminal paper, but see Farrell and Rabin (1996) for a great introduction to cheap talk games.

above. Case ii) can be represented by figure 1, and we are now ready to formally find the game's solutions and implications.

The solution concept appropriate for this game is of course the Perfect Bayesian Equilibrium. An equilibrium will consist of the set of strategies and beliefs such that all players are optimising given their beliefs and other players' strategies, and all beliefs are updated using Bayes' rule where possible.

Figure 1 - Case ii) where $P_1 = P_H$
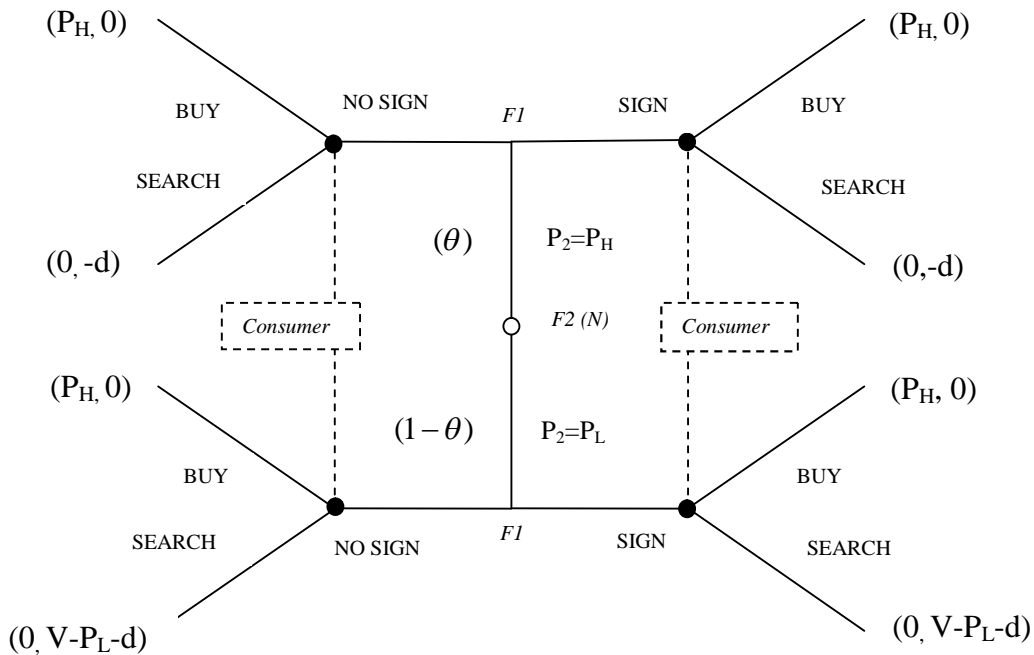
Firm 1's strategy (m│**P**) shows his choice of message given the exogenous vector **P**. The consumer must have a belief structure q(.), where q(.) is the probability that $P_2 = P_H$, dependent upon the observed message m. (This is independent of P_1 because the prices

are uncorrelated). The consumer must also have an action strategy a(.) given P_1 and m. The unique solution is given in proposition 1.

Proposition 1:   *If A1 holds there exists a unique 'babbling' equilibrium.*

Firm 1 Strategy: *If $P_1=P_L$ or P_H, m is chosen randomly over M*

Consumer Beliefs: *q(.)= θ for all m*

Consumer Strategy: *(a│ $P_1=P_H$) = Search and buy from Firm 2, for all m*

                      (a│ $P_1=P_L$)= Buy, for all m

Proof: When $P_1=P_L$ the consumer always remains with Firm 1, as described in case i). This makes messages redundant, so the firm mixes indifferently over M. When $P_1=P_H$ in case ii), Firm 1 faces a severe credibility problem. Firm 1 always prefers the consumer to buy, not search. The consumer will only buy if he believes $P_2=P_H$. Such uniformity of Firm 1's preferences prevents any credible communication, as Firm 1 always has the (weak) incentive to set m=Sign, suggesting $P_2=P_H$. The rational consumer will discard all messages. The consumer is left to use his priors to inform his decision to search, and therefore always searches, due to A1. Consequently Firm 1 is indifferent between messages and 'babbles' by mixing over M, reinforcing the consumer's decision not to listen to the messages, as they are uninformative. This equilibrium is unique also due to the uniformity of preferences (as in Farrell (1993) Fact 1 p.528). ●

It is of interest to note the efficiency of the consumer's decisions. As the consumer is fully rational all decisions are efficient ex ante by maximising expected surplus, but notice that ex post the consumer's decisions are not efficient. When $P_1=P_L$ the consumer

correctly remains with Firm 1. When $P_1 = P_H$ the consumer always switches, and so makes inefficient ex post mistakes when $P_2 = P_H$ as he pays an unnecessary search cost of d. We may term this as a Type I error because the consumer incorrectly disbelieves / rejects Firm 1's communications. This error occurs for a fraction of the time, θ, conditional on $P_1 = P_H$. Type II errors, where the consumer incorrectly believes Firm 1, can be seen as the case of price deception. Here, with no sources of credibility in a one shot game, a firm cannot use relative price communications to gain market power as all messages are discarded by the rational consumer. Search cannot be deterred.

The model and proposition 1 provide a simple platform for analysing the issues of credibility for relative price communications. It could be used as the base model for analysing possible sources of credibility that a firm may use to allow consumers to listen to price communications, and how these sources affect the potential for market power and welfare. These sources could clearly mirror the familiar mechanisms found in the quality uncertainty literature, such as reputation, signalling or warranties (price matching guarantees). This however would require dynamic modelling, and is left for future work. Instead, the rest of this paper concentrates on another possible source that can be analysed at a simple level in the static base model. This source derives from the regulation of messages by consumer regulatory authorities. The results in section 4 are insufficient to give full policy advice as the base model is over simplified, but the results raise some interesting issues, that can be expanded in future work.

4. The Effects of Regulation

A crude form of regulation will now be introduced into the simplified static base model developed in section 3. A regulatory agency will monitor any in-store messages by Firm 1 and will fine Firm 1 an expected fine of G if Firm 1 sends a false message, irrespective of how the consumer responds to the message. Equally the fine G could be interpreted as a cost resulting form a loss of reputation. As we have assumed that there is only one consumer, G can be interpreted as the fine per consumer. G is common knowledge, and administered at the end of the game. False messages are not censored in any way, only punished.[8]

The effect of such regulation on the game is only seen when Firm 1 sends a false message at the bottom right hand side branch of fig.1. This branch corresponds to the case where $P_2=P_L$, but Firm 1 falsely claims that $P_2=P_H$. If the consumer believes the false claim and buys from Firm 1 then the payoffs can be re-expressed as $(P_H-G, 0)$ for the firm and consumer respectively, and if the consumer searches following the false claim the payoffs are now $(-G, V_H-P_L-d)$. Talk is no longer (always) cheap, and the so the game is now more like a traditional signalling game.

We can now distinguish between three levels of G. When G=0, we return to the case of cheap talk, already discussed in the base model. When $G>P_H$, the expected fine from lying exceeds its gain. I term this the full regulation case, but there is also an intermediary

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case which I term as the case of weak regulation where $0<G<P_H$. Both the full and weak regulation cases are now discussed.

Full Regulation

This is a fairly trivial case. When $G>P_H$, deceptive communications are dominated messages and so Firm 1 always tells the truth. Firm 1 efficiently forfeits the consumer's trade to Firm 2 when $P_1=P_H$ and $P_2=P_L$.

Proposition 2:   *When $G>P_H$, and A1 holds there is a unique fully separating equilibrium.*

Firm 1 Strategy: *(m/ $P_1=P_H$, $P_2=P_H$) =Sign*

                         (m/ $P_1=P_H$, $P_2=P_L$) =No Sign

                         (m/ $P_1=P_L$) = mixes over M

Consumer Beliefs: *q(./$P_1=P_H$, m=Sign) =1,*   *(beliefs when $P_1=P_L$ are irrelevant)*

                         q(./$P_1=P_H$, m=No Sign) =0

Consumer Strategy: *(a /$P_1=P_H$, m=No Sign) = Search*

                         (a/ $P_1=P_H$, m= Sign) = Buy

                         (a/ $P_1=P_L$)= Buy

Proof: The proof is trivial. Case i) when $P_1=P_L$, is unchanged so the consumer always remains at Firm 1. In case ii) telling the truth is the (weakly) dominant strategy for Firm 1. Consequently beliefs can be adjusted to infer the correct price of Firm 2. All information can be credibly transmitted. Another equilibrium can exist where the firm always sets (m=No Sign) and the consumer always switches. However this forces the consumer to have out of equilibrium beliefs such that positive weight is put on Firm 1

playing a dominated strategy of m=Sign, when $P_2=P_L$. Justifiable refinements leave the unique separating equilibrium. ●

This equilibrium is actually a simple persuasion game, Milgrom and Roberts's (1986). A persuasion game is a sender-receiver game where all messages are perfectly verifiable. If so, a sign can perfectly signal the truth, while the lack of a sign can be perfectly inferred by the consumer to imply that Firm 1 cannot truthfully make such a claim, and that Firm 2 has the better deal. The consumer makes fully efficient decisions, with no error in his choices due to full information revelation. There is no deception. This case is obviously the first best welfare optimal if the enforcement of G is not too costly. In reality there is good reason to suggest that such high levels of G may not be maintained due to poor monitoring. A more realistic scenario is the case of weaker regulation, where the expected fine is lower. The case of weak regulation is shown next, with some interesting results.

Weak Regulation

The expected fine, G, is in an intermediate range, $0<G< P_H$. G is not high enough to fully deter deceptive messages as the gains from successful deception (P_H-G) are still higher than truth telling (m=No Sign), 0. However deception is only a preferred strategy if the consumer buys. If not, the firm only receives the expected fine –G and so would prefer to tell the truth. The impact of weak regulation creates two new equilibria, equilibrium A and B. We take each in turn, although Equilibrium B seems the more interesting case.

Proposition 3: When regulation is weak and A1 holds, 2 equilibria result.

Equilibrium A:

Firm 1 Strategy: $\quad$ *(m| P_1=P_H) =No Sign*

$\qquad\qquad\qquad$ *(m| P_1=P_L) = mix over M*

Consumer Beliefs: $\quad$ *q(./P_1=P_H, m=No Sign) =θ* $\quad$ *(Beliefs when P_1=P_L are irrelevant)*

Consumer Action: $\quad$ *(a| P_1=P_H, m= No Sign) = Search*

$\qquad\qquad\qquad$ *(a| P_1=P_L)= Buy*

Proof: Equilibrium A is a counterpart to the equilibrium with no regulation. The consumer does not listen and always switches when P_1=P_H, and so the firm is indifferent over *costless* messages, which here implies that he always sets m=No Sign, reinforcing the consumer's decision not to listen. This requires a specification of out of equilibrium beliefs. If a sign is observed off the equilibrium path, the consumer is required to search, not acting on the sign, to maintain the equilibrium This requires not unreasonably that

q(./P_1=P_H, m=Sign) $< (\dfrac{V - P_L - d}{V - P_L})$. This equilibrium is akin to the awkwardly persistent

babbling equilibrium in cheap talk games, but is not called so here, as messages cannot be classified as cheap. ●

Equilibrium A disappointingly shows no information transmission, despite the government's efforts. As in the equilibrium with no regulation, when P_1=P_H, the consumer does not listen and inefficiently switches too often, making only Type I errors. However there is no price deception.

Equilibrium B is more complicated, and is actually a hybrid equilibrium, where Firm 1 and the consumer use (behavioural) mixed strategies. When $P_1=P_H$, and $P_2=P_L$ the firm actually mixes over false and truthful communications, while always truthfully signing when $P_2=P_H$. On seeing a sign the consumer similar mixes over believing it or not. Note the firm's strategy is similar to A+S's (1998) theoretical and empirical findings but in a single product context. There they investigated a multi-product case without regulation, where a fraction of high priced goods would have false signs. The current model shows a high priced single product which is falsely signed for a fraction of the time as a consequence of weak regulation.

Equilibrium B:

Firm 1 Strategy: *(m/ $P_1=P_H$,$P_2=P_L$) =Sign (lie) with probability L, and No sign with probability (1-L)*

                        (m/ $P_1=P_H$, $P_2=P_H$) =Sign

                        (m/ $P_1=P_L$) = mix over M

Consumer Beliefs: *$q(./P_1=P_H$, m=Sign) $= \dfrac{\theta}{\theta + (1-\theta)L}$*

                        $q(./P_1=P_H$, m=No Sign) =0   (beliefs when $P_1=P_L$ are irrelevant)*

Consumer Action: *(a/ $P_1=P_H$, m= Sign) = Buy with probability b, and Search with probability (1-b)*

                        (a /$P_1=P_H$, m=No Sign) = Search

                        (a/ $P_1=P_L$)= Buy

Where the mixing probabilities L and b are defined as

$$L = \frac{\theta d}{(1-\theta)(V - P_L - d)} \tag{1}$$

$$b = \frac{G}{V} \qquad (2)$$

Proof: When $P_1 = P_L$ the consumer correctly buys from Firm 1. When $P_1 = P_H$ the firm faces a credibility issue similar to the case of no regulation, as deception can be profitable. When $P_2 = P_H$, Firm 1 has a weak incentive to be truthful so m=Sign. Technically the hybrid equilibrium requires the firm to be indifferent between lying and being honest when $P_2 = P_L$. This requires the payoffs from either option to be equal, as shown in equation (3). Having observed a sign, the consumer, must be indifferent between buying and searching, using Bayesian updated beliefs, as expressed in equation (4) respectively.

$$b(V - G) - (1 - b)G = 0 \qquad (3)$$

$$0 = (\frac{(1-\theta)L}{\theta + (1-\theta)L})(V - P_L - d) - (\frac{\theta}{\theta + (1-\theta)L})d \qquad (4)$$

(3) and (4) when solved provide the solutions (1) and (2). The observation of no sign, is correctly inferred to imply that the consumer should search. ●

Intuitively, when $P_2 = P_L$ the firm has the incentive to deceive, but cannot lie all the time because the consumer would then always search. If the consumer always searches then the firm will prefer to tell the truth, avoiding the fine. By telling the truth, the consumer would buy all the time, which would then give the incentive for the firm to always lie. The cycle continues, and the cycle intuitively describes the hybrid equilibrium.

Equilibrium B is the more interesting case[9]. Several features of the equilibrium seem particularly pertinent. Firstly, as stated, the firm's strategy is empirically supported and the concept of lying only some of the time seems very intuitive. Secondly, and again sensibly, unlike in equilibrium A, the regulatory efforts do manage to facilitate (partial) information transmission. With non-zero probability the firm will be truthful and the consumer will listen allowing an efficient choice. Thirdly, and most importantly, this equilibrium provides an answer to the main question posed in the introduction – can price communications act as a source of market power?

Yes it can. In this equilibrium, price deception occurs with positive probability, occurring when the mixed strategy selections are such that the consumer chooses to listen to a false communication. With positive probability, Firm 1 is anti-competitively preventing beneficial search, gaining market power due to the effects of weak government regulation. Ironically, the weak government regulation of relative price communications facilitates price deception that would otherwise not occur, by providing a weak source of credibility. Note that it is only the weak regulation of communications that facilitates this effect, not the other levels of regulation. Full regulation prevents false messages from being sent, no regulation deters consumers from listening and it is only weak regulation that allows both lying and listening. As Nelson (1974, p.749) first elegantly suggested for the case of quality deception,

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[9] Although more interesting, equilibrium B cannot be chosen over equilibrium A using standard refinements. Refinements dependent upon out of equilibrium belief specification or welfare comparisons cannot eliminate either equilbrium.

"Deception requires not only a misleading or untrue statement, but somebody ready to be misled by that statement"

Nelson (1974, p.749) recognised the role of 'moderately enforced regulation' in deception but his arguments were of course made before the modern tools for analysing problems of asymmetric information were developed. Here, by applying those tools, Nelson's arguments have been validated and formalised, in the specific case of price deception. Equilibrium B presents a provocative result. *In a one shot game, price communications can become a source of market power when accompanied by mediocre levels of regulatory effort. Ineffectual effort by consumer regulatory agencies can have direct implications for competition policy agencies by giving firms an exploitable source of credibility, with which they can deter search and gain market power.*

Equilibrium B also presents a potential explanation of some empirical findings that show consumers often mistakenly buy from the 'wrong' more expensive firms (see Miravete, 2003 and the references therein). This has been claimed by some as evidence of irrationality but here the mixed strategies create the possibility of a rational consumer making ex post equilibrium mistakes in his choice of firm.

We should not conclude, however, that weak regulation is undesirable purely because it facilitates price deception. Deception is only one form of an inefficient consumer mistake. In fact, we can easily see the effects of G in determining the levels of errors. We already know that when G=0 only type I errors are made as all signs are rejected, and

when G>V_H no mistakes are made. However when regulation is weak, as G increases the incidence of type II errors (deception) increases, and type I errors fall, as the credibility of signs gradually increases. This can be shown by using equations (5) and (6) which show the probabilities of a type I and II error respectively, given $P_1=P_H$.

Type I error:
$$\theta(1-b) = \theta(1 - \frac{G}{V_H}) \tag{5}$$

Type II error:
$$(1-\theta)Lb = (\frac{\theta d}{(V_H - P_L - d)})(\frac{G}{V_H}) \tag{6}$$

The effect of G upon consumer mistakes, consumer welfare, and more generally, total economic welfare must be analysed with more care. Within this simple model, the welfare effects are presented in proposition 4.

Proposition 4*: Weak regulation provides no change to consumer welfare – consumers are indifferent between values of the expected fine, $G \in [0, P_H)$. The full effects of weak regulation on social welfare are ambiguous.*

Proof: See Appendix.

Regardless of equilibrium non-uniqueness, weak regulation has no overall effect on consumer welfare. In equilibrium B, regulation facilitates price deception and provides market power but it also reduces the likelihood of the consumer switching incorrectly. Weak regulation purely transfers mistakes between error types, with no gains for consumers within the market. However, we must be cautious as this is a static result and makes use of unit demand functions. Further the model has made many simple assumptions that are discussed in the conclusion.

Conclusions

This paper has a provided a first platform for understanding the possible anti-competitive issues surrounding the use of relative price communications to deter search. A simplified model has been presented and has shown that in a static cheap talk game, price communications can have no market power effects and price deception cannot occur. Without a source of credibility, a firm cannot use a price communication to deceive consumers or to alter the consumer's search behaviour. However, in the model, the introduction of consumer authorities who regulate price communications can, under some conditions, directly provide a source of market power to firms that would not otherwise occur. Inappropriate regulation can provide the credibility for consumers to believe a communication, while not sufficiently deterring firms from using false communications. Under the simple assumptions of the model however, despite assisting market power, the impact of this regulation does not affect consumer surplus.

We must treat these results with caution however as the model needs to be expanded to endogenise many of its features and simplifying assumptions. In particular, the model does not allow firms' pricing decisions to react to the changes in market power, nor does it show how firms may create and exploit their own sources of credibility. Current work is progressing on relaxing these assumptions in order to provide a deeper understanding of the issues.

Appendix:

Proof of Proposition 4:

For simplicity we only need consider the welfare measures in case ii) when $P_1 = P_H$ because case i) is unaffected by regulation. I define total welfare as the sum of expected consumer surplus, the two firms' profits net of fines, and the fine revenue. $W = CS + \Pi_1 + \Pi_2 + G$. Assume that any collected fines are perfectly appropriated and transferred into social surplus.

Firstly find the welfare under no regulation, W_0. The consumer always switches, and so Firm 1 earns no profits. The consumer expects to earn a surplus of $CS_0 = V - d - (\theta P_H + (1 - \theta) P_L)$, while Firm 2 earns $\Pi_2 = (\theta P_H + (1 - \theta) P_L)$, giving a total welfare of $W_0 = V - d$.

Now define welfare under weak regulation, W_w under equilibrium B. Welfare under equilibrium A is the same as no regulation. The consumer can now buy from either firm under his mixed strategy. Having observed a sign we know from (4) that his equilibrium payoff is zero. However, with no sign he correctly switches to Firm 2 for the low price, which gives him a positive expected surplus of $CS_w = (1 - \theta)(1 - L)(V - P_L - d)$ which can be shown to exactly equal CS_0. Thus the consumer is indifferent between $G \in [0, P_H)$. Firm 1 gains some sales but this is totally offset by fines, as dictated by equation (3), as his equilibrium payoff must be zero. Firm 1 gains nothing from weak regulation. Firm 2 now loses some sales, as the consumer no longer always switches. Firm 2's welfare can be shown to be equal to $\Pi_{2w} = \theta(1 - b)P_H + (1 - \theta)[(1 - L) + L(1 - b)]P_L$. When rearranged one can show that the loss in Firm 2's profits equals, $\Pi_{2w} - \Pi_{20} = -G[\theta(1 + \dfrac{dP_L}{P_H(V - P_L - d)})]$. The total welfare change $(W_w - W_0)$ then equals $((\Pi_{2w} - \Pi_{20}) + G)$ which is ambiguously signed. ●

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