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How Limiting Deceptive Practices Harms Consumers*

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Abstract

There are two competing sellers of an experience good, one offers high quality, one low. The low-quality seller can engage in deceptive advertising, potentially fooling a buyer into thinking the product is better than it is. Although deceptive advertising might seem to harm the buyer, we show that he could be better off when the low-quality seller can engage in deceptive advertising than not. We characterize the optimal deterrence rule that a regulatory agency seeking to punish deceptive practices should adopt. We show that greater protection against deceptive practices does not necessarily improve the buyer-welfare.

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1 Introduction

When the quality of an item on sale can be verified before purchase, firms' advertised claims about quality are unlikely to harm consumers. It is a different story, though, when product quality is not observable before purchase: low-quality firms may use advertising to deceive consumers about quality, leading them to make *ex-post* undesirable purchases.

This danger is well recognized by regulatory authorities.[1,2] Misleading or deceptive advertising is generally sanctioned under regulations designed to protect consumers. Yet, although deceptive claims might seem unambiguously bad, the effects of such practices on competition have not been well researched. In particular, what is the effect of deceptive advertising on consumer welfare in a competitive setting? Do regulations against it necessarily make consumers better-off? Surprisingly, we derive conditions under which consumers fare better when firms can make deceptive claims than when they are prevented from doing so.

To study these issues, we consider two sellers competing to attract a representative buyer. The sellers produce products of different quality. The buyer cannot determine which seller is offering high quality and which low, although he knows one seller supplies high quality and the other low. A seller deceives the buyer if she sells him a low-quality product that she falsely claims to be of high quality.

The objective of the analysis is to provide a rationale for deceptive practices in a competitive setting and derive implications for public policies about such practices. Interestingly, we show that the buyer can do better in pooling outcomes, in which the sellers charge equal prices, the low-quality seller advertises deceptively, and the buyer is deceived with positive probability, than he can in separating outcomes, in which the sellers quote different prices, there is no deception, and the buyer purchases the high-quality item with certainty. This is because our model highlights a novel tension between transparency

[1] In Canada, for example, section 74.01(1)(a) of the Competition Act prohibits any "representation to the public that is false or misleading in a material respect", whereas section 74.01(1)(b) prohibits any "representation to the public...of the performance, efficacy, or length of life of the product that is not based on adequate and proper test thereof...". When a court finds that a firm has violated these provisions, it may order the firm to stop the claim, to engage in corrective advertising, to returns to the buyers a portion of their purchase price and to pay significant damages of up to $10 million for the first violation and $15 million per violation thereafter.

[2] In the US, the *FTC Policy Statement Regarding Advertising Substantiation* states that: the FTC "intends to continue vigorous enforcement of the existing legal requirement that advertisers substantiate express and implied claims..." and that "...a firm's failure to possess and rely upon a reasonable basis for objective claims constitutes an unfair or deceptive act or practice in violation of Section 5 of the FTC Act". See, e.g., the FTC Policy Statement on Deception (1982) at: http://www.ftc.gov/bcp/policystmt/ad-decept.htm

and competition: given deception, the sellers appear to be closer substitutes in the buyer's eye, which creates downward pressure on prices. Hence, although the risk exists of being deceived, a product can be purchased at a lower price. In equilibrium, the gain from paying a lower price can outweigh the potential loss from acquiring a low-quality product. This can induce a regulatory authority concerned with consumer protection to choose a strategy of no deterrence. In fact, a *laissez-faire* policy maximizes the gains from competition by reducing the cost of deception, thereby making sellers more symmetric — a logic that echoes the literature on raising rivals' costs (see e.g., Salop and Scheffman (1983) and related literature). We also show that competition between sellers is a necessary ingredient for our results. Under monopoly, optimal fines need to be finite and consumers achieve their highest utility when information about quality is transmitted through prices.

There is a large literature that investigates how firms may signal product quality through prices — see, e.g., Nelson (1974), Milgrom and Roberts (1986), and Bagwell and Riordan (1991) among many others. The signaling mechanisms emphasized in these models typically distort prices, thereby creating additional costs to quality revelation that hinder its social value. However, even though they suggest that transparency may have implicit costs, these models are usually silent on the effect of enforcement policies on consumer welfare. This gap has been filled by the more recent information acquisition literature showing that mandatory disclosure rules about product quality and stronger liability regimes need not favor consumers when firms acquire costly and imperfect information about the quality of their products — see, e.g., Polinsky and Shavell (2012), Daughety and Reinganum (2008), Farrell (1986), and Matthews and Postlewaite (1985) among others. In fact, when the information that firms gather about their products' quality is imperfect, mandatory disclosure rules may hinder their *ex-ante* incentives to acquire information if the cost (or fine) of selling a low-quality product, 'advertised' as high-quality, is sufficiently high. This may, in turn, harm consumers as long as they prefer firms to disclose the information gathered rather than remain fully uninformed about quality. Hence, a strong liability regime may reduce consumer welfare when the cost of information acquisition is large enough. Yet, all these models assume that firms cannot make false statements about quality — i.e., that the evidence they gather is hard — and are silent regarding deceptive practices. This possibility has been introduced in an information acquisition setting by Corts (2013, 2014, 2015) who obtains similar conclusions: tougher enforcement policies against deceptive practices may harm consumers insofar as they hinder firms' incentives to acquire information about product quality.[3]

Our work offers three novel contributions to this literature. First, it points out that strong enforcement regimes may harm consumers even if firms do not need to acquire information about product quality, an assumption which seems natural in many industries. Second, while previous articles mostly focus on a monopolistic environment, we show that, without the need for information acquisition, deterrence is detrimental to consumers only in a competitive setting. Finally, to the best of our knowledge, our analysis is the first to emphasize the importance of pooling equilibria for the buyer-welfare, whereas previous models mostly focus on separating equilibria in which information is fully revealed.

2 The baseline model

Consider a duopoly in which one firm sells a high-quality good and the other a low-quality good. There is a single (representative) buyer, who consumes at most one unit of product.[4] He values the high-quality good at v_h and the low-quality good at v_l, both strictly positive and such that $\Delta \equiv v_h - v_l > 0$. The buyer knows that one firm produces high quality and the other low, but he cannot tell which is which.[5] The buyer's prior is that each is equally likely to be the high-quality seller: the buyer expects quality $\mathrm{E}[v] \equiv v_l + \frac{\Delta}{2}$. His utility after purchase is the value of the good less price paid.

Each seller can market its good by making a claim to the buyer about the quality of its product. Making a truthful claim is costless. A false claim is instead costly: a regulatory authority (hereafter, the Authority) may punish deceptive claims with a fine f, which is levied on a seller who misleads consumers whenever a purchase from that seller is made. An interpretation of f is that it corresponds to the expected monetary sanction which the Authority may impose on a seller who has falsely advertised her product quality after consumer complaints. Alternatively, it represents the expected loss should the buyer sue. Production costs are normalized to zero.

[3]Other models that deal with deceptive advertising but do not address the issue of optimal enforcement are Barigozzi, Garella, and Peitz (2009) and Hattori and Higashida (2012). See Bagwell (2007) for a comprehensive overview of the advertising literature.

[4]Non-negligible search costs allow us to rule out uninteresting cases where the buyer purchases from both sellers. Notice that a unit demand is also reasonable when the goods on sale are durable.

[5]We focus on the case of perfectly negatively correlated qualities to make our point in the clearest possible way. See Piccolo, Tedeschi, and Ursino (2014) for a similar model with weakly correlated qualities.

The timing of the game is as follows:

- t=0 Sellers learn their qualities.
- t=1 Prices are set and claims (if any) are made.
- t=2 The buyer observes prices and claims of quality (if any), updates beliefs, and decides which seller to patronize.

The equilibrium concept is *weak* Perfect Bayesian Equilibrium. A pure strategy for each seller is the choice of a price and a claim about quality.[6] Upon observing ads and prices, the buyer updates his beliefs, and decides whom to buy from.

To simplify the exposition, we will make the following assumption:

A1 The qualities supplied by the two sellers are not too different — i.e., $v_l > \frac{\Delta}{2}$.

This restriction, which applies if sellers are close competitors, allows us to focus on the most interesting case for our purposes: due to **A1**, there is a region of parameters in which only pooling equilibria exist. This allows us to focus on the competitive nature of our game. If **A1** did not hold, our policy prescriptions would remain valid, but require a further instrument, a price cap. We examine that case in an online Appendix for the interested reader.[7]

Finally, to focus on the most interesting equilibria in which at least one seller makes claims (advertises), we also impose that the buyer's beliefs on- and off-the-equilibrium path are such that when both sellers charge the same price, but only one of them advertises, the buyer believes that the advertising seller is the one supplying high quality. This rules out uninteresting equilibria in which sellers do not advertise.

Equilibrium analysis

In this section two types of equilibria are considered: separating and pooling equilibria.

[6]Because sellers' qualities are binary and perfectly negatively correlated, there is no loss of generality in assuming that sellers can either claim that their product is of high quality or make no claim.

[7]The online Appendix can be found at www.giovanniursino.eu/papers/Appendix_PTU_RAND.pdf.

Separating equilibria. In this type of equilibria, sellers charge different prices and the buyer is fully informed about the products' quality before he makes a purchase. Consider an equilibrium candidate in which the high-quality seller posts a price $p_h \leq v_h$ and the low-quality seller charges $p_l \leq v_l$, with $p_l \neq p_h$ and

$$v_h - p_h \geq v_l - p_l, \tag{1}$$

that is, the buyer purchases the high-quality product. In addition, suppose that both sellers advertise. The buyer's off-equilibrium beliefs are as follows:

A2 If the buyer observes only one unexpected price, off-equilibrium beliefs are the same as the on-equilibrium ones, regardless of advertising choices. If sellers charge the same price and both advertise, the buyer believes that they have an equal probability of supplying a high-quality good. If sellers charge the same price but only one advertises, the buyer believes that the one advertising is of high quality.

The reason for restricting attention to equilibria in which both sellers advertise is twofold. First, assuming that the high-quality seller advertises allows us to characterize the largest possible region of parameters in which a separating equilibrium exists. In fact, a successful deviation by the low-quality seller must involve costly deceptive advertising if the high-quality seller advertises in equilibrium, thereby making deviations less appealing. Second, recall that (by assumption) false advertising is costly to the low-quality seller only if she serves the buyer. As a consequence, there is no reason *a priori* to rule out equilibria in which she advertises and does not sell.[8]

It is now easy to verify that the equilibrium prices are those of a vertically differentiated Bertrand duopoly — i.e., $p_h = \Delta$ and $p_l = 0$. The argument hinges on the standard undercutting logic. First, under assumption **A2**, condition (1) must hold as an equality in a separating equilibrium: otherwise the high-quality seller would have an incentive to increase her price. Second, any other pair of prices that satisfy (1) as an equality, but features $p_l > 0$ cannot be an equilibrium as the low-quality seller would then profitably lower her price.

[8] The equilibrium analysis, as well as the policy implications highlighted in Section 3, do not change if the low-quality seller does not advertise in a separating equilibrium.

Having derived the sellers' equilibrium behavior, we now characterize the conditions under which the pair $p_h = \Delta$ and $p_l = 0$ is incentive compatible, provided that the buyer's off-equilibrium beliefs are as stated in assumption **A2** — i.e., there are no mimicking incentives. To begin with, consider a deviation in which the low-quality seller charges Δ. Obviously, given assumption **A2**, this deviation can be profitable only if she advertises. In this case, the buyer believes that sellers supply high quality with equal probability and thus values the good at $v_l + \frac{\Delta}{2}$ in expected terms. He will then purchase off-equilibrium as long as $v_l + \frac{\Delta}{2} > \Delta$, which is always true under **A1**. We assume the natural mixed strategy of the buyer (hereafter, the tie-breaking rule) that he purchases with equal probability from either seller when indifferent. It then follows that the low-quality seller has no incentive to mimic if and only if her deviation profit $\frac{\Delta - f}{2}$ is lower than 0 — i.e., $f \geq \Delta$. We have thus established the following result:

Proposition 1. *If assumptions* **A1** *and* **A2** *hold, a separating equilibrium in which $p_l = 0$, $p_h = \Delta$, both sellers advertise and only the high-quality one serves the buyer, exists if and only if $f \geq \Delta$. In this equilibrium, the high-quality seller obtains a profit of Δ, the low-quality seller makes zero profits and the buyer's utility is $v_h - \Delta$.*

The underlying intuition is simple: the buyer purchases if the low-quality seller deviates and mimics the high-quality seller. In fact, because of **A2**, he expects quality $v_l + \frac{\Delta}{2}$ and the off-equilibrium price Δ to be lower than that by **A1**. Hence, the separating equilibrium described above exists if and only if the low-quality seller has no incentive to deviate because the cost of mimicking exceeds the gain from deviation when $f \geq \Delta$ — i.e., her deviation payoff $\frac{\Delta - f}{2}$ is lower than or equal to zero.

Pooling equilibria. In this class of equilibria no information is transmitted. Consider a candidate equilibrium in which both sellers charge the same price (say p) and claim that their product is of high quality so that the buyer is potentially deceived by the low-quality seller. As the buyer holds symmetric priors, his posteriors are such that each seller supplies high quality with equal probability. Hence, the buyer's expected utility is non-negative as long as the equilibrium price does not exceed the expected quality — i.e.,

$$p \leq v_l + \frac{\Delta}{2}. \tag{2}$$

When the buyer is undecided between qualities, he may patronize either seller. As before, we assume that, in this case, he purchases from each seller with probability $1/2$.[9] It then follows that the (expected) equilibrium payoff of the high-quality seller is $\frac{p}{2}$, whereas the expected profit of the low-quality seller is $\frac{1}{2}[p-f]$, which is non-negative as long as

$$p \geq f. \tag{3}$$

Hence, the equilibrium price cannot fall short of f.

In order to form an equilibrium, the outcome described so far must be immune to deviations by the sellers. To check firms' incentives to deviate, we must first specify the off-equilibrium beliefs of the buyer. We make the standard assumption of pessimistic beliefs.

A3 The buyer believes that any deviation from the equilibrium path is made by a low-quality seller.

Assumption **A3** implies that: (i) the best deviation available to a low-quality seller features no advertising; (ii) a deviation to a price $p^d \neq p$ will be successful as long as the buyer has an incentive to purchase at p^d — i.e., if and only if

$$v_l - p^d > v_h - p.$$

That is, the deviation is successful provided that the buyer's utility from purchasing a low-quality product at price p^d is larger than his utility from buying a high-quality good at the equilibrium price p — i.e., the deviating seller, perceived as low-quality, has to offer a discount such that $p^d \leq p - \Delta$. As a result, the price that maximizes the payoff from deviation is $p^d = p - \Delta$, provided that $p - \Delta > 0$.

We first note that the incentives which really matter to establish the equilibrium are those of the low-quality seller. In fact, the equilibrium profit of the high-quality seller is larger than that of the low-quality one, whereas deviation profits are the same across seller types and equal to $p - \Delta$. Hence, a price p can be sustained in a pooling equilibrium if and only if the low-quality seller does not deviate, which implies that neither does.

Given **A3**, the best deviation of a low-quality seller requires no quality claims. Clearly, a low-quality seller will not deviate to a price $p^d > p$: the buyer would perceive her as supplying low quality at a high

[9] Allowing for different tie-breaking rules always restricts the range of pooling equilibria adding little intuition and complicating the analysis to no avail.

price and would not buy her product. Hence, her only plausible deviation is to undercut the prevailing price provided it is feasible — i.e., $p - \Delta > 0$. If she does so, the seller will earn lower profits than in equilibrium as long as

$$\frac{p-f}{2} \geq p - \Delta \quad \Leftrightarrow \quad p \leq 2\Delta - f. \tag{4}$$

Thus, the low-quality seller has more incentive to deviate the higher the equilibrium price p. The reason is that in equilibrium she sells with probability $\frac{1}{2}$, whereas off-equilibrium she sells for sure. Instead, her incentive to deviate weakens when the quality discount Δ needed for the buyer off-equilibrium increases, and when deceptive advertising is punished less harshly.

Summing up, a pooling equilibrium in which both sellers advertise exists if and only if there exists a price level that satisfies inequalities (2), (3) and (4) altogether. However, when this is the case, there are typically multiple equilibria — i.e., the price p that satisfies these conditions is not unique.[10] In what follows, we focus on the equilibrium with the lowest pooling price — i.e., $p^* = f$ as implied by the low-quality seller participation constraint (3). Intuitively, when no information is transmitted in equilibrium, it is as if the sellers produce a homogeneous good that the buyer values at $v_l + \frac{\Delta}{2}$. Hence, a Bertrand-like argument leads to an equilibrium price of f. In Remark 1 below we argue more formally why this is the most reasonable equilibrium to consider in our competitive environment.

At the lowest pooling price f, the no-deviation constraint of the low-quality seller ($f \leq 2\Delta - f$) is satisfied if and only if $f \leq \Delta$. Moreover, by **A1**, the buyer's expected utility in a pooling equilibrium is $v_l + \frac{\Delta}{2} > \Delta$. Hence, also the participation constraint of the buyer is satisfied at price f.

We define a pooling equilibrium in which both sellers charge the lowest possible price $p^* = f$ as the *most competitive pooling equilibrium.* Thus, we have established the following result:

Proposition 2. *If assumptions* **A1** *and* **A3** *hold, the most competitive pooling equilibrium in which both sellers advertise exists if and only if $f \leq \Delta$. The buyer purchases each product at price $p^* = f$ with probability equal to $\frac{1}{2}$.*

The underlying intuition is clear. Only if deceptive practices are not punished too severely, equilibria in which the low-quality seller issues false claims can exist. The novel feature of this outcome is that a larger fine f increases the sellers' expected profit and reduces the buyer's surplus. Hence, when no

[10]In a related article, Piccolo, Tedeschi, and Ursino (2014) characterize the entire set of pooling equilibria.

information is transmitted in equilibrium, sellers prefer a stricter enforcement, whereas the buyer ideally prefers no enforcement. We will expand on this point in Section 3.

Remark 1. As noted above, there exist other pooling equilibria featuring prices higher than f. We motivated our focus on the lowest price equilibrium using a Bertrand-like argument. We offer now a more formal argument to rule out equilibria with prices greater than f and provide a rationale for selecting the most competitive pooling equilibrium. In fact, suppose the off-equilibrium beliefs of the buyer are as follows:

A3a When the buyer expects sellers to post the same price $p > f$ and advertise, then:

- (i) if both sellers advertise and post any two prices not smaller than f, the buyer retains the equilibrium beliefs that each seller has equal probability of providing a high-quality good;
- (ii) following any other deviation, the buyer believes that the deviating seller provides low quality.

Relative to **A3**, assumption **A3a** features the additional property (i). This can be justified by the following reasoning of the buyer: "I expect that sellers coordinate on a price above f — if the price is lower, the low-quality seller will make a loss! When I see advertising from both sellers, but two different prices above f, they must have not coordinated on the same price. In fact, I can't tell who picked the wrong price and I shall think that they are equally likely to sell a high-quality good!".[11]

Thus, it is easy to show that, under **A3a**, there exists a *unique* pooling equilibrium, $p^* = f$. Of course, equilibria with price lower than f do not exist as they violate the participation constraint of the low-quality seller. Consider, then, an equilibrium candidate in which sellers quote a price $p > f$ and advertise. Clearly, both sellers have an incentive to slightly undercut p pretending to be making a coordination mistake. In fact, because this does not alter his beliefs, the buyer will purchase from the deviating seller making deviation profits higher than equilibrium ones. Hence, under **A3a**, $p > f$ cannot be an equilibrium. By contrast, showing that $p^* = f$ is still an equilibrium is straightforward.

[11]Note that the buyer may be smarter than implied by **A3a**. For instance, if he observes a price below f from a seller who is also advertising, he may realize that it might be the high-quality seller trying to signal her quality. In fact, this out-of-equilibrium strategy would cause a loss to the low-quality seller. We elaborate on this in Section 5.

3 Buyer-welfare and optimal enforcement

In this section, we present the novel insights our simple model holds for consumer welfare and policy recommendations. To this end, we now consider the Authority's choice of an enforcement level f. In setting f, the Authority has the power to determine the information received by the buyer. In fact, the choice of f determines whether sellers pool and the buyer may purchase a low quality product ($f < \Delta$), or whether sellers separate and signal their qualities through prices ($f \geq \Delta$), in which case the buyer always purchases the high-quality good.[12]

Consider first the separating outcome ($f \geq \Delta$). In this equilibrium, the buyer purchases the high-quality product but pays a price that fully extracts the quality premium Δ — i.e., his welfare is v_l. The possibility of making false claims about product quality plays a role only out of equilibrium, where constrains the separating outcome to the region in which $f \geq \Delta$, as shown by Proposition 1.

Next, consider the pooling equilibrium ($f < \Delta$). In this equilibrium, the enforcement level has a direct impact through prices on the buyer-welfare, which is equal to the expected quality minus the price: $v_l + \frac{\Delta}{2} - f$. Hence, a larger fine reduces the buyer-surplus.

We have established that:

Proposition 3. *If assumptions* **A1**–**A3** *hold, the buyer-surplus is maximized at* $f = 0$.

Figure 1 provides a graphical illustration of the welfare implications of our model. The cutoff point $f = \Delta$ splits the parameter space into two regions: one in which only the separating equilibrium exists and the other in which sellers coordinate on pooling equilibria.

Insert Figure 1 here

The figure shows that the buyer-surplus decreases as the enforcement effort increases at the most competitive pooling equilibrium, and it is higher at the separating equilibrium than at the most competitive pooling equilibrium for the intermediate levels of enforcement $f \in \left(\frac{\Delta}{2}, \Delta\right)$. This suggests that,

[12]Before learning her type, the expected profit of a seller at the pooling equilibrium is $\frac{f}{4}$ whereas it is $\frac{\Delta}{2}$ at the separating equilibrium. When $f = \Delta$ both equilibria exist. To select between them, we make the natural assumption that sellers coordinate on the separating equilibrium, which yields a higher expected payoff.

although the buyer ideally prefers no enforcement, he prefers an enforcement strict enough to deter deception — i.e., $f \geq \Delta$ — to intermediate levels of enforcement — i.e., $f \in (\frac{\Delta}{2}, \Delta)$.

Summing up, the Authority maximizes buyer-surplus by setting no fine (i.e., $f = 0$) against deceptive practices. In our model, this is because, even though the buyer purchases a low-quality good half the times, the downward pressure on prices at the most competitive pooling equilibrium benefits him more than enough to compensate for the expected quality loss. This result is, to the best of our knowledge, novel and shows that a stricter enforcement may actually harm uninformed consumers rather than enhancing their welfare, even in a setting in which firms do not need to acquire information about the quality of their products.

Remark 2. In the previous analysis, sellers coordinate on the pooling equilibrium with the lowest price. Although focusing on this equilibrium makes sense in many circumstances and can be micro-founded as discussed in Remark 1, one may wonder whether the main result holds when firms coordinate on pooling prices larger than the competitive one — e.g., because sellers are able to coordinate on higher prices. In other words, do consumers prefer to be deceived by low-quality sellers rather than learning qualities through prices and avail market power to the high-quality seller at any pooling price? In the model considered so far, in which advertising is perfect, it can be shown that this is not true if sellers coordinate on the maximal pooling price.[13] However, in a more general environment, in which advertising is costly not only on the extensive but also on the intensive margin — i.e., it is not perfect and its intensity matters — Piccolo, Tedeschi, and Ursino (2014) show that the qualitative insights of Proposition 3 hold even when sellers coordinate on the highest possible pooling price. This suggests that the policy prediction of our simple model does not rely on specific assumptions, but carries over to more general environments.

4 The role of competition

We now highlight the fundamental role played by competition in our analysis. The objective is to study whether the policy predictions derived in Sections 3 still apply in a monopolistic industry.

Suppose that, instead of two sellers, there is a single monopolist selling a good whose quality is

[13] The proof of this result is available upon request.

not known to the buyer. Again, the buyer's prior on the quality sold by the monopolist is 1/2 and false advertising of a low-quality product costs f to the monopolist (provided she sells). We assume off-equilibrium beliefs which follow the same logic of **A2-A3**, with the caveat that off-equilibrium beliefs now refer to different types of a unique seller rather than to different sellers. Namely, we will assume pessimistic beliefs, that is, any off-equilibrium strategy is attributed to a low-quality seller.

As before, first consider separating equilibria. Assume that both types claim that the product is high-quality, but charge different prices — i.e., p_h and p_l, respectively. A low-quality monopolist charges $p_l = v_l$: that is, the buyer does not purchase at higher prices, and lower prices are clearly sub-optimal. The price charged by the high-quality monopolist, instead, has to fall short of $v_h = v_l + \Delta$, otherwise the buyer does not purchase, and it must also exceed v_l, so as to guarantee information disclosure and maximize the monopolist's profits. It turns out that, as in the case of duopoly, this price is pinned down by the no-mimicking condition of the low-quality monopolist, which depends on the enforcement level and the quality differential. In fact, if the low-quality monopolist deviates and mimics the high-quality type, she earns $p_h - f$ provided that the buyer is willing to purchase. Hence, to prevent deviations, the equilibrium level of p_h has to be the highest price such that $p_h - f \leq v_l$. Together with the buyer's participation constraint, this yields:

$$p_h = \min \{v_l + f, v_h\}.$$

Therefore:

Proposition 4. *For pessimistic beliefs, a separating equilibrium under monopoly exists for every f. The monopolist charges price $p_l = v_l$ when selling a low-quality good, whereas she charges a price $p_h = v_l + f$ if $f < \Delta$ and a price $p_h = v_l + \Delta$ if $f \geq \Delta$, when selling a high quality good. Only the high-quality seller advertises and the buyer always purchases the good.*

Next, consider pooling equilibria in which the monopolist charges p regardless of her type and always claims to sell a high-quality product. Obviously, the monopolist will make a sale for sure, but p must exceed f to guarantee non-negative profits when selling a low-quality product. Hence, when selling the high-quality good, profit is p; whereas it is $p - f$ when selling low quality. Clearly, the monopolist has no incentive to charge a price lower than p. By contrast, when deviating to a price $p^d > p$, the monopolist is believed to be of low-quality and earns at most v_l. Thus, for the assumed off-equilibrium beliefs, the low-quality monopolist has no incentive to deviate as long as $p - f \geq v_l$. Because the buyer must be willing to purchase, the price must be $p \leq v_l + \frac{\Delta}{2}$. We thus have established:

Proposition 5. *If assumption* **A3** *holds, a pooling equilibrium under monopoly exists if and only if $f \leq \frac{\Delta}{2}$. The monopolist can charge any price between $v_l + f$ and $v_l + \frac{\Delta}{2}$, advertises the product and the buyer purchases the product.*

Proposition 5 characterizes the full set of pooling equilibria. Arguably, there is just one reasonable outcome in this setting — i.e., the maximal pooling price $v_l + \frac{\Delta}{2}$ that fully extracts the buyer-surplus. In fact, the Bertrand-like argument of Section 2, which allowed us to select the lowest pooling price f, does not apply here: under monopoly, any price less than $v_l + \frac{\Delta}{2}$ is difficult to rationalize.

Propositions 4 and 5 together imply that pooling and separating equilibria coexist when $f \leq \frac{\Delta}{2}$. As argued above, we select the equilibrium in which the monopolist earns the highest (expected) profit. In the range of parameters under consideration, the most profitable equilibrium for the monopolist is the pooling one. In fact, the high-quality monopolist earns more in the pooling ($v_l + \frac{\Delta}{2}$) than in the separating ($v_l + f$) equilibrium. The same is true for the low-quality monopolist as $v_l + \frac{\Delta}{2} - f$ exceeds v_l.

Assuming that the monopolist separates when indifferent to pooling or separating, which is the most favorable tie-breaking rule for the buyer, as it will be clear from Figure 2, we expect the pooling equilibrium with price $v_l + \frac{\Delta}{2}$ to be the prevailing outcome when $f < \frac{\Delta}{2}$. In this range of parameters the buyer-surplus is zero. The same is true when $f \geq \Delta$ as both types fully extract the buyer-surplus. By contrast, when $f \in \left[\frac{\Delta}{2}, \Delta\right)$ the separating equilibrium features $p_h = v_l + f$, so that the buyer-surplus is positive when purchasing from the high-quality monopolist. In particular, the buyer-surplus evaluated *ex-ante* — i.e., before the type of the monopolist is revealed — is $\frac{\Delta - f}{2}$. This leads to the following result:

Proposition 6. *Under monopoly, the buyer-surplus is maximized at $f = \frac{\Delta}{2}$.*

The intuition is straightforward. Full surplus extraction occurs both at the pooling equilibrium and at the separating equilibrium when $f \geq \Delta$. Hence, the best policy for the Authority is to induce a separating equilibrium with the lowest possible fine. In fact, provided f does not fall short of $\frac{\Delta}{2}$, so that the the pooling equilibrium does not prevail, selecting the smallest possible f maximizes the incentives of the low-quality monopolist to deviate. This, in turn, drives down the price that the high-quality monopolist can charge in equilibrium to prevent deviations, which benefits the buyer. In a sense, a low f induces tougher competition between the different types of monopolist. Figure 2 provides a graphical illustration of the welfare under monopoly: it plots the buyer-surplus as a function of f.

Insert Figure 2 here

This result has an interesting policy implication: even though in competitive markets any attempt by the Authority to discourage false claims can be detrimental to consumers — i.e., the optimal level of enforcement is $f = 0$ — and consumers prefer to be deceived rather than learning qualities through prices, under monopoly, optimal fines need to be finite and consumers achieve their highest utility when information about quality is transmitted through prices. Finally, it is easy to verify that at the optimal policy, the buyer-surplus is larger when sellers compete than in a monopoly — i.e., $v_l + \frac{\Delta}{2} > \frac{\Delta}{4}$.

5 Robustness

This section provides a robustness check on the analysis developed up to this point. In particular, we characterize the pooling equilibrium assuming that the buyer is more sophisticated and realizes that a high-quality seller can credibly signal her type by pricing below f and advertising. To account for this feature, the off-equilibrium beliefs are:

A4 If a seller advertises and sets a price lower than f, the buyer believes that she provides high quality. For any other deviation, he believes that the deviating seller provides low quality.

Assumption **A4** implies that: (i) the best deviation of a low-quality seller features no advertising; (ii) deviation to price $p^d \neq p$ is successful as long as the buyer has an incentive to purchase at p^d — i.e., if and only if

$$\begin{aligned} v_l - p^d > v_h - p \qquad & \text{if} \quad p^d > f, \\ v_h - p^d > v_l - p \qquad & \text{if} \quad p^d \leq f. \end{aligned}$$

That is, if the deviating seller's price is above f, the deviation is successful provided that the buyer's utility from purchasing a low-quality product at price p^d is larger than his utility from buying a high-quality good at the equilibrium price p — i.e., the deviating seller, perceived as low-quality, has to offer a discount such that $p^d \leq p - \Delta$. If, instead, the seller deviates to a price lower than f, she effectively signals her high-quality type and the buyer is willing to purchase from her as long as the price does not exceed the equilibrium price by more than the quality premium — i.e., $p^d \leq p + \Delta$.

Thus, in the first case — i.e., when $p^d > f$ — the price that maximizes the payoff from deviation is $p^d = p - \Delta$, provided that $p - \Delta > f$. In the second case — i.e., when $p^d \leq f$ — the price which maximizes deviation payoffs is $p^d = f$ because $f < p + \Delta$ by (3).

Consider the sellers' incentives to deviate. Price p can be charged in a pooling equilibrium if the profits of both sellers are larger than deviation profits at any off-equilibrium price, be it above or below f. Consider first a high-quality seller: she will not deviate to a price (lower or) equal to f and signal her high quality as long as

$$\frac{p}{2} \geq f \quad \Leftrightarrow \quad p \geq 2f. \tag{5}$$

On the other hand, if the equilibrium price is sufficiently high — i.e., if $p - \Delta > f$, which implies that undercutting to a price above f is profitable — a high-quality seller will not undercut to $p^d = p - \Delta$ if

$$\frac{p}{2} \geq p - \Delta \quad \Leftrightarrow \quad p \leq 2\Delta. \tag{6}$$

Hence, any price $p \in [2f, 2\Delta]$ is invulnerable to deviations from a high-quality seller. If it is better to serve the buyer with even chances at the equilibrium price p rather than serving the buyer for sure at the lower price f, then p is not vulnerable to such a deviation — i.e., (5) holds. Moreover, if the discount Δ needed to attract the buyer when he believes he is purchasing a low-quality good is too high relative to the equilibrium profits, then there is no incentive to undercut the equilibrium price — i.e., (6) holds.

Let's now turn to the incentives of a low-quality seller. Clearly she will not deviate to price $p^d \leq f$ while advertising. If she did so, she would sell at a price lower or equal to the sanction she would pay for deceiving the customer. Hence, the only plausible deviation is to undercut the prevailing price, provided it is feasible — i.e., $p - \Delta > f$. In this case, the no-deviation condition is the same as in the baseline model: the seller will not deviate as long as (4) holds.

Summing up, a pooling equilibrium in which both sellers advertise exists if and only if there exists a price level that satisfies inequalities (2), (4) and (5) altogether. Clearly, the no-deviation constraint of the high-quality seller (5) defines the minimum price which can be charged in a pooling equilibrium under **A4** — i.e., $p^* = 2f$. Moreover, at the minimum price, the no-deviation constraint of the low-quality seller (4) is satisfied if and only if $f \leq \frac{2}{3}\Delta$ whereas the participation constraint of the buyer (2) is satisfied if and only if

$$f \leq \frac{1}{2}\left(v_l + \frac{\Delta}{2}\right).$$

Differently from the baseline case, the participation constraint of the buyer is no longer implied by the combination of **A1** and the low-quality seller's no-deviation constraint. We have thus proved the following result.

Proposition 7. *If assumptions* **A1** *and* **A4** *hold, the most competitive pooling equilibrium in which both sellers advertise exists if and only if*

$$f \leq \overline{f} \equiv \min\left\{\frac{2}{3}\Delta, \frac{1}{2}\left(v_l + \frac{\Delta}{2}\right)\right\}.$$

The buyer purchases each product at price $p^* = 2f$ with probability equal to $\frac{1}{2}$.

Assuming that the buyer is more sophisticated restricts the range of parameters in which a pooling equilibrium with advertising exists. The intuitive reason is that the equilibrium price must now be high enough to prevent high-quality sellers from signaling their type. This, in turn, makes a deviation by low-quality seller more attractive and the buyer participation constraint tighter, thereby making a pooling equilibrium harder to sustain.

The analysis of the separating outcome, characterized in Proposition 1, is unaffected by the change in the buyer's sophistication. Hence, none of the equilibria characterized so far — both separating and pooling — exists when $f \in \left(\overline{f}, \Delta\right)$. What type of outcome emerges in this range of parameters? Do the welfare properties of the previous equilibria remain valid also in this region? In what follows, we show that, in this range of parameters, there exists a separating equilibrium, sustained by off-equilibrium beliefs different from those of **A2**. In this equilibrium sellers signal their quality through the advertising strategy rather than through prices.

Consider a candidate equilibrium in which both sellers charge a price equal to f, the high-quality seller advertises, and the low-quality one does not. In equilibrium the buyer purchases from the high-quality seller, whereas out of equilibrium he holds the following belief:

A5 If sellers charge the same price and choose the same advertising strategy, the buyer believes that it is equally likely that they are of high quality. If the buyer observes a price lower than f coupled with advertising, he believes that the deviating seller is of high quality. Any other deviation is attributed to a low-quality seller.

Showing that the above strategy profile and system of beliefs form an equilibrium is straightforward. The high-quality seller would obviously never profit from any deviation: there is no incentive to charge a price below f because this strategy would yield a profit lower than the equilibrium one. Neither is there any incentive to set a price greater than f, because the buyer would not purchase from her. *A fortiori*, as long as $f \leq \Delta$, the low-quality seller has no incentive to deviate because any successful deviation requires costly advertising.[14] As a result:

Proposition 8. *Assuming that **A5** holds, then for any $f \leq \Delta$ there always exists a separating equilibrium in which sellers charge the same price f, but separate through advertising. The buyer purchases the advertised good.*

Summing up, for $f \in \left[0, \overline{f}\,\right]$ both pooling and separating equilibria exist, whereas for $f > \overline{f}$ only separating equilibria exist. It remains to ascertain which equilibrium prevails when the Authority sets $f \leq \overline{f}$. We adopt the selection criterion that sellers coordinate on the equilibrium that yields the greatest *ex-ante* profit. It is easy to check that a seller expects profit $\frac{3}{4}f$ in the pooling equilibrium of Proposition 7, whereas she earns $\frac{f}{2}$ in the separating equilibrium of Proposition 8. Hence, the pooling equilibrium emerges when $f \leq \overline{f}$, the separating equilibrium with high-quality price $p_h = f$ arises when $\overline{f} < f < \Delta$ and the separating equilibrium with high-quality price $p_h = \Delta$ is the outcome when $f \geq \Delta$.

Finally, the buyer's welfare under the three equilibria corresponding to the different parameter regions is $v_l + \frac{\Delta}{2} - 2f$, $v_l + \Delta - f$ and v_l as f moves from $\left[0, \overline{f}\right]$ to $\left(\overline{f}, \Delta\right)$ and then to $[\Delta, +\infty)$, respectively.

[14]Note that alongside the equilibrium just described, by using the same logic, it is possible to show that in the range of parameters under consideration, there are other pay-off equivalent equilibria in which the low-quality seller charges a price between 0 and f.

Let's now consider the Authority's problem. The Authority has the power, by setting f, to determine which equilibrium emerges given the sellers' coordination described above. We solve the optimization problem of a buyer-oriented Authority in two steps: first we derive the buyer-surplus maximizing policy within each equilibrium and then pick the one that globally maximizes the buyer's surplus. To do so, notice that, in the pooling region, $f \leq \overline{f}$, the best policy is to set $f = 0$ so as to induce a price equal to zero. Then, the buyer-surplus is $v_l + \frac{\Delta}{2}$. When $f \geq \Delta$ the buyer-surplus is always v_l, which is trivially lower. Hence, the Authority never sets $f \geq \Delta$. Finally, in the intermediate region, $f \in \left(\overline{f}, \Delta\right)$, the Authority optimally sets $f = \overline{f} + \epsilon$. In this case, the buyer-surplus is (slightly lower than) either $v_l + \frac{\Delta}{3}$ or $\frac{v_l}{2} + \frac{3}{4}\Delta$, depending on whether $\overline{f} = \frac{2}{3}\Delta$ or $\overline{f} = \frac{1}{2}\left(v_l + \frac{\Delta}{2}\right)$. It is immediate to verify that, under **A1**, both surpluses are lower then the buyer's surplus in the best pooling equilibrium. We have thus established the following result:

Proposition 9. *If assumptions* **A1** *and* **A3**–**A5** *hold, buyer surplus is maximized at* $f = 0$.

Hence, our main policy implication is unaffected by a greater degree of buyer sophistication.

6 Conclusion

We developed a model in which competing sellers of an experience good offer similar products of different qualities. The low-quality seller can make false claims about its product, potentially fooling a buyer into thinking the product is better than it is. We characterized uninformative (pooling) equilibria in which the buyer purchases without information about the products' qualities and informative (separating) equilibria in which the he is perfectly informed about the qualities. Uninformative equilibria exist because the low-quality seller can be deceptive. Although deception may harm the buyer *ex-post*, we have shown that he can be better off *ex-post* when the low-quality seller can engage in deception because of the resulting downward pressure on prices. Building on this insight, we showed that a strong liability regime reduces consumer welfare. This result is driven by the assumption of competition between sellers and cannot emerge in a monopoly; in addition, it is robust to the introduction of a greater degree of buyer sophistication.

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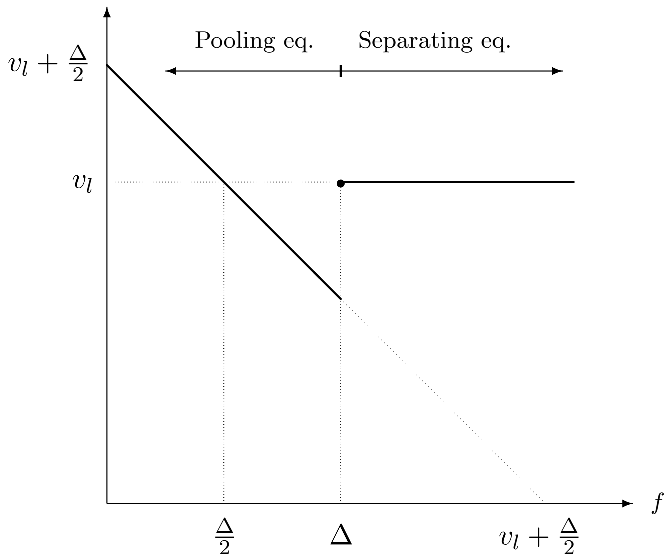

Figure 1: Buyer-surplus and Authority enforcement

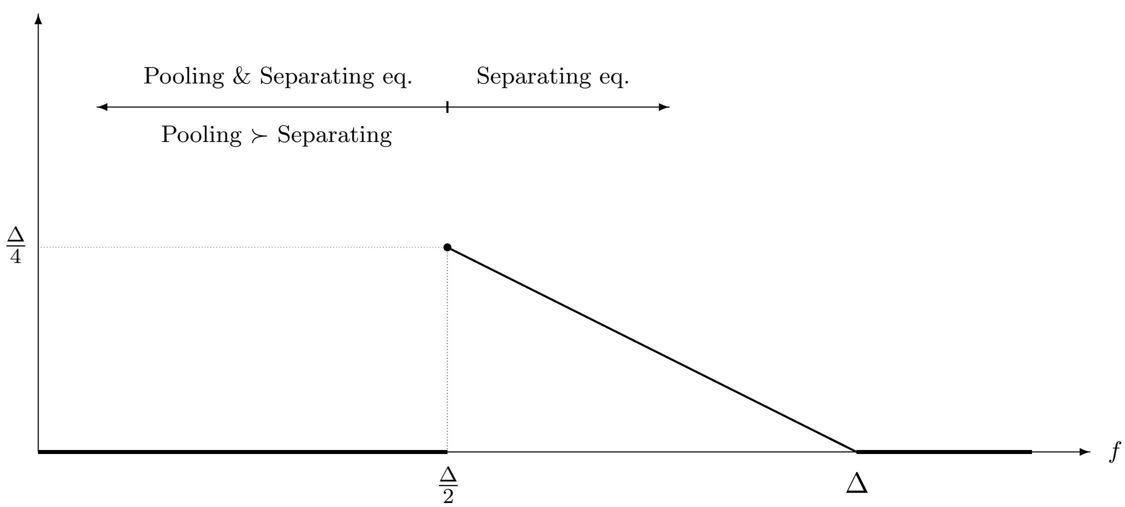

Figure 2: Buyer-surplus and Authority enforcement under Monopoly

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