WHAT DO THE PAPERS SELL? A MODEL OF ADVERTISING AND MEDIA BIAS*

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Matthew Ellman (corresponding author)
Institut d'Anàlisi Econòmica, IAE-CSIC, Barcelona, Spain

Fabrizio Germano
Universitat Pompeu Fabra, Barcelona, Spain

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Abstract

We model the market for news as a two-sided market where newspapers sell news to readers who value accuracy and sell space to advertisers who value advert-receptive readers. In this setting, monopolistic newspapers under-report or bias news that sufficiently reduces advertiser profits. Paradoxically, increasing the size of advertising eventually leads competing newspapers to reduce advertiser bias. Nonetheless, advertisers can counter this effect if able to commit to news-sensitive cut-off strategies, potentially inducing as much bias as in the monopoly case. We use these results to explain contrasting historical and recent evidence on commercial bias and influence in the media.

Keywords: Two-sided markets; advertising; media accuracy; media bias; influence; media economics. *JEL Classification*: L13; L82.

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Emails: Matthew.Ellman@IAE.CSIC.ES and Fabrizio.Germano@UPF.Edu.

> "[French TV channel] TF1's job is to help a company like Coca-Cola sell its products. For a TV commercial's message to get through, the viewer's brain must be receptive. Our programs are there to make it receptive, that is to say to divert and relax viewers between two commercials. What we are selling to Coca-Cola is human brain time."
>
> Patrick Le Lay, President of TF1 (James, 2004)

A free and independent press is vital to society and to democratic government. Advertising plays an important role as a major source of media funding.[1] This paper studies how advertising affects the ability and incentives of media to provide high quality, independent news. There are two contrasting views. The "liberal" view of media history claims advertising has a positive effect on the media, highlighting how the revenues enable newspapers to be independent from states and political parties. The "regulatory" view, on the other hand, argues that media may distort their coverage to accommodate advertiser concerns, even claiming that excessive commercialism in news and media content weakens the participatory foundations of democracy.

We develop a simple unifying framework within which both positions can be articulated. Specifically, we model the market for news as a two-sided market where newspapers sell news to readers who value accuracy and sell space to advertisers who value access to ad-receptive readers. We prove that advertising can actually raise accuracy by increasing the intensity of competition for readers. Concretely, our first main result is that, when advertising is sufficiently large, competing papers set maximal accuracy, even on topics

[1] Mainstream US newspapers generally earn over 50 and up to 80% of their revenue from advertising; in Europe, this percentage lies between 30 and 80%, e.g., averaging 40% in the UK (see e.g., Baker, 1994; Gabszewicz *et al.*, 2001). Overall, advertising exceeds 2% of GDP in the US and a substantial fraction of this becomes media revenue: 17.7% to newspapers, 17.5% to broadcast TV, 7.4% to radio and 4.6% to consumer magazines (Advertising Age, 2007).

sensitive to advertisers. So, paradoxically, advertisers have no influence precisely when their economic importance is greatest. Our second main result shows, in contrast, that advertisers escape the paradox when able to commit to withdraw advertising from papers that are "too accurate" on certain sensitive topics.

Two historical episodes (called "media revolutions" by Lippmann, 1931) provide the cornerstone of the liberal view. First, after sharp cuts in advertising duties accelerated newspaper advertising in the 1830s, British newspapers began to proclaim their independence from government and to reject their clandestine government grants (see Asquith, 1975, and Curran and Seaton, 2003). Second, newspapers became significantly more independent of political parties over the late 19th Century, partly thanks to the growth in advertising that accompanied mass production.[2]

The regulatory view grew out of evidence that some advertisers seriously interfere with media content.[3] The case of tobacco is particularly well-documented. Baker (1994) and Bagdikian (2000) offer detailed accounts of the history of suppression of news on tobacco-related diseases. Complementing this evidence, Warner and Goldenhar (1989) statistically identify tobacco advertising as causing the reporting bias (for further evidence, see e.g., Kennedy and Bero, 1999). Another more recent case is misreporting on anthropogenic climate change. Boykoff and Boykoff (2004) demonstrate a clear bias in the US quality press over 1988-2002 (see Oreskes, 2004, on the scientific benchmark). Automotive advertising has been signalled as a key explanatory factor: in the US in 2006, automotive advertising alone accounted for \$19.8 billion of which nearly 40% went to newspapers and magazines (Advertising Age, 2007).

Proponents of the regulatory view also point to a general "dumbing down"

[2]See Curran and Seaton (2003) and Koss (1981, 1984) for the British case, and Baker (1994), Baldasty (1992), Hamilton (2004) and Kaplan (2002) for the US case.

[3]Baldasty (1992) and Curran and Seaton (2003) provide historical evidence; Bagdikian (2000), Baker (1994), Hamilton (2004), Herman and Chomsky (1988) and McChesney (2004) all contain well-documented accounts of ongoing distortions. See also the series of Royal Commissions on the Press (and FCC hearings in the US) that investigated specific concerns (discussed in Curran and Seaton, 2003, and Doyle, 1968).

and “neutralization” of media content. Hamilton (2004) carefully documents a reduction in “hard news” and a growing tendency to emphasize happy, positive and uncontroversial content. See also Baker (1994) whose evidence on the causal role of advertising corroborates the comments of Le Lay quoted above.

This evidence motivates us to formally analyze why profit-maximizing advertisers might have a preference for suppression of information on specific topics or for a general dumbing-down of content. In Subsection 2.5, we sketch a derivation of such preferences with fully rational readers. To isolate the effect of these advertiser preferences on media content, we assume all readers prefer informative content.

In the market benchmark without advertising, newspapers report all news accurately. As advertising grows, a monopoly newspaper will end up under-reporting on all topics sensitive to advertisers; newspapers simply internalise a share of aggregate advertiser surplus.

In Section 4, we derive our first main result: paradoxically, heavy advertising eventually leads competing newspapers to set *maximal* accuracy on all topics, against the interest of advertisers. Competing papers do not immediately guarantee accuracy, because they can usually differentiate their reporting strategies to segment the market and avoid head-on competition. Nonetheless, with sufficiently heavy advertising, each paper’s value from attracting an extra reader is so high as to preclude this market segmentation. So, by catalyzing competition, heavy advertising ends up generating full accuracy. This clearly supports the liberal view of advertising.

Indeed, the result can be used to explain a puzzling early interaction between newspapers and advertising. Initially, advertising led to reporting distortions. For instance, Baldasty (1992) describes how “‘reading notices’ - essentially, advertisements disguised to appear as news articles” became common, because “readers would tend to be more receptive to a product promoted by a supposedly independent source (viz., the newspaper)”; thus news on the illnesses of excess “brain work” helped sell Warners’ Safe Cure and similar news stories promoted “Dr Williams’ Pink Pill for Pale People”.

Despite the duplicity involved, these notices became widespread in the 1880s and 1890s; indeed, major US newspapers offered standardized rates (Lawson, 1988; Baldasty, 1992). However, as advertising continued to rise, newspapers sought to attract readers by publicly committing against printing unlabeled reading notices and the notices declined sharply (Lawson, 1988). More generally, the ensuing Progressive Era brought increased advertising and is widely viewed as a golden age of the press, with newspapers competing for readers by building reputations for "objectivity"(Kaplan, 2002).

Nonetheless, advertising distortions did not disappear. Just as newspapers were building reputations for accuracy, large advertisers began building reputations for withdrawing their ads from media whose reporting went against their interest. For instance, the foremost advertiser, Procter & Gamble, set up a policy against advertising in media outlets that broke any of a broad list of restrictions.[4] Moreover, companies began to coordinate their withdrawals (often through a common advertising agency); for instance, all US tobacco companies withdrew their ad contracts from the magazine, *Mother Jones*, in 1980 after it published an article linking tobacco to health dangers; similarly, *Reader's Digest* was punished for an incisive article on medical evidence against tobacco.[5]

In Section 5, we model this by allowing each advertiser to commit to withdraw its ads from a newspaper that reports beyond a specified cut-off on sensitive topics. Even without collusion among advertisers, we find that advertisers with common news sensitivities optimally commit to the same cut-offs (see also Section 7). Moreover, as advertisers grow in number or size, they make the cut-offs more restrictive, eventually forcing all newspapers to under-report or bias as heavily as in the monopolistic case of Section 3. Our

[4]E.g., stating that reporting should not "in any way further the concept of business as cold [or] ruthless" (Bagdikian, 2004). Procter & Gamble also ruled out advertising in any issue of a magazine "that included any material on gun control, abortion, the occult, cults, or the disparagement of religion" (Baker, 1994).

[5]See e.g., Bagdikian (2000) and Baker (1994) for a long list of similar withdrawals and threats. Brown (1979) presents the famous case of NBC's losses and cautious programming after being punished for airing a documentary criticising Coca Cola worker conditions in Florida. Miraldi (1990) even identifies a coalition of businesses that organised to punish "muckraking" papers back in the 1900s.

second main result thus reveals how large advertisers with the ability to commit to withdraw their ads can evade the above paradox. Tobacco's long history of success in distorting health reporting by mainstream media offers a particularly clear and well-documented example.

Our paper is part of a rapidly growing literature. Most closely related is the idea that advertising affects news content by encouraging media to target the readers most valued by advertisers. This targeting approach has been used to study political bias and general dumbing-down (see Hamilton's, 2004, book-length treatment), cultural bias (see e.g., George and Waldfogel's, 2003, empirical evidence) and policy bias (see Strömberg's, 2004a,b, model and empirical evidence on how the media focus on target-relevant information and end up inducing policy outcomes that favor the target group). Indeed, Curran (1978) qualifies the liberal view that advertising freed the press from political bias, by showing how the radical British press of the 1850s lost its competitive position, because its working-class readers were unattractive to advertisers.

What is novel in our paper is to analyze the possibility that advertisers may want to distort news to influence a given set of readers, rather than distorting content to target particular types of reader. The implications are very different. For instance, in the targeting models, newspaper competition does not avoid bias, because any bias is there to please the readers (Strömberg, 2004a; Mullainathan and Shleifer, 2005); by contrast, in our paradox result, competition helps remove the bias generated by advertisers seeking to influence readers, and increasing the value of advertising then actually reduces advertiser influence.[6]

Reuter and Zitzewitz (2006) provide a thorough empirical analysis that supports our second main result: in their data, magazines report (or rank) most favorably those mutual funds that pay for most in-magazine adverts and their empirical refinements suggest this represents a reporting bias caused by advertising. Others have analyzed different sources of bias where competi-

[6]In Gabszewicz *et al.* (2001), advertising also increases the intensity of competition for readers, but leads papers to converge on news with a centrist ideology (or "pensée unique"). So, contrary to our paradox result, advertising is harmful there.

tion may help. Dyck and Zingales (2003) suggest that journalists bias news as a way to "thank" their sources for privileged access to news; Patterson and Donbasch (1996) study journalists' own biases; Balan *et al.* (2003) study media mergers when newspaper owners want to influence reader ideology; Anderson and McLaren (2007) analyze this (influence) with fully rational readers; Baron (2006) considers journalists who seek to have influence. Finally, our commitment results apply to media influence by other actors (e.g., governments and banks) that can threaten to withdraw support from newspapers; these results offer a new perspective on Besley and Prat's (2001) model of how governments influence reporting by buying silence.

The paper is organized as follows. Section 2 sets out the general model. Sections 3, 4, and 5 present the main results on monopoly, duopoly, and the impact of cut-off strategies. Section 6 elucidates the logic of our results by allowing for negative pricing. Section 7 analyzes advertiser and newspaper commitment strategies with multiple topics and advertiser types to determine which of our main results (paradox or cut-off strategy) applies in a given setting. Section 8 concludes. All proofs are in the Appendix.

1 The Basic Framework

We study competition between profit-maximizing newspapers in a two-sided market: newspapers sell news to readers and space to advertisers.[7] We focus on the content and accuracy of news. To characterize news reporting, we classify news stories into K topics (e.g., the stock market, the environment, sports and health). Each paper chooses how accurately to report news on each topic: $r \in [0,1]^K$ with $r_k = 1$ if the paper reports fully on topic k and $r_k = 0$ if it makes no reports (or reports uninformatively) on k. We interpret r as average reporting over an extended period; Subsection 1.5 provides background and alternative interpretations.

[7]See Rochet and Tirole (2003) and Armstrong (2006) for general treatments of competition in two-sided markets.

1.1 *Newspapers*

There are N competing newspapers. The newspapers can price discriminate among advertisers but not readers. So a typical paper, n, selects its reporting strategy $r_n \in [0,1]^K$, its copy price charged to readers, $p_n \geq 0$, and its prices $q_n^j \geq 0$ for advertising by each type of advertiser j.

1.2 *Readers*

Readers are interested in news, but vary in their degree of "interest" in each topic k. There are I reader types, each characterized by a taste vector $s^i \in [0,1]^K$ where s_k^i represents i's marginal value of news or increased accuracy on topic k (e.g., a value from useful information as in Subsection 2.5, or from knowledge or entertainment) and a reservation value $b^i \geq 0$. We assume that readers buy at most one newspaper. So a reader of type i buys any paper n that maximizes utility,

$$\sum_{k=1}^{K} s_k^i r_{n,k} - p_n$$

provided this maximized value exceeds b^i; $b^i \geq 0$ since we assume no reader is willing to pay a positive price for a paper with $r_n = 0$. To avoid the degenerate case where newspapers cannot attract any readers even with zero prices and full accuracy ($p_n = 0, r_n = 1$), we assume $b^i \leq \sum_{k=1}^{K} s_k^i$ for some $i \in I$. There is an equal number (unit mass) of readers of each type, so denoting reader decisions by the probability $x_n^i \in [0,1]$ that reader i buys or reads newspaper n, we can write paper n's readership as $\sum_{i \in I} x_n^i$.

1.3 *Advertisers*

Advertisers are interested in reaching many ad-receptive readers. They care about how many people read the papers. They also care about what is reported in the papers, because reporting affects how readers respond to ads and hence the return to advertising. In 2.5 below, we present a microeconomic foundation of the following reduced-form of advertisers' distaste for reporting on certain topics (namely, those that reduce readers' adreceptiveness). Each of J advertiser types is characterized by a distaste vector $t^j \in [0,1]^K$ defining its utility from advertising in paper n,

$$\sum_{i \in I} x_n^i \left(1 - \sum_{k=1}^{K} t_k^j r_{n,k}\right) - q_n^j, \tag{1}$$

(see Subsections 2.5 and 7.1 for the case $t_k^j < 0$ with advertisers who instead value accurate reporting). Since these utilities are additively separable across newspapers, advertiser j chooses to advertise in paper n (denoted $y_n^j = 1$) if it gives non-negative utility, and otherwise j chooses not to advertise there ($y_n^j = 0$). To study variation in the numerical importance of advertising relative to readers, we use α^j to denote the overall number (or mass) of advertisers of type j. When talking about an individual advertiser, we will also use a^j to denote the size of the advertiser j (i.e., a^j scales up j's advertising benefits).

We can now state the objective function for newspaper n,

$$\sum_{i=1}^{I} p_n x_n^i + \sum_{j=1}^{J} \alpha^j q_n^j y_n^j. \tag{2}$$

This implicitly assumes a trivial marginal cost of reporting and printing for a newspaper paying the fixed costs of maintaining its network of reporters, editors and news sources, but our results readily generalize.[8]

1.4 *Timing*

We study the following four stage game: In **stage 1**, newspapers set their reporting strategies; in **stage 2**, newspapers set the copy price charged to readers; in **stage 3**, readers buy newspapers; and in **stage 4**, newspapers

[8] When these fixed costs are high, the market may be unable to support competing papers. Since increased advertising supports a larger number of competing papers, modelling the fixed costs explicitly has no effect on our main results. Moreover, letting the paper's fixed costs increase with potential accuracy does not change our results, because all papers spend the maximal fixed cost when advertising is large enough. (Suppressing news on a single, sensitive topic may anyway waste potential for accuracy rather than save on cost.)

and advertisers negotiate over advertising prices and quantities. In each case, all players observe the outcomes of all previous stages before acting.

This time ordering is standard. What is important is that r is set in advance. The idea is that a newspaper takes time to build up its reporting reputation (see Subsections 1.5 and 7.2); then readers respond to the reputation and advertisers begin negotiating with papers once the papers have established a strong readership. Nonetheless, advertisers can also build up reputations over time, so we revisit this timing assumption in Sections 5 and 7. Simultaneity of stages 2, 3 and 4 would slightly complicate the derivations, but not change our results.

We solve for subgame perfect equilibria. To simplify the exposition, we assume $1 - \sum_{k=1}^{K} t_k^j \geq 0$, $j \in J$; this implies that it is attractive to advertise in all papers, even a paper n reporting fully accurately on all topics ($r_{n,k} = 1$, $k \in K$). We also assume efficient bargaining with sharing in a ratio $\rho : 1 - \rho$ between newspapers and advertisers, where $\rho \in (0, 1)$.[9] So the full advertising surplus is exploited, $y_n^j = 1$, for all $n \in N, j \in J$, and the advertising price is a fraction ρ of the surplus, as shown in the following lemma.

Lemma 1 *Newspapers charge advertising prices given by*

$$q_n^j = \rho \sum_{i \in I} x_n^i \left(1 - \sum_{k=1}^{K} t_k^j r_{n,k} \right)$$

and all advertisers buy ads in all papers, $y_n^j = 1$, for $j \in J, n \in N$.

1.5 *Interpretation of reporting and derivation of advertiser preferences*

In this subsection, we offer three related interpretations of the reporting variable r: accuracy, intensity and complexity (or depth) of average reporting. We then sketch a micromodel of advertiser preferences. In our view, advertisers do not care about news reporting *per se*, but they do care about the

[9] This sharing rule can readily be derived as the outcome of standard non-cooperative bargaining. Notice that newspapers compete for readers (who by construction seek at most one paper), but that advertiser preferences are additively separable across newspapers.

impact of news on readers' consumption of advertised goods. Our sketch is therefore based on a derivation of readers' consumption decisions.

Accuracy Our first interpretation of r is in terms of "accuracy". Newspapers can selectively present information to generate bias (see e.g., Mullainathan and Shleifer, 2005, for a micro-model of this "slanting"). For instance, a paper might report on the climate whenever a scientist makes statements suggesting that global warming is minimal and omit news suggesting global warming is a serious risk. Newspapers can thereby choose how much to bias reporting in a particular direction (e.g., towards under-estimation of the risk of global warming). In our multi-dimensional analysis, $1 - r_k$ represents the degree of bias in a particular direction on topic k.[10] We analyze this case formally below.

Intensity A second, related interpretation of r is based on "intensity". Newspapers select the frequency and persistence, length and prominence (e.g., frontpage headline) with which they report on given topics. This can affect reader behaviour in two ways: one temporary, the other more permanent. First, news reporting can affect readers' moods and attitudes *while* reading the paper and coming across its ads; see below for evidence on optimistic reporting frames.[11] Second, newspapers play a significant role in shaping their readers' *long-term* attitudes and beliefs.[12] This has recently been demonstrated in a controlled field experiment by Gerber *et al.* (2007): free subscriptions to the Washington Post (but not Washington Times) significantly increased the Democratic vote. Relatedly, DellaVigna and Kaplan (2007) use a quasi-natural experiment on availability of Fox News to demonstrate that Fox News shifts beliefs and attitudes in favour of the Republican Party. Tobacco companies' success in influencing beliefs about tobacco health risks

[10] To study biased readers, $r_k = 1$ could instead represent readers' preferred bias. Note that if advertisers valued accuracy ($t < 0$), they would then help de-bias news.

[11] Businesses care about quite general attitudes: e.g., Baker (1994) reports how Estée Lauder explained that it would not advertise in the magazine *Ms* because *Ms* was not portraying the sort of "kept-woman mentality" (Lauder's words) desired by Lauder.

[12] See Cialdini (1993) on the influential power of message repetition; DeMarzo *et al.* (1993) offer a related economic model of beliefs.

are also well-documented.

The durable effects of news reporting on people's beliefs and attitudes explain why firms and governments often care about a newspaper's reporting strategy independently of whether they advertise in the given paper; for instance, reporting can affect how readers respond to ads encountered elsewhere, how readers vote and whether they pressure for regulation or other policy change. These advertising-independent effects only have impact in the commitment framework of Section 4, so we defer analysis until then.

Complexity and optimism   A third interpretation is that r represents the "complexity" or "depth" of reporting. As suggested by Le Lay (in above quotation), critical thinking may distract people from advertisements or put them in a critical frame of mind, so they become less receptive to ads.[13] This view suggests that t would be positive on a very broad range of topics or programming choices, so we can use it to explain the general "dumbing down" of coverage mentioned in the introduction. The empirical work of Brown and Cavazos (2005) analyzes advertiser premia as a function of programming content; they conclude that advertisers prefer content that is "light and unchallenging." This also suggests a bias towards optimistic news and content. Marketing studies repeatedly find that "happy" program contexts tend to enhance advertising (see e.g., Goldberg and Gorn, 1987) which fits with psychology research on mood and decision-making (see e.g., Forgas, 1995). All this may generate a trend towards more entertainment and superficial programming, particularly in media outlets like television.[14]

We now sketch a foundation for the above advertiser preferences in the case of the accuracy interpretation with self-interested, Bayes rational readers. Newspapers cannot lie, but can suppress information. Readers are aware

[13] Anand and Sternthal (1992) review the evidence on distraction. Bagdikian (2000) suggests that complexity may "put the reader in an analytical frame of mind [that] does not encourage the reader to take seriously an ad that depends on fantasy or promotes a trivial product."

[14] While our focus is on newspapers, our results also hold for television, especially cable or other subscription-based TV; the only important change is that, with free-to-air TV (forcing zero prices), the vertical segmentation of Section 3 is not possible.

of the paper's strategy, but cannot themselves observe the information available to the newspaper. We show that advertisers can sometimes still gain by having the paper suppress information. The underlying intuition is readily described in the context of tobacco. In the 1920s, most readers had optimistic priors in that they believed smoking was safe; with all news suppressed, posteriors would equal priors and readers would remain willing to smoke;[15] with accurate reporting, by contrast, tobacco companies knew that readers would, with some probability, learn that tobacco was unsafe and therefore become unresponsive to tobacco ads. Baron (2006) and Anderson and McLaren (2007) both provide detailed models of related reader consumption decisions. Our sketch makes the point in the simplest way possible; it is readily generalized.

The key assumption is that newspapers, but not readers, may observe the value of a random variable χ that contains information relevant to each reader in choosing what advertised goods to buy. For simplicity, fix a good produced by advertiser j and suppose a representative reader's value of this good exactly equals the random amount χ, with distribution function $F(\cdot)$. Suppose also the newspaper observes χ with probability $\lambda > 0$ while the reader does not observe it at all. With $E(\chi|H)$ denoting the expected value of the good, given information H, the reader buys a unit if and only if

$$E(\chi|H) \geq m,$$

where m is the (fixed) price of the good. To focus on advertising costs and benefits, we simply set the advertiser's fixed and marginal production costs to zero, so m is also the mark-up over unit cost.

As in the tobacco example, we are interested in the case where readers have moderately optimistic priors: their unconditional expectation of χ, $\chi_0 = \int \chi dF \geq m$. In this case, higher accuracy can *reduce* expected consumption of the paper's readers. If the paper reports fully accurately ($r = 1$), each reader consumes with probability

$$1 - \lambda + \lambda (1 - F(m)) = 1 - \lambda F(m) < 1.$$

[15] Surveys suggest that, as late as the 1980s, two thirds of the smoking population in the US did not believe smoking made a great difference to life expectancy (Baker, 1994).

If instead the paper suppresses news fully ($r = 0$), each reader consumes with probability 1 (since the posterior belief equals the prior). So the advertiser gains from the information suppression strategy ($r = 0$): average, per-reader consumption is higher by $\lambda F(m)m > 0$.[16] In this example, $r = 0$ (denoting full suppression) is an optimal reporting strategy from the advertising perspective.[17]

Since reader i reads at most one paper and only comes across j's ad through paper n if $y_n^j > 0$, the expected quantity of goods purchased by reader type i from advertiser j is:

$$\sum_{n \in N} x_n^i \left(1 - \sum_{k=1}^{K} t_k^j r_{n,k}\right) y_n^j.$$

where $t_k^j = \lambda F(m)m$ for the topic k dealing with the information χ. Since advertisers make profits m per unit sold, normalizing markup m to one, and subtracting the advertising costs $q_n^j y_n^j$, (notice now $t_k^j = \lambda F(1) < 1$), we can write advertiser j's overall profits as

$$\sum_{i \in I} \sum_{n \in N} x_n^i \left(1 - \sum_{k=1}^{K} t_k^j r_{n,k}\right) y_n^j - \sum_{n \in N} q_n^j y_n^j \, ,$$

which immediately generates the reduced form in Equation (1).

2 Newspaper Monopoly

We start with the benchmark case of a monopoly newspaper ($N = 1$).[18] Our goal is to understand how the newspaper's equilibrium reporting varies

[16]By contrast, readers gain at least $s = E(\chi - m/\chi > m) \Pr(\chi > m) - E(\chi - m) > 0$ from accurate reporting; they gain more if using χ for other decisions too.

[17]When advertisers also face pessimistic readers, they prefer a different type of reporting bias. For example, if on top of the above optimistic readers, some fraction of pessimistic readers have consumption value $\chi - k$ where $\chi_0 - k < m$, the strategy r of reporting χ if and only if $\chi \geq m + k$ may be optimal (provided λ is not too high).

[18]The single paper monopoly benchmark proves most relevant for Section 4, but see below on alternative benchmarks. Monopolistic newspaper markets became increasingly relevant over the last century; see e.g., Genesove (2004) and see McChesney (2004) on general media consolidation.

with the importance (α) of advertising. Until the more general analysis of Section 6, we focus on the case with one type of advertiser and one topic ($J = K = 1$) that interests all readers ($s^i > 0$, $i \in I$), but to which advertisers are sensitive ($t > 0$).

Substituting the advertising prices from Lemma 1 into the monopolist's objective function (2) above, gives the monopolist's reduced-form profits:

$$\pi(p, r) = \sum_{i=1}^{I} px^i(p, r) + \rho\alpha \sum_{i=1}^{I} x^i(p, r)(1 - tr). \tag{3}$$

The first term represents reader revenue (from selling copies) and the second term represents advertising revenue (from selling ad space). The tradeoff in choosing r is straightforward: the paper pleases readers by raising r and pleases advertisers by lowering r (at fixed readership); since advertisers also want the paper to have many readers, it helps to define,

$$r^i_{min} = \frac{b^i}{s^i}, \tag{4}$$

the minimal level of accuracy that enables a newspaper to retain type i readers at $p = 0$; recall that, except for Section 5, copy prices are always assumed to be nonnegative. We illustrate this with an example.

Example 1 There are two reader types with $(s^1, b^1) = (1, \frac{3}{8})$ and $(s^2, b^2) = (\frac{1}{8}, 0)$, a mass α of advertisers of type $t = \frac{1}{2}$, and a sharing rule between newspaper and advertisers of $\rho = \frac{1}{2}$. When α is small ($\alpha < 0.97$), the paper selects maximal accuracy $r = 1$ and a copy price of $p = \frac{5}{8}$. This extracts the full surplus from type 1 readers, while type 2 readers are priced out of the market. Higher α increases the importance of advertising revenues; this induces the monopolist to reduce accuracy and cut prices to increase readership. For intermediate values of α ($0.97 \leq \alpha < 4$), the newspaper chooses $r = \frac{3}{7}$ and $p = \frac{3}{56}$, and all readers buy the paper. When α is large ($\alpha \geq 4$), the paper decreases accuracy and chooses $r = \frac{3}{8}$ ($= r^1_{\min}$) and $p = 0$; again all readers buy the paper and it is impossible to further reduce accuracy without losing readers. See Figure 1. $\square$

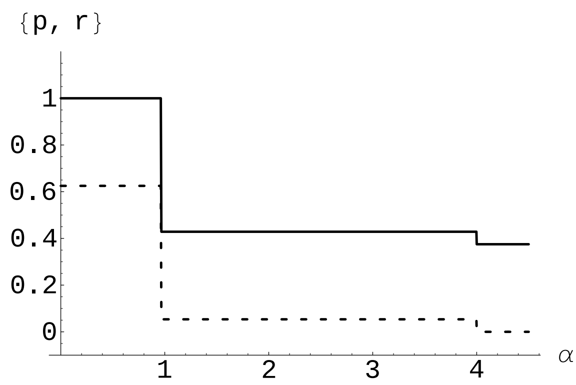

Figure 1: Monopoly accuracy (solid line) and reader prices (dashed line).

When $\alpha = 0$, the monopolist always maximizes accuracy to please readers, but as α becomes large, the advertising revenue term dominates, and the monopolist focuses on pleasing the advertiser. This drives accuracy downwards, eventually to a minimal level that retains a profit-maximizing audience. In general, we can state,[19]

Proposition 1 *For α sufficiently small, a monopolist reports fully accurately, $r = 1$. For α sufficiently large, it sets $p = 0$ and reduces accuracy to the minimal level, $r = r^{\hat{\imath}}_{min} < 1$, sufficient to attract reader type $\hat{\imath}$, where $\hat{\imath} = \arg\max_{i \in I} \pi(0, r^i_{min})$.*

An immediate corollary is that if all readers have zero reservation values ($b^i = 0$, $i \in I$) so that $r^{\hat{\imath}}_{min} = 0$, then sufficiently large α leads the monopolist to reduce accuracy to zero. In general, however, it faces a tradeoff between reducing r to raise advertiser surplus per reader, and increasing r to increase readership. For instance, even when advertising from car and energy companies is very large, a monopoly newspaper will not fully suppress global warming reports or bias towards environmental reports claiming a zero risk,

[19]The alternative benchmark (for duopoly) of a two newspaper monopolist deviates slightly: $\alpha = 0$ only guarantees full accuracy on one paper and high α only guarantees a zero price on one paper, because (respectively) differentiation can raise reader revenue and price discrimination can lower the average accuracy accepted by readers.

because such a paper would lose credibility and hence all its readers; in the model, we capture this credibility factor with positive reservation values b_i.

An important corollary is that the news reported by the monopolist remains the same whether there is a number α of advertisers of size 1, or a single advertiser of size $a = \alpha$. For a single advertiser of size a, whose utility from advertising in paper n is given by $a\left[\sum_{i\in I} x_n^i \left(1 - \sum_{k=1}^K t_k r_{n,k}\right)\right] - q_n$, Lemma 1 is easily adjusted; the paper charges this advertiser a price of $q_n = \rho a\left[\sum_{i\in I} x_n^i \left(1 - \sum_{k=1}^K t_k r_{n,k}\right)\right]$ and substituting $a = \alpha$ reveals that the monopolist's profit remains unchanged. In other words, advertisers still exert influence rather than free-ride. This result explains why monopolistic newspapers might distort their reporting strategies to favor advertisers even when advertisers are numerous and each advertiser is small; for evidence, see generic reporting distortions discussed in Sections 1 and 7.

3 Newspaper Duopoly and the Paradox

We now consider duopoly newspaper markets ($N = 2$), first with homogeneous and then heterogeneous readers. We show how heterogeneity may lead to vertical differentiation (see also Section 6 on horizontal differentiation) and we derive our paradoxical result that increasing the number or size of advertisers may actually improve the reporting accuracy of competing newspapers.

3.1 *Homogeneous readers*

Reader homogeneity precludes market segmentation. Bertrand price-setting generates perfect competition for readers, who therefore get what they want, namely full accuracy at zero prices (regardless of α).

Proposition 2 *For any α, in a duopoly with only one reader type, the unique subgame perfect equilibrium has full accuracy and zero prices, $r_n = 1$ and $p_n = 0$ for $n = 1, 2$.*

This full accuracy result shows that (perfect) competition prevents bias. It is driven by the following lemma.

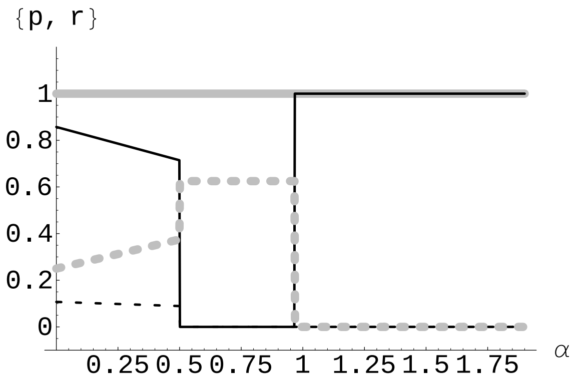

Figure 2: Duopoly without commitment: accuracy (solid lines) and reader prices (dashed lines).

Lemma 2 *Under the assumptions of Proposition 2, in the unique subgame perfect equilibrium of any subgame starting at a profile of reporting strategies* (r_1, r_2)*, with* $r_1 \neq r_2$*, all readers buy the high accuracy newspaper.*

For small and intermediate values of α, both lemma and proposition depend on the homogeneity assumption, but for large α, they hold more generally, as we now show.

3.2 *Heterogeneous readers*

In the more realistic case of heterogeneous readers, advertising can have a non-monotonic effect on accuracy. When α is small, newspapers differentiate their reporting strategies to soften price competition for readers. Increasing α *initially* leads to lower accuracy as a monopolistic reaction by at least one paper. When α becomes sufficiently large, the value to each paper of winning an additional reader is so high that market segmentation is no longer possible. Intense competition for readers then forces the papers to raise accuracy to its maximal level (and set the copy price to zero).

Example 2 Take the same parameter values as in Example 1, but with $N = 2$ newspapers instead of 1. For α small ($\alpha < 0.97$), the papers vertically differentiate their reporting strategies. The high quality paper is fully accurate and charges a higher price. Figure 2 shows how increasing α initially leads the low quality paper to reduce its accuracy to maintain market segmentation, and then (for $0.5 \leq \alpha < 0.97$), to reduce it to zero to further raise advertiser profits. When α gets too large ($\alpha \geq 0.97$), market segmentation becomes impossible. The high quality paper would have an incentive to compete for the low quality paper's readers, and the unique subgame perfect equilibrium has both papers choosing full accuracy and zero copy prices. □

The non-monotonicity effect of advertising on reporting accuracy illustrated in this example is a robust phenomenon (see Ellman and Germano, 2006, for a sufficient, heterogeneity condition).

Proposition 3 *In a duopoly with heterogeneous readers:* **(a)** *when α is small, the subgame perfect equilibria can involve vertical differentiation with limited accuracy (in at least one newspaper);* **(b)** *large α always leads to full accuracy and zero prices in both newspapers.*

The most important general point here is that of (b): increasing advertising eventually leads all papers to report with full accuracy even though advertisers prefer minimal accuracy. This paradox follows from a Bertrand-type competition for readers: advertisers care about reaching readers; indeed, readers are a prerequisite for newspapers to sell ad space; so increased advertising raises the intensity of competition for readers.[20]

As explained in the introduction, this is precisely what occurred at the turn of the 19th Century in the US. Advertising had grown substantially to support the marketing needs of increasingly large, mass production firms. Initially newspapers were more than willing to heavily distort their reporting by publishing readers' notices and advertiser puffs (editorials designed to promote an advertisers' products), but the growing advertising prize for winning a large readership eventually induced the newspapers to compete intensely for readers. Accordingly, the papers sought reputations for accuracy by publicly rejecting reading notices, by committing against related

[20] This result is about competition between owners and not about the number of newspapers per se: A monopolist owning two newspapers essentially minimizes accuracy just like the one paper monopolist of Section 2.

pro-advertiser biases and by attempting to demonstrate their "objectivity". As documented above, there is strong evidence that reading notices were significantly reduced as a result of the increased competition for readers. See also Lacy and Martin (2004) who describe modern evidence on the intensity of competition and accuracy.

Notice that this paradox result does not depend on the number of advertisers: we can again replace α, the number (or mass) of advertisers, by a, the size of a single advertiser. Nonetheless, large advertisers with common interests might be able to build up commitment power and we next show that this can overturn the paradox result. So the paradox result is most relevant to contexts with numerous small (and diverse) advertisers, but see Section 7 for a more thorough discussion.

4 Advertiser Cut-Offs (Paradox Revisited)

As noted in the introduction, many advertisers are sufficiently long-lived to build up reputations for withdrawing their custom from "unfriendly" media outlets. In this section, we analyze how advertisers can use such commitment power to influence newspaper reporting. We offer a simple model to capture in reduced-form the dynamic process by which advertisers build commitment reputations (alongside newspapers building reporting reputations); see Subsection 7.2 for a discussion and further examples of withdrawal threats. We then derive implications. We end by explaining how this section's results on media influence apply to any actor providing significant media revenue (not just advertisers).

To influence newspapers, advertisers must move before newspapers fix their reporting strategies. So we now add a stage 0 at which advertisers can commit to withhold advertising custom from newspapers that breach a given level of accuracy on a sensitive topic. This is the natural threat strategy: at stage 0, each advertiser announces a cut-off level of accuracy $\bar{r}^j$, for $j \in J$, which commits them to set $y_n^j = 0$ if $r_n > \bar{r}^j$. We refer to this as the **model with commitment**.[21] Our goal is to investigate whether commitment enables large advertisers to escape the competition logic that led to full accuracy (as α or $a \to \infty$) in the duopoly case.

Consider first a single advertiser of size a that sets $\bar{r} < 1$. Lemma 1 is slightly adjusted, because now $y_n^j = 0$ if $r_n^j > \bar{r}^j$. For large a, there is a subgame perfect equilibrium of the continuation game with $r_n = \bar{r}$ and $p_n = 0$ for $n = 1, 2$; competition is intense for r_n restricted to $[0, \bar{r}]$, and deviating outside this range is dominated for large a, since it generates zero advertising revenue.[22] So, how will the advertiser set $\bar{r}$? For a fixed readership, the advertiser surplus is decreasing in $\bar{r}$, hence the advertiser minimizes $\bar{r}$ subject to satisfying $r^i_{\min}$ for enough readers. In the limit as a becomes large, reader profits become relatively insignificant, so the advertiser's tradeoff approaches that of the monopolist in Proposition 1.

When instead there is a large number (α) of advertisers of the same type, advertisers face a minor coordination problem. If enough advertisers set the optimal level of $\bar{r}$, then the papers will accept this restriction and setting $r = \bar{r}$ is privately optimal for each advertiser. However, if all other advertisers make weaker threats, the papers will set $r > \bar{r}$ and any advertiser setting $r = \bar{r}$ will not advertise at all. Notice that it is Pareto optimal for all advertisers to set $r = \bar{r}$.

Proposition 4 *For sufficiently large α or a, in a duopoly with commitment, there exists a subgame perfect equilibrium with accuracy restricted as in the monopoly case, $r_n = \bar{r} = r^{\hat{\imath}}_{min}$, $n = 1, 2$, (as in Proposition 1).*

The advertisers' optimal cut-offs gradually become more extreme as the importance of advertising (α or a) grows. Our ongoing example illustrates.

[21] Alternative commitment models (e.g., with direct negotiation with newspapers over r and commitments affecting ρ) also generate our key results. Newspaper-specific cut-offs ($\bar{r}_n^j$) *do* imply subtle changes, but are less plausible: advertisers often build (cut-off) reputations ($\bar{r}^j$) relevant to the widest group (all newspapers) or even follow a norm ($\bar{r}$) of avoiding all newspapers that contravene a generic "business-friendly" standard.

[22] There is also a subgame perfect equilibrium with $r_n = 1$ and $p_n = 0$ for $n = 1, 2$, but this is less plausible since it is Pareto dominated for the newspapers (and advertisers).

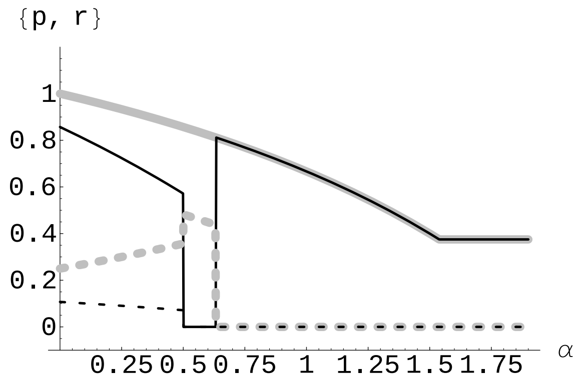

Figure 3: Duopoly with commitment: accuracy (solid lines) and reader prices (dashed lines).

Example 3 Adding stage 0 to Example 2 generally has a negative impact on accuracy, since, as α increases, advertisers make increasingly stringent demands on newspapers. For low α, ($\alpha < 0.63$), the market is segmented and accuracy on the high quality paper is $r_1 = \bar{r} = \frac{2(2-\alpha)}{4-\alpha}$. Segmentation becomes impossible already at $\alpha = 0.63$, but instead of jumping to 1, r now jumps to the new cut-off $\bar{r} = 0.81$, and prices fall to zero. Accuracy on both papers is then $r = \bar{r} = \frac{2(2-\alpha)}{4-\alpha}$ (for $0.63 \leq \alpha < 1.54$), but eventually falls to the limiting monopoly value, $r^{\hat{\iota}}_{min} = \frac{3}{8}(= r^{1}_{\min}$ as in Example 1) (for all $\alpha \geq 1.54$). See Figure 3. □

Combined with evidence of extensive and repeated threats by tobacco companies (see e.g., Baker, 1994), this result provides a plausible explanation of the panel data evidence of Warner and Goldenhar (1989): they found that reporting bias (suppression of news on tobacco health risks) grew in magazines that received substantial increases in tobacco advertising in the wake of the 1971 US ban on advertising tobacco on TV; for these magazines, the size of tobacco advertising a (and α) increased sharply in 1971, making the magazines more sensitive to tobacco company threats over reporting. The evidence in Kennedy and Bero (1999) is also consistent with this result. Furthermore, Reuter and Zitzewitz's (2006) find that single mutual fund advertisers can have significant influence in the magazine market specializing in money issues (where they are large advertisers), but no influence on the *Wall Street Journal* and *New York Times*. In the newspaper market, these mutual funds count as relatively small advertisers, so a^j is low. So this evidence also supports Proposition 4.

As motivated at the end of Subsection 1.5, businesses and governments may care about news reporting even if they are not advertising in the given newspaper. To the extent that these parties directly or indirectly contribute to the paper's revenues, and can commit to withdraw this support, they too can force papers to respect their reporting concerns through the mechanism shown above; their threat must simply place a sufficiently large revenue share in the balance.[23] Examples include mass subscriptions, cheap and reliable credit, privileged access to information, and direct subsidies of newspapers or special supplements.

5 Negative Prices

For the sake of completeness, we address here the case where negative pricing is feasible.[24] Allowing newspapers to compete on a broader range of prices removes the need for them to use accuracy when the competition for readers becomes extreme. Indeed, we prove that when advertisers are sufficiently important, newspapers focus on pleasing advertisers by minimizing accuracy; their advertising revenue allows them to set a negative price that "bribes" readers to buy their paper in place of a more accurate rival one.

[23] In Besley and Prat's (2001) model of media influence, governments bribe all papers, since information is public once printed in any paper. By contrast, we assume readers only learn news from their own paper. Our information assumption is common and applies when readers have neither time nor incentive to tell others all that they learn from their papers' ongoing reporting. Their assumption is most appropriate to reporting on major scandals.

[24] Negative prices should not be taken literally, but can capture the effect of bundling the newspaper with a valuable coupon or gift. Baldasty (1992) describes how newspapers were often bundled with gifts, such as stockings, watches, cameras and insurance 100 years back. Such practices remain common today. The moderate gift values may not equate to actual negative prices, but negative prices do shed light on what drives our paradox result.

5.1 *Monopoly*

The possibility of negative pricing requires only a slight change in Proposition 1: increasing the importance of advertising now *always* leads a monopolist to reduce accuracy to zero and attract all readers (with a negative price if necessary).

Proposition 5 *If a monopoly newspaper is able to offer negative prices, then when α is sufficiently large, accuracy falls to zero and prices are just low enough to attract all readers, $r = 0$ and $p = \min\{-b_1, \ldots, -b_I\} \leq 0$.*

5.2 *Duopoly*

Allowing duopolists to charge unbounded negative prices, overturns the competition paradox identified in Section 3. Competition for readers is just as intense, but newspapers now can, and for sufficiently significant advertising always will, compete for readers by lowering copy price instead of raising accuracy. The reason is that the increase in advertising surplus from lowering accuracy can eventually compensate readers for lower accuracy. The newspaper with lower accuracy therefore ends up winning all the readers. So Lemma 2 is inverted:

Lemma 3 *For sufficiently large α, in a duopoly with negative pricing, the unique subgame perfect equilibrium of any subgame starting at a profile of reporting strategies (r_1, r_2), with $r_1 \neq r_2$, all readers buy the low accuracy newspaper.*

As a result, intense competition now leads papers to minimize accuracy at $r = 0$ and set (negative) prices that pass on advertising surplus to readers.

Proposition 6 *For sufficiently large α, in a duopoly with negative pricing, all subgame perfect equilibria have zero accuracy and readers are subsidized, $r_n = 0$ and $p_n = -\rho\alpha < 0$, for $n = 1, 2$.*

Newspapers just break even, but accuracy is minimized instead of maximized; advertisers are much better off than in the case with bounded pricing, because the paradox is evaded. This result is, however, subject to two major caveats. First, using coupons to attract readers typically involves distortions, in that the coupons cost more to the paper than they are worth to readers, so it may become optimal to compete on accuracy as well as negative prices. Indeed, the results of Section 3 are re-established if readers' values from coupon expenditures are sufficiently concave. Second, advertisers only value readers who will notice their ads,[25] but coupons may attract "readers" who simply tear out the coupons and discard the paper. Indeed, in the realistic case where readers can take both papers and just read the better one (if sufficiently interesting), papers must again compete on accuracy; so the paradox is re-established (as are the other results of Section 3).

6 Commitment and Coordination: Advertiser Influence Revisited

The analysis of Sections 3 and 4 makes strongly diverging predictions concerning the extent and nature of advertiser influence on media coverage. In this section, we investigate further the question of when to expect which type of influence by discussing advertiser commitment and coordination issues in an extended preference context.

6.1 *Multiple topics and advertiser types*

We take the multiple topics and advertiser types setting as a starting point to better understand under which circumstances the equilibria of Section 3 are more likely than those of Section 4 and vice versa. All our results generalize, but we identify some important caveats below in the conflicting preferences case.

In the basic framework, we assume $s_k^i > 0$ and $t_k^j < 1$ for all $k \in K, i \in I, j \in J$. For simplicity, we now also assume $b^i = 0$ for all $i \in I$. The monopoly case is straightforward: whenever a topic is disliked enough by

[25] Advertising rates (per reader) are much higher at paid-for papers than zero-price papers ("freesheets"), because free-sheet readers are less attentive (Thompson, 1989).

sufficiently many advertisers (i.e., $\sum \alpha^j \cdot t_k^j$ is large), accuracy drops to zero on that topic. In the duopoly case, multiple topics permit horizontal as well as vertical differentiation, so market segmentation becomes even easier (see Ellman and Germano, 2006, for an example). Nonetheless, segmentation is unsustainable when advertisers are large, so Lemma 2 and Proposition 3 both extend. In particular, the paradox result is robust.

Proposition 7 *In a duopoly, when aggregate advertising* ($\sum_j \alpha^j$) *is sufficiently large, the unique subgame perfect equilibrium has* $r_{n,k} = 1$ *and* $p_n = 0$, $n = 1, 2$ *for* $k \in K$.

Just as before, sufficiently important advertising provokes a fully accurate subgame perfect equilibrium, until we introduce advertiser commitment power, in which case under-reporting at the monopoly level may be imposed. Proposition 4 becomes

Proposition 8 *In a duopoly with commitment, when aggregate advertising* ($\sum_j \alpha^j$) *is large enough, there is a subgame perfect equilibrium where all papers set zero accuracy on any topic disliked by some advertiser,* $r_k = 0$ *if* $t_k^j > 0$ *for any* j.

The sensitivities of advertisers combine additively in terms of ad space pricing, which is why the Section 3 and 4 results generalize. Advertiser pressures also add up, hence Proposition 8, but notice that this emphasizes one of many possible equilibria. The stated equilibrium *is* the Pareto optimal equilibrium for advertisers (and newspapers), but advertiser diversity might complicate coordination of cut-off threats. To see this point, consider **conflicting advertiser** preferences, meaning that some advertisers are sensitive to accurate reporting on some topic k ($t_k^j > 0$ as before) while others instead strictly prefer accuracy on this topic ($t_k^{j'} < 0$). Agreement among advertisers on how to coordinate is particularly difficult, since they no longer share a Pareto-preferred cut-off strategy. Some cut-off strategy equilibria are still feasible, but the advertiser conflict makes coordination much less likely. So conflicting advertiser preferences tend to work in favor of the results of Section 3 and against those of Section 4. This point sheds further light on Reuter and Zitzewitz's (2006) evidence, cited above in Section 5, that while influencing specialized magazines, mutual fund advertisers have no influence in the general interest newspaper market containing more diverse, large advertisers.

By contrast, our results are largely unchanged if we allow for **conflicting reader** preferences, meaning that for some topic k, some readers prefer accurate reporting ($s_k^j > 0$ as before) while others prefer less accuracy ($s_k^{j'} < 0$). This form of heterogeneity further facilitates market segmentation, but if there are enough independently-owned newspapers to make each local market competitive, the paradox result holds unchanged for commonly valued topics. The cut-off strategy equilibria also hold unchanged, because this heterogeneity does not prevent advertisers from using cut-off threats.

6.2 *Commitment and coordination*

Whether to expect the paradox result or the cut-off strategy result reduces to the question of whether or not advertisers can commit "early" enough to withdrawing their ads from excessively "accurate" newspapers. In the model extension of Section 4, newspapers commit in stage 1 to their reporting strategy r, while advertisers commit in stage 0 to their cut-offs $\bar{r}$. In reality, both such reputations are built up over time. Here we briefly discuss the ability and incentives of advertisers and newspapers to make effective commitments.

To attract readers, newspapers seek to establish a good reputation by reporting accurately over time, but readers observe distortions imperfectly (and face costs of switching papers). So newspaper owners typically reinforce journalistic standards by setting up a board of directors which aims to guarantee editorial and journalistic independence from the paper's owners and business division; indeed, professionals often speak of a "wall of separation" between the editorial and business wings. As recently debated during Murdoch's 2007 takeover of the Wall Street Journal, boards play a valuable role but are far from fully effective in this respect (see e.g., Curran and Seaton, 2003, for UK examples, Baker, 1994, Herman and Chomsky, 1988, and McChesney, 2004, for US examples).

At the same time, newspapers want to build a reputation with advertisers. Here, their main concern is just to bargain for a high advertising price. Advertisers, on the other hand, have a strong incentive to build a reputation for enforcing reporting cut-offs on the newspapers (as well as to bargain for low prices). Moreover, when advertising α is large, newspapers actually benefit if advertisers are successful in building cut-off reputations. So newspapers are attentive to advertisers and this gives advertisers an important advantage in setting up their reputation.

When many advertisers gain from a given reputation, the reputation is a public good, so affected advertisers may need to make a group commitment. This is easiest in concentrated industries where the number of advertisers with a given concern is small, particularly if these companies already cooperate to fund an industry interest group (and can inflict punishment on any member company that defects on a cut-off commitment). So concentrated industries with established lobbying activities (such as the tobacco, energy and automotive industries) are the most able to exert the greatest pressure on news reporting.

Nonetheless, mutual enforcement of commitment among advertisers is not always necessary. Consider a commitment to reject newspapers that publish particularly controversial or critical reports. Even after a specific newspaper report sharply criticising only one advertiser, other advertisers and their agencies may value the opportunity to signal that they are tough by punishing this newspaper. Also they may view such reports as bad signals about the newspaper (if e.g., editors differ in their resistance to advertiser pressure). This helps understand the evidence suggesting that multiple diverse advertisers can pressure media to impose a generic advertiser-friendly reporting norm (Baker, 1994) avoiding controversy and dumbing-down general coverage (Hamilton, 2004).

Ad agencies, marketing and advertising journals help advertisers build such reputations. The agencies and journals specialize in monitoring how media reporting strategies affect advertising profits, so they can readily inform clients about papers' "excess" reporting on sensitive topics. Also, large agencies internalize the benefits from making large numbers of papers more amenable to advertising, so they reduce the coordination problem among advertisers in applying pressure on "deviant" papers. For example, *Reader's Digest* lost the ad agency it had used for 28 years for running an article on the medical dangers of smoking (Bagdikian, 2000). Relatedly, large advertisers sometimes apply pressure on ad agencies, as when RJR/Nabisco, a conglomerate with tobacco interests, punished Saatchi and Saatchi (with loss of an $80 million food advertising contract) for preparing ads on Northwest Airlines' no-smoking policy (Baker, 1994).

In sum, the paradox result can be a robust and realistic prediction when advertisers are small and have diverse or conflicting interests. On the other hand, advertisers can influence news content when individual advertisers are large and potentially also when numerous advertisers share some common interests, especially if coordinated by large advertising agencies.

7 Concluding Remarks

This paper analyzed how and why advertisers might influence media content. We found that advertising automatically influences reporting in monopolistic media markets, but that, paradoxically, with competing newspapers, increasing advertising eventually induces maximal accuracy. We also found that advertisers can escape this paradox, if they can commit to withdraw advertising from papers that report too accurately on sensitive topics. Large, coordinated advertisers most readily exert influence via these cut-off commitments, but we found that even diverse advertisers sharing a common concern (such as for light and uncontroversial media content) may exert such influence.

This influence potentially leads to poor coverage of important issues. In our key examples, the influence may have serious consequences, for example on health, the environment, and even voter participation.[26] In these cases,

[26]The controversy-evasion and general dumbing-down of news coverage (documented above) has been linked to falls in political participation (see e.g., Teixeira, 1987, and Baker, 1994), so our results offer a theoretical basis for the concern that advertiser influence may lower participation levels as well as the quality of democratic debate. The underlying problem in each of our key examples is that, owing for example to externalities, readers are not willing to pay the social marginal value of improved information.

our results have clear normative implications: it is socially optimal to avoid the conditions that generate media distortion. Our paradox result shows that regulating media competition is extremely important when advertising is large. Our cut-off results show that, even with competition, regulators should try to prevent coordinated pressure by large, concentrated advertisers. If prevention requires banning those advertisers, the welfare costs from lost advertising benefits and revenues (perhaps implying higher copy prices and fewer readers) may be too great, but more subtle policies have been proposed and implemented (see e.g., Baker, 1994, and Doyle, 1968).[27]

These ideas build on a wealth of empirical evidence (described above) consistent with our predictions (in particular, Reuter and Zitzewitz, 2006, and the tobacco papers documented above). The recent work estimating bias in reporting on anthropogenic global-warming (e.g., Boykoff and Boykoff, 2006, and Oreskes, 2004) could be used to test for influence by automobile and energy advertisers. Our theory also makes precise predictions that remain to be tested: in particular, the prediction on how competition interacts with advertising intensity and the non-monotonicity prediction present in our paradox result. Testing will need estimates of media market concentration, the size, composition and sensitivity of the relevant advertising market, and the size of other media revenues, as well as the key dependent variable, media bias. Thanks to the increasingly sophisticated empirical literature on bias estimation,[28] we are optimistic that such tests can be performed and will permit thorough evaluations of the impact of advertising on media content.

Appendix

Proof of Lemma 1. This follows immediately from our assumptions. □

[27]Some medical associations ban pharmaceutical advertising in their journals to prevent influence on drug trial reporting. Tobacco advertising, long banned by medical journals, is now banned for broadcast and print media throughout the US and the EU, albeit mostly to prevent direct influence by the advertisements. Finally, all advertising is banned from many publicly-funded TV stations, such as the BBC; here our theory predicts less commercial influence, but a higher risk of political influence.

[28]E.g., Boykoff and Boykoff (2004); Groseclose and Milyo (2005); Kennedy and Bero (1999); Larcinese *et al.* (2007); Reuter and Zitzewitz (2006).

Proof of Proposition 1. Reporting strategy r and copy price p are chosen at stages 1 and 2 to maximize the continuation payoff $\pi(p, r)$ defined in Equation (3). When $\alpha = 0$, we get full accuracy ($r = 1$), because marginally raising r permits to raise p at a rate of at least $\min_{i \in I} s_i > 0$ and has no cost. As α increases, raising r begins to have a cost, but as long as α is small, the benefits from raising p dominate.

For large α, we first prove that $r = r^i_{\min}$ for some $i \in I$. Suppose to the contrary that $r \in \left(r^{i_1}_{\min}, r^{i_2}_{\min}\right)$ for some pair of reader types, i_1 and i_2 with consecutive values of $r_{\min}$. By reducing r towards $r^{i_1}_{\min}$ and reducing p by $\max_{i \in I} s^i$ times the reduction in r, the paper avoids losing any readers and it increases its advertising revenue at the rate $\rho\alpha t \sum_{i=1}^{I} x^i(p, r)$, while only decreasing reader revenue at the rate $\max_{i \in I} s^i \sum_{i=1}^{I} x^i(p, r)$. Since $\rho, t > 0$, for sufficiently large α, the gain in advertising revenue dominates the lost reader revenue. This contradicts the optimality of the above r. The same argument applies for $r > \max_{i \in I}\{r^i_{\min}\}$. Moreover, clearly $r < \min_{i \in I}\{r^i_{\min}\}$ cannot be optimal since it would lead to zero profits, when positive profits are possible. This proves the claim.

Now, given $r = r^i_{\min}$, if $p > 0$, reducing p to 0, strictly increases readership by at least 1 (by definition, the readers i with $r^i_{\min} = r$ start buying when $p = 0$) and this raises advertising revenue by at least $\rho\alpha(1 - tr)$ which again dominates the loss in reader revenue of $\sum_{i=1}^{I} px^i(p, r)$ for sufficiently large α (notice that $1 - tr > 0$ by the assumption in Subsection 1.4). The monopolist's profits are therefore given by $\pi(0, r^i_{min})$ and i is chosen to maximize this. Hence $i = \hat{\imath}$ as stated. □

Proof of Lemma 2. Without loss of generality, assume that at stage 1, newspaper 2 sets $r_2 < r_1$, and $sr_1 > sr_2 \geq b$ (otherwise, if $sr_2 < b$, there is no demand for newspaper 2 in any continuation game, and the claim is trivially true). We show that there is a unique SPE of this continuation game and that newspaper 1 wins all the readers. Essentially, this follows as in standard Bertrand competition, where both newspapers seek to undercut each other. Here, since $r_2 < r_1$, for any price $p_2 \geq 0$, 1 can always win all readers by offering a price marginally below $p_2 + s(r_1 - r_2)$ (the price at which the readers are indifferent between buying from 1 rather than buying from 2 at p_2). In particular, for any $p_2 \geq 0$, 1 can always find a price at which it wins all the readers. This is not true for player 2: since prices are assumed nonnegative, the lowest price 2 can charge is $p_2 = 0$ and so, unless $p_1 > s(r_1 - r_2)$, 2 cannot undercut 1. Hence 1 will set $p_1 \leq s(r_1 - r_2)$. Moreover, from $sr_2 \geq b$, we have $sr_1 - b \geq s(r_1 - r_2)$, which guarantees that buying at p_1 is individually rational for readers. Hence, if the inequality is strict and $p_1 < s(r_1 - r_2)$, 1 can always increase profits by raising p_1 marginally. It follows that $p_1 = s(r_1 - r_2)$ and $p_2 = 0$ is the unique continuation SPE. Also, $x_1 = 1$ here, because otherwise 1 would marginally reduce p_1 to win over the $1 - x_1$ remaining readers. □

Proof of Proposition 2. If newspapers set $r_1 = r_2$, then Bertrand price competition generates zero prices. If one paper sets a positive price, the other paper can either set a higher price and get no readers, set the same price and get some fraction of the readers, or win all the readers by setting a lower price. Since a paper without readers makes no profits, and at least one paper can sharply increase its readership and profits by setting a marginally lower price than its competitor's, competition drives prices down to zero.

Using Lemma 2, given a pure strategy of, say, paper 1 with $r_1 < 1$, the other paper would set r_2 marginally higher, thus taking all the readers and leaving 1 with no profits: if 2 sets $r_2 < r_1$, it gets no profits whereas it is guaranteed positive profits if it sets $r_2 > r_1$. Furthermore, $r_2 = r_1 < 1$ cannot be an equilibrium, because at least one paper could marginally raise r and sharply increase its readership and marginally increase reader revenue (and advertising profits if $\alpha > 0$). The equilibrium with $r_1 = r_2 = 1$ and zero prices is the only possible one, since if one paper had a positive price, the other paper would want to marginally undercut that price. □

Proof of Proposition 3. Part **(a)**. This follows from Example 2. Part **(b)**. As α increases further, the incentive to capture all readers increases. The segmentation equilibrium in (a) eventually becomes unsustainable, because for sufficiently large α, the paper with higher r would want to compete to take all the readers. Once segmentation is ruled out, there is no equilibrium with $r_1 \neq r_2$, because in such equilibria the low r paper makes zero profits by the same logic as in Lemma 2. Furthermore, because all elements in the support of the equilibrium distribution over levels of accuracy must have equal expected payoff, there are no mixed strategy equilibria involving positive mass on levels of accuracy below 1. Hence, the unique SPE has $r_1 = r_2 = 1$ and zero prices as in Proposition 2. $\square$

Proof of Proposition 4. Given any $\bar{r} \in [0, 1]$ and α sufficiently large, there is a SPE with $r_n = \bar{r}$, $n = 1, 2$ and zero prices. By setting $r > \bar{r}$, a paper gets all the readers, but even the full reader surplus is less than the $\frac{\rho}{2}$ of the advertising surplus guaranteed from getting half the readers at $\bar{r}$. This is the unique continuation equilibrium given $\bar{r}$, because lower r_n's are ruled out by the logic of Lemma 2. With α sufficiently large, the advertisers choose $\bar{r}$ to maximize their surplus $((1-\rho)\sum_{i \in I} x_n^i(0, \bar{r})(1-t\bar{r}))$ at $r_{min}^{\hat{\iota}}$, since the monopolist's objective at $(\bar{r}, 0)$ only differs by $\frac{\rho\alpha}{1-\rho}$ times the advertiser surplus . Notice that in the limit, the equilibrium of this proposition Pareto dominates all the other ones for both advertisers and newspapers. $\square$

Proof of Proposition 5. The proof is similar to the case of Proposition 1 with the difference that now a monopolist can set negative prices. It is now possible to lower r to 0 and retain all the readers by setting a price of $p = \min\{-b_1, \ldots, -b_I\} \leq 0$. For large α, the bounded cost $(-p)$ of attracting readers in this way is worth paying, because the advertising surplus even on just one reader is so high. Furthermore, the marginal reduction in reader subsidy permitted by a marginal increase in r is dominated by the loss in advertising surplus. Thus, for α sufficiently large, the paper will set $r = 0$ and set $p = \min\{-b_1, \ldots, -b_I\} \leq 0$ so as to capture all readers. At this price all readers either strictly or weakly prefer to read the newspaper and newspaper profits are given by $(\rho\alpha + p)I \gg 0 \ \forall$ large α. $\square$

Proof of Lemma 3. Without loss of generality, assume that at stage 1, newspapers set $r_2 < r_1$, and $sr_1 > sr_2 \geq b$ as before. In stark contrast to Lemma 2, we show that newspaper 2 now wins all the readers. This follows by Bertrand competition with the important difference that now prices are not bounded from below. Newspapers continue to undercut each other as long as they can make positive profits. Since $s > 0$, the newspaper with the lower level of accuracy (here paper 2) is the one that can win the readers, because its greater advertising "subsidy" dominates the reader disutility from its accuracy deficit. More precisely, let $\underline{p}_n(r_n)$ denote the lowest copy price that paper n with accuracy r_n can charge (as monopolist) and break even; it is immediate that $\underline{p}_n(r_n) = -\rho\alpha(1 - tr_n)$ and $\underline{p}_2(r_2) < \underline{p}_1(r_1)(< 0)$ since $r_2 < r_1$. Clearly, neither paper will ever charge a lower price. Moreover, for α sufficiently large, for any $p_1 \geq \underline{p}_1(r_1)$, paper 2 can always gain by undercutting paper 1 by just enough to take the entire market. In the unique continuation SPE, paper 1 competes as far as it can by setting $p_1 = \underline{p}_1(r_1)$ and paper 2 wins the whole market ($x_2 = 1$) by setting $p_2 = \underline{p}_1(r_1) - s(r_1 - r_2)$. Note that x_2 must equal 1, otherwise paper 2 would marginally reduce p_2 to win over the $1 - x_2$ remaining readers. □

Proof of Proposition 6. If newspapers both set $r = r_1 = r_2$, then Bertrand price competition will lead to zero profits and to all papers being sold at the lowest sustainable price, namely, $\underline{p}(r)$ equals the lowest price a newspaper with $r = r_1 = r_2$ can charge and break even (this coincides with $\underline{p}_1$, $\underline{p}_2$ of Lemma 3 where now $\underline{p}(r) = \underline{p}_1(r) = \underline{p}_2(r) = -\rho\alpha(1 - tr)$). This is true regardless of how demand is split between two papers that charge the same price. A paper selling at a price higher than $\underline{p}(r)$ can be profitably undercut.

Using Lemma 3, (and parallel to Proposition 3(b)), given any pure strategy of, say, paper 1 with $r_1 > 0$, the other paper's response is to set r_2 marginally lower, thus taking all the readers and leaving 1 with no profits. Furthermore, $r_2 = r_1 > 0$ cannot be an equilibrium, because either paper could marginally decrease its accuracy and sharply increase readership and revenues (since α large). Again, because all elements in the support of the distribution must have the same expected payoff, there are no mixed equilibria with positive mass on accuracy levels $r_n > 0$, $n = 1, 2$. Hence the equilibrium with $r_1 = r_2 = 0$ and prices $p_1 = p_2 = \underline{p}(0) = -\rho\alpha$ is the only possible one. □

Proof of Proposition 7. This result extends Proposition 3(b) and the proof is very similar. Take a stage 1 profile $(r_1, r_2) \leq 1$ with $r_1, r_2 \neq 1$, (r_1 and r_2 are now vectors), and suppose without loss that the subgame perfect continuation payoff for newspaper 1 is greater or equal to that of newspaper 2. We show that 2 then has an optimal deviation to set $r_2' \geq r_1$ with $r_2' \neq r_1$ (for any $\alpha > 0$). So the two papers drive accuracy up to $r_n = 1$ in any subgame perfect equilibrium. To see this, fix $r_1 \leq 1$ with $r_1 \neq 1$ and consider the payoff function of newspaper 2,

$$\sum_{i \in I} p_2 x_2^i + \sum_{j \in J} \rho \alpha^j \left(\sum_{i \in I} x_2^i (p_2, r_2) \sum_{k \in K} \left(1 - t_k^j r_{2,k}\right) \right)$$

since $\bar{r}^j = 1$ and $t^j \in [0,1)^K$, $j \in J$. The numbers of readers are characterized by the following lemma, which extends Lemma 2.

Lemma 4 *If, under the assumptions of Proposition 7, we have $r_2' \geq r_1$ and $r_2' \neq r_1$, then newspaper 2 captures all the readers, (i.e., $\sum_{i \in I} x_2^i(p, r_1, r_2') = 2$ and $\sum_{i \in I} x_1^i(p, r_1, r_2') = 0$).*

> To see this, notice that because there are no reservation values for readers and $s_k^i > 0$ for all $k \in K, i \in I$, newspaper 2 can attract all the readers by charging a sufficiently low price. Since $\sum_j \alpha^j$ is large, it is in newspaper 2's interest to do so. □

Now, given r_1, if newspaper 2's continuation payoff at r_2 is less than or equal to newspaper 1's payoff, 2 would gain by deviating to some r_2' sufficiently close to r_1 with $r_2' \geq r_1$ and $r_2' \neq r_1$. This gives approximately paper 1's advertising profits multiplied by a factor (the total number of readers divided by the original number of paper 1 readers) that exceeds unity. Advertising revenues dominate reader revenues, so paper 2 would get more than paper 1 had. Hence there is no subgame perfect equilibrium with either $r_n \leq 1$ and $r_n \neq 1$. To see that the profile $(r_n, p_n) = (1, 0)$, $n = 1, 2$, is part of a subgame perfect equilibrium, notice that by Lemma 4, newspapers cannot have a profitable deviation by changing the level of accuracy since they would get zero readers and hence zero profits. At $r_1 = r_2 = 1$, prices charged in stage 2 will again be zero, as the argument of the proof of Proposition 2 (see its second paragraph) applies here as well. □

Proof of Proposition 8. This result extends Proposition 4. Consider the continuation game following selection of $\bar{r}^j = \bar{r}$ by all advertisers in stage 0. Using Proposition 7 (in place of Proposition 3), it is readily verified that $r = \bar{r}$ and zero pricing constitutes the unique SPE outcome for sufficiently large $\sum_j \alpha^j$. Therefore, as long as $\bar{r}_k = 0$ for all topics k sensitive to any advertiser j, this outcome generates the best payoff that each advertiser can hope for (note that all readers already buy some paper since $b_i = 0$ for all i). So it is clearly an equilibrium for all advertisers to coordinate on $\bar{r}^j_k = \bar{r}_k$ in stage 0 (indeed it generates the only Pareto optimal SPE outcome for advertisers). $\square$

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