Advertising and the Media*

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Abstract

This paper argues that advertising should be viewed as a transaction between a consumer and a firm that potentially generates a mutual benefit. We develop that there exists a problem of adverse selection, however, which makes it impossible to establish direct markets for advertising. The media is regarded as an intermediary that can channel advertising and allocate it efficiently by screening consumers. This screening process may result in excessive prices of media products even in competitive markets, over- or underprovision of advertising, and in an overprovision of media quality for high income consumers (relative to first best levels). If consumer's quality preferences are sufficiently heterogeneous, the first best can be achieved.

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1 Introduction

The complementary view of advertising (pioneered by Becker and Murphy, 1993) holds that advertising should be seen as a good or bad that is complementary to the advertised good. This approach has been instrumental in analyzing the welfare effects of advertising (see Bagwell, forthcoming, for a discussion). Suppose that advertising is a bad for consumers.[1] Then firms have to

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[1] This is the view that we will hold throughout this paper.

pay consumers to consume their advertising. If the resulting increase in the firms' profits (via increased sales through advertising) outweighs the utility loss incurred by the consumers (due for instance to the annoyance caused by the exposure to the advertisement), then there is scope for a mutually beneficial transaction.[2]

However, given that advertising can be viewed as a standard good or bad consumed by economic agents, the question arises why there are hardly any direct markets on which advertising is traded. In this paper we argue that this is mainly due to adverse selection. Clearly, firms are willing to pay different amounts of money for different consumers, depending on unobservable characteristics like income, interest in the advertised product, or past consumption. Hence, every consumer would have an incentive to claim that she has profitable characteristics. This effect is absent in most models of advertising, as it is usually assumed that consumers are homogeneous.

As an illustration of our point, consider the few marketplaces on which advertising is traded between firms and consumers which do exist. Both in the US and in Europe several websites offer consumers money for reading e-mail advertisements, viewing banners in their browser and the like. Those websites are financed by the firms that book the advertising. Some of them are paying out since several years and have managed to acquire quite impressive client bases. The German start-up Bonimail.de for instance claims to have almost 100,000 members. Still, all those websites are visibly plagued by adverse selection. Most of them pay extremely low rates (often below one euro cent for viewing an on-line advertisement for at least 30 seconds and then following a confirmation procedure). Also, the advertising that they feature is obviously targeted at low income consumers. Major advertisers are bargain-websites, loan-sharks, financial institutions offering credit cards without solvency check and dubious internet business opportunities. The market outcome is thus as proposed in Akerlof's (1970) classic lemons market: the average payout rate is too low for high income consumers, who drop out of the market, reducing the quality of the pool; this implies that the payout rate is deteriorated even more and the process repeats until only the lowest income type remains.[3]

[2] Note that for an analysis of the welfare effects that are involved here, one would also have to take externalities into account that the two parties exert on others. For example, if advertising simply shifts consumption of a certain good from one company to another, as is often put forward by the literature on sunk costs and market structure (for instance Sutton, 1991), then advertising may be socially inefficient even if the two parties can make a mutually beneficial trade.

[3] Apparently, the above webpages also have to handle a problem of moral hazard, as it is difficult to guarantee that consumers pay sufficient attention to the advertisements. However, software technologies tackle this problem quite efficiently. For instance, websites that pay for viewing banners only award credits if the user clicks a confirmation button in regular intervals, in order to prevent that the ads are run while the user is absent from the computer.

In this paper we analyze how media firms can mitigate the adverse selection problem from which direct markets suffer. There are some obvious ways in which they do this. For instance, tennis rackets are advertised in tennis magazines. Also, high income types can be targeted by placing ads in golf magazines. There is, however, a limit to this kind of targeting. In particular, most companies want to reach broader audiences of high income types than the very small subset of those happening to read golf magazines. In addition, most products are not as target-group specific as tennis-rackets. Hence, most advertising has to rely on mass media in order to get its message across.

Mass media like television or magazines sell a bundle of products consisting of a primary product (the content) and a secondary product (the advertising). Agents have to pay a price for consuming the content and receive a reimbursement for consuming the advertising (in the form of a lower cover price or subscription fee). In trading the advertising, the media firm acts as an intermediary on behalf of the advertising companies. Since it offers both products as a bundle, it can tackle the adverse selection problem: by distorting the market for its primary product (for example by altering its price or quality) it can mitigate the distortion in the secondary market. Thus, the two-sided market nature of media firms allows achieving more efficiency in the market for advertising.

As an illustrative example of what we have in mind consider two competitive TV markets in countries *R(ich)* and *P(oor)* that broadcast the latest Hollywood movies. Suppose the film industry demands a fixed price per viewer from the TV stations that want to show their movies. Assume that people who live in R are rich, whereas people who live in P are poor. Consider the case where advertising rates are sufficiently high so that all stations are financed by advertising rather than a subscription fee. Clearly, as consumers in country R are more attractive to advertisers, the price for an advertisement is higher in country R than in country P. Therefore, in the competitive equilibria (where media firms earn zero profits) there is less advertising in country R than in country P. Now consider a trade liberalization which makes it possible that TV stations broadcast in both countries. Apparently, the full information competitive outcome that was just described is not stable in this new situation as all viewers in country P would switch to channels of country R, where there is less advertising. Since the TV stations in country R were just breaking even with the high advertising rates they received for their rich viewers, they would now make losses with the new mixed audience. A possible solution for this problem is that the channels in R demand a positive subscription fee and reduce their advertising. This is a helpful separating mechanism because poor viewers may suffer harder from a subscription fee than rich viewers, hence incentive compatibility can be achieved. Note that this mechanism seriously hampers price competition of media products: as lowering the price attracts low income viewers, competition for high income types will mainly be driven by the quality of the media and the amount of advertising.

We analyze both monopolistic and competitive media markets, assuming that there are high and low income consumers. The main findings of this paper are as follows. Unless consumers' tastes for the quality of media content are very heterogeneous, first best pricing schemes for media products are not incentive compatible. In order to separate types, media firms use two instruments. By increasing the price of the high type bundle above the first best level, firms can deter low types from consuming it. The second means to separate types is increasing the quality of the high type bundle beyond first best levels. This deters low types indirectly as it involves an increase in advertising or price in order to finance the higher production costs. But as low types are likely to have a lower willingness to pay for a quality improvement than high types, the incentive constraint of low types is relaxed.

It turns out that an increase in the difference of the two types' quality preference has two effects: (i) It is cheaper to use the quality distortion as a screening instrument; hence there is more of it and less price distortion. (ii) As the preferred bundles of the two types differ more, screening becomes easier, so both types of distortion will be used less. The second effect implies that if the preferences of the two types are very different, the first best is attainable. These effects will be shown to persist both in competitive and monopolistic media markets.

Our results are well in line with empirical evidence on media markets. In particular, Thompson's (1989) and Kaiser's (2003) analyses of newspaper and magazine markets show that media firms, when considering a cover price cut, face a trade-off between increased sales and deteriorating advertising rates. This is exactly the trade-off that is generated by adverse selection in our model. A more detailed discussion of empirical results can be found in Section 6.

Recently, media markets have been analyzed extensively in the two-sided market literature.[4] Models in this spirit are Anderson and Coate (forthcoming), Chaudhri (1998), Gabszewicz, Laussel, and Sonnac (2001b), Gal-Or and Dukes (forthcoming), Häckner and Nyberg (2000) and Nilssen and Sørgard (2001). These papers offer interesting insights into the nature of competition in media markets, but do not address the question of adverse selection we are concerned with here.

[4] See Armstrong (2004) and Rochet and Tirole (2003) for some of the general insights from this literature. They also contain some analysis of media markets.

The monopoly case in this paper is closely related to the literature on monopolistic price discrimination with endogenous quality choice (most notably Mussa and Rosen, 1978, and Sprinagesh and Bradburd, 1989). As should become clear below, however, the basic intuitions that were derived in this literature usually fail to hold in the case of media markets.

Our model is a model of multidimensional screening in the sense that media firms have several screening instruments at their disposal. On the other hand, it is one-dimensional in the sense that consumer types are differentiated along a single dimension alone. This feature is responsible for the fact that it does not inherit the technical difficulties that characterize general models of multidimensional screening, where often no clear ordering of types is possible (see Rochet and Stole, 2003, for an overview).

The remainder of this paper is organized as follows. In Section 2 we present the formal model. Section 3 characterizes the equilibrium in a monopolistic media market, whereas Section 4 considers a competitive media market. Section 5 presents some comparative statics analysis. Finally, in Section 6 we offer some extensions of our basic model, discuss our results and relate them to empirical work.

2 The Model

Consider a market for an homogeneous media product. This could be any kind of product that can be financed both via advertising and via price (for example a TV station, a newspaper or a webpage).[5] In principle, it could even be a professional sports event or a software program. There are two types of consumers: high types (denoted by subscript H)) with high income, high involvement or the like and low types (denoted by subscript L). There is a continuum of consumers of measure 1. A proportion γ is of type H, while a proportion $1-\gamma$ is of type L. Consumers have unit demand and buy from the media firm providing them with the highest utility (if above zero). The utility of a consumer of type i from consumption of a given media product is

$$V_i = \bar{U}_i - \alpha - \beta_i p + v_i q \tag{1}$$

[5] Throughout this paper we assume that media companies have access to a technology that enables them to raise a price from consumers. If such a technology was costly, these transaction costs would bias the results in this paper towards advertising finance of the media product (as is encountered for instance in the radio market).

where $\alpha \geq 0$ denotes the amount of advertising, $p \geq 0$ denotes the cover price or subscription fee and $q \in \mathbb{R}$ denotes the quality of the content of the media product. "Quality" refers to some unambiguously measurable quality characteristic of the media output, say the number of color pages in a newspaper or the amount of money that a TV station spends on broadcasting rights. Naturally, price enters negatively and quality enters positively in the utility function. Advertising enters negatively, that is, there are nuisance costs of advertising. This is a weak assumption in the case of television (which predominantly features persuasive advertising) but may be less innocuous in the case of newspapers (which often have a large fraction of informative advertising).[6]

$\bar{U}_i$ is a constant measuring the utility of consuming a free, base-quality media product containing no advertising. $\beta_i > 0$ measures type i's aversion to monetary expenditures.[7] Let $\beta_L > \beta_H$, implying that poor consumers suffer more from a higher price than rich consumers. $v_i \geq 0$ is an indicator of type i's willingness to pay for quality. Let $v_H \geq v_L$. With this assumption we do not want to suggest that low types have a lower appreciation for quality, but rather that their lack of wealth induces a lower marginal willingness to pay for it. We normalize $v_L = 0$ which has no impact on the quality of our results but greatly simplifies calculations.

We will differentiate between the two polar cases of a monopolistic media firm and a competitive media market with many firms. Media firms can offer media products which are characterized by the vector $C = (p, \alpha, q)$. Although media firms may have market power regarding consumers, they are assumed to be price-takers regarding the advertising side of the market. That is, there is perfect competition on the market for advertising. This means that, although a trucking magazine does not compete with a women's magazine for readers, the two *do* compete for advertising. This concords with the motivation that was given in the introduction: advertising firms can not fully reach their target groups by advertising in special interest media alone, but have to spread out their campaigns over different types of (mass) media. Accordingly, let δ_i denote the market price for one unit of advertising that is consumed by a consumer of type i.[8] It is natural to have $\delta_H > \delta_L$. This is supported by Fisher, McGowan and Evans (1980) who find that U.S. broad-

[6]It is generally accepted that TV advertising annoys most viewers. Sometimes it is argued that newspaper advertising is not harmful to readers. Contrary to this view, Sonnac (2000) presents evidence that most European readers are ad-averse. American newspaper readers, on the other hand, often seem to like advertising (Rosse 1980). It is clear that beyond some percentage of newspaper space that is devoted to advertising, advertisements become annoying even to ad-lovers. As it is optimal for media firms to increase advertising beyond this threshold, the last units of advertising will cause disultility in any case.

[7]As equation (1) has been normalized with respect to α, β_i can also be interpreted as the marginal rate of substitution between watching advertising and paying a fee to finance a media good.

[8]δ_i is the price that brings demand and supply for type i advertising across media markets into equilibrium.

casting stations with high income viewers receive much more favorable advertising rates than otherwise equal stations with relatively poor audience. Similar evidence was found for newspaper (Thompson 1989) and magazine markets (Koschat and Putsis 2000).

Consumers can remunerate media firms for obtaining the media content they desire by paying a subscription fee and/or by accepting advertising. Which form of obligation they prefer of course depends on their preferences.[9] From (1) we have that consumers of type i strictly prefer advertising-financed media to subscription-based media if $\delta_i \beta_i > 1$. If $\delta_i \beta_i = 1$, they are indifferent between the two. And if $\delta_i \beta_i < 1$, they strictly prefer paying in money rather than consuming advertisements. As this paper is concerned with the provision of advertising, we fully concentrate on the case where $\delta_i \beta_i > 1$ for $i \in \{H, L\}$ and hence assume advertising to be the efficient form of financing for media content. We forgo the analysis of the other possible cases. Note, however, that the adverse selection problem may be less severe in alternative settings, as it is then possible that some consumers prefer subrscription-based media while others prefer advertising-based media, which facilitates screening.[10]

Media firms have a cost function that consists of marginal cost $c > 0$ and fixed cost $F \geq 0$, which has to be incurred by every firm that wants to engage in the media market. This is in accordance with empirical evidence that media firms exhibit increasing returns to scale (Rosse 1967, 1970). We assume that the provision of quality increases the marginal cost of the media product in a convex way. To be concrete, we choose quality costs to be $\frac{1}{2}\varphi q_i^2$, where $\varphi > 0$ is a parameter that measures how costly the provision of quality is. One could argue that quality costs are fixed rather than variable. We claim that this is not the case for most components of quality. For instance, arguably the most costly component of magazine quality are printing costs, which are determined by the number of pages, the extent of color-printing, the type of paper and the like. Kaiser (2002) estimates marginal costs of German women's magazines at roughly twice the cover price. Likewise, broadcasting quality-costs are variable rather than fixed: usually the prices that television stations have to payfor content from outside providers, who sell the rights to broadcast movies, sports events or the like, are sharply increasing with the number of consumers. Naturally,

[9] Note that media firms' preferences concerning the form of payment are perfectly in line with consumers' in a first best world: letting consumers choose the form of payment maximizes the sum that can be extracted from them – directly via a subscription fee or indirectly via advertising revenue.

[10] In the real world, at least *some* advertising must be efficient in the sense employed above. Otherwise, we would not observe advertising, as then media firms could increase their profit by having less advertising and increasing the media price such that consumers' utility levels stay constant. As will become clear below, this argument does not hold for subscription fees. Asymmetric information might guarantee their existance even in a world where every consumer would prefer all types of media to be fully advertising-financed.

Belgian television pays much lower fees to obtain the broadcasting rights for the Olympic Games than a French station does.

Note that because of the above technological specifications, our model crucially differs from the view that (broadcasting) media are public goods. For instance, many undergraduate textbooks in public economics list television as an example for a pure public good, satisfying non-rivalry and non-excludability. In contrast to this we have argued that media provision *is* excludable (as media firms can charge a price) and rivalrous (as additional viewers increase costs).

Putting the above together, a media product $C = (p, \alpha, q)$ that caters to a consumer of type i makes a marginal profit of

$$\pi = \alpha\delta_i + p - c - \frac{1}{2}\varphi q^2 \tag{2}$$

per consumer.

An interesting problem of course only arises if consumers' willingness to pay is high enough to make production of the media product efficient. The condition $\bar{U}_i/\beta_i \geq F + c$ for $i \in \{H, L\}$, which says that the willingness to pay for a media good exceeds its production costs, is sufficient for production to be constrained Pareto optimal.[11] We assume this condition to hold throughout the paper.

3 Monopoly Media

3.1 First Best

We will now analyze the equilibrium in the media market for a monopolistic media firm. As a benchmark, we first consider the market equilibrium under full information, assuming that the media firm can perfectly discriminate between types. In order to make sure that consumers buy the media product, the monopolist has to bear in mind the participation constraints

$$\bar{U}_H - \alpha_H - \beta_H p_H + v_H q_H \geq 0 \tag{3}$$

for high types and

$$\bar{U}_L - \alpha_L - \beta_L p_L \geq 0 \tag{4}$$

[11] Remember that consumers are of measure 1.

for low types, which follow directly from (1). Also, the monopolist has to ensure that the non-negativity constraints

$$\alpha_i \geq 0 \text{ for } i \in \{H, L\} \tag{5}$$

and

$$p_i \geq 0 \text{ for } i \in \{H, L\} \tag{6}$$

are met. The monopolist's program thus becomes to solve

$$\max_{\substack{\{(p_H,\alpha_H,q_H),\\ (p_L,\alpha_L,q_L)\}}} \gamma(\alpha_H\delta_H + p_H - c - \frac{1}{2}\varphi q_H^2) + (1-\gamma)(\alpha_L\delta_L + p_L - c - \frac{1}{2}\varphi q_L^2) - F \tag{P1}$$

subject to (3) to (6).

The solution to program (P1) is straightforward to find and has $p_H^{FB} = 0$, $\alpha_H^{FB} = \bar{U}_H + (\delta_H/\varphi)v_H^2$ and $q_H^{FB} = (\delta_H/\varphi)v_H$ for the high type and $p_L^{FB} = 0$, $\alpha_L^{FB} = \bar{U}_L$ and $q_L^{FB} = 0$ for the low type. This is quite intuitive. As advertising is the efficient way of paying for the media product, prices are zero for both types and the media product is fully financed by advertising. This way, the monopolist is able to extract most rent. Low types receive zero quality as they do not care about it. High types, on the other hand, receive a positive amount of quality, which is increasing in their valuation v_H and in advertising receipts δ_H, while it is decreasing in the cost of the provision of quality φ. The monopolist provides both types with the efficient amount of quality as this maximizes the amount of rent he can extract from them. Which type has to accept more advertising depends on the two types' maximum willingness to accept advertising ($\bar{U}_L$ and $\bar{U}_H$) and on the quality preferences of the H-types. Consumers are held to zero utility.

3.2 Second Best

Next we turn to the case of asymmetric information with respect to consumers' types. In this case consumers are free to buy any media product that is available on the market. The monopolist has two possibilities. Either he can price discriminate and thereby sell to the whole market. Or he can offer a single bundle only and thence extract the whole rent from one type alone, while rationing the other one. Which of these strategies is optimal typically depends on the relative frequency of types. As is usual in the literature on price discrimination, we first consider the case of price discrimination without worrying about the possibility of rationing for the moment.

In this case the monopolist again maximizes her profit given participation constraints of the two types. But now she also has to consider the following incentive constraints, which guarantee that both types actually prefer the bundle that is designed for them. The high type's incentive constraint can be easily constructed from (1) as

$$\alpha_L - \alpha_H + \beta_H(p_L - p_H) - v_H(q_L - q_H) \geq 0. \tag{7}$$

Similarly, the low type's incentive constraint is

$$\alpha_H - \alpha_L + \beta_L(p_H - p_L) \geq 0. \tag{8}$$

Note that the L-type's incentive constraint is independent of the quality of the media goods because $v_L = 0$. The monopolist solves

$$\max_{\substack{\{(p_H,\alpha_H,q_H),\\ (p_L,\alpha_L,q_L)\}}} \gamma(\alpha_H\delta_H + p_H - c - \frac{1}{2}\varphi q_H^2) + (1-\gamma)(\alpha_L\delta_L + p_L - c - \frac{1}{2}\varphi q_L^2) - F \tag{P2}$$

subject to (3) to (8).

It turns out that the solution to this program is different for two distinct cases: (i) High types have a higher willingness to pay for a media good of base quality than low types (in terms of money); but low types will accept a higher maximum amount of advertising than high types. (ii) One type has a higher willingness to pay in both dimensions.[12] We have argued that (compared to low types) high types find price increases relatively less worrying than an equivalent advertising increase. Situation (i) corresponds to the case where this statement does not only hold in marginal but also in absolute terms. Hence, this seems to be the natural case to consider. Accordingly, this situation will be the one that we are going to analyze here. Formally, we have $\bar{U}_L \geq \bar{U}_H$ (low types have a higher willingness to accept advertising) and $\bar{U}_H/\beta_H \geq \bar{U}_L/\beta_L$ (high types have a

[12]It is not possible that low types have a higher willingness to pay, but a lower willingness to accept advertising. This would imply $\bar{U}_L/\beta_L \geq \bar{U}_H/\beta_H$ and $\bar{U}_H \geq \bar{U}_L$. The second inequality is equivalent to $\bar{U}_H/\beta_L \geq \bar{U}_L/\beta_L$. This, together with the first inequality, gives $\bar{U}_H/\beta_L \geq \bar{U}_H/\beta_H$, which in turn is equivalent to $\beta_H \geq \beta_L$, a contradiction to our assumptions.

higher willingness to pay). We have included an analysis of case (b) in Appendix B.

Before analyzing the solution it is useful to note that the first best solution that was determined in the previous subsection may not be incentive compatible in the second best. The reason is that – as long as high types have to endure less advertising than low types – there is always an incentive for low types to consume the high type product, which costs the same but has less advertising (and more quality).

The solution to program (P2) crucially depends on the relative frequency of types. Let us first consider the case where there are relatively many low types so that $\gamma \leq \bar{\gamma}$. Propositions 1 formally states the solution in this case.[13]

Proposition 1 *In the solution to program (P2) for the case $\gamma \leq \bar{\gamma}$, the low type always receives his first best bundle. The high type's bundle is as follows.*
(i) If $v_H \in [0, \underline{v}_H)$, then $p_H^{SB} = \frac{\bar{U}_H - \bar{U}_L}{\beta_H - \beta_L} + \frac{1-\delta_H \beta_L}{\varphi(\beta_H - \beta_L)^2} v_H^2$, $\alpha_H^{SB} = \frac{\beta_H \bar{U}_L - \beta_L \bar{U}_H}{\beta_H - \beta_L} - \frac{\beta_L(1-\delta_H \beta_L)}{\varphi(\beta_H - \beta_L)^2} v_H^2$ and $q_H^{SB} = \frac{1-\delta_H \beta_L}{\varphi(\beta_H - \beta_L)} v_H$.
(ii) If $v_H \in [\underline{v}_H, \bar{v}_H)$, then $p_H^{SB} = 0$, $\alpha_H^{SB} = \bar{U}_L$ and $q_H^{SB} = \frac{\bar{U}_L - \bar{U}_H}{v_H}$.
(iii) If $v_H \in [\bar{v}_H, \infty)$, then the high type receives his first best bundle.

It is interesting to note that the low types receive their first best bundle, while the high types' bundle is distorted. This is not surprising as the low types have to be deterred from consuming the high type product. It is convenient to present the solution graphically as we do here in Figure 1, which depicts the first and second best bundle for high types depending on the valuation v_H. As can be seen, optimal price, advertising and quality largely depend on the size of the H-type's preference for quality v_H.

Figure 1 shows that both a quality and a price distortion are used to achieve incentive compatibility. As a price increase hurts low types relatively more, the upward distortion in p_H can be used to scare away L-types from the H-bundle. The reason that an overprovision of quality is a useful screening instrument is that more quality for the H-bundle has to be financed. High types would like to have less quality, but at least they somewhat value its increase. Low types, on the other hand, have no benefit from increased quality whatsoever. And since quality has to be paid for by α_H and p_H, the quality distortion relaxes the low type's incentive constraint. The level

[13] All proofs are in Appendix A, which also contains the precise definitions for the threshold levels $\bar{\gamma}$, $\underline{v}_H$, $\underline{v}'_H$, $\bar{v}_H$ and $\bar{v}'_H$ which satisfy $\bar{\gamma} \in (0, 1)$, $0 < \underline{v}_H < \bar{v}_H < \infty$, $0 < \underline{v}'_H \leq \bar{v}_H < \infty$ and $0 < \underline{v}_H < \bar{v}'_H < \infty$.

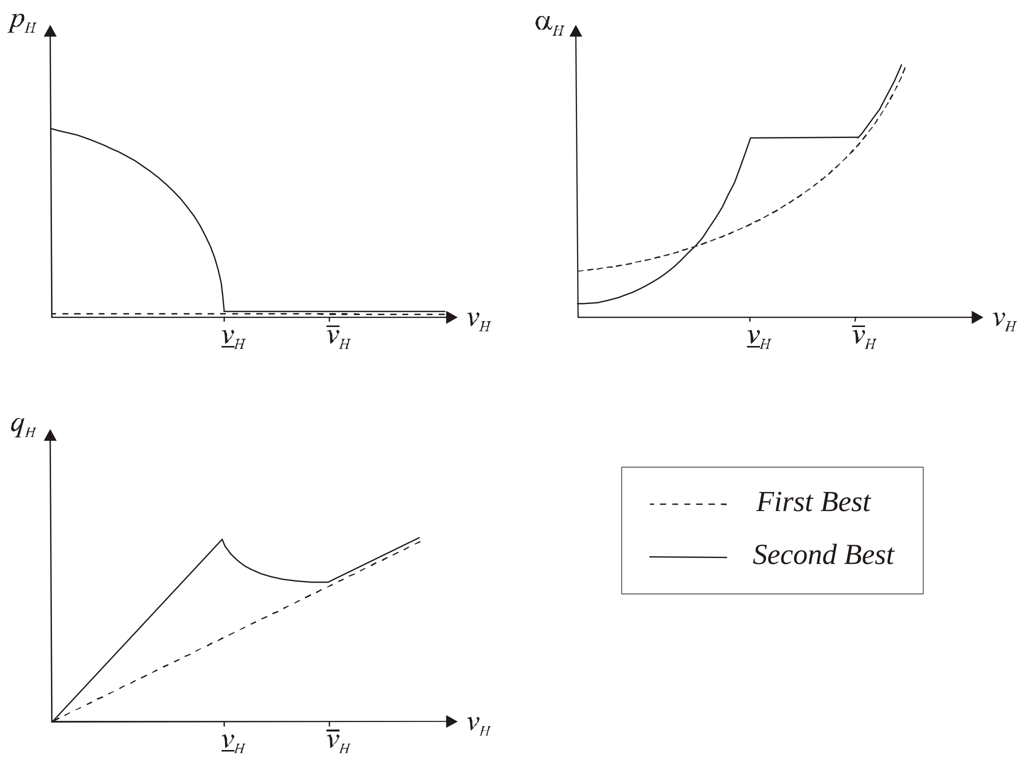

Figure 1: The Monopoly Case for $\gamma \leq \bar{\gamma}$

of advertising, on the other hand, is not a screening instrument, but adapts to price and quality distortions in a way that holds the participation constraints of consumers binding.

If the difference in quality preferences of the two types is low ($v_H < \underline{v}_H$), both price and quality distortions are used by the monopolist. An increase in v_H then has two effects. The first effect is that the increasingly different preferences for quality make it more and more profitable to use q_H as a screening instrument. Hence, the high type's quality moves further away from its first best level. At the same time, the price distortion is used less and less, until p_H reaches zero at $v_H = \underline{v}_H$. Therefore, the first effect of a widening gap between quality preferences is an exchange of screening instruments.

The second notable effect is that screening becomes easier overall, as the products the two types would like to consume are getting more differentiated. This effect drives the use of both screening instruments down. This process is completed if $v_H \geq \bar{v}_H$, where the first best is attained. It is straightforward to show that second best profits monotonically increase towards first best levels, which they reach at $v_H = \bar{v}_H$. Thus, the more differentiated the products are that high and low types would ideally like to consume, the easier it is for media firms to efficiently sort types.[14]

The amount of advertising for high types, α_H, is below first best for low levels of v_H. The monopolist has to do this in order to compensate high type consumers for the price distortion. As v_H increases, two forces drive α_H up: the reduction in price screening renders it possible to increase α_H and in addition to that, the rapid increase in q_H must be financed by more advertising. As a result, α_H increases above its first best level beyond some point. Finally, α_H^{SB} and α_H^{FB} approach each other again, as all distortions go down.

Note that the quality distortion that potentially occurs in monopoly media markets is quite different to the quality distortion observed in regular goods markets with price discrimination (as analyzed by Mussa and Rosen 1978, among others). While in Mussa and Rosen (1978) quality is distorted downwards, here we have an upwards distortion. This difference occurs because in media markets (other than in goods markets) the low types have to be deterred from consuming the high type bundle. This is so even though the high types are usually the more profitable clientele for the monopolist. The crucial point is that high types generate far higher advertising receipts than low types.

Next we turn to the case where there are many high types ($\gamma > \bar{\gamma}$). Proposition 2 states the monopolistic equilibrium in this case.

Proposition 2 *In the solution to program (P2) for the case $\gamma > \bar{\gamma}$, the low type always receives his first best bundle, except that $\alpha_L^{SB} = \bar{U}_H + (\frac{\delta_H}{\varphi} + \frac{1-\gamma}{\gamma}\frac{\delta_L}{\varphi})v_H^2$ if $v_H \in [0, \underline{v}'_H)$. The high type's bundle is as follows.*
(i) If $v_H \in [0, \underline{v}'_H)$, then $p_H^{SB} = 0$, $\alpha_H^{SB} = \bar{U}_H + (\frac{\delta_H}{\varphi} + \frac{1-\gamma}{\gamma}\frac{\delta_L}{\varphi})v_H^2$ and $q_H^{SB} = (\frac{\delta_H}{\varphi} + \frac{1-\gamma}{\gamma}\frac{\delta_L}{\varphi})v_H$.
(ii) If $v_H \in [\underline{v}'_H, \bar{v}_H)$, then $p_H^{SB} = 0$, $\alpha_H^{SB} = \bar{U}_L$ and $q_H^{SB} = \frac{\bar{U}_L - \bar{U}_H}{v_H}$.
(iii) If $v_H \in [\bar{v}_H, \infty)$, then the high type receives his first best bundle.

Note that the optimal solution now not only depends on the size of v_H but also on the size of γ. Figure 2 represents this solution graphically. It is drawn for some given $\gamma > \bar{\gamma}$. Figure 2 reflects a sudden change in the monopolist's screening policy if γ gets larger than $\bar{\gamma}$. While the screening of the high type quality remains unchanged, the monopolist now refrains from using the price instrument. This allows her to increase the advertising of H-types. To guarantee incentive

[14] This result is akin to a result from insurance economics. Bond and Crocker (1991) show that differential consumption of hazardous goods may allow insurance companies to reach the first best in insurance markets with adverse selection.

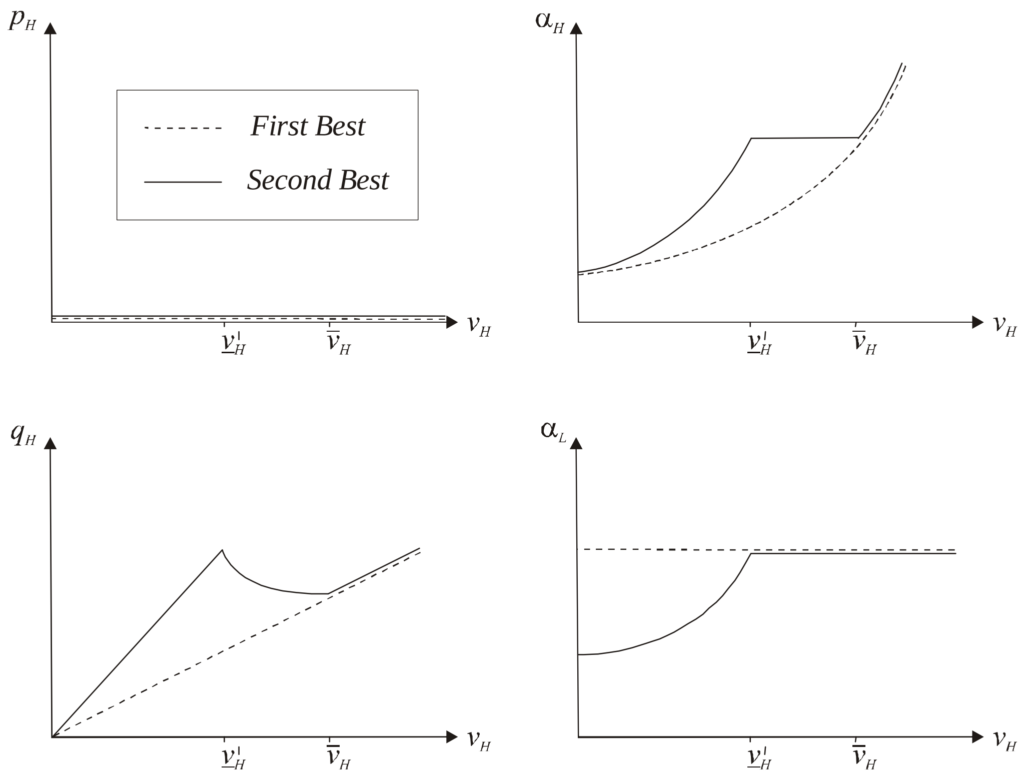

Figure 2: The Monopoly Case for $\gamma > \bar{\gamma}$

compatibility it now becomes necessary to decrease α_L below first best levels. This policy is quite intuitive: The more high types there are, the more costly it becomes for the monopolist to distort the high type bundle in order to achieve incentive compatibility. Beyond $\bar{\gamma}$, there are so few low types that it is profitable to distort the low type bundle instead, by lowering its advertising level below first best. As the low type bundle otherwise remains unchanged, this policy generates an information rent for L-types.

Figure 2 shows that the two effects of an increase in v_H that we observed for $\gamma \leq \bar{\gamma}$ are at work here, too. First of all, the quality instrument becomes more effective, so the advertising distortion is exchanged for the quality distortion until α_L reaches its first best level. Second of all, screening becomes easier, which decreases the use of both instruments. Again, for $v_H \geq \bar{v}_H$ the two types demand so different goods that self-selection is without costs.

Let us now analyze, how the solution changes if γ increases beyond $\bar{\gamma}$. It turns out that in this case, the remaining quality distortion of high types gets still smaller and is gradually exchanged for a further distortion of the low types' advertising.

So we have the following two observations from the monopoly case. (i) As the number of high types increases, the high type distortion gradually gets exchanged for a distortion of low types. (ii) As the differential of the types' quality preferences increases, the distortion in q_H will be used more often than the distortion in p_H (respectively α_L); in addition, screening becomes easier and the overall distortion is reduced.[15]

As was mentioned above, the solution to program (P2) only determines the optimal behavior of the monopolist if it is not preferable to ration one type of customer while extracting the whole rent from the other.

Proposition 3 *Independent of the size of γ, there will be no rationing of consumers. That is, the monopolist always makes her pricing decision according to Propositions 1 and 2.*

This is an important observation. Quite contrary to standard models of monopolistic price discrimination as Mussa and Rosen (1978), rationing in media markets is never profitable for a monopolist – irrespective of the relative frequencies of types. This means that the efficiency loss from monopolization may be smaller in media markets than in standard goods markets.[16] The difference occurs because the monopolist can use different forms of payment from different types, which gives him greater leeway in profitably separating types.

For this result to hold it is crucial that low types have a higher willingness to accept advertising for a media product of quality $q = 0$. If high types had a higher willingness to accept advertising, we would be back in a situation where rationing of low types may be profitable if there are sufficiently many high types.[17]

4 Competitive Media

In the case of free entry into the media market, an effectively competitive outcome involving the market presence of more than one media company requires that $F = 0$. This stems from the fact that the media products we consider here are perfectly homogeneous (except for the quality and the amount of advertising). This implies Bertrand competition of all companies that have entered

[15]Further comparative statics results can be found in Section 5.

[16]Of course, monopolization in media markets may bring about other inefficiencies than purely economic ones. For instance, it may lead to political biases and disinformation. This alone may be enough in order to worry about media monopolies. On the other hand, competition may also lead to biased news by making it necessary to exaggerate stories in order to attract readers or viewers. See Mullainathan and Shleifer (2003) for a model that analyzes both types of media bias.

[17]See the analysis of this case in Appendix B.

the market. Hence, with increasing returns to scale a situation of natural monopoly would arise. In order to be able to analyze a competitive media market, we thus set $F = 0$. It should become clear that the problems that adverse selection may pose in media markets are quite general and not driven by a specific formulation of market structure.

4.1 First Best

Again, we first consider the market equilibrium under full information as a benchmark. We can look at the H- and the L-market separately. It is straightforward to see that the following conditions are necessary and sufficient for a Nash equilibrium of the game that the media firms play: (i) media firms earn non-negative profits and (ii) there does not exist a contract $C = (p, \alpha, q)$ which is not offered in equilibrium but would make positive profits for a media firm offering it. In order to guarantee condition (i) we must have

$$\alpha_i \delta_i + p_i \geq c + \frac{1}{2}\varphi q_i^2 \text{ for } i \in \{H, L\} \tag{9}$$

from equation (2). Condition (ii) then implies that an equilibrium can be found by maximizing the agent's utility subject to these zero profit constraints. Hence, we have to solve for $i \in \{H, L\}$

$$\max_{\{(p_i, \alpha_i, q_i)\}} \bar{U}_i - \alpha_i - \beta_i p_i + v_i q_i \tag{P3}$$

subject to (5), (6) and (9).

As in the monopoly case we forgo a proof for the solution of the first best. This solution has $p_H^{FB} = 0$, $\alpha_H^{FB} = c/\delta_H + (\delta_H/2\varphi)v_H^2$ and $q_H^{FB} = (\delta_H/\varphi)v_H$ for the high type and $p_L^{FB} = 0$, $\alpha_L^{FB} = c/\delta_L$ and $q_L^{FB} = 0$ for the low type. Again, this is quite intuitive. As advertising is the efficient way of paying for the media product, prices are zero for both types and the media product is fully financed by advertising. Low types receive zero quality as they do not care about it. High types, on the other hand, receive a positive amount of quality, which is increasing in their valuation v_H and in advertising receipts δ_H, while it is decreasing in the cost of provision of quality φ. Which type has to accept more advertising depends on the quality preferences of H-types. If their desire for quality is sufficiently small, high types have to endure less advertising. This is because they are more attractive to advertising firms. If their desire for quality is sufficiently large, however, they still have to accept more advertising than low types, in order to finance the additional costs of quality. The firms in the market offer two different types of bundles, one for high and one for low types, and make zero profits. The entire surplus goes to consumers.

4.2 Second Best

Next turn to the more realistic case of asymmetric information. Lemma 1 guarantees that we can direct our attention to separating equilibria.

Lemma 1 *There does not exist a pooling equilibrium in the competitive media market.*

The intuition for Lemma 1 is that every pooling contract can be destabilized by another contract that baits only high types, thereby ruining the advertising rate for the pooling contract.

Apart from the constraints from the first best case, we must now also guarantee incentive compatibility, as in the monopoly case. Again, we maximize the agents' utility to satisfy condition (ii) for a Nash equilibrium.

$$\max_{\substack{\{(p_H,\alpha_H,q_H),\\(p_L,\alpha_L,q_L)\}}} \gamma(\bar{U}_H - \alpha_H - \beta_H p_H + v_H q_H) + (1-\gamma)(\bar{U}_L - \alpha_L - \beta_L p_L) \tag{P4}$$

$$\text{subject to (5) to (9)}$$

Proposition 4 formally states the solution to program (P4).

Proposition 4 *In the solution to program (P4), the low type always receives his first best bundle. The high type's bundle is as follows.*
(i) If $v_H \in [0, \underline{v}_H)$, *then* $p_H^{SB} = \frac{\delta_L - \delta_H}{\delta_L(1-\delta_H\beta_L)}c + \frac{1-\delta_H\beta_L}{2\varphi(\beta_H-\beta_L)^2}v_H^2$, $\alpha_H^{SB} = \frac{1-\delta_L\beta_L}{\delta_L(1-\delta_H\beta_L)}c - \frac{\beta_L(1-\delta_H\beta_L)}{2\varphi(\beta_H-\beta_L)^2}v_H^2$ *and* $q_H^{SB} = \frac{1-\delta_H\beta_L}{\varphi(\beta_H-\beta_L)}v_H$.
(ii) If $v_H \in [\underline{v}_H, \bar{v}'_H)$, *then* $p_H^{SB} = 0$, $\alpha_H^{SB} = \frac{c}{\delta_L}$ *and* $q_H^{SB} = \sqrt{\frac{2(\delta_H-\delta_L)}{\varphi\delta_L}}c$.
(iii) If $v_H \in [\bar{v}'_H, \infty)$, *then the high type receives his first best bundle.*

Again we proceed with the graphical representation of the solution, which can be found in Figure 3. A comparison of Figures 1 and 3 immediately shows that the way competitive firms deal

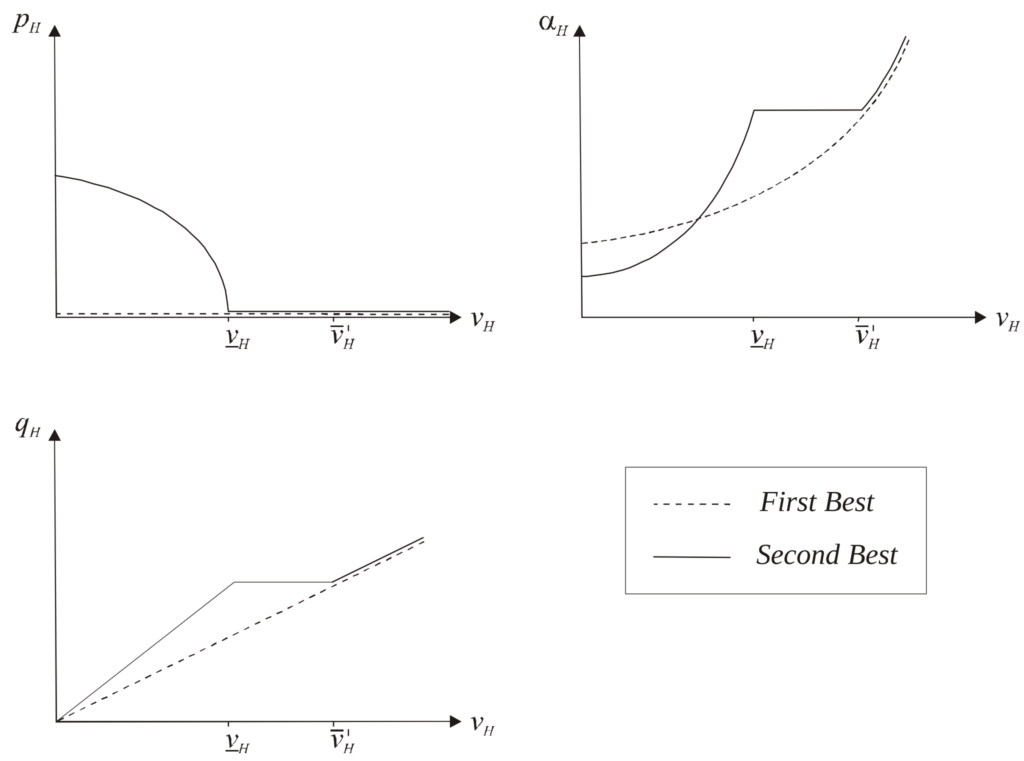

Figure 3: The Competitive Case

with adverse selection almost perfectly corresponds to the way a monopolist deals with it if there are many low types. The only big difference is that in the competitive case firms make zero profits and hence there is less advertising overall. It is interesting that the solution is independent of γ. This is so because competitive firms can not use cross-subsidizing schemes. Since in equilibrium there must be zero profits for both high and low types, firms can not trade off which type they like to screen more intensively.

Again, we see that if v_H is small, both quality- and price-screening occur. As the valuations get different, there are the by now well known effects of an exchange of instruments and of a general reduction in screening. As before, beyond some threshold $\bar{v}'_H$ the first best is achieved.

It is well known that in competitive markets with adverse selection, separating pure strategy equilibria exist if and only if there is no pooling contract that has the following two properties: (i) it makes non-negative profits if offered and (ii) both types prefer it to the separating contracts that were proposed as equilibrium candidates (given here by the solution to program (P4)). Non-existence of pure-strategy equilibria is worrying because it is unclear how a mixed strategy by firms could be interpreted. The following proposition addresses the question of equilibrium existence in the context of media markets.

Proposition 5 *If $v_H \in [0, \bar{v}'_H)$, then a pure strategy equilibrium in the media market exists if and only if $\gamma \leq \hat{\gamma}(v_H)$ for some $\hat{\gamma}(v_H) \in (0,1)$. $\partial\hat{\gamma}(v_H)/\partial v_H > 0$ and $\hat{\gamma} \to 1$ as $v_H \to \bar{v}'_H$. If $v_H \geq \bar{v}'_H$, a pure strategy equilibrium exists for all $\gamma \in [0,1]$.*

Therefore, also in media markets, there is a problem of non-existence of pure strategy equilibria. However, the problem gets less severe as v_H increases and finally vanishes beyond some point. Note that in the case of non-existence of a pure strategy equilibrium it is known that a mixed-strategy equilibrium does exist (Dasgupta and Maskin 1986). Also, various equilibrium refinements have been proposed by the literature in order to guarantee the existence of pure strategy equilibria. We do not want to delve into this matter, however, and refer to Hellwig (1987) for a discussion.

5 Comparative Statics

We will now analyze how media market distortions that are due to adverse selection are affected by a change in the exogenous parameters of the model.[18] Note that p_H^{SB} is a direct measure of the price distortion as $p_H^{FB} = 0$. In order to measure the quality distortion, let $\Delta q_H := q_H^{SB}/q_H^{FB} - 1$ denote the percentagewise distortion of quality. Unless otherwise stated, all results hold both for the monopoly and for the competitive case.

Let us first analyze a change in the marginal rate of substitution between monetary payments and advertising, β_H and β_L. It is easy to show that $\partial p_H^{SB}/\partial\beta_H \leq 0$ and $\partial\Delta q_H/\partial\beta_H > 0$. This corresponds to an exchange in screening instruments. The reason for this is that an increase in β_H means that the payment preferences of the two types get closer. Hence, screening via the price becomes more expensive. Therefore, it is optimal to use the quality instrument more intensively, while the use of the price distortion should be reduced.[19]

Secondly, consider an increase in φ, that is the provision of quality becomes more expensive. We find $\partial p_H^{SB}/\partial\varphi \geq 0$ and $\partial\Delta q_H/\partial\varphi = 0$. These changes embody two effects. First of all, the increase in φ makes screening via quality more costly. This force reduces quality screening and increases price screening. Second of all, a higher φ means that q_H is decreasing in first best,

[18] Accordingly, all derivatives we present here are taken at a value of v_H such that we are strictly in second best.

[19] Analogously, an increase in β_L implies that more emphasis is put on the price distortion, while the quality distortion is reduced.

too. Since we know from above that the adverse selection problem gets worse when the quality preferences of the two types get more similar, there now has to be more screening overall. This pushes up both kinds of distortion. The net effect has the quality distortion unchanged and the price distortion increased.

Now consider a change in c. Here, the result of the comparative statics analysis depends on the market structure. We first analyze the competitive case. There, we immediately find that $\partial \Delta q_H / \partial c \geq 0$ and $\partial p_H^{SB} / \partial c \geq 0$. Hence, an increase in marginal costs implies (weakly) more use of both distortions. This is reasonable: a higher cost of the product brings about more advertising and hence it becomes more attractive for L-types to consume the H-type bundle. As a response, screening must be intensified.

In the monopoly case, the level of c does not influence the screening policy. This is a consequence of the fact that in monopoly, the amount of advertising (and hence the severity of the adverse selection problem) is determined by the consumers' valuations and not by the producers' marginal cost.

Finally, consider a change of the advertising prices δ_H and δ_L. It is well known that advertising prices change pro-cyclically and very amplified along the business cycle. This makes it a particularly interesting case to consider. It turns out that comparative statics with respect to the advertising rates again yield different results depending on the type of market structure. Let us first consider the competitive case. Simple calculations show that $\partial p_H^{SB} / \partial \delta_i < 0$ for $i \in \{H, L\}$ and $\partial \Delta q_H / \partial \delta_H < 0$ (and $\partial \Delta q_H / \partial \delta_L = 0$). Bad times let the adverse selection problem become more severe, which calls for more intensive distortions. This is intuitive: an economic downturn implies lower advertising rates. This increases not only the *absolute* number of advertisements α_H and α_L that a competitive media firm has to display in order to break even, but also the *difference* between α_H and α_L. Alas, this makes the low type incentive constraint harder to fulfill, which necessitates a bigger distortion.

In the monopoly case things are different. There, the media firm always tries to have as much advertising as possible in order to extract rent. This is independent of advertising rates. Nonetheless, a change in δ_H alters the distortions in the monopoly case. It is straightforward to show that $\partial p_H^{SB} / \partial \delta_H \leq 0$, $\partial p_H^{SB} / \partial \delta_L = 0$, $\partial \Delta q_H / \partial \delta_H \geq 0$ and $\partial \Delta q_H / \partial \delta_L = 0$. That is, the distortions are unaffected by the low type advertising rate. But if δ_H goes up, the price distortion decreases and the quality distortion increases. If δ_H increases, the high type wants more quality as quality has become less expensive. This makes screening via quality relatively less expensive. Hence an increase in δ_H results in an exchange of screening instruments as we have seen before. All in all, in the case of a media monopoly, economic changes have no influence on the severity of the adverse selection problem. But they do have an effect on the way this problem is tackled by the media firm.[20] The following corollary summarizes the effect of an economic crisis.

Corollary 1 *An economic downturn that decreases advertising rates aggravates the adverse selection problem in competitive media markets, but leaves it unchanged for a monopolist.*

6 Discussion

One assumption that we have made in the case of a competitive media market is that consumers' basic valuations $\bar{U}_L$ and $\bar{U}_H$ are sufficiently high compared to production costs, so that trade of the media products is efficient. Alternatively, consider the situation where only the H-type's valuation is high enough to enable trade of the media product. It is tempting to suspect that in such a case the adverse selection problem vanishes and we return to first best. This, however, turns out to be wrong. Even though low types do not find the first best low type bundle attractive, they still may have to be deterred from buying the high type bundle. This may be necessary because the high type bundle is very attractive due to its (relatively) low amount of advertising. It is straightforward to show in our basic model that whenever $\bar{U}_L$ decreases below some threshold level, production for low types becomes inefficient. As $\bar{U}_L$ decreases from this point on, the necessary distortion of the high types becomes weaker and weaker, because buying the high type bundle becomes less and less attractive to L-types. But until $\bar{U}_L$ has decreased below some second threshold level, we are strictly in second best.

The above case may be the relevant one for newspaper markets. Here the distinguishing characteristic of readers is probably the average reading time more than income. It is well known that usually only 15% or less of newspaper subscribers actually read their paper on a given day. If the price is low enough, most people want to subscribe to a newspaper, even if they do not read it very often. Naturally, advertisers pay lower rates for "readers" who do not actually see their advertisements. It is well conceivable that it would be efficient (in a first best world) to finance newspapers wholly by advertising. But given that free papers would attract subscriptions

[20] This indirect effect is of course also present in the competitive market. However, it is wholly overshadowed by the direct effect that was discussed above.

of readers who merely use the paper for checking the lottery numbers and the cinema program, newspapers are forced to distort their pricing policy.[21]

Another interesting extension of our model is to the question of the political bias of mass media. It has been argued that the reliance of mass media on advertising revenue causes a distortion of political content away from extreme views towards softer positions (see Gabszewicz, Laussel, and Sonnac, 2001a, and the references therein). According to this view, advertising reduces the heterogeneity of the media market's political spectrum and leads to a "pensée unique". Our model shows that adverse selection may work as a countervailing force against this problem. Assume that the political spectrum can be represented by a one-dimensional continuous variable (say, by a left-right index). Now, if there is some correlation between income and political opinion[22] then the political orientation of a media product may be used as a screening instrument. The consequence of this is straightforward: if the political preference of the two types is sufficiently different, the orientation of the media product suffices to separate the two types without distortion. If the political preference of the two types is not too different, however, the political orientation of high type media products will be distorted further away from the low type's preference. Hence, to the extent that there is political heterogeneity among readers, the media's political heterogeneity will be amplified as a response to adverse selection. A similar argument holds of course for content diversity. Therefore, our model also suggests a countervailing force against the problem of restricted diversity of broadcasting content (as argued by Steiner, 1952, Spence and Owen, 1977, Beebe, 1977, Anderson and Coate, forthcoming, and Gal-Or and Dukes, 2004).

In the analysis so far, we have restricted ourselves to positive aspects and have refrained from engaging in welfare analysis. As we have pointed out in the introduction, interpreting a downward-distortion in the advertising market as welfare-reducing is not obvious, as advertising may exert negative externalities on competitors. In order to evaluate this question it plays a crucial role whether advertising is informative or persuasive. If advertising is informative, a downward distortion is clearly welfare-reducing. While there is a negative externality on other firms also, this externality is purely pecuniary and thus irrelevant for welfare comparisons. If advertising is persuasive, however, it may just shift consumption from one firm to another; hence

[21] Newspapers usually raise 50 to 90% of their revenue from advertising but almost all regular papers have a positive cover price. There do exist free newspapers in some major cities. Usually these are distributed in subways and are very thin, which ensures that most readers will actually have a look at the paper. Their appearance is well in line with our theory: they can readily be recognized as a low type bundle with low quality appearance and a large amount of advertising.

[22] Such correlation is claimed by political economy models of redistributive politics. See for instance Romer (1975), Roberts (1977) or Meltzer and Richard (1981).

the benefit of the advertising firm may just correspond to a reduction in profit for another firm, while the consumer dislikes viewing the ad and gets a comparable utility from consuming the advertised product. In this case, advertising is clearly inefficient in the sense of social welfare and any reduction in its level is desirable, while any upward distortion would be welfare reducing. In short, the welfare effects of adverse selection in advertising markets crucially depend on the type of advertising. See Bagwell (2003) for a general discussion of the welfare effects of advertising.

Our theory accords well with empirical regularities. Fisher, McGowan and Evans (1980) report the strong impact that viewer characteristics have on advertising prices in the broadcasting industry. Thompson (1989) and Koschat and Putsis (2000) find similar results for newspapers and magazines, respectively. In addition to that Thompson finds that price setting involves a trade-off between circulation and advertising revenue. If media companies decide to reduce the cover price of their medium, this increases sales but substantially deteriorates advertising rates, as many of the new readers are less attractive for advertisers. Similarly, Kaiser's (2003) empirical results for women's magazines show that increasing the circulation by one percent increases advertising revenues by far less than one percent. This implies that price cuts dramatically worsen advertising rates per reader. This effect is particularly strong for magazines which are aimed at high income women.

These facts can be easily explained within our model: high-type media firms do not compete themselves down in prices as much as possible, since lowering the price too much would attract low types, which would deteriorate advertising rates substantially. Instead, in our model high-type media compete via quality and the amount of advertising. Casual observation confirms that the proposed positive correlation between subscription fees and advertising rates is met in reality.

It is interesting to note that the classic papers in media economics already hint at problems of adverse selection in the media industry. Reddaway (1963, p. 214) observes the dangers of using cover price cuts as a competitive instrument:

> "Even if the price-cut succeeded, however, there is a real risk that the new readers would be concentrated in low-income groups, and so lower A's status as an advertising medium."

In a similar vein, Corden (1953, p. 186) explains that advertising revenue increases less than proportionally with increases in circulation (caused, say, by a cover price cut):

> "Firstly, as circulation increases the average income of readers usually falls; hence the quality of the advertising space to advertisers is decreased, and to some extent the increase in quality resulting from the rise in circulation itself is offset."

But while both authors already see the problem, they lack the analytical tools of modern contract theory for a proper analysis of the matter. Consequently, these issues are just asides in the non-technical parts of their papers.

It is much more difficult to find convincing evidence for an overprovision of quality in media markets. The main problem stems from the fact that there is no microeconomic foundation of what constitutes the first best. In insurance economics or in banking, where we know from first principles that full-insurance and zero collateral are efficient, we can immediately link the observation of partial insurance and collateralized loans to market failures like adverse selection or moral hazard. In the media industry, on the other hand, there is no clear-cut level of first-best quality that is easily recognizable.

We do want to mention, however, the remarks of Reddaway (1963, p. 217) on the economics of newspapers:

> "[...] [There is] a question which has always puzzled me - namely, is it really necessary for a national paper of wide appeal to spend such vast sums on "editorial"? [...] Could not an editor of ideas produce the text for a normal popular national without spending more than (say) three times as much as the Birmingham Post?"

Our model would claim that, indeed, a popular national would be able to; *but that it does not want to.* In fact one could argue that increasing the paper's quality enables the national paper to scare away low type readers who are not willing to pay for the artificially increased quality. Quite possibly, many of the high type readers would actually prefer reducing editorial expenditures as well, since the marginal value they contribute to reading enjoyment is arguably low (as exemplified by the above quote).

7 Appendix

7.1 A. Proofs

Before going into the proofs we will need to define some threshold levels. Let $\underline{v}_H := \sqrt{2\varphi(\delta_H-\delta_L)(\beta_H-\beta_L)^2 c/[\delta_L(1-\delta_H\beta_L)^2]}$, $\underline{v}'_H := \sqrt{(\bar{U}_L-\bar{U}_H)\varphi/[\delta_L(1-\gamma)/\gamma+\delta_H]}$, $\bar{v}_H := \sqrt{(\bar{U}_L-\bar{U}_H)\varphi/\delta_H}$, $\bar{v}'_H := \sqrt{2\varphi(\delta_H-\delta_L)c/(\delta_L\delta_H^2)}$ and $\bar{\gamma} := \delta_L(\beta_H-\beta_L)/[1-\delta_H\beta_H+\delta_L(\beta_H-\beta_L)]$.

Proof of Proposition 1. To simplify the reference, let us split conditions (5) and (6) into their single parts. We refer to the constraint $\alpha_H \geq 0$ by (5h), while we refer to $\alpha_L \geq 0$ by (5l). Likewise we refer to $p_H \geq 0$ by (6h) and to $p_L \geq 0$ by (6l).

First conjecture that (3), (4), (6l) and (8) are binding, whereas (5h), (5l), (6h) and (7) are slack. Let μ_i be the multiplier for constraint (i). This gives us the Lagrangean

$$\begin{aligned} L &= \gamma(\alpha_H\delta_H+p_H-c-\frac{1}{2}\varphi q_H^2)+(1-\gamma)(\alpha_L\delta_L+p_L-c-\frac{1}{2}\varphi q_L^2)-F \\ &\quad +\mu_3[\bar{U}_H-\alpha_H-\beta_H p_H+v_H q_H] \\ &\quad +\mu_4[\bar{U}_L-\alpha_L-\beta_L p_L] \\ &\quad +\mu_{6l}p_L \\ &\quad +\mu_8[\alpha_H-\alpha_L+\beta_L(p_H-p_L)]. \end{aligned}$$

Using $\gamma \leq \bar{\gamma}$, $v_H < \underline{v}_H$ and the assumptions from Section 2 we find that all multipliers are larger than zero and get the equilibrium values proposed in the proposition for the case where $v_H \in [0, \underline{v}_H]$. Substituting the solutions back in the constraints and rearranging shows that none of the constraints is violated.[23]

Next conjecture that (3), (6h), (6l) and (8) are binding, whereas (4), (5h), (5l) and (7) are

[23] More detailed calculations of this and later maximization problems are available from the authors upon request.

slack. The Lagrangean then becomes

$$
\begin{aligned}
L &= \gamma(\alpha_H\delta_H + p_H - c - \frac{1}{2}\varphi q_H^2) + (1-\gamma)(\alpha_L\delta_L + p_L - c - \frac{1}{2}\varphi q_L^2) - F \\
&\quad +\mu_3[\bar{U}_H - \alpha_H - \beta_H p_H + v_H q_H] \\
&\quad +\mu_4[\bar{U}_L - \alpha_L - \beta_L p_L] \\
&\quad +\mu_{6h} p_H \\
&\quad +\mu_{6l} p_L \\
&\quad +\mu_8[\alpha_H - \alpha_L + \beta_L(p_H - p_L)].
\end{aligned}
$$

Using $\gamma \leq \bar{\gamma}$, $\underline{v}_H \leq v_H < \bar{v}_H$ and the assumptions from Section 2 we again find the multipliers to be larger than zero and get the equilibrium values proposed in the proposition for the case $v_H \in [\underline{v}_H, \bar{v}_H]$. As before, substitution of these values into the constraints and rearranging confirms that all constraints are fulfilled by the solution.

Finally, using using $\gamma \leq \bar{\gamma}$, $v_H \geq \bar{v}_H$ and the assumptions from Section 2, simple substitution of the first best values into the constraints and rearranging confirms that the first best can be achieved for $v_H \geq \bar{v}_H$. ■

Proof of Proposition 2. First conjecture that (3), (6h), (6l) and (8) are binding, whereas (4), (5h), (5l), and (7) are slack. This gives us the Lagrangean

$$
\begin{aligned}
L &= \gamma(\alpha_H\delta_H + p_H - c - \frac{1}{2}\varphi q_H^2) + (1-\gamma)(\alpha_L\delta_L + p_L - c - \frac{1}{2}\varphi q_L^2) - F \\
&\quad +\mu_3[\bar{U}_H - \alpha_H - \beta_H p_H + v_H q_H] \\
&\quad +\mu_{6h} p_H \\
&\quad +\mu_{6l} p_L \\
&\quad +\mu_8[\alpha_H - \alpha_L + \beta_L(p_H - p_L)].
\end{aligned}
$$

Using $\gamma > \bar{\gamma}$, $v_H < \underline{v}'_H$ and the assumptions from Section 2 we find that all multipliers are larger than zero and get the equilibrium values proposed in the proposition for the case where $v_H \in [0, \underline{v}'_H]$. Substituting the solutions back in the constraints and rearranging shows that none of the constraints is violated.

Next conjecture that (3), (4), (6h), (6l) and (8) are binding, whereas (5h), (5l) and (7) are slack. The Lagrangean then becomes

$$\begin{aligned}
L &= \gamma(\alpha_H\delta_H + p_H - c - \frac{1}{2}\varphi q_H^2) + (1-\gamma)(\alpha_L\delta_L + p_L - c - \frac{1}{2}\varphi q_L^2) - F \\
&+\mu_3[\bar{U}_H - \alpha_H - \beta_H p_H + v_H q_H] \\
&+\mu_4[\bar{U}_L - \alpha_L - \beta_L p_L] \\
&+\mu_{6h} p_H \\
&+\mu_{6l} p_L \\
&+\mu_8[\alpha_H - \alpha_L + \beta_L(p_H - p_L)].
\end{aligned}$$

Using $\gamma > \bar{\gamma}$, $\underline{v}'_H \leq v_H < \bar{v}_H$ and the assumptions from Section 2 we again find the multipliers to be larger than zero and get the equilibrium values proposed in the proposition for the case $v_H \in [\underline{v}'_H, \bar{v}_H]$. As before, substitution of these values into the constraints and rearranging confirms that all constraints are fulfilled by the solution.

Finally, using using $\gamma > \bar{\gamma}$, $v_H \geq \bar{v}_H$ and the assumptions from Section 2, simple substitution of the first best values into the constraints and rearranging confirms that the first best can be achieved for $v_H \geq \bar{v}_H$. ■

Proof of Proposition 3. First note that in the case $v_H \geq \bar{v}_H$ we are in first best. Hence, rationing can only be profitable if $v_H < \bar{v}_H$. Let us assume this to be the case. Denote by C_i^{FB} (C_i^{SB}) the first best (second best) contract offered to type i according to program (P2); and denote a no-trade situation by N. As for low types $C_L^{FB} = C_L^{SB}$, rationing high types can never improve the monopolist's profit. The most profitable strategy that possibly rations low types is offering C_H^{FB} only.

As the low type's incentive constraint is binding if $v_H < \bar{v}_H$, we must have $C_H^{FB} \succ_L C_L^{FB}$. Furthermore, $C_L^{FB} \sim_L C_L^{SB}$ as $C_L^{FB} = C_L^{SB}$. Finally, since the low type's participation constraint is fulfilled, we must have $C_L^{SB} \succeq_L N$. Hence, by transitivity of L's preferences, $C_H^{FB} \succ_L N$. This means that the most profitable candidate for rationing actually does not involve any rationing if offered alone. Therefore, there exists no rationing contract that generates a higher profit for the monopolist than the solution to program (P2). ■

Proof of Lemma 1. Suppose there exists a pooling equilibrium in which only the bundle $C_P = (p_P, \alpha_P, q_P)$ is offered by the media firms. As both types consume the bundle, the advertising rate that C_P generates is $\delta_P = \gamma\delta_H + (1-\gamma)\delta_L$. Since firms engage in Bertrand competition, we must have that C_P entails zero profits for media firms.

We will first prove the lemma for the case $\alpha_P > 0$. Consider entry of a firm that offers bundle $C_A = (p_P + \varepsilon_1, \alpha_P - \varepsilon_1/\delta_P - \varepsilon_2, q_P)$ with ε_1 and ε_2 small.[24] We will show that there exist $\varepsilon_1 > 0$ and $\varepsilon_2 > 0$ such that all high types strictly prefer C_A, all low types strictly prefer C_P and the entering firm makes a strictly positive profit. Evidently, this is a contradiction to C_P being a pooling equilibrium contract.

From (1) and after simple rearranging we find that $C_A \succ_H C_P$ is equivalent to $\varepsilon_2/\varepsilon_1 < \beta_L - 1/\delta_P$. Similarly, $C_P \succ_L C_A$ is equivalent to $\varepsilon_2/\varepsilon_1 > \beta_H - 1/\delta_P$. There must exist small ε_1 and ε_2 such that both inequalities are fulfilled as $\beta_L > \beta_H$. Let $\bar{\varepsilon}$ be a value of $\varepsilon_2/\varepsilon_1$ such that both conditions hold.

As firms make zero profits with C_P alone, C_A makes positive profits whenever C_A generates higher profits than C_P. From (2) and after some rearranging we find that this is the case whenever $\alpha_P > \varepsilon_1/\delta_P + \varepsilon_2\delta_H/(\delta_H - \delta_P)$. Substituting $\varepsilon_2 = \bar{\varepsilon} \cdot \varepsilon_1$ into this inequalityyields $\alpha_P > [1/\delta_P + \bar{\varepsilon}\delta_H/(\delta_H - \delta_P)]\varepsilon_1$. Clearly, this inequality holds for small enough ε_1, which completes the proof for $\alpha_P > 0$.

In the case $\alpha_P = 0$ an analoguous proof can be used, where this time quality and price are varied in the destabilizing contract (instead of advertising and price). ■

Proof of Proposition 4. First conjecture that (6l), (8) and (9) are binding, whereas (5h), (5l), (6h) and (7) are slack. This gives us the Lagrangean

$$
\begin{aligned}
L \;=\; & \gamma(\bar{U}_H - \alpha_H - \beta_H p_H + v_H q_H) + (1-\gamma)(\bar{U}_L - \alpha_L - \beta_L p_L) \\
& + \mu_{6l} p_L \\
& + \mu_8[\alpha_H - \alpha_L + \beta_L(p_H - p_L)] \\
& + \mu_{9h}[\alpha_H\delta_H + p_H - c - \frac{1}{2}\varphi q_H^2] \\
& + \mu_{9l}[\alpha_L\delta_L + p_L - c - \frac{1}{2}\varphi q_L^2].
\end{aligned}
$$

Using $v_H < \underline{v}_H$ and the assumptions from Section 2 we find that all multipliers are larger than zero and get the equilibrium values proposed in the proposition for the case where $v_H \in [0, \underline{v}_H)$. Sub-

[24] This guarantees that the non-negativity constraint for advertising is not violated.

stituting the solutions back in the constraints and rearranging shows that none of the constraints is violated.

Next conjecture that (6h), (6l), (8) and (9) are binding, whereas (5h), (5l) and (7) are slack. The Lagrangean then becomes

$$
\begin{aligned}
L \;=\;& \gamma(\bar{U}_H - \alpha_H - \beta_H p_H + v_H q_H) + (1-\gamma)(\bar{U}_L - \alpha_L - \beta_L p_L) \\
&+\mu_{6h} p_H \\
&+\mu_{6l} p_L \\
&+\mu_8[\alpha_H - \alpha_L + \beta_L(p_H - p_L)] \\
&+\mu_{9h}[\alpha_H \delta_H + p_H - c - \frac{1}{2}\varphi q_H^2] \\
&+\mu_{9l}[\alpha_L \delta_L + p_L - c - \frac{1}{2}\varphi q_L^2].
\end{aligned}
$$

Using $\underline{v}_H \leq v_H < \bar{v}'_H$ and the assumptions from Section 2 we again find the multipliers to be larger than zero and get the equilibrium values proposed in the proposition for the case $v_H \in [\underline{v}_H, \bar{v}'_H)$. As before, substitution of these values into the constraints and rearranging confirms that all constraints are fulfilled by the solution.

Finally, using using $v_H \geq \bar{v}'_H$ and the assumptions from Section 2, simple substitution of the first best values into the constraints and rearranging confirms that the first best can be achieved for $v_H \geq \bar{v}'_H$. ■

Proof of Proposition 5. A pure strategy equilibrium exists if and only if there does not exist a pooling contract $C_P = (p_P, \alpha_P, q_P)$ that the high types prefer to their separating contract $C_H^{SB} = (p_H^{SB}, \alpha_H^{SB}, q_H^{SB})$ and that generates non-negative profits for a media company offering it. Denote by C_P^* the pooling contract that is the most preferable for high types among the contracts that generate non-negative profits for firms if the advertising rate is $\delta_P = \gamma\delta_H + (1-\gamma)\delta_L$. This contract can be found just as the first best contract for high types, but replacing δ_H with δ_P. First assume that $\beta_H \delta_L > 1$. This guarantees that advertising is the efficient way of financing the pooling media product. Then the best pooling contract corresponds to the solution to program (P3), with δ_H replaced by δ_P. We will proceed in several steps.

Step 1: $\hat{\gamma}(0) \in (0, 1)$

For $\gamma = 1$, we must have $C_P^* \succ_H C_H^{SB}$ as $C_P^* = C_H^{FB}$ in that case. And we know $C_H^{FB} \succ_H C_H^{SB}$ as C_H^{SB} is distorted away from first best at $v_H = 0$. For $\gamma = 0$ we must have $C_H^{SB} \succ_H C_P^*$ as $C_P^* = C_L^{SB}$ in that case. And we know that $C_H^{SB} \succ_H C_L^{SB}$ from the fact that (7) is slack in program (P4). Clearly, the utility that C_P^* generates for high types is continuously increasing in γ, as an increase in γ increases δ_P in a continuous way. Hence, there exists a unique $\hat{\gamma}(0) \in (0,1)$ at which $C_P^* \sim_H C_H^{SB}$.

Step 2: $\hat{\gamma}(v_H) = 1$ for all $v_H \geq \bar{v}'_H$

This follows immediately from Proposition 4, as the first best must constitute a pure strategy Nash equilibrium for every $v_H \geq \bar{v}'_H$.

Step 3: $\partial V_H(C_H^{SB})/\partial v_H > \partial V_H(C_P^*)/\partial v_H \geq 0$ and $\partial V_H(C_P^*)/\partial\gamma > 0$ for all $v_H < \bar{v}'_H$

Substituting the equilibrium values in (1) for high types and taking derivatives we find

$$\frac{\partial V_H(C_P^*(\gamma, v_H))}{\partial v_H} = \frac{\delta_P}{\varphi} v_H \geq 0 \text{ for all } v_H < \bar{v}'_H,$$

$$\frac{\partial V_H(C_H^{SB}(\gamma, v_H))}{\partial v_H} = \begin{cases} \frac{1-\delta_H\beta_L}{\varphi(\beta_H-\beta_L)} v_H \text{ for } v_H \in [0, \underline{v}_H) \\ \sqrt{\frac{2(\delta_H-\delta_L)}{\varphi\delta_L}} c \text{ for } v_H \in [\underline{v}_H, \bar{v}'_H). \end{cases} \geq 0 \text{ for all } v_H < \bar{v}'_H$$

and

$$\frac{\partial V_H(C_P^*(\gamma, v_H))}{\partial \gamma} = \frac{\delta_H - \delta_L}{\delta_P} c + \frac{\delta_H - \delta_L}{\varphi} v_H^2 > 0 \text{ for all } v_H < \bar{v}'_H$$

Simple comparisons show that $\partial V_H(C_H^{SB})/\partial v_H \leq \partial V_H(C_P^*)/\partial v_H$ would imply that either $v_H \geq \bar{v}'_H$ or $0 > 1 - \beta_H\delta_P \geq \beta_L(\delta_H - \delta_P) > 0$, both of which is a contradiction.

Step 4: $d\hat{\gamma}(v_H)/dv_H > 0$ for all $v_H \leq \bar{v}'_H$

$\hat{\gamma}(v_H)$ is implicitly defined by the equation $V_H(C_H^{SB}(\gamma, v_H)) - V_H(C_P^*(\gamma, v_H)) = 0$, whose left-hand-side is a function $F(\gamma, v_H)$. From the implicit function theorem we have $d\hat{\gamma}(v_H)/dv_H = -(\partial F/\partial v_H)/(\partial F/\partial\gamma)$. Therefore,

$$\begin{aligned} \frac{d\hat{\gamma}(v_H)}{dv_H} &= -\frac{\partial V_H(C_H^{SB}(\gamma, v_H))/\partial v_H - \partial V_H(C_P^*(\gamma, v_H))/\partial v_H}{\partial V_H(C_H^{SB}(\gamma, v_H))/\partial\gamma - \partial V_H(C_P^*(\gamma, v_H))/\partial\gamma} \\ &= \frac{\partial V_H(C_H^{SB}(\gamma, v_H))/\partial v_H - \partial V_H(C_P^*(\gamma, v_H))/\partial v_H}{\partial V_H(C_P^*(\gamma, v_H))/\partial\gamma} > 0, \end{aligned}$$

where we use $\partial V_H(C_H^{SB}(\gamma, v_H))/\partial\gamma = 0$ from Proposition 4 and $\partial V_H(C_H^{SB}(\gamma, v_H))/\partial v_H - \partial V_H(C_P^*(\gamma, v_H))/\partial v_H > 0$ and $\partial V_H(C_P^*(\gamma, v_H))/\partial\gamma > 0$ from Step 3.

Step 5: $\hat{\gamma} \to 1$ as $v_H \to \bar{v}_H'$

As $v_H \to \bar{v}_H'$ we have $C_H^{SB} \to C_H^{FB}$ from Proposition 4. Also we know $C_H^{FB} \succ_H C_P^*$ for $\gamma < 1$. Hence, for every $\gamma < 1$ there exists an $\varepsilon > 0$ such that $C_H^{SB}(\gamma, \bar{v}_H' - \varepsilon) \succ_H C_P^*(\gamma, \bar{v}_H' - \varepsilon)$, which proves the statement.

Taken together, Steps 1, 2, 4 and 5 prove the proposition for the case $\beta_H\delta_L > 1$. If this condition is not met, the high types will prefer financing of the pooling media product by price rather than advertising whenever $\beta_H\delta_P \leq 1$. In this case, it may thus be that the equilibrium values in C_P^* change if γ gets too low. Simple adaptation of the above steps for the new equilibrium values then completes the proof. ■

7.2 B. Analysis of Alternative Monopoly Cases

In this Appendix we analyze the monopoly media case in the situation where one type has both a higher willingness to pay and a higher willingness to accept advertising. Let us first consider the subcase where $\bar{U}_H \geq \bar{U}_L$ and $\bar{U}_H/\beta_H \geq \bar{U}_L/\beta_L$, that is where the high types have a higher willingness to pay in both dimensions. In this case, the high types are unambiguously the more attractive customers for the monopolist. This renders the optimal behavior of the monopolist similar to price discriminating behavior in standard goods markets (Mussa and Rosen 1978). We forgo presenting the formal solution to this case; instead we will present the results graphically.[25] Figure 4 shows the results.

The first notable feature of this case is that high types have to be impeded from choosing the low type contract. This implies that they receive their first best quality throughout (no distortion at the top). In addition, they have to endure less advertising than in first best (that is, they receive an information rent). Low types' quality is distorted downwards throughout, in order to deter high types. Note that this quality distortion is not due to the adverse selection of advertising, but due to price discrimination, quite contrary to the case that is analyzed in the main text. As can be seen from Figure 4, in the present case it is never possible to obtain the first best. However,

[25] A complete algebraic solution for this case is available from the authors upon request.

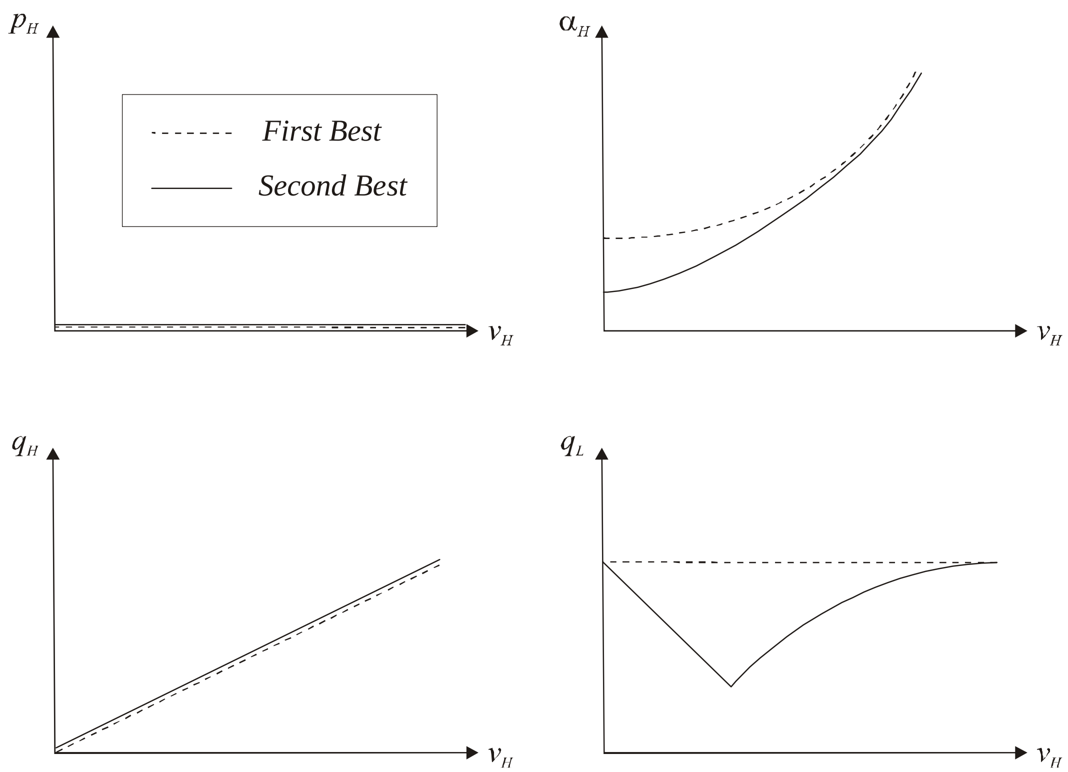

Figure 4: The Alternative Monopoly Case

for $v_H \to \infty$ the optimal price discriminating contract converges to the first best contract. Note that it may be profitable for the monopolist to ration low types. Rationing will occur whenever γ is high, $\bar{U}_H$ is high and v_H is low.

Next turn to the case where low types have a higher willingness to pay in both dimensions, that is $\bar{U}_L \geq \bar{U}_H$ and $\bar{U}_L/\beta_L \geq \bar{U}_H/\beta_H$. This is the case that has been analyzed by Srinagesh and Bradburd (1989) for standard goods. This time, however, the results in the media market do not match the results in goods markets at all. Quite to the contrary, the analysis in this case corresponds to the analysis in the main text in all but one subcases. The only difference occurs when $\gamma \leq \bar{\gamma}$ and $v_H \in [0, \underline{v}_H)$. Even in this subcase, a difference to the main text only occurs within an interval $[0, \underline{v}''_H)$, where $\underline{v}''_H < \underline{v}_H$. In this subinterval there will be pooling of types. Whether the pooling involves positive price and zero advertising or the other way around depends on the parameters. Since this difference is so minor we forgo a more detailed analysis.

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