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Exposing false advertising

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Abstract. Countries rely on different public and private agents to enforce consumer protection and fair competition regulations. To analyze the repercussions of different regimes on social welfare, we consider the possibility of false advertising by a firm in an environment with duopolistic competition and with consumers who can be rational or naïve regarding the trustworthiness of advertising claims. We compare the incentives for and outcomes of false advertisement verification and injunction requests made by one of three parties: a government agency with a broad focus maximizing (ex post) total welfare and two narrowly focused parties, the first a public or private party focused on consumer welfare net of its own enforcement costs and the second a competitor interested exclusively in its own profits. Considering ex ante welfare, we find that having a narrowly focused party as the plaintiff can be optimal due to government agency commitment problems. The optimal regime depends on both the share of the population's naïve consumers and the level of enforcement costs.

Résumé. Dénonciation de la publicité mensongère. Pour veiller à l'application des réglementations en matières de protection des consommateurs et de concurrence loyale, les états s'appuient sur différents régimes de contrôle représentés par des agents publics et privés. Afin d'analyser les répercussions de ces différents régimes sur le bien-être, nous évaluons la possibilité qu'une entreprise puisse diffuser de la publicité mensongère dans un environnement concurrentiel duopolistique avec des consommateurs potentiellement rationnels ou « naïfs » relativement à la véracité des allégations publicitaires. Nous comparons les mesures incitatives pour contrôler la publicité mensongère et leurs résultats, ainsi que les mises en demeure initiées par l'une de ces trois parties : une agence gouvernementale à visée large aux fins de maximisation totale du bien-être ex post, et deux autres parties à visée plus ciblée: l'une publique ou privée tournée vers le bien-être des consommateurs, déduction faite de ses propres coûts de mise en œuvre, et l'autre représentée par un concurrent s'intéressant exclusivement à ses propres profits. En tenant compte du bien-être ex ante, et en raison des problèmes d'engagement des agences gouvernementales, nous constatons qu'une procédure peut s'avérer optimale

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dès lors que le demandeur représente une partie à visée plus ciblée. Le régime optimal dépend à la fois de la proportion de consommateurs « naïfs » et du niveau des coûts de mise en œuvre.

JEL classification: K41, K42, L13, L15

1. Introduction

WE ANALYZE LAW enforcement in the context of false advertising, a prominent aspect in consumer protection and unfair competition law. Advertising is a fundamental strategic variable that firms use to highlight their own product's quality in an attempt to gain a competitive edge over their competitors. For consumers, the value of the information conveyed by advertisements depends on its trustworthiness. Consequently, regulations typically restrict firms from making inaccurate or misleading claims.

Courts can order injunctions to stop misleading advertising. The rules specifying which parties are allowed to file injunction suits or take other actions against false advertising differ across countries. For example, in the European Union, Directive 2005/29/EC sets the rules concerning misleading advertising in the business-to-consumer relationship. Article 11 requires member states to “ensure adequate and effective means” to enforce firms' compliance in the interest of consumers; it explicitly stresses the role of persons and institutions with a legitimate interest in bringing forth claims. The mode of implementation is left to national governments and allows for private parties, a specialized administrative authority or a combination of both to initiate legal proceedings. This means that public entities as well as competitors or non-governmental consumer protection agencies may be involved in enforcement and that implementation differs across the member states (see European Commission 2012). In some countries (e.g., France, Italy and the United Kingdom), public authorities generally take action against rogue traders, whereas Austria and Germany rely to a large extent on private law enforcement by competitors, consumer protection agencies or industry organizations. In comparison, in the United States, the Federal Trade Commission (FTC) and its Division of Advertising Practices enforce the truth-in-advertising laws across different media outlets.¹ However, private parties can also bring claims against false advertising on their own (for example based on section 43(a) of the *Lanham Act*).

We compare the incentives for different parties to initiate verification of advertising claims and injunctions against false advertising. We organize our

1 The FTC “authorizes the filing of a complaint when it has ‘reason to believe’ that the law has been or is being violated and it appears to the Commission that a proceeding is in the public interest” (ftc.gov). In addition, alongside its authority to investigate law violations by individuals and businesses, the FTC also has federal rule-making authority to issue industry-wide regulations (e.g., labelling requirements).

analysis according to the plaintiffs' objective functions. We consider three options involving three different types of plaintiffs. The first plaintiff is a public agency, such as the FTC, that has a broad focus on total (ex post) welfare. The second type of plaintiff could be one of two entities, both with narrower focuses. These could also be a public agency such as the Food and Drug Administration (FDA) or, again, the FTC—both of whom also often concentrate on consumer welfare (possibly net enforcement costs) or they could be private entities. The other narrowly focused agent is a profit-maximizing competitor. A main assumption is that some consumers take all uncontested advertising messages at face value, whereas rational consumers understand that an uncontested advertisement may contain exaggerated claims. Our work shows the incentives to file suit and analyzes the equilibrium outcomes from a welfare perspective.

Only limited research on the economic effects and implications of false advertising explicitly takes law enforcement into account. In this paper, we contribute to the literature in two important ways. First, we take advantage of differences in national legislation as a way to analyze the incentives of different parties to demand verification of advertising claims and injunctions against false advertising. From a social welfare and consumer point of view, these incentives have important implications with regards to who should be involved in law enforcement in the first place (to maximize the ex ante expected surplus). Second, we identify consumer rationality and the costs of law enforcement as two important factors for designing an adequate legal framework. Both elements affect the behaviour of each potential plaintiff in distinct ways with direct repercussions for social welfare.

We analyze a duopoly market with horizontal product differentiation à la Hotelling (1929). In this market, one firm offers a product of known *standard* quality, whereas the other firm has private information with regards to whether its product is of *high* or *standard* quality (which introduces possible vertical product differentiation). The latter firm decides whether to (possibly falsely) advertise a *high*-quality product. The public or private entities involved in law enforcement may ask for verification of the true quality and may issue injunctions against false advertising. The process of verifying false advertising, which, in turn, leads to a possible injunction, entails enforcement costs. In the main part of the paper, allocation of these costs follows the *English* cost-allocation rule, that is, the party losing in court bears all enforcement costs and has to reimburse the prevailing party's costs.

Our results for the comparison of plaintiffs' incentives given their broad or narrow focus, respectively, are driven by two main mechanisms. First, there is a fundamental distortion induced by the differences in (expected) product qualities and duopolistic price setting. From a social welfare point of view, consumer choices should be made based on a comparison of transport costs and rationally expected product qualities. However, the actual decisions in the market equilibrium are distorted for two reasons: First, a firm claiming higher quality charges higher prices which, given rational beliefs, leads

to underconsumption of the product. Second, naïve consumers overestimate the probability of high quality in the event of uncontested advertising. This counteracts the tendency of underconsumption for this group of consumers, possibly leading to some overconsumption. In the event of uncontested advertising, a higher share of naïve consumers leads to a larger price difference aggravating the first distortion (relevant for rational consumers) but can increase overall welfare, as for naïve consumers, their non-adjusted beliefs counteract their tendency toward underconsumption. As a result, for some range, an increase in the share of naïve consumers reduces incentives for demanding quality verification for a welfare-maximizing government agency, whereas it increases incentives for those plaintiffs with a narrow focus. This is because misled, naïve consumers especially hurt narrowly focused plaintiffs either directly as consumer rent decreases or indirectly as profits decline.

The second important mechanism is the existence of a possible commitment problem of the law enforcer. Demand for the verification of advertising claims arises only after an advertisement has been placed, whereas the decision to advertise in a false way is based on the likelihood of being taken to court. That is, a more aggressive strategy by the law enforcer—or, in other words, a higher probability of demanding verification—is likely to deter false advertisement in the first place. In such a setting, it may be welfare-enhancing to appoint a plaintiff with a narrow focus that is more aggressive than an ex post welfare-maximizing public entity.

We find that when enforcement costs are not too high, there is an equilibrium in mixed strategies in which the firm with private information about its product quality sometimes falsely advertises a high quality and the law enforcement agent sometimes demands verification and injunctions against false advertising. When enforcement costs are high, verification is never requested and the firm with the unobservable quality always advertises a high quality (independent of actual quality). Given enforcement costs, a party with a narrow focus is more likely to demand verification when the share of naïve consumers is larger. A comparison of the incentives to request for verification shows that a welfare-maximizing agency is more likely to initiate legal action when both the shares of naïve consumers and enforcement costs are low; otherwise, the party with a narrow focus is (weakly) more likely to take legal action.

These positive findings have important normative implications for consumer surplus and ex ante expected social welfare. In equilibrium, neglecting law enforcement costs, consumers always prefer the party with the greater incentives to ask for verification (the more aggressive agent), that is, the welfare-maximizing agency for low shares of naïve consumers and low enforcement costs, and the party with a narrow focus otherwise. Turning to social welfare, we find that an ex post welfare-maximizing agency also obtains higher levels of ex ante expected social welfare as long as it is the most aggressive entity. In contrast, when a party with a narrow focus is the more aggressive agent, social welfare can be higher or lower for the entity with a narrow focus.

As long as enforcement costs are not too high, the loss in welfare due to too many trials *ex post* can be more than offset by stronger deterrence of false advertising. As a result, for low to intermediate enforcement costs and a sufficiently high share of naïve consumers, expected social welfare is higher for a party with a narrow focus.

The paper proceeds as follows. In section 2, we review the related literature. Section 3 presents the model. We derive the equilibrium in section 4 and compare the incentives to demand quality verification for the welfare-maximizing agency and the two parties with a narrow focus. In section 5, we describe the implications for social welfare and consumer surplus. We discuss several extensions to the main analysis in section 6. Section 7 concludes.

2. Literature review

Our paper focuses on false advertising regarding a product's quality² and law enforcement when advertising aims to reach a population that includes both rational and naïve consumers.³

Early contributions that also allow for false advertising include Nelson (1974), who distinguishes search and experience goods, and Schmalensee (1978), who considers advertising as a contest. Mizuno and Hiroyuki (1990) include the possibility of consumer learning about true quality. Dixit and Norman (1978) assume that advertising leads to an outward shift in demand for a firm and discuss whether the original or the shifted demand curve should be used for evaluating consumer welfare.

More recently, Glaeser and Ujhelyi (2010) analyze various responses to regulating misinformation (counter-advertising, taxation and product regulation). The authors assume that consumers naïvely believe all advertising claims (see also Hattori and Higashida 2012 and 2014 for duopoly markets with either horizontally or vertically differentiated goods). Their results suggest that a certain amount of misinformation about product quality may improve social welfare under imperfect competition. Our work differs from theirs in

2 Some contributions on false advertising consider specific practices which are not related to claims about quality. For example, Lazear (1995) considers the “bait and switch” strategy in which the seller falsely claims to provide a good to lure consumers to its store, whereas Armstrong and Chen (2013) investigate the false depiction of offered prices as a discount. Similarly, Deng et al. (2018) investigate firms' incentives to offer false promotions and the impact of consumer sophistication and word-of-mouth effects.

3 Advertising regarding product quality may also be considered as a specific form of information transmission, which is part of a more general strand of the literature. Models in this vein consider the possibility of credible information transmission of self-interested parties and sometimes invoke the notion of lying costs. See, for example, Milgrom and Roberts (1986), Kartik et al. (2007), Kartik (2009) and Kamenica and Gentzkow (2011).

two respects: (i) while considering a market with constant overall demand, we allow for a variable share of naïve consumers and, most importantly, (ii) we focus on law enforcement against misleading claims.

As in our model, Nagler (1993) and Hattori and Higashida (2015) relax the assumption of only naïve consumers. Nagler (1993) allows consumers to learn, at some cost, about the trustworthiness of advertising and establishes that firms may still use misleading advertising. Hattori and Higashida (2015) set up a model of price competition between two firms producing horizontally and vertically differentiated products allowing for misleading advertising. Their findings, similar to those of Glaeser and Ujhelyi (2010), show that misinformation has two effects, which go in opposite directions from a social welfare point of view: misinformation distorts consumers' decision-making but can correct inefficiencies resulting from the misallocation of goods. Our study differs from theirs in that we consider that advertising can be informative, rather than always being misleading. Furthermore, while fully rational consumers in our setup may not know the product quality with certainty, they also learn from advertisements. And, again, we focus on different agents' incentives to take legal action, a topic that these studies do not address.

A different strand of the literature addresses law enforcement by introducing fines for false statements in settings with rational consumers and costless advertising. As pointed out in Corts (2013), in a monopoly setting, the existence of fines allows for advertising to become a credible signal of high quality. Depending on the fine, pooling or separating equilibria for advertising will occur.⁴ Corts (2014a) introduces the idea that very high fines may be detrimental when firms face uncertainty about product quality and that they may refrain from advertising altogether. Piccolo et al. (2015) use a duopoly model in which the consumer buys one unit from either of two firms. As in Corts (2013), the type of equilibrium depends on the fine for false statements. The authors emphasize that high fines can hurt the consumer by weakening the degree of price competition; this can more than offset the advantage from the higher probability of buying the higher-quality product.

Closely related to this literature and also to our paper is Rhodes and Wilson (2018). The authors analyze a model with rational consumers and a regulator who is able to punish false claims. In their setup, false advertising can have a beneficial effect ("price" effect) by counteracting market power; the high-quality firm will choose a lower price if it cannot signal its type. As a result, firms favor stricter regulations (higher fines) than consumers do. At the same time, the negative consequences of false advertising are due to the "persuasion" effect, leading consumers to misperceive true quality. The authors provide conditions under which weak, rather than strong, regulation can be optimal for consumers and society due to the positive effects of false advertising in counteracting firms' market power. These studies mainly focus

4 Using the same basic setting as in Corts (2013), Corts (2014b) looks more generally at the welfare effects of information about quality.

on a monopoly setup (see Piccolo et al. 2015 for an exception) and, throughout the analysis, they assume that consumers are rational. By contrast, we focus on competition, and we allow for naïve consumers.⁵ More importantly however, instead of introducing an expected fine, we assume a different kind of law enforcement by explicitly modelling the decisions of whether to request costly verification of quality.

The topic of different law enforcement entities has received only limited attention in the literature on advertising. With regards to competitors as plaintiffs in false advertising claims, Barigozzi et al. (2009) consider comparative advertising. In their model, false comparative advertising allows the competitor to file suit, which—as in Corts (2013)—may allow for credible signalling of product quality and therefore facilitates market entry of high-quality firms.⁶ The latter finding contrasts with the earlier considerations of Jordan and Rubin (1979), who deliberate on the incentives of different parties to file suit with regards to false advertising. Whereas consumers might not file a suit due to a rather low value of an individual claim, the authors indicate that allowing for injunction suits by competitors may be misused as a device to deter market entry, especially when claims about quality are difficult to verify. In our setup, we abstract from the possibility of errors in court but also indicate that advertising becomes more credible the more aggressive the law enforcement party is.

3. The model

We consider a model of horizontal product differentiation à la Hotelling (1929) with two firms, 1 and 2. The firms are located at the extremes of a linear city of unit length. Firm 2 is located on the right end and offers a product of normal quality, which consumers value at v , where $v > 0$. Firm 1 is located at the left end and is one of two types. With probability $1/2$, firm 1 offers a product with normal quality. With the remaining probability of $1/2$, firm 1 is of high type and produces a high-quality good, which is valued by consumers at $v + 1$.⁷

5 Allowing for naïve and rational consumers has increasingly gained attention in the industrial organization literature. Different from our advertising setup, these models often look at strategies such as hidden prices which firms may use to exploit consumer naïveté. See, for example, the early survey by Ellison (2006) or contributions such as Gabaix and Laibson (2006) and Heidhues et al. (2017).

6 Emons and Fluett (2012) also compare non-comparative and comparative advertising and allow for overstatement of product quality in a signalling game.

7 In section 6, we briefly report results for a second case in which firm 1 offers either normal or low quality. Note that, in a situation involving two firms with large quality differences, if firm 1 were able to use uncontested advertising as a consistent strategy for driving its competitor out of the market, the competitor would always demand verification of quality in an attempt to survive. (This assumes limited liability, which means that the competitor does not bear enforcement costs in case of losing in court.) Then, however, false advertising

The type of firm 1 is its private information. Firm 1 may choose whether to (possibly falsely) advertise high product quality to consumers. Advertising is assumed costless per se.⁸ For both firms and both quality levels, production costs are normalized to zero.

Consumers of mass one are uniformly distributed along the line. With valuation v sufficiently high, each consumer buys one unit from either firm 1 or firm 2. Consumers know that firm 2 offers a product of normal quality, whereas firm 1 may offer a high-quality product. A consumer located at x who buys from firm 1 pays price p_1 and bears linear transport costs x ; buying from firm 2 results in costs p_2 and $1 - x$.⁹ We consider two types of consumers. At each point along the line, a share q of consumers is naïve (subscript n), whereas the remaining share $1 - q$ is rational (subscript r). As made precise below, naïve and rational consumers differ in how they process available information to assess product quality.

In the event that firm 1 advertises high quality, it may be confronted with a demand for verification of quality. If false advertising is verified, the firm is faced with an injunction to cease advertising.¹⁰ We assume that verification and associated court trials always result in a correct ruling.

We consider three different parties demanding the verification of quality and an injunction in the case of false advertising. The first entity's objective function is given by expected (ex post) social welfare; it can be interpreted as a public authority. The other two parties are characterized by a narrower focus. We consider the competitor or an agency interested in consumer welfare net its own enforcement costs. The total costs for verification and a possible injunction are denoted by k , where $k > 0$.¹¹ The cost-sharing rule applied corresponds to the English rule, which means that full costs are borne by the law-enforcing party in the case of high quality and by firm 1 in the event of false advertising.¹² In our setup, all parties have the same knowledge about the market characteristics and decide on a demand for verification only after

would not be an issue. We conjecture that the main effects of our analysis are valid, even if corner solutions are obtained in the price-setting game without limited liability.

- 8 We mainly require that advertisement costs do not depend on the product's true quality. By this assumption, signalling via advertising expenditures is excluded.
- 9 Assuming quadratic transportation costs would result in qualitatively similar results.
- 10 In section 6, we discuss the consequences of considering damages or fine payments in the event of detected false advertising.
- 11 We neglect the possibility of different costs for different parties in law enforcement. Costs could certainly differ leading to corresponding consequences for welfare. For an early discussion of this issue, see Polinsky (1980).
- 12 Qualitatively, our results are not affected if we instead assume the American rule for cost sharing, which implies that each party bears its own litigation costs independent of the outcome of the verification process (see section 6).

observing an advertisement. With the latter assumption, we follow McAfee et al. (2008), who assume that neither public nor private enforcement involves the possibility of pre-commitment.¹³

Consumers' posterior beliefs at the time of their purchase decisions are dependent on their type, on firm 1's decision on advertising and on the outcome of a possible verification procedure. We denote consumers' beliefs with regards to the probability that firm 1 offers a product of high quality by ψ_j , with $0 \leq \psi_j \leq 1$, $j = n, r$. Note that attention will be restricted to equilibria in which a firm offering a high-quality product always advertises and in which consumers expect the firm to offer a product of normal quality (superscript N), that is, $\psi_n = \psi_r = \psi^N = 0$, whenever they do not observe advertising activity by firm 1.¹⁴

If firm 1 initially chose to advertise, but the claim of high quality was falsified, all consumers share the same belief $\psi_n = \psi_r = \psi^N = 0$.^{15,16} If firm 1 indeed offers high quality and verification is demanded, all consumers share the belief $\psi_n = \psi_r = \psi^H = 1$. When firm 1 advertises a high-quality product and verification is not demanded (superscript A), consumers do not receive any further information in addition to observing advertising. In this case, naïve consumers are assumed to fully believe in firm 1's advertising message and hence $\psi_n = \psi_n^A = 1$. In contrast, rational consumers update their beliefs taking into account that the firm may have falsely advertised a high quality such that $\psi_r = \psi_r^A$, where—as high-quality firms always advertise—in equilibrium, $1/2 \leq \psi_r^A \leq 1$. Figure 1 summarizes the beliefs of the two different consumer groups.

Following advertising and court decisions, competition in prices ensues. Finally, given the advertising decision, verification demand and price setting, consumers decide which firm to buy from and profits are realized.

One may question why the demand for product verification has to be made before pricing and consumption take place instead of an intervention after

13 However, McAfee et al. (2008) discuss the possibility of information advantages for private parties.

14 Other recent contributions on misleading advertising (e.g., Corts 2013) also employ this assumption. By using this assumption, we exclude the existence of some less plausible but possible equilibria.

15 In this case, consumers do not necessarily have to be aware of the court verdict; the fact that they are not confronted with any advertisements in the period directly prior to purchase may suffice. Alternatively, one might assume that only rational consumers and a share of naïve consumers adjust to $\psi_j = 0$, whereas some naïve consumers stick to $\psi_n = 1$. Results are not qualitatively different as long as the share of naïve consumers with belief $\psi_n = 0$ is not too low.

16 Note that due to the assumption that quality verification precedes consumers' buying decisions, no direct harm is incurred by consumers or the competitor in the event of verification revealing only normal quality. Correspondingly, we abstain from damage payments in this case. The model could be extended, however, to encompass this additional instrument.

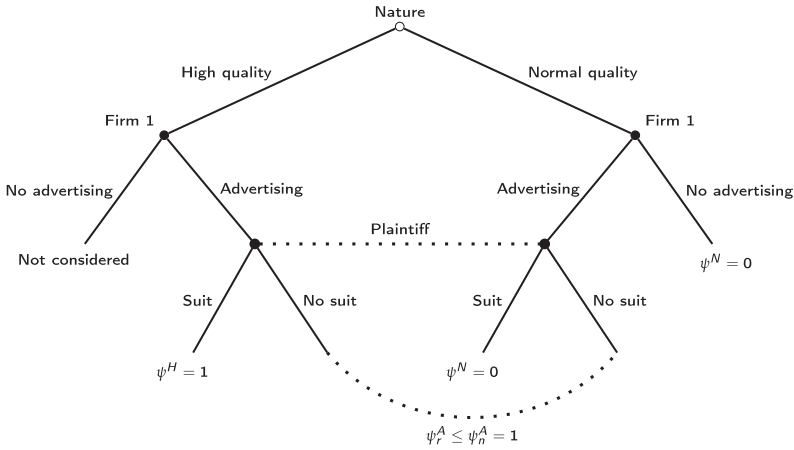


FIGURE 1 Consumers' beliefs

consumers have tried the product and learned about its quality. A situation that fits our setup is one in which firms introduce new products or allegedly improved product variants. Firms may show their prototypes and products at trade fairs and launch advertising campaigns. This means that competitors or relevant agencies learn about the new products and may question the truth of the advertising campaigns. If no one steps in and goes to court, the current generation of consumers is “lost” (even if quality is known ex post), and only future generations benefit from ex post learning about quality. In addition, ex post assessment of quality is not possible for individual consumers. This is the case, for example, for pharmaceutical products that promise a higher probability but no certainty of beneficial effects. Gathering ex post experience of dispersed consumers could be associated with high costs, whereas quality verification by controlled, centralized tests is more likely to be feasible.

4. Equilibrium

4.1. Price competition and welfare

We solve the model by backward induction and start by analyzing consumers' purchase decisions.¹⁷ Given firm 1's advertising strategy, the decision about demanding verification and the resulting belief ψ_j ($\psi_j \in \{\psi^N, \psi^H, \psi_j^A\}$ with $j = n, r$), a consumer of type j who is indifferent between buying from firm 1 or firm 2 is located at \tilde{x}_j , where

$$v + \psi_j - p_1 - \tilde{x}_j = v - p_2 - (1 - \tilde{x}_j) \Rightarrow \tilde{x}_j = \frac{1}{2} + \frac{\psi_j - p_1 + p_2}{2}.$$

We implicitly assume that both firms serve both groups of consumers, that is, $\tilde{x}_j \in (0, 1)$, which is indeed the case in any equilibrium considered.

¹⁷ The analysis here is similar to the treatment of horizontal-plus-vertical differentiation in chapter 3.1.4 of Belleflamme and Peitz (2015).

Lemma 1 summarizes the equilibrium under price competition.

LEMMA 1 *With $\Psi := q\psi_n + (1 - q)\psi_r$ denoting the weighted belief about firm 1's quality, price competition results in*

- (i) *prices $p_1 = 1 + \Psi/3$ and $p_2 = 1 - \Psi/3$,*
- (ii) *the position of indifferent consumers $\tilde{x}_j = 1 + \psi_j/2 - \Psi/3$, $j = n, r$,*
- (iii) *and profits $\pi_1 = (3 + \Psi)^2/18$ and $\pi_2 = (3 - \Psi)^2/18$.*

The difference in equilibrium prices is increasing in the weighted belief about firm 1's quality level. As $0 \leq \psi_r \leq \Psi \leq \psi_n \leq 1$, firm 1 always serves weakly more than half of the naïve consumers, whereas fewer than half of the rational consumers choose the product of firm 1 when beliefs differ starkly and when the share of naïve consumers is relatively large (which implies a relatively high price charged by firm 1). Nevertheless, for some positive belief about firm 1's quality advantage, firm 1 always serves more than half of the total market:

$$D_1 := q\tilde{x}_n + (1 - q)\tilde{x}_r = \frac{1}{2} + \frac{\Psi}{6} \geq \frac{1}{2}. \tag{1}$$

Profits are increasing in expected quality for firm 1 and decreasing for firm 2.

Three different cases for consumers' beliefs are relevant: (i) no advertising is observed or advertising had to be stopped, (ii) advertising can be upheld after verification and (iii) advertising occurs without verification. The corresponding beliefs are (see figure 1): (i) $\psi_n = \psi_r = 0$, (ii) $\psi_n = \psi_r = 1$ and (iii) $\psi_n = 1 \geq \psi_r = \psi_r^A$. Lemma 2 summarizes profits and consumer and total welfare, neglecting enforcement costs k for the moment.

LEMMA 2

- (i) *With no advertising or advertising abandoned after verification, we have profits $\pi_1^N = \pi_2^N = 1/2$, consumer surplus $CS^N = v - 5/4$ and social welfare $SW^N = v - 1/4$.*
- (ii) *With high quality being ascertained by verification, we have profits $\pi_1^H = 8/9 > \pi_2^H = 2/9$, consumer surplus $CS^H = v - 13/18$ and social welfare $SW^H = v + 7/18$.*
- (iii) *With advertising and no verification of quality, we obtain profits*

$$\pi_1^A(\psi_r^A) = \frac{(3 + \Psi^A)^2}{18} \quad \pi_2^A(\psi_r^A) = \frac{(3 - \Psi^A)^2}{18},$$

where $\Psi^A := q + (1 - q)\psi_r^A$, consumer surplus

$$CS^A(\psi_r^A) = v - \frac{5}{4} + \frac{\psi_r^A(18 + \psi_r^A) - q(1 - \psi_r^A)(9 - 5\psi_r^A) + 4q^2(1 - \psi_r^A)^2}{36}$$

and social welfare

$$SW^A(\psi_r^A) = v - \frac{1}{4} + \frac{\psi_r^A}{2} + \frac{5(\psi_r^A)^2 - q(1 - \psi_r^A)(9 - 13\psi_r^A) + 8q^2(1 - \psi_r^A)^2}{36}.$$

Regarding consumer surplus and total welfare in the event of unverified advertising, some remarks seem in order. Both consumer surplus and social welfare necessarily increase in ψ_r^A which results from the direct effect of a higher probability of obtaining a high-quality product. Interestingly, whereas aggregate consumer surplus in this case decreases in the share of naïve consumers, social welfare increases in the share of naïve consumers for a sufficiently high probability of firm 1 serving high quality or a sufficiently large share of naïve consumers.

Consumer surplus decreases with an increase in the share of naïve consumers for two main reasons: First, due to misperception with respect to expected quality, consumer surplus for the group of naïve consumers is lower than for the group of rational consumers such that a shift toward the group of naïve consumers lowers aggregate consumer welfare. Second, the ensuing price adjustments by firms (increase in price for firm 1 and a symmetric decrease in price for firm 2) lead to an increase in the average price $p_1D_1 + p_2(1 - D_1)$ due to $D_1 > 1/2$ (see expression (1)).

The contrasting non-monotonic effect of consumer naïveté on social welfare is important to explain our results below. Note that for a given probability of high quality, the market equilibrium exhibits a systematic distortion, which can be attributed to two sources. The first is the fact that firms charge different prices: As firm 1 is the firm with the higher (expected) quality (i.e., there is vertical differentiation among firms), it will charge a higher price than firm 2. As a result, the price difference affects consumers' purchase decisions and, hence, firms' market shares. From a social welfare perspective, however, market shares should not depend on prices but solely on a comparison of additional transport costs and different expected benefits from consumption. This means that the socially optimal consumption decision should be characterized by the type-independent indifferent consumer located at \tilde{x}_{so} :

$$v + \psi_r^A - \tilde{x}_{so} = v - (1 - \tilde{x}_{so}) \Leftrightarrow \tilde{x}_{so} = \frac{1 + \psi_r^A}{2}.$$

However, given firms' above-mentioned pricing decisions, a (standard) distortion results in too low demand by rational consumers:

$$\tilde{x}_r = \frac{1 + \psi_r^A}{2} - \frac{\Psi^A}{3} < \tilde{x}_{so}.$$

The second source of distortion results from naïve consumers' misperception of expected quality offered by firm 1. Because they overestimate the quality of product 1 and are also affected by the price difference between firms, the overall effect can go either way, resulting in naïve consumers' overconsumption or underconsumption of the firm 1's product:

$$\tilde{x}_n = 1 - \frac{\Psi^A}{3} \begin{matrix} \leq \\ \geq \end{matrix} \tilde{x}_{so} \Leftrightarrow \frac{3 - 5\psi_r^A - 2q(1 - \psi_r^A)}{6} \begin{matrix} \leq \\ \geq \end{matrix} 0.$$

A comparison with the socially optimal level of demand holds that, for naïve consumers, overconsumption of the product offered by firm 1 occurs when their share is low ($q < (3 - 5\psi_r^A)/2(1 - \psi_r^A)$) or when the probability that firm 1 offers a high-quality product is low ($\psi_r^A < (3 - 2q)/(5 - 2q)$); otherwise, also naïve consumers buy too few units from firm 1. The dependence on the share of naïve consumers can be explained by the price difference, which increases in the share of naïve consumers. Note that the opposing effects for naïve consumers in our setup, the absolute distortion is always larger for the group of rational consumers in comparison to naïve consumers.

To understand how an increase in the share of naïve consumers impacts on social welfare, we note that such an increase causes a direct and indirect effect. The direct effect is due to the change of consumer composition taking the price difference between firms as given. As the absolute distortion is always smaller for the group of naïve consumers, replacing rational by naïve consumers implies a positive impact on welfare due to the direct effect.

With regards to the indirect effect, we note that a higher share of naïve consumers results in a further increase in the price difference. This effect aggravates the distortion for rational consumers; it ameliorates the distortion for naïve consumers in the event of initial overconsumption of the product offered by firm 1 and aggravates the distortion in the event of initial underconsumption. In contrast to the direct effect, this effect is always negative—even if naïve consumers initially overconsume the product offered by firm 1. This is explained as follows: In models with linear transport costs, distortions enter social welfare quadratically. In consequence, the marginal welfare costs increase in the magnitude of the distortion in consumption decisions which is more pronounced for rational consumers. To calculate the total indirect effect, the marginal costs have to be weighted by group size. However, if naïve consumers constitute a majority, both groups underconsume the product such that an increase in the share of naïve consumers by increasing the price difference leads to a welfare loss for both consumer groups. Naïve consumers overconsume only if their share is low, but in this case, both the higher marginal welfare costs and the higher number of rational consumers imply that the indirect welfare effect is again negative.¹⁸

Finally, the relative importance of direct and indirect effects for social welfare again depends on the initial share of naïve consumers. In particular, note that the indirect effect becomes less important when a higher initial share of naïve consumers is involved; this is because the indirect effect is driven by the share of rational consumers, and this share is already low. As a

18 As can be shown, the fact that the indirect effect is negative is mathematically equivalent to the fact that firm 1's market share is above one half, which is always the case.

result, when the initial share of naïve consumers is relatively high, an increase in this share raises social welfare, but the opposite holds when the share of naïve consumers is initially high. As we will see below, a government agency’s incentives to demand verification depend on the share of naïve consumers—as these observations demonstrate.

4.2. Verification demand and advertising decision

We next analyze the incentives to demand verification of quality among the narrowly focused parties and the welfare-maximizing agency (section 4.2.1), and we compare these incentives (section 4.2.2). Section 4.2.3 presents analysis of firm 1’s incentive to falsely advertise high product quality. The two decisions—a firm’s decision to deliberately put out false advertising and the law enforcement parties’ decisions over whether to contest the ad—determine the equilibrium outcomes as described in section 4.2.4.

4.2.1. Decision on demanding verification

When deciding on the demand for verification of quality, the agents take rational consumers’ belief ψ_r^A as given. Furthermore, with all potential law enforcing parties acting as rational decision-makers, in equilibrium, ψ_r^A will coincide with their own assessment of the probability that the advertisement campaign has been initiated by a high-quality firm.

Firm 2

Observing an advertisement by firm 1, firm 2 must decide whether to demand verification of quality. If verification reveals normal quality, an additional profit is realized by firm 2 which obtains π^N instead of $\pi_2^A(\psi_r^A)$. When high quality is confirmed, firm 2’s profit reduces to π_2^H and, in addition, firm 2 has to bear the enforcement costs k . The increase in expected profits from demanding verification is given by

$$\begin{aligned} \Delta_{F2}(\psi_r^A) &= \psi_r^A(\pi_2^H - k) + (1 - \psi_r^A)\pi^N - \pi_2^A(\psi_r^A) \\ &= \frac{(1 - \psi_r^A)(6q + \psi_r^A(1 - q)^2 - q^2)}{18} - \psi_r^A k. \end{aligned}$$

Accordingly, initiating verification is optimal for firm 2 for $\Delta_{F2} > 0$ and, for $\Delta_{F2} = 0$, firm 2 is just indifferent between its options. For $\psi_r^A = 1$, that is, rational beliefs suggest only high-quality firms advertise, $\Delta_{F2} = -k < 0$ and verification is never demanded. The more likely it is that the advertisement comes from a firm offering only normal quality (decrease in ψ_r^A), the more profitable demanding verification becomes in expectation, as

$$\frac{\partial \Delta_{F2}}{\partial \psi_r^A} = \frac{1 - 2q(4 - q) - 2\psi_r^A(1 - q)^2}{18} - k < \left. \frac{\partial \Delta_{F2}}{\partial \psi_r^A} \right|_{\psi_r^A = \frac{1}{2}, k=0} = -\frac{q(6 - q)}{18} < 0.$$

The maximal level of Δ_{F2} results for the minimum feasible level of $\psi_r^A, \psi_r^A = 1/2$, and consequently, we obtain an upper bound for enforcement costs \hat{k}_{F2} , such that for higher enforcement costs, firm 2 will never demand verification of quality:

$$\Delta_{F2} \left(\frac{1}{2} \right) = 0 \Rightarrow \hat{k}_{F2} := \frac{1+q(10-q)}{36}.$$

Further, note that demanding verification becomes more profitable for firm 2 as the share of naïve consumers increases:

$$\frac{\partial \Delta_{F2}}{\partial q} = \frac{(1-\psi_r^A)(3-\Psi^A)}{9} > 0.$$

The higher the share of naïve consumers, the higher the additional profit from correcting consumers' expectations downwards in the event of revealing false advertising and the smaller the unfavourable shift in demand if verification results in high quality being confirmed.

Party interested in (net) consumer surplus

The expected gain from demanding verification amounts to

$$\begin{aligned} \Delta_{CS}(\psi_r^A) &= \psi_r^A (CS^H - k) + (1 - \psi_r^A) CS^N - CS^A(\psi_r^A) \\ &= \frac{(1 - \psi_r^A)(9q + \psi_r^A(1 - 5q) - 4q^2(1 - \psi_r^A))}{36} - \psi_r^A k, \end{aligned}$$

As for firm 2, the expected gain from verification decreases with the probability that the advertising is true, that is,

$$\frac{\partial \Delta_{CS}(\psi_r^A)}{\partial \psi_r^A} = \frac{-10q(1 - \psi_r^A) - 4q(1 - 2q(1 - \psi_r^A)) + 1 - 2\psi_r^A}{36} - k < 0.$$

Accordingly, this implies that verification will never be demanded for $k \geq \hat{k}_{CS}$, where

$$\Delta_{CS} \left(\frac{1}{2} \right) = 0 \Rightarrow \hat{k}_{CS} := \frac{1+q(13-4q)}{72}.$$

Note that the critical value for enforcement costs increases in the share of naïve consumers (since $q \leq 1$) as does the expected gain from verification:

$$\frac{\partial \Delta_{CS}}{\partial q} = \frac{1 - \psi_r^A}{36} ((9 - 8q)(1 - \psi_r^A) + 4\psi_r^A) > 0,$$

which shows that incentives to file suit increase with the levels of consumer naïveté.

Welfare-maximizing agency

The expected increase in social welfare from quality verification amounts to

$$\begin{aligned} \Delta_{SW}(\psi_r^A) &= \psi_r^A SW^H + (1 - \psi_r^A) SW^N - k - SW^A(\psi_r^A) \\ &= \frac{(1 - \psi_r^A) (5\psi_r^A + q(9 - 13\psi_r^A) - 8q^2(1 - \psi_r^A))}{36} - k. \end{aligned}$$

Note that, in contrast to the agents with a narrow focus, the welfare-maximizing agency takes into account enforcement costs k as social costs irrespective of the outcome of the verification process; it also recognizes that the verification of high quality might raise social welfare. As for the agents with a narrow focus, for $\psi_r^A = 1$, that is, absent false advertising, the expected gain from verification is necessarily negative ($\Delta_{SW} = -k < 0$). Moreover, given $\psi_r^A \geq 1/2$, it also holds for the welfare-maximizing agency that quality verification becomes more favourable the lower beliefs ψ_r^A are¹⁹

$$\frac{\partial \Delta_{SW}}{\partial \psi_r^A} = - \frac{(2\psi_r^A - 1)(5 - 13q + 8q^2) + q(9 - 8q)}{36} < 0.$$

With ψ_r^A being constrained from below by $1/2$, any increase in ψ_r^A implies relatively less uncertainty about the product's true quality and a lower value of quality verification from a welfare perspective. As for the agents with a narrow focus, this implies that we find a critical cost level \hat{k}_{SW} such that verification will never be demanded for enforcement costs exceeding this level:

$$\Delta_{SW}\left(\frac{1}{2}\right) = 0 \Rightarrow \hat{k}_{SW} := \frac{5 + q(5 - 8q)}{144}.$$

Finally, an increase in the share of naïve consumers changes the increase in expected welfare according to

$$\frac{\partial \Delta_{SW}}{\partial q} = \frac{(1 - \psi_r^A) (9 - 13\psi_r^A - 16q(1 - \psi_r^A))}{36},$$

which is larger than zero for low values of q and ψ_r^A but negative otherwise. That is, for a given belief ψ_r^A , an increase in the share of naïve consumers increases the incentives for narrowly focused agents to verify quality, but can decrease incentives for the welfare-maximizing agency to act. This is due to the fact that, as previously described, that in the absence of quality verification, social welfare can increase in the share of naïve consumers as the degree of distortions is attenuated.

¹⁹ Note that $1 \geq 2\psi_r^A - 1 \geq 0$. Therefore, a sufficient condition for the derivative to be negative is $q(9 - 8q) > -(5 - 13q + 8q^2)$ which is true due to $5 > 4q$.

4.2.2 Comparison of verification incentives

We start the comparison of verification incentives by highlighting the differences in agents' considerations with regards to enforcement costs and the value of information transmission by verification of quality. As far as enforcement costs are concerned, their relevance depends on the outcome of the verification process for the agents with a narrow focus because they have to pay these costs only if high quality is confirmed. By contrast, enforcement costs as social costs are relevant for the welfare-maximizing agency independent of the outcome of the verification process. With regards to information transmission, it is true that the competitor benefits only when advertising is found to be false, since its profits are even lower if high quality is confirmed. In contrast, the dissemination of information through verification may also increase consumer surplus if high quality is established. An increase in consumer surplus is always obtained when false advertising is detected because the distortion in purchase decisions is avoided, and average prices are lower. If high quality is confirmed, consumer surplus might still increase because rational consumers now correctly believe with certainty that firm 1 offers a high-quality product. Nevertheless, the resulting price adjustments can lead to lower overall consumer welfare. However, note that, in expected terms, consumer surplus (calculated without taking enforcement costs into account) always increases with information dissemination. For total welfare, as calculated without taking into account enforcement costs, information transmission is always beneficial.

Firm 2 vs. agent interested in (net) consumer surplus

As described, for both parties with a narrow focus, the expected gain from quality verification increases in the share of naïve consumers. Given our model specifications, we find that the expected gain from quality verification is always larger for firm 2 compared to an agent interested in the (net) consumer surplus, which implies that firm 2 will have greater incentives to demand quality verification:

$$\Delta_{F2}(\psi_r^A) - \Delta_{CS}(\psi_r^A) = \frac{1 - \psi_r^A}{36} \left(3q + \psi_r^A(1 + q) + 2q^2(1 - \psi_r^A) \right) > 0.$$

This is mirrored in a higher critical level for enforcement costs for firm 2:

$$\hat{k}_{F2} - \hat{k}_{CS} = \frac{1 + q(7 + 2q)}{72} > 0.$$

Comparing the two agents with a narrow focus, we have that either both or none of them have an incentive to sue (for $\Delta_{F2}(\psi_r^A) > \Delta_{CS}(\psi_r^A) > 0$ or $0 > \Delta_{F2}(\psi_r^A) > \Delta_{CS}(\psi_r^A)$) or only firm 2 has an incentive to demand quality verification (for $\Delta_{F2}(\psi_r^A) > 0 > \Delta_{CS}(\psi_r^A)$).

However, we note that the ranking between the two parties is parameter specific and stems from the fact that the transport-cost parameter is set to one (and equal to the possible difference in quality). The transport-cost parameter is an inverse measure of the degree of competition between firms. An increase in transport costs implies higher profit levels and lower

consumer welfare in equilibrium. Due to this effect, with lower transport costs, it is very possible that the agent interested in (net) consumer surplus gains more in expected terms from product verification than the rival firm; as a result, the agent interested in (net) consumer gains will be more likely to demand product verification. We now turn to our main focus, the comparison between the welfare-maximizing agent and a party with a narrow focus, where the qualitative results are robust to variations in the transport-cost parameter.

Agents with a narrow focus vs. a welfare-maximizing agency

We will focus on the comparison of the incentives of firm 2 and the welfare-maximizing agency. We select this focus because the incentives of an agent interested in (net) consumer welfare and those of the welfare-maximizing agency are qualitatively similar.

Consider the difference in the expected gains from verification of quality:

$$\begin{aligned}\Delta_{\Delta} &:= \Delta_{F2} - \Delta_{SW} \\ &= (1 - \psi_r^A) \frac{q(1 + 2q(1 - \psi_r^A) + 3\psi_r^A) - \psi_r^A}{12} + (1 - \psi_r^A)k,\end{aligned}\tag{2}$$

which can be smaller or larger than zero. The last term indicates the different perception of enforcement costs, whereas the first term, which can be larger or smaller than zero, summarizes the differences in the value of information transmission from quality verification. As the expected change in welfare comprises the expected change in firm 2's profits, term 1 in expression (2) measures the sum of the expected changes in the consumer surplus and firm 1's profit. As previously described, consumers, on aggregate, benefit from information transmission in expected terms. Firm 1 benefits if it serves high quality but forgoes profits if its deceitful advertising is revealed. In summary, the gain from quality verification may be higher or lower for firm 2 in comparison to the potential gain of the welfare-maximizing agency depending on the parameter values. Note that different expected gains do not necessarily result in different actions, as the decision to demand verification is a binary decision. However, differences in expected gains are necessary to induce different decisions. In particular, for a given belief ψ_r^A , we have

$$\frac{\partial \Delta_{\Delta}}{\partial q} = \frac{(1 - \psi_r^A)(1 + 4q(1 - \psi_r^A) + 3\psi_r^A)}{12} > 0,$$

that is, an increase in the share of naïve consumers makes quality verification more favourable for firm 2 in comparison to the welfare-maximizing agency. Indeed, for only naïve consumers, $q = 1$,

$$\Delta_{\Delta}|_{q=1} = (1 - \psi_r^A) \left(\frac{1}{4} + k \right) > 0,$$

which means that with only naïve consumers present, the gain from quality verification is always higher for firm 2 than for the welfare-maximizing agency. Note that, in this case, the informational value of quality verification can never be negative for firm 2, and its gain from revealing false advertising is larger than the corresponding increase in social welfare. Instead, for only rational consumers, $q=0$, we obtain

$$\Delta_{\Delta}|_{q=0} = -\left(1 - \psi_r^A\right) \left(\frac{1}{12} - k\right),$$

which is smaller zero for $k < 1/12$, implying higher expected gains from quality verification for the welfare-maximizing agency for low values of enforcement costs.²⁰ In this case, the expected change in social welfare from quality verification is larger than the gain in profits for firm 2, and this difference can even outweigh the fact that the welfare-maximizing agency always takes into account the full enforcement costs.

We may also compare the critical cost levels \hat{k}_{F2} and \hat{k}_{SW} . The difference amounts to

$$\Delta_k := \hat{k}_{F2} - \hat{k}_{SW} = \frac{-1 + q(35 + 4q)}{144}.$$

In line with the considerations above, for the extremes of $q=1$, only naïve consumers, and $q=0$, only rational consumers, we find

$$\Delta_k|_{q=1} = \frac{19}{72} > 0$$

and

$$\Delta_k|_{q=0} = -\frac{1}{144} < 0.$$

Accordingly, with only naïve consumers, there is a range for enforcement costs k for which the welfare-maximizing agency would never demand quality verification, whereas firm 2 might do so. In contrast, with only naïve consumers, it might be the case that firm 2 will never demand verification for some values of k , for which the welfare-maximizing agency will nevertheless do so. Finally, since

$$\frac{\partial \Delta_k}{\partial q} = \frac{35 + 8q}{144} > 0,$$

there exists exactly one value for the share of naïve consumers q for which the two critical values for enforcement costs coincide.

Given qualitatively similar results with regards to the consumer protection agency's incentives, we summarize our results as follows:

LEMMA 3 *For given beliefs about firm 1's product quality in the event of advertising, the expected gain from demanding quality verification can be higher*

²⁰ Note that, for $q=0$, we have $\hat{k}_{F2} = 1/36 < \hat{k}_{SW} = 5/144 < 1/12$ such that $k < 1/12$ is necessary for any demand for quality verification.

for either an agent with a narrow focus or the welfare-maximizing agency. The difference in expected gains increases in favour of the agents with a narrow focus for a higher share of naïve consumers. This is mirrored in a higher critical level for enforcement costs for these agents in comparison to the welfare-maximizing agency for a large share of naïve consumers. At the same time, a lower critical level for enforcement costs for these agents surfaces in comparison to the welfare-maximizing agency for a low share of naïve consumers.

4.2.3. Advertising decision

Given our assumptions regarding beliefs, it is a dominant strategy for a firm offering high quality to advertise. For a firm of normal type, no advertising assures a profit level of π^N . With advertising profits increase to $\pi_1^A(\psi_r^A)$ as long as quality verification is not demanded, whereas otherwise, firm 1’s profits equal π^N again, but it has to bear costs k . As a result, the expected gain from advertising for a firm 1 offering normal quality is given by

$$\Delta_{F1} := (1 - \beta) \left(\pi_1^A(\psi_r^A) - \pi^N \right) - \beta k = (1 - \beta) \frac{\Psi^A(2 + \Psi^A)}{18} - \beta k, \quad (3)$$

where β is the probability of a demand for quality verification. The firm chooses to advertise for certain if $\Delta_{F1} > 0$; it is indifferent between advertising and no advertising for $\Delta_{F1} = 0$. Intuitively, expected profits from advertising decrease with the probability of quality verification and increase in the belief ψ_r^A and the share of naïve consumers (for $\beta < 1$).

4.2.4. Equilibrium

The equilibrium can take on two forms: an equilibrium in mixed strategies or a pure-strategy equilibrium in which quality assessment is never demanded, and, therefore, firm 1 always advertises. In any equilibrium, the equilibrium value of ψ_r^A is determined by the advertising strategy of firm 1. Denoting by α the probability that a firm 1 with normal quality chooses to advertise, we obtain

$$\psi_r^A = \frac{1}{1 + \alpha} \Leftrightarrow \alpha = \frac{1 - \psi_r^A}{\psi_r^A}.$$

Hence, in equilibrium, there is an inverse relationship between consumers’ beliefs about quality and firm 1’s advertising decision: a higher likelihood of advertising by a normal-quality firm results in a lower belief that firm 1 offers a high-quality product. We will focus on the equilibrium value of ψ_r^A instead of α .

For a mixed-strategy equilibrium, $\psi_r^A \in (1/2, 1)$ must hold, and the equilibrium is derived from $\Delta_{F1} = 0$ and $\Delta_{F2}, \Delta_{CS} = 0$ or $\Delta_{SW} = 0$. If $\Delta_{F2} < 0$ (or $\Delta_{CS} < 0$ or $\Delta_{SW} < 0$) for every value of $\psi_r^A \in (1/2, 1)$, the corner solution

of $\beta = 0$ and $\psi_r^A = 1/2$ results, which is the possible pure-strategy equilibrium. The pure-strategy equilibrium results in the scenarios considered if $k > \hat{k}_{F2}$, $k > \hat{k}_{CS}$ and $k > \hat{k}_{SW}$, respectively.

For firm 2 as the relevant agent, from $\Delta_{F2} = 0$, a mixed-strategy equilibrium requires the belief ψ_r^A to equal

$$\psi_{F2} = \frac{1 - 2q(4 - q) - 18k + \sqrt{(1 + 4q)^2 - 36k(1 - 2q(4 - q)) + 324k^2}}{2(1 - q)^2},$$

whereas otherwise, we obtain a pure-strategy equilibrium if $\psi_{F2} < 1/2$ (note that $\partial\Delta_{F2}/\partial\psi_r^A < 0$). That is, in equilibrium,

$$\psi_r^A = \max \left\{ \psi_{F2}, \frac{1}{2} \right\}$$

if it is firm 2's decision to demand quality verification.²¹

A similar threshold can be defined for the case with an agent interested in (net) consumer welfare:

$$\psi_{CS} = \frac{1 - 14q + 8q^2 - 36k + \sqrt{1296k^2 + (1 + 4q^2) - 72k(1 - 14q + 8q^2)}}{2(1 - q)(1 - 4q)}.$$

Hence, in equilibrium,

$$\psi_r^A = \max \left\{ \psi_{CS}, \frac{1}{2} \right\}.$$

In the scenario in which the welfare-maximizing agency acts as the plaintiff, we solve for $\Delta_{SW} = 0$ and obtain

$$\psi_{SW} = \frac{5 - 2q(11 - 8q) + \sqrt{(5 - 4q)^2 - 144k(1 - q)(5 - 8q)}}{2(1 - q)(5 - 8q)}.$$

Analogously to the agents with a narrow focus, since $\partial\Delta_{SW}/\partial\psi_r^A < 0$, the equilibrium is characterized by²²

$$\psi_r^A = \max \left\{ \psi_{SW}, \frac{1}{2} \right\}.$$

For the equilibrium probability of quality verification, we note that only $\beta = 0$ can be part of a pure-strategy equilibrium. Otherwise, in a mixed-strategy equilibrium, we have to plug in the equilibrium belief ψ_r^A into expression (3) and solve $\Delta_{F1} = 0$ for β to arrive at

21 For the extreme value of $q = 1$, we obtain $\psi_r^A = \max\{5/(5 + 18k), 1/2\}$.

22 For the extreme value of $q = 1$, we obtain $\psi_r^A = \max\{1 - 36k, 1/2\}$.

$$\begin{aligned} \beta(\psi_r^A) &= 1 - \frac{k}{\pi_1^A(\psi_r^A) - \pi^N + k} \\ &= 1 - \frac{18k}{18k + (3 + \psi_r^A + q(1 - \psi_r^A))^2 - 9}. \end{aligned}$$

Note that $\partial\pi_1^A/\partial\psi_r^A > 0$ and accordingly $\partial\beta/\partial\psi_r^A > 0$, that is, the equilibrium probability for quality verification increases in the equilibrium belief ψ_r^A , which is intuitive given that a higher belief ψ_r^A increases the profit from undetected false advertising. As a result, false advertising becomes more attractive, which, in a mixed-strategy equilibrium, must be compensated by a higher probability for quality verification.

The following lemma summarizes the equilibrium.

LEMMA 4 *The equilibrium of the advertising-verification game is in either pure strategies with no demand for quality verification and all types of firm 1 advertising or mixed strategies:*

- (i) *For firm 2 as relevant agent, the equilibrium is given by $\psi_r^A = 1/2$ and $\beta = 0$ for $k \geq \hat{k}_{F2}$ and by $\psi_r^A = \psi_{F2}$ and $\beta = \beta(\psi_{F2})$ for $k < \hat{k}_{F2}$.*
- (ii) *For an agent interested in (net) consumer welfare, the equilibrium is given by $\psi_r^A = 1/2$ and $\beta = 0$ for $k \geq \hat{k}_{CS}$ and by $\psi_r^A = \psi_{CS}$ and $\beta = \beta(\psi_{CS})$ for $k < \hat{k}_{CS}$.*
- (iii) *In the scenario with the welfare-maximizing agency, the equilibrium is given by $\psi_r^A = 1/2$ and $\beta = 0$ for $k \geq \hat{k}_{SW}$ and by $\psi_r^A = \psi_{SW}$ and $\beta = \beta(\psi_{SW})$ for $k < \hat{k}_{SW}$.*

With respect to comparative statics in a mixed-strategy equilibrium, we can establish for the agents with a narrow focus that

$$\frac{\partial\psi_{F2}}{\partial q} > 0, \frac{\partial\psi_{CS}}{\partial q} > 0, \frac{\partial\psi_{F2}}{\partial k} < 0, \frac{\partial\psi_{CS}}{\partial k} < 0.$$

The intuition runs as follows. As previously pointed out, a higher share of naïve consumers increases the expected payoffs from quality verification for the agent with a narrow focus, giving the agent greater incentives to demand quality verification. The opposite is true for higher enforcement costs. In equilibrium, this must be compensated by a decrease in the probability of a misleading advertisement in the event of a higher share of naïve consumers or by an increase in this probability for higher enforcement costs until the agent with a narrow focus is again indifferent between options. Due to $\partial\beta/\partial\psi_r^A > 0$, an increase in the share of naïve consumers will be accompanied by a higher probability of the demand for quality verification in the event of advertising and an increase in enforcement costs will lead to a lower probability of such a demand. A higher share of naïve consumers increases the expected gain

from false advertisements, which, in equilibrium, must be compensated by a higher probability of facing a demand for quality verification such that a firm 1 of normal type is indifferent again. An increase in enforcement costs makes advertising less attractive, which, in equilibrium, will be compensated by a lower probability of false advertising being detected.

With the welfare-maximizing agency as a potential plaintiff, we find for a mixed-strategy equilibrium ($k < \hat{k}_{SW}$)

$$\frac{\partial \psi_{SW}}{\partial q} > (<) 0 \text{ or } q \text{ small and } k \text{ sufficiently large (otherwise), } \frac{\partial \psi_{SW}}{\partial k} < 0.$$

Accordingly, we find that an increase in the share of naïve consumers may lead to either a lower or a higher probability of misleading advertising. As shown previously, the expected gain from quality verification for the welfare-maximizing agency may be decreasing in the share of naïve consumers. In this case, the agency becomes less aggressive, and, in equilibrium, the likelihood of misleading advertising increases (and ψ_r^A falls). Regarding enforcement costs, no qualitative differences arise in comparison to agents with a narrow focus.

Comparing outcomes, we already established in section 4.2.2 that *ceteris paribus* firm 2 gains more from demanding quality verification compared to the agent interested in (net) consumer welfare. Hence, for both types of agents, a mixed-strategy equilibrium will emerge in which: (i) firm 2 files suit with a higher probability, and less advertising is observed (for $k \leq \hat{k}_{CS}$) or (ii) only firm 2 demands quality verification with positive probability (for $\hat{k}_{CS} < k \leq \hat{k}_{F2}$). For high enforcement costs, $k > \hat{k}_{F2}$, neither agent ever demands quality verification. In equilibrium, firm 2 is always the (weakly) more aggressive agent.

Figure 2 summarizes the differences in the equilibrium levels when comparing one of the agents with a narrow focus with the welfare-maximizing agency. We start with the description of the differences in outcomes for firm 2 and the welfare-maximizing agency, depicted in figure 2(a). Given a (very) limited number of naïve consumers in the market (low value of q), less false advertising occurs when the welfare-maximizing agency decides whether to verify quality, compared to the case in which the competitor can do so (light shaded areas in figure 2(a)). Facing relatively high enforcement costs and a very small fraction of naïve consumers, the competitor will refrain from quality verification altogether, and only the welfare-maximizing agency will do so with positive probability (see the upper small part of the light shaded area above the \hat{k}_{F2} curve). In the lower part of the light shaded area, both agents may demand quality verification, but the welfare-maximizing agency is more aggressive, resulting in a lower equilibrium share of false advertising. In these situations, firm 2 can gain relatively little from quality verification, as most consumers already heavily discount any advertising claim (see also lemma 3). In equilibrium, the limited incentives to demand quality verification are anticipated by firm 1, which opts for false advertising more often.

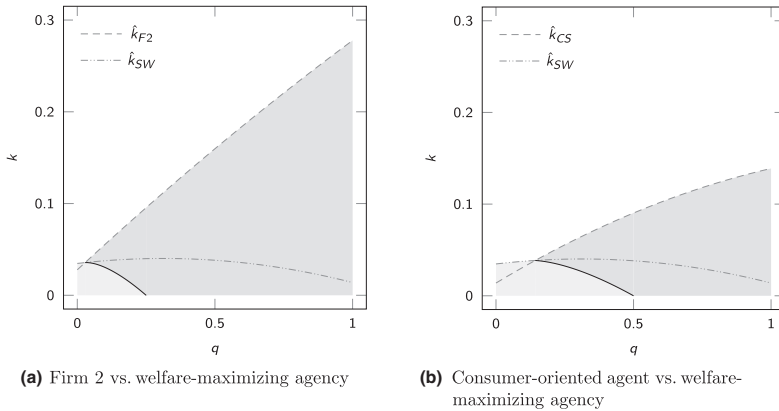


FIGURE 2 Comparison of incentives to demand the verification of quality
 NOTES: The light shaded area represents those combinations of the share of naïve consumers and enforcement cost for which the welfare-maximizing agency is more aggressive and therefore ψ_r^A is higher for the welfare-maximizing agency. The dark shaded area represents those combinations of the share of naïve consumers and enforcement cost for which an agent with a narrow focus is more aggressive, and, therefore, ψ_r^A is higher for an agent with a narrow focus.

For a higher share of naïve consumers, the opposite is true. Now firm 2 can benefit more in terms of higher profits from quality assessment, as consumers are less likely to accurately discount statements about quality and are more likely to simply trust the advertising message. This means that more of them go to the competitor expecting a better quality. In this case, the competitor is more *aggressive*, resulting in a lower equilibrium probability for misleading advertisements and a higher probability for a demand for quality verification given advertising (darker shaded area). For relatively high enforcement costs, only the competitor will demand quality verification with positive probability (see the upper part of the dark shaded area above the \hat{k}_{SW} curve), whereas, in the lower part of the dark shaded area, both agents will do so, but the likelihood that firm 1 will initiate a false advertisement is lower for firm 2 as the relevant agent.

A similar reasoning holds for the comparison between the welfare-maximizing agency and the agent interested in (net) consumer welfare. As can be seen from figure 2(b), the qualitative findings are similar to those comparing the welfare-maximizing agency and firm 2. However, given that the agent interested in (net) consumer welfare is less aggressive than firm 2, the welfare-maximizing agency is the more aggressive agent for a wider range of parameter combinations.

We can summarize our findings as follows.

PROPOSITION 1 *Firm 2 is more aggressive than the agent interested in (net) consumer welfare independent of the share of naïve consumers. The welfare-maximizing agency is more aggressive than an agent with a narrow focus for*

a low share of naïve consumers combined with not too high enforcement costs. For larger shares of naïve consumers, the agent with a narrow focus is more aggressive as long as enforcement costs do not negate incentives for quality verification altogether.

5. Consumer surplus and social welfare

We now turn to the welfare comparison. We first investigate consumer welfare before analyzing social welfare.

5.1. Consumer surplus

With regards to (gross) consumer welfare, four possible states can emerge, three of which involve advertising. First, firm 1 is of the high type, which becomes public knowledge due to the demand for quality verification. In this case, consumer surplus amounts to CS^H . The ex ante probability for this state, which is determined by the probability of high quality and the equilibrium probability for quality assessment, amounts to $\beta(\psi_r^A)/2$. Second, quality verification may reveal misleading advertising. In this case, consumer surplus is given by CS^N . Recognizing the probability for a normal-type firm to advertise, the ex ante probability for this state to occur is given by $\beta(\psi_r^A)\alpha/2 = \beta(\psi_r^A)(1 - \psi_r^A)/2\psi_r^A$. Third, an advertising campaign has been launched but no quality assessment is initiated. In this case, expected consumer surplus amounts to CS^A . The ex ante probability for this state is given by $(1 - \beta(\psi_r^A))(1 + \alpha)/2 = (1 - \beta(\psi_r^A))/2\psi_r^A$. Fourth, no advertising may be observed in the first place. In this case, firm 1 is correctly perceived to serve normal quality and consumer surplus amounts to CS^N . This state occurs with probability $(1 - \alpha)/2 = (2\psi_r^A - 1)/2\psi_r^A$. In sum, the ex ante expected consumer surplus is given by

$$\begin{aligned} \mathbb{E}[CS] = & \frac{\beta(\psi_r^A)}{2} \cdot CS^H + \frac{1 - \beta(\psi_r^A)}{2\psi_r^A} \cdot CS^A(\psi_r^A) \\ & + \frac{2\psi_r^A - 1 + \beta(\psi_r^A)(1 - \psi_r^A)}{2\psi_r^A} \cdot CS^N. \end{aligned}$$

With regards to expected consumer welfare, consumers always prefer the more aggressive entity, which is associated with both less false advertising (i.e., a higher equilibrium belief ψ_r^A) and a higher quality-verification rate β in equilibrium. In the event of observing an advertisement, concentrating on gross consumer welfare (absent any enforcement costs), consumers always prefer to be informed about true product quality, that is, they prefer a higher verification rate ($\partial\mathbb{E}[CS]/\partial\beta > 0$). A reduction in false advertising has a direct positive effect on consumer welfare ($\partial\mathbb{E}[CS]/\partial\psi_r^A > 0$) due to the more informative advertising. Obviously, consumers are indifferent between law

enforcement agents if neither of them demands quality verification with positive probability. Hence, as long as enforcement costs are not borne by consumers, we find that, given the commitment problem that exists for all agents, consumers are better off under the situation in which the competitor serves as the potential plaintiff rather than under the situation in which the law enforcement agent is interested only in the net consumer surplus. Consumers prefer the more aggressive firm 2 as the law enforcement agent because they gain from the higher deterrence of false advertising and they do not bear law enforcement costs. The light and dark shaded areas of figure 2 illustrate the comparison of expected consumer surplus. We summarize in proposition 2.

PROPOSITION 2 *Expected consumer welfare is higher the more aggressive the law enforcement agent is. Accordingly, consumers prefer the welfare-maximizing agency for a situation that features a small share of naïve consumers and low enforcement costs. Otherwise, they strictly prefer the agent with a narrow focus as long as enforcement costs are not too high to prevent the demand for quality verification in equilibrium. With consumers bearing no enforcement costs, expected consumer welfare is always at least as high for firm 2 as for the agent interested in net consumer welfare.*

5.2. Social welfare

We follow the procedure from section 5.1 and account, in addition, for profits and enforcement costs. Expected social welfare amounts to

$$\begin{aligned} \mathbb{E}[SW] = & \frac{\beta(\psi_r^A)}{2} \cdot (SW^H - k) + \frac{\beta(\psi_r^A)(1 - \psi_r^A)}{2\psi_r^A} \cdot (SW^N - k) \\ & + \frac{1 - \beta(\psi_r^A)}{2\psi_r^A} \cdot SW^A(\psi_r^A) + \frac{2\psi_r^A - 1}{2\psi_r^A} \cdot SW^N. \end{aligned} \tag{4}$$

With regards to the agents with a narrow focus, as long as both agents demand verification with positive probability, welfare is higher with the more aggressive firm 2. In the event that only firm 2 demands verification with positive probability, welfare is higher for firm 2 only when the share of naïve consumers is relatively low; otherwise, welfare is higher for the (inactive) agent interested in net consumer welfare. If the share of naïve consumers is high, both agents with a narrow focus are more aggressive than the welfare-maximizing agency, as we have previously shown. This means that their incentives to demand quality verification can be excessive, resulting in lower ex ante expected welfare. This is especially likely for the more aggressive firm 2, which explains that, with a large share of naïve consumers and with only firm 2 demanding quality verification with positive probability, ex ante expected welfare is higher for the agent interested in net consumer welfare.

A comparison of the expected levels of social welfare for the welfare-maximizing agency and the agents with a narrower focus yields our main result, below.

PROPOSITION 3 *Expected social welfare is higher for the welfare-maximizing agency as long as it is more aggressive with regards to demanding quality verification. When an agent with a narrow focus is more aggressive, expected social welfare is higher for this agent when both the welfare-maximizing agency and the agent with a narrow focus will demand verification with positive probability. When only the agent with a narrow focus demands quality verification with positive probability, expected social welfare is higher for this agent when there are intermediate enforcement costs and higher for the welfare-maximizing agency when there are high enforcement costs.*

Proposition 3 is illustrated in figure 3.

The results can be explained by resorting to the description of social welfare in equation (4). Social welfare is a function of ψ_r^A and therefore (an inverse measure of) the extent of false advertising. In slight abuse of the model, we consider an exogenous change in the probability of high quality being offered conditional on advertising, that is, an exogenous increase in ψ_r^A . We obtain

$$\frac{dE[SW]}{d\psi_r^A} = \frac{\partial E[SW]}{\partial \psi_r^A} + \frac{\partial E[SW]}{\partial \beta(\psi_r^A)} \frac{\partial \beta(\psi_r^A)}{\partial \psi_r^A}.$$

The direct (partial) effect of higher informational content of advertising, that is, an increase in ψ_r^A , is positive, as

$$\begin{aligned} \frac{\partial E[SW]}{\partial \psi_r^A} &= \frac{1 - \beta}{72(\psi_r^A)^2} \left(q + 8q(1 - q) \left(1 - (\psi_r^A)^2 \right) + 5(1 - q) (\psi_r^A)^2 \right) \\ &+ \frac{\beta}{2(\psi_r^A)^2} k > 0. \end{aligned}$$

When the welfare-maximizing agency is more aggressive than the agent with a narrow focus, with respect to demanding verification, the equilibrium with the welfare-maximizing agency displays lower false advertisement, that is, $\psi_{F2}, \psi_{CS} > \psi_{SW}$. Because, with respect to the filing decision, the welfare-maximizing agency that considers (ex post) social welfare is just indifferent, it holds that $\partial E[SW] / \partial \beta(\psi_r^A) \approx 0$ near equilibrium. Accordingly, welfare is strictly higher for the welfare-maximizing agency.

When an agent with a narrow focus is more aggressive than the welfare-maximizing agency, expected social welfare can be higher or lower for either party. As long as a mixed-strategy equilibrium results for both parties (lower part of the dark shaded area in figure 3), expected welfare is necessarily higher

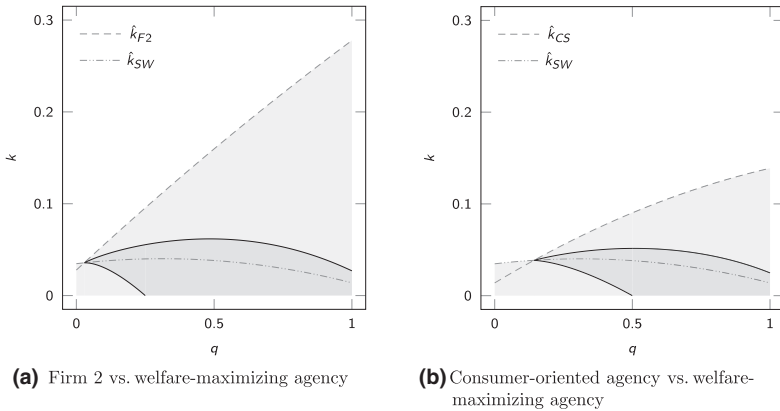


FIGURE 3 Comparison of expected social welfare and the scope of legal action
 NOTES: The light shaded area represents those combinations of the share of naïve consumers and enforcement cost for which expected social welfare is higher under the welfare-maximizing agency. The dark shaded area represents those combinations of the share of naïve consumers and enforcement cost for which expected social welfare is higher under an agent with a narrow focus.

for the agent with a narrow focus. Again, it holds that $\partial E[SW]/\partial \beta(\psi_r^A) \approx 0$, whereas the direct effect of a lower probability of false advertisements leads to a higher welfare level with the agent with a narrow focus (since $\psi_{F2}, \psi_{CS} > \psi_{SW}$). Although the welfare-maximizing agency considers social welfare when deciding about the demand for quality assessment, it is constrained by the commitment problem described above. Ideally, it would commit to a more aggressive strategy in order to make false advertising less attractive. Given the welfare-maximizing agency’s commitment problem, it can therefore be beneficial from a welfare point of view to appoint the more aggressive agent with a narrow focus as responsible for initiating verification.

The positive effect of a lower probability of false advertisements is still present when only an agent with a narrow focus demands quality verification with positive probability. However, in these circumstances, the direct positive effect of fewer false advertisements has to be weighed against the negative effect of enforcement costs incurred surpassing the expected ex post gain from quality verification, since now $\partial E[SW]/\partial \beta(\psi_r^A) < 0$ and $\beta(\psi_{F2}), \beta(\psi_{CS}) > \beta(\psi_{SW}) = 0$. Summing up the positive and negative effects of the more aggressive behaviour of the agent with a narrow focus in comparison to the welfare-maximizing agency, we find that for intermediate levels of enforcement costs, expected welfare is still higher for the agent with a narrow focus (upper parts of the dark shaded areas in figure 3), whereas the opposite results for high levels of enforcement costs.

6. Discussion

In this section, we briefly comment on some relevant modifications in modelling assumptions and discuss how they affect our results.

American cost-allocation rule. Whereas the English cost-allocation rule applies for legal proceedings in many European countries, other jurisdictions rely on the American rule, under which each party bears its own costs. For an analysis of the American rule, assume that both the defendant (firm 1) and plaintiff (the law enforcement agent) in the quality-verification proceedings bear costs of $k/2$ irrespective of the outcome. It can be shown that this change in assumptions leaves qualitative results of our analysis unchanged, while some quantitative changes occur.²³ For the welfare-maximizing agency, the decision whether to demand quality verification is not affected by the cost-sharing rule. However, agents with a narrow focus become more aggressive given that the probability of establishing false advertising is always below 50%. For firm 1 offering normal quality, advertising intrinsically becomes more attractive, given that the firm has to bear lower costs in the event of a lawsuit. In contrast to our main analysis, a firm 1 offering high quality now also has to bear some costs when quality verification is initiated. However, this will not lead to the firm abstaining from advertising as—in expected terms—it always gains more from advertising than a normal-quality firm does. In equilibrium, the main quantitative change is that the agents with a narrow focus will be more aggressive than the welfare-maximizing agency for more parameter combinations. This can increase social welfare with agents with a narrow focus, but welfare can also be lower because plaintiffs externalize a higher share of enforcement costs. Nevertheless, the results from the main section remain qualitatively unchanged.

Multiple potential law enforcement agents. In our main analysis, we have allowed only one law enforcement agent at a time. In many circumstances, it may be conceived that different law enforcement agents may be allowed to start proceedings. In our setup, the consequences of allowing for multiple parties to initiate the assessment of quality are relatively easy to describe. In every equilibrium in our model, a law enforcement agent either is indifferent between starting and abstaining from proceedings or clearly prefers abstaining. Allowing for multiple law enforcement parties will therefore result in an equilibrium with only the most aggressive agent starting proceedings with positive probability, while less aggressive agents abstain. If quality assessment is demanded with positive probability by the most aggressive agent, this party is just indifferent between demanding and not demanding, whereas the additional deterrence of false advertising renders the expected value of proceedings negative for less aggressive actors. In our setup, this leads to a clear identification of the relevant law enforcement agent given the combination of naïve consumers and enforcement costs. Interestingly, the welfare-maximizing agency may be active in markets characterized by a low

23 See the working paper version (Baumann and Rasch 2019).

share of naïve consumers, and agents with a narrow focus may be active in markets with a medium to high share of naïve consumers.²⁴

Damages and fines. In our main analysis, we considered only that, in the event of an identified false advertising, firm 1 must stop its advertising campaign and bear full enforcement costs. Depending on the jurisdiction considered, the firm might also have to pay damages or fines.²⁵ In our simplified setup, court rulings always occur before purchase decisions have been made such that, in the case of identified false advertising, no harm occurred, rendering claims for damages moot. However, with some reservation, the model may be reinterpreted in that some purchases have already taken place before verification of quality, and firm 1 has to pay compensation to harmed parties.

The inclusion of a fine payment produces interesting results. Assume a monetary sanction s in the event of identified false advertising that, following the usual approach in the law and economics literature, is a pure transfer (see, for example, Polinsky and Shavell 2007). The sanction does not have a direct bearing on the discussion of agents' incentives to demand quality verification, but it directly enters the calculus by a firm 1 offering normal quality over whether to advertise. Indeed, the gain from advertising described in expression (3) becomes

$$\Delta_{F1}^s := (1 - \beta) \left(\pi_1^A \left(\psi_r^A \right) - \pi^N \right) - \beta(k + s) = \Delta_{F1} - \beta s,$$

such that in any equilibrium with a positive probability of demands for quality verification, we have

$$\beta = \frac{\pi_1^A \left(\psi_r^A \right) - \pi_1^N}{\pi_1^A \left(\psi_r^A \right) - \pi_1^N - (k + s)}.$$

At the same time, the equilibrium probability of false advertising is not affected by the sanction. In a mixed-strategy equilibrium, this is because the probability results from the requirement of making law enforcement agents

24 In our setup, because the equilibrium is always determined by the more aggressive plaintiff, we cannot have the effect of free-riding resulting in a lower overall trial rate. However, this result is specific to our assumptions. For example, free-riding is discussed widely in the literature on collective legal action (see, for example, Keske et al. 2010).

25 For example, in *POM Wonderful LLC v. Coca Cola Co.*, the plaintiff was asking for US\$77 million for lost business. Likewise, the FTC may impose fines in the case of false advertising. In Germany, the *Act Against Unfair Competition* (UWG) allows for competitors' claims on compensation for damages (UWG, section 9) and the confiscation of profits in the event of harm to numerous purchasers (UWG, section 10).

(whose objective function has not changed) indifferent; in a pure-strategy equilibrium, all firms use advertising. In summary, the existence of the fine leaves the frequency of false advertising unaffected but reduces the rate of quality verification in a mixed-strategy equilibrium. In consequence, the higher the sanction, the lower the equilibrium probability that false advertising is identified and the more likely the outcome with advertising but no verification.

Whereas the ranking regarding agents' aggressiveness does not change, the fact that there is less demand for quality verification may bear on welfare. With the frequency of false advertising being unaffected by the sanction, welfare effects emerge only via the ex post trade-off between enforcement costs and the ex post gain in welfare from revealing quality. For the welfare-maximizing agency, this effect is necessarily zero, as in this case, any equilibrium with quality verification is already characterized by socially efficient ex post decisions. In contrast, in the event of an agent with a narrow focus, welfare increases with the sanction in the range in which the agent is more aggressive than the welfare-maximizing agency, and welfare decreases in the range in which it is less aggressive. This mirrors the ex post excessive incentives to demand quality verification in the case in which the agent is more aggressive than the welfare-maximizing agency and the insufficient incentives in the case in which the agent is less aggressive than the welfare-maximizing agency. Accordingly, welfare results described in proposition 3 remain qualitatively unaffected. However, the range of parameter constellations in which only the agent with a narrow focus files suit and welfare is higher for this agent is larger due to the saving of costs as a consequence of the lower equilibrium verification-assessment rate.²⁶

Low instead of high quality. In contrast to the main part of the paper, assume that firm 1 still offers normal quality with probability $1/2$ but provides low quality with the remaining probability of $1/2$. A low-quality product is valued by consumers at $v - 1$.

In this case, firm 2 becomes a relatively more aggressive plaintiff, whereas a consumer-oriented agent becomes less aggressive. This is explained by the way in which a confirmed low degree of quality provided by firm 1 affects profits. With firm 1 offering either normal or low quality, the fact that the quality assessment reveals low quality implies that firms become more heterogeneous instead of more similar. This increases overall profits of the two firms, making

²⁶ Note that in our setting, the court always rules correctly on false advertising. In the law and economics literature, it is a standard result that in this case, monetary sanctions should be used to their maximum, as it allows for lower enforcement costs without jeopardizing deterrence (see, for example, Polinsky and Shavell 2007). The use of less-than-maximal fines may, however, be advisable in the event of possible court errors (see, for example, Andreoni 1991 and, for a setting with false advertising, see Corts 2014a).

it less attractive for the consumer-oriented agent to demand the evaluation of quality in the first place.

In contrast, the gain in profits in the case in which a low quality is revealed is larger for firm 2.²⁷ The comparison between the welfare-maximizing agency and firm 2 remains qualitatively unaffected. Likewise, firm 2 is always more aggressive than an agent interested in maximizing consumer surplus net own enforcement costs. However, in this scenario, the welfare-maximizing agency is always more aggressive compared to the consumer-oriented agent.

Given these observations, we note that proposition 2 holds for this alternative specification, that is, when enforcement costs are not taken into account, consumers always prefer a more aggressive law enforcer. In our setup, this means that consumer surplus is now always lowest under a consumer-oriented agent. Similarly, proposition 3 also continues to hold: the consumer-oriented agent, given its less aggressive behaviour, can never contribute to higher ex ante expected social welfare in comparison to the welfare-maximizing agency.

7. Conclusion

False advertising is a widespread phenomenon. Interestingly, jurisdictions across the world use quite different policies for law enforcement to fight false advertising campaigns and to protect consumers. In this paper, we use a duopoly model to analyze incentives to make false advertising claims about product quality. In contrast to much of the literature, we use a specific design to integrate the mode of law enforcement. Whereas in many models an expected fine for false advertising is incorporated, we explicitly use an inspection game to model incentives for demanding quality verification and injunctions against false advertising. We distinguish between three different potential law enforcement parties. On the one hand, we consider an agency interested in social welfare. On the other hand, we consider two, more narrowly focused agents: the advertising firm's competitor and an agent interested in consumer welfare (net its own enforcement costs). With regards to consumers, we allow for two different kinds of consumers: rational consumers, who discount unverified advertising claims according to Bayes' rule, and naïve consumers, who fully trust unverified advertising statements.

The answer to the question of which party has more to gain from demanding quality verification depends to a great deal on the shares of naïve and rational consumers in the population. The agents with a narrow focus have

²⁷ Note that in our main analysis, the sum of profits $\pi_1 + \pi_2 = 1 + \Psi^A/9$ is increasing in the weighted belief in firm 1 offering high quality. With firm 1 offering low or normal quality, and Ψ^A denoting the weighted belief that an advertising firm 1 offers normal quality, we have $\pi_1 + \pi_2 = (2 + \Psi^A)^2/18 + (4 - \Psi^A)^2/18 = 1 + (1 - \Psi^A)^2/9$. The latter term is decreasing in Ψ^A .

greater incentive to initiate the assessment of quality when naïve consumers account for medium to large shares of the population. The opposite is true when the consumer population is largely composed of rational consumers; in this case, the welfare-maximizing agency obtains relatively large benefits from informing consumers also about a firm's high product quality.

Our results can be explained by two aspects. First, there are fundamental distortions due to both differences in prices charged by the firms and naïve consumers' inability to critically assess unchallenged advertising messages. Therefore, the answer to the question of which agent is more aggressive depends on the share of naïve consumers. Second, law enforcement agents face a commitment problem because advertising decisions precede verification decisions. This effect implies that it can be optimal from a social welfare point of view to allow the request for quality verification to come from a more aggressive agent with a narrow focus, rather than from the (ex post) welfare-maximizing agency.

Our results shed light on the optimal law enforcement regime regarding unfair competition through false advertisements about product quality. The results indicate that private enforcement (by a competitor/private consumer protection agency) can outperform public enforcement, but this depends on the court system (affecting the size of enforcement costs) as well as on the characteristics of the consumer base. In our setting, filing decisions by plaintiffs with a narrow focus are likely to yield better outcomes for populations that have medium and high shares of naïve consumers—as long as enforcement costs are not too high. On the other hand, our results indicate that when market characteristics suggest that the consumer base has a greater proportion of rational consumers, giving a (ex post) welfare-maximizing government agency the right to take legal action against presumably false advertising claims is reasonable. Hence, we can conclude from our analysis that, from a public policy point of view, the decision over which party should be given the right to initiate law enforcement by demanding quality verification can be directly related to the share of naïve consumers—as long as injunction suits come at reasonable costs. This finding stems from the fact that the incentive to file an injunction suit depends on the degree of a consumer population's naïveté.

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