Discussion paper

Newspaper Differentiation and Investments in Journalism: The Role of Tax Policy

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Abstract: Newspapers are considered to be important providers of information, culture and language, and are taxed at a reduced VAT rate in most countries. This paper shows that such a policy may affect newspaper differentiation and lead to greater media bias. We further show that a reduced-rate VAT scheme may lead to higher newspaper prices and less investment in journalism. These results are obtained by explicitly taking into account the fact that newspapers operate in two sided markets, where they raise revenue both from readers and advertisers.

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JEL Codes: D4; D43; H21; H22; L13

1   Introduction

Media firms may not always have incentives to accurately report the truth. Selective omission and choice of words may convey a picture that looks very different from one newspaper to another although the underlying story is the same. This is what is known as slanted news or media bias. Such media bias has historically been affiliated with political parties or ideologies. It is also well documented in psychology and economics that slanted news may be driven by consumers who have a preference for information that is likely to confirm their prior beliefs.[1]

In this paper we shall argue that slanted news in the sense of left-wing or right-wing profile of content, say, may be driven by public policy. In many countries media regulation is based on the presumption that media firms are important providers of information, language, and culture that strongly affect politics.[2] This is the case with government regulation of news media in the United States, and has also been the attitude among most European countries (see Gentzkow and Shapiro 2006b). Such views have led most countries to tax newspapers at a reduced ad-valorem tax rate compared to that for other goods and services (in the continuation we shall use the terms VAT and ad-valorem tax interchangeably). The stated goal of this policy is to reduce newspaper prices and increase the incentives to invest in journalism.[3]

We show that this policy may be counterproductive, in the sense that a reduced-rate VAT scheme may lead to higher newspaper prices and less investment in journalism. However, this does not necessarily mean that the VAT rate should be increased. Indeed, we show that a tax increase would make the newspapers more dependent on advertising revenue, increasing their incentives to aim for the mass market. This might reduce media pluralism, and violate public goals of having a differentiated

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[1] For documentation in psychology see Nisbett and Ross (1980). For evidence in economics see Gentzkow and Shapiro (2006a, 2006b, 2007); Mullainathan and Schleifer (2007).

[2] Examples of papers that link media firms to the political process and democracy are Gentzkow and Shapiro (2004) and Strømberg (2004).

[3] In Germany, for example, newspapers are subject to a rate of 7% in contrast to the regular rate of 19%, whilst countries like the UK, Denmark, Finland and Norway exempt newspapers from the VAT altogether. Newspapers are also either fully or partially exempted from sales taxes in a number of U.S. states.

newspaper industry.

In order to bring forward these results we take into account the fact that printed newspapers derive income from two groups of customers: advertisers and readers.[4] Since advertisers find it more attractive to place ads in a newspaper the larger its circulation, newspapers are a prime example of a platform in a two-sided market.[5] To embed the two-sidedness of the print media business we use a Hotelling-type framework with two competing newspapers and a continuum of consumers uniformly distributed along the unit line. The newspapers' choice of location on the line can be interpreted as describing their profiles. We consider a three-stage game. At stage 1 each newspaper decides on its location on the Hotelling line and how much to invest in journalism. At stage 2 the ad level is determined, and ad-revenue is assumed to be proportional to the number of readers. Then at stage 3 the newspapers compete in prices. A reduction in the ad-valorem tax rate for newspapers implies that the profitability of selling newspapers increases relative to the profitability of selling advertisements. As a consequence, it becomes less imperative for the newspapers to attract a large audience in order to sell advertising space. Instead, each newspaper wants to increase its earnings from the reader side of the market. It can do so by choosing a profile that differentiates it further from its competitor; thereby each newspaper gains market power that allows it to charge a higher price to readers. The greater market power in turn makes it less important for each newspaper to invest in journalism. In this sense a reduced VAT rate harms consumers; newspaper prices increase and the quality levels fall.

Our paper relates to two strands of literature. Most closely related to our paper is a growing literature on the price-setting behavior of firms in two-sided markets.[6] This literature typically abstracts from taxation issues. The literature on commodity

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[4]The share of advertising in total revenue in the press industry differs across countries, but is typically around 50 percent. See Albarran and Chan-Olmsted (1998).

[5]See Evans (2003a,b) or Rochet and Tirole (2003) for examples and classifications of two-sided platform firms.

[6]See for instance Rochet and Tirole (2003, 2006), Crampes, Haritchabalet and Jullien (2005), and Armstrong (2006).

taxation, on the other hand, does not consider two-sided markets.[7] One exception is Kind, Koethenbuerger and Schjelderup (2008), who compare the effects of ad-valorem and specific taxes on a good sold by a monopoly in a two-sided market. They find, contrary to popular beliefs, that a lower ad-valorem tax may increase the price and reduce sales, while a per-unit subsidy (or a lower specific tax) has the opposite effect. They do not consider how taxes influence differentiation and investment incentives. More closely related to our analysis is Gabszewicz et al (2001, 2002), who use the Hotelling model to analyze how the size of the advertising market affects the political profiles of newspapers. They find that the larger the ad-market, the more important it is for the newspapers to moderate their political profile. Thereby the newspapers are better able to serve the mass market and raise income from the advertising market.

Furthermore, there is a growing literature on the impact of media diversity on truth-telling. If a reduced rate VAT regime leads newspapers to either become conservative or left-wing, say, it matters if such differences in stance affect truth telling. Milgrom and Roberts (1986) use a "persuasion game" and find that as long as there is at least one information provider in every state of nature that wants the truth to be told, the true story will be revealed to individuals with access to all providers of news. Using a very different model Mullainathan and Shleifer (2005) show that individuals who combine news from different sources can form accurate beliefs about an event even though the stories told may be biased. In an empirical paper Gentzkow, Glaeser, and Goldin (2006) study the Crédit Mobilier scandal of 1878, where bribes were paid to US Republican congressmen in exchange for favorable votes. They show that Republican newspapers in the end reported just as many facts as Democratic newspapers. One interpretation of their finding is that it over time became too costly in terms of reputation and credibility for Republican papers to suppress information. Our contribution is to show that public policy may create media bias.

This paper is organized as follows. The formal model is presented in Section 2,

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[7]E.g., Keen and Delipalla (1992), Dierickx, Matutes and Neven (1998) and Anderson *et al* (2001a, 2001b). For a survey, see Fullerton and Metcalf (2002).

and Section 3 derives the newspapers' equilibrium prices, investments in journalism and profile choices. Section 4 analyzes the effects of changing the ad-valorem tax rate levied on newspapers and ads. Section 5 concludes.

2   The Model

We employ a standard Hotelling model with two competing media firms each selling a newspaper to readers and ad-inserts to advertisers. The readers are uniformly distributed along the unit line according to their political view; a consumer who is located at point 0 is extremely left-wing, whilst a consumer located at 1 is extremely right-wing. Consumers with more moderate views are located closer to the center of the unit line. We assume that each reader buys the newspaper which has the profile which best corresponds to his political view, other things equal.

The political profiles of Newspaper 1 and 2 are given by the locations x_1 and $1 - x_2$, respectively, as illustrated in Figure 1. Throughout, we assume that newspaper 2 is located (weakly) to the right of newspaper 1; $(1 - x_2) \geq x_1$. The newspapers are perfect (horizontal) substitutes if $x_1 + x_2 = 1$ and maximally (horizontally) differentiated if $x_1 = x_2 = 0$. More generally, an increase in x_1 and/or x_2 means that the newspapers become less horizontally differentiated, and vice versa. The further away a newspaper profile is from the "ideal position" of a specific reader, the smaller is his utility from reading it. We model this utility loss by a distance cost parameter, $t > 0$.
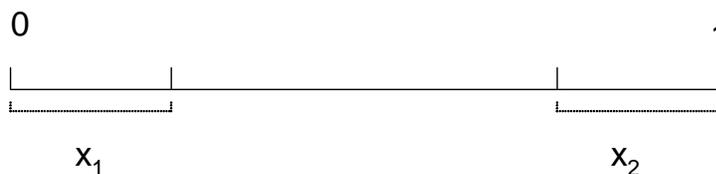
Figure 1: *Location of the newspapers*

In addition to choosing its profile, each newspaper can also make investments in journalism in order to become more attractive to the readers. Letting $p_i \geq 0$ denote the price and $j_i \geq 0$ the journalistic quality level of newspaper $i = 1, 2$, the utility

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level of a consumer located at point x who buys newspaper i is given by

$$U = v + j_i - p_i - t(d_i - x)^2, \tag{1}$$

where $d_1 = x_1$, $d_2 = 1 - x_2$, and v is a positive constant. The squaring of the last term in (1) means that distance costs increase quadratically with the distance from the most preferred location.[8]

Consumers have unit demand, and we assume that the parameter v is sufficiently large to ensure complete market coverage. This means that each consumer buys either newspaper 1 or newspaper 2. Let $\tilde{x}$ denote the location of the consumer who is indifferent between buying newspaper 1 and newspaper 2; $v + j_1 - p_1 - t(x_1 - \tilde{x})^2 = v + j_2 - p_2 - t(1 - x_2 - \tilde{x})^2$. Consumers located to the left of $\tilde{x}$ $(x < \tilde{x})$ consequently prefer newspaper 1, while consumers to the right of $\tilde{x}$ $(x > \tilde{x})$ prefer newspaper 2. From this we find that demand D_i for newspaper i equals

$$D_i = x_i + \frac{1 - x_1 - x_2}{2} + \frac{p_{-i} - p_i}{2t(1 - x_1 - x_2)} + \frac{j_i - j_{-i}}{2t(1 - x_1 - x_2)}; i, j = 1, 2; i \neq j. \tag{2}$$

Advertisers may buy inserts in either or both newspapers, and newspaper i's gross advertising income is given by A_i. The willingness to pay for advertising depends on the number of readers and the advertising volume. We follow Peitz and Valletti (2008) and Anderson and Coate (2005) in assuming that newspaper i faces a simple downward-sloping demand curve for advertising per reader. More specifically, letting r_i be the price of advertising per reader and a_i the advertising volume, we have

$$r_i = \alpha - \beta a_i \qquad (\alpha, \beta > 0). \tag{3}$$

With D_i readers, we consequently find that advertising income equals

$$A_i = \left(\frac{\alpha - \beta a_i}{1 + T} - c_A \right) a_i D_i, \tag{4}$$

where $c_A \geq 0$ is the marginal cost of adverts, and $T \geq 0$ is the ad-valorem tax on advertising. A higher α or a smaller β can be interpreted as though the size of the ad market has increased.[9]

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[8]It is worth pointing out that the linear way in which quality enters the utility function achieves simplicity without compromising the qualitative direction of our results.

[9]An increase in α means that the willingness to pay for advertising becomes higher, while a reduction in β is equivalent to an increase in the number of advertisers.

The profit level of newspaper i is given by

$$\pi_i = \left(\frac{p_i}{1+\tau} - c_N\right) D_i + A_i - K(j_i), \tag{5}$$

where $\tau \geq 0$ is the ad-valorem tax rate on newspaper sales and $c_N \geq 0$ is the marginal cost of printing and distributing the newspaper. The last term in (5) represents the costs of investing in journalism, with $K'(j_i) > 0$. We further assume that the cost function is convex $(K''(j_i) > 0)$, such that it is more expensive to achieve a given increase in the perceived journalistic quality the higher the quality level is as the outset. The obtain closed-form solutions, we shall in the following let $K(j_i) = \phi j_i^2/2$. The constant $\phi > 0$ is assumed to be sufficiently large to fulfill all second-order conditions for profit maximization.

3 Equilibrium

The timing of the game turns out to be important when analyzing the effects of tax policy in Hotelling models. Regularly, it is assumed that newspapers set advertising levels and newspaper prices simultaneously at the final stage of the game. Such a timing is useful to highlight the fact that an increase in the size of the advertising market may lead media firms to reduce newspaper prices; by doing so they will attract a larger number of readers and thus increase revenue from the advertising market. However, due to the peculiarities of the Hotelling model, the media firms would pass on 100 % of any additional revenue from the advertising market to the consumers in the form of lower newspaper prices. This has the implication that the newspapers would actually be completely indifferent to the size of the advertising market. The peculiarities of the Hotelling model further implies that the size of marginal production costs does not influence firm profitability in a symmetric equilibrium (unless the consumers' reservation prices are too low to make it unprofitable to serve everyone). Along the same lines it can be shown that if advertising levels and newspaper prices are set simultaneously, the media firms would also be indifferent to whether the government imposes taxes on ads and/or newspaper sales.

In our view, these predictions do not ring true. Media firms seem to care about

the size of advertising markets, and they seem to prefer low rather than high VAT rates on newspaper sales. To capture this, we shall below model a sequential game with three stages, where at stage 1 each media platform decides on its newspaper profile and investments in journalism. Then at stage 2 they choose advertising levels, while newspaper prices are determined at stage 3. Since newspaper prices and thus the number of copies sold are the outcome of the final stage, the sequencing of the game implies that the media firms cannot commit to a certain number of readers or write contracts with advertisers which depend on the number of copies. We believe that this fits well with the actual working of the newspaper market, where advertisers buy advertising space based on some anticipation on how many readers they will reach. In the formal model we assume that the advertisers correctly anticipate the number of readers in equilibrium. In practice a proxy for such anticipations is the use of daily, weekly, monthly and yearly circulation numbers that newspapers in most countries make available for advertisers.

Stage 3. Solving the game backwards, at stage 3 each newspaper takes profiles, investments in journalism and advertising levels as given when it decides on the newspaper price. Using (2) and (5) to solve $\partial \pi_i / \partial p_i = 0$ we find

$$p_i = c_N(1+\tau) + \frac{t\left(1 - x_i - x_{-i}\right)\left(3 + x_i - x_{-i}\right)}{3} + \frac{j_i - j_{-i}}{3}, i = 1, 2. \qquad (6)$$

Equation (6) shows that the price of newspaper i depends positively on how horizontally differentiated it is from its rival and on its journalistic quality level ($\partial p_i / \partial x_i < 0$ and $\partial p_i / \partial j_i > 0$). We also see that the consumer price, other things equal, is increasing in newspaper taxes; $\partial p_i / \partial \tau > 0$. Apparently, this lends support to a public policy of imposing low ad-valorem taxes on newspapers in order to reduce their prices.

Stage 2. At the second stage each platform sells advertising space. Substituting equations (4) and (6) into (5) and solving $\partial \pi_i / \partial a_i = 0$, we find that the profit-maximizing advertising volume equals

$$a_i = \frac{\alpha - c_A\left(1+T\right)}{2\beta}. \qquad (7)$$

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From (7) we see that the level of advertising (a_i) is decreasing in the ad-valorem tax T, but increasing in the size of the advertising market (α). Making use of equation (7) in (4), we can rewrite total advertising profit for each platform as

$$A_i = \frac{[\alpha - c_A (1+T)]^2}{4(1+T)\beta} D_i. \tag{8}$$

Using equations (5) and (8) we can now derive revenue per reader R_i of each platform as

$$R_i = \left(\frac{p_i}{1+\tau} - c_N\right) + \frac{[\alpha - c_A(1+T)]^2}{4(1+T)\beta},$$

where it is useful to note that revenue per reader falls following a rise in either of the two ad-valorem tax rates.[10]

Stage 1. At the first stage the two media platforms choose their profiles and investments in journalism. The first-order conditions are found by solving $\partial \pi_i^* / \partial x_i = \partial \pi_i^* / \partial j_i = 0$ $(i = 1, 2)$, where π_i^* denotes profits given optimal prices and ad levels.

Starting with each newspaper's choice of profile (horizontal dimension), we note that

$$\frac{d\pi_i^*}{dx_i} = \underbrace{\left(\frac{p_i}{1+\tau} - c_N\right) \left[\overbrace{\frac{\partial D_i}{\partial x_i}}^{\text{direct effect}} + \overbrace{\frac{\partial D_i}{\partial p_{-i}} \frac{dp_{-i}}{dx_i}}^{\text{strategic effect}}\right]}_{\text{(I) Reader market (-)}} + \underbrace{\frac{\partial A_i}{\partial D_i} \frac{dD_i}{dx_i}}_{\text{(II) Ad market (+)}}. \tag{9}$$

Terms (I) and (II) in equation (9) measure the marginal profit for newspaper i in the reader and ad market, respectively, of choosing a profile which is closer to that of the rival. Following the convention in the Hotelling literature, the two terms in the square bracket of equation (9) are labelled the direct and the strategic effect, respectively. The direct effect is positive, other things equal, and captures the fact that the newspaper increases its market share by moving closer to its rival. However, the price charged by the rival is lower the smaller the distance between the firms $(dp_{-i}/dx_i < 0)$, so the strategic effect is negative.

It is well known from the Principle of *Maximum Differentiation* that the strategic effect dominates over the demand effect (*e.g.* Tirole, 1988). Thus, expression (I)

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[10]It is easily verified that $\partial R_i(\tau, T)/\partial \tau < 0$ and $\partial R_i(\tau, T)/\partial T < 0$.

in equation (9) is negative. Expression (II), on the other hand, is positive (see Appendix for a proof). The reason is that the newspaper gets a larger readership and consequently earns higher profit in the ad market if it moves closer to its rival. A large ad market may therefore give rise to the Principle of *Minimum Differentiation*, as discussed by Gabszewicz *et al* (2001, 2002).

Differentiating profit with respect to investments in journalism (the vertical dimension) we find

$$\frac{d\pi_i^*}{dj_i} = \underbrace{\left(\frac{p_i}{1+\tau} - c_N\right) \left[\overbrace{\frac{\partial D_i}{\partial j_i}}^{\text{direct effect}} + \overbrace{\frac{\partial D_i}{\partial p_{-i}}\frac{dp_{-i}}{dj_i}}^{\text{strategic effect}} \right]}_{\text{(I): Reader market } (+)} + \underbrace{\frac{\partial A_i}{\partial D_i}\frac{dD_i}{dj_i}}_{\text{(II): Ad market } (+)} - \phi j_i. \quad (10)$$

The square bracket in (10) shows that there is a direct and a strategic effect also for journalistic investments; demand for newspaper i increases if it invests more in journalism, but the rival will respond by reducing its newspaper price. The latter reduces the positive effect of journalistic improvements, but the former effect unambiguously dominates. Therefore Expression (I) in (10) is positive (see Appendix).

It is straightforward to show that also Expression (II) is positive. The reason is that a higher investment level increases the size of the readership and thus revenue from ad-inserts: formally, we have

$$\frac{\partial A_i}{\partial D_i} = \left(\frac{\alpha - \beta a_i}{1+T} - c_A\right) a_i > 0$$

and

$$\frac{dD_i}{dj_i} = \frac{1}{6t\left(1 - x_1 - x_2\right)} > 0. \quad (11)$$

Equation (11) contains the important message that dD_i/dj_i is increasing in x_1 and x_2. This means that the demand-expanding effect of a given improvement in journalism is larger if the newspapers are good substitutes than if they are poor substitutes. The intuitive explanation is that the better substitutes the newspapers are, the more prone consumers are to shift from a newspaper with a low journalistic quality

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to one with a high journalistic quality. As we shall see later, this gives rise to a business-stealing effect which implies that each newspaper has greater incentives to make investments in journalism in order to capture readers from its rival the closer the newspapers are located on the Hotelling line.

In order to characterize the optimal profile and investment level we set (9) and (10) equal to zero. This yields the equilibrium conditions

$$x_i^* = -\frac{1}{4} + \frac{[\alpha - c_A (1 + T)]^2 (1 + \tau)}{16\beta (1 + T) t},$$ (12)

and

$$j_i^* = \frac{4t\beta (1 + T)}{\{12t\beta (1 + T) - [\alpha - c_A (1 + T)]^2 (1 + \tau)\} (1 + \tau) \phi}.$$ (13)

For (12) and (13) to describe an equilibrium, the second-order condition for an optimum must hold (see Appendix). In addition, we must impose a restriction on the willingness to pay for advertising (α) which guarantees that $x_i^* \in [0, 1/2]$. This restriction amounts to requiring

$$\underline{\alpha} \leq \alpha \leq \bar{\alpha},$$ (14)

$$\underline{\alpha} \equiv 2\sqrt{\frac{t\beta(1 + T)}{1 + \tau}} + c_A(1 + T),$$

$$\bar{\alpha} \equiv 2\sqrt{\frac{3t\beta (1 + T)}{1 + \tau}} + c_A (1 + T).$$

If demand for advertising is sufficiently small ($\alpha \leqslant \underline{\alpha}$), equation (12) implies that the newspapers will be located at each end of the Hotelling line. However, the larger the advertising market, the closer the firms will locate to each other, and in the limit when α approaches $\bar{\alpha}$ we have $x_i = 1/2$.

The advertisers do not care about the journalistic quality of the newspaper *per se*; their only concern is the number of readers. The size of the ad market therefore has no direct effect on the firms' investment incentives. However, the newspapers will be less differentiated the larger the advertising market, and we know from equation (11) that less horizontal differentiation makes the business stealing motive for investing in journalism stronger. From equation (13) it can therefore be verified that j_i^* is increasing in the size of the advertising market.

Summing up, we have:

Proposition 1 *The newspapers will be less differentiated but undertake larger investments in journalism the greater the size of the advertising market* $(dx_i^*/d\alpha > 0,\ dx_i^*/d\beta < 0$ *and* $dj_i^*/d\alpha > 0,\ dj_i^*/d\beta < 0)$.

The equilibrium values in the consumer and advertising markets are now found by inserting for (12) and (13) into (2), (6) and (8):

$$p_i^* = \frac{3}{2}t + c_N\left(1 + \tau\right) - \frac{\left[\alpha - c_A\left(1 + T\right)\right]^2\left(1 + \tau\right)}{8\beta\left(1 + T\right)}, \tag{15}$$

$$A_i^* = \frac{\left[\alpha - c_A\left(1 + T\right)\right]^2}{8\beta\left(1 + T\right)}. \tag{16}$$

By inspecting equation (15) we may state:

Corollary 2 *The newspaper price is decreasing in the size of the advertising market.*

Corollary 2 reflects the fact that each media firm is willing to accept a low newspaper price in order to attract a larger number of readers when the advertising market is very profitable.

4 Effects of taxing media products

This section analyzes how higher ad-valorem taxes affect the newspapers' strategic choices. For this purpose, we treat locations, investments in journalism and newspaper prices as functions of the two exogenous tax rates, *i.e.*, $x_i^*(\xi), j_i^*(\xi), p_i^*(\xi)$ where $\xi \in \{\tau, T\}$. Let us first consider the newspapers' choice of location. From equation (12) we find that

$$\frac{dx_i^*}{d\tau} = \frac{\left[\alpha - c_A\left(1 + T\right)\right]^2}{16t\beta\left(1 + T\right)} > 0. \tag{17}$$

Equation (17) reflects the fact that higher ad-valorem taxes on newspapers make the advertising market relatively more important for the media firms. Thereby it becomes more valuable to aim for the mass market, inducing each newspaper to locate closer to its competitor. This *relocation effect* is clearly stronger the larger is the advertising market (higher α, smaller β).

To see what happens to the newspaper price if τ goes up, we differentiating equation (15) and obtain

$$\frac{dp_i^*}{d\tau} = c_N - \frac{[\alpha - c_A(1+T)]^2}{8\beta(1+T)}. \tag{18}$$

As in a one-sided market, the direct effect of a higher τ is to increase the newspaper price if marginal costs are positive. This is captured by the first term on the right-hand side of (18). However, the fact that the newspapers endogenously become less horizontally differentiated when τ increases, means that there will be tougher price competition between the newspapers. This relocation effect in turn tends to reduce the newspaper price, as shown by the second term on the right-hand side of (18).

The net result depends on the relative strength of these two effects and cannot be signed in general. However, equation (18) shows that the relocation effect is more likely to dominate and lead to a price reduction the larger the advertising market. Specifically, it can be shown that $dp_i^*/d\tau < 0$ if $\alpha > \alpha_1 \equiv 2\sqrt{2\beta(1+T)c_N} + c_A(1+T)$. This condition holds always if marginal costs are equal to zero ($c_A = c_N = 0$).

The consequences of a higher τ for investments in journalism are also ambiguous. On the one hand, the profit margin of the newspapers falls subsequent to a tax increase, other things equal. This has a negative effect on the incentives to invest in journalism. On the other hand, we have seen that the newspapers will locate closer to each other if τ increases. To clearly see the implications of the latter for investments in journalism, we differentiate equation (13) and use (17) to find

$$\frac{dj_i^*}{d\tau} = 3(1+\tau)\phi j_i^2 \left(\frac{8}{3}\frac{dx_i^*}{d\tau} - \frac{1}{1+\tau}\right). \tag{19}$$

The larger $dx_i^*/d\tau$, the less differentiated the newspapers will be, and the stronger each newspaper's incentive will be to invest in journalism in order to capture readers from its rival (business-stealing effect). This explains why the change in investments is proportional to the relocation effect. Since the relocation effect in turn is stronger the larger the advertising market, we find that a higher newspaper tax increases journalistic investments if the ad market is sufficiently large - combining equations (17) and (19) - we have $dj_i^*/d\tau > 0$ if $\alpha > \alpha_2 \equiv \sqrt{\frac{6\beta(1+T)t}{1+\tau}} + c_A(1+T)$.

We can now state:

Proposition 3 *Suppose that the ad-valorem tax on newspapers increases. Then:*

(a) the newspapers become less differentiated ($dx_i^*/d\tau > 0$),

(b) the newspaper price falls if $\alpha > \alpha_1$ ($dp_i^*/d\tau < 0$), and

(c) investments in journalism increases if $\alpha > \alpha_2$ ($dj_i^*/d\tau > 0$).

Figure 2 provides a numerical illustration of Proposition 3. The size of the advertising market is captured by α on the horizontal axis, and with the chosen parameter values (see Appendix), we find that $dp_i^*/d\tau < 0$ if $\alpha > \frac{4}{5}\sqrt{5} \approx 1.79$. The the upward-sloping curve shows that $dj_i^*/d\tau > 0$ if $\alpha > \sqrt{3} \approx 1.73$.[11] For $\alpha > \frac{4}{5}\sqrt{5}$ a higher ad-valorem tax will thus reduce the newspaper price and increase investments in journalism.
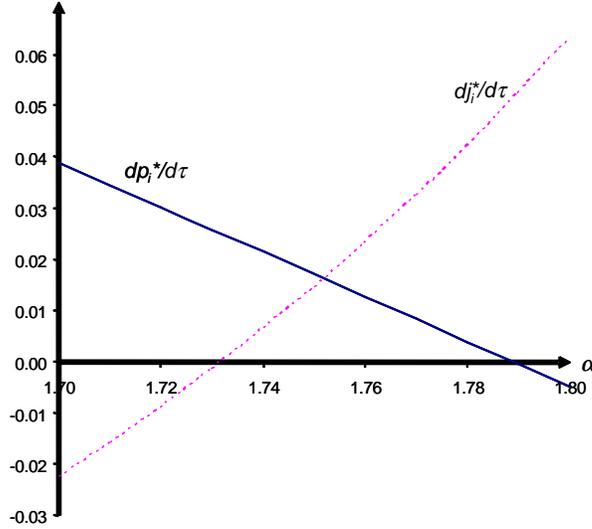

Figure 2: *Value added taxes on newspapers: price and investment responses.*

Finally, let us consider the effects of increasing T. Higher ad-valorem taxes on ads make the advertising market relatively less profitable for the newspapers, and will therefore lead to increased differentiation:

$$\frac{dx_i^*}{dT} = -\frac{\left[\alpha^2 - c_A^2 (1+T)^2\right](1+\tau)}{16t\beta (1+T)^2} < 0.$$

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[11] As shown by equation (17), x_i^* is monotonically increasing in α. For the parameter values used in Figure 2, we have $x_i^* = -1/4 + \alpha^2/8$. This means that $x_i^* = 0.111$ at $\alpha = 1.7$ and $x_i^* = 0.155$ at $\alpha = 1.8$.

How does the newspaper price depend on the tax level on ads? We have already seen that p_i is independent of T at the final stage of the game; c.f. equation (6). The newspaper price is nevertheless increasing in advertising taxes. This is due to the relocation effect: since the newspapers end up being more differentiated if T increases, the competitive pressure falls. This unambiguously allows the newspapers to increase their prices. Additionally, the lower competitive pressure reduces the newspapers' incentive to invest in journalism. We therefore have

$$\frac{dp_i^*}{dT} = \frac{(1+\tau)\left[\alpha - c_A(1+T)\right]\left[2c_A + (1+T)\right]}{1+T} > 0,$$

$$\frac{dj_i^*}{dT} = -\frac{4t\beta\left\{\left[\alpha - c_A(1+T)\right]^2 + 2c_A(1+T)^2\right\}}{\phi\left\{12t\beta(1+T) - \left[\alpha - c_A(1+T)\right]^2(1+\tau)\right\}} < 0.$$

The effects of taxing advertising can be summarized as follows:

Proposition 4 *Suppose that the ad valorem tax on ads increases. Then*

(a) *the newspapers become more differentiated ($dx_i^*/dT < 0$),*

(b) *the newspaper price increases ($dp_i^*/dT > 0$), and*

(c) *investments in journalism fall ($dj_i^*/dT < 0$).*

Comparing Propositions 2 and 3 we see that the two taxes have very different effects. A reduction in the ad-valorem tax on newspapers (the reduced-rate regime in many countries) makes each platform differentiate its profile further. In contrast, a fall in the tax on ads has the opposite effect; it leads to less differentiation. The impact on journalistic investments and newspaper prices may also be of opposite signs, but whether this is the case depends on the importance of advertising as a source of revenue.

5   Concluding remarks

Newspapers are based on a two-sided business model where the newspaper creates content that is used to attract readers. The more readers the newspapers get on board, the more attractive it is for advertisers. We have demonstrated that this

two-sidedness has a profound effect on how tax policy affects the strategic variables of the newspapers. A main finding that emerges from our analysis is that a fall in the ad valorem tax rate on newspapers implies that they become more differentiated. The reason is that a lower newspaper tax makes it more attractive for the media firms to derive income from newspaper sales relative to selling advertising space. By choosing a different profile from its competitor, the firm gains market power and thus earns more revenue from the sale of the newspaper.

It is a well-known result from standard Hotelling models in one-sided markets that product differentiation, which in our context corresponds to media pluralism, can be excessive compared to social optimum. This benchmark result should be contrasted with the literature on truth telling, which shows that media diversity might foster truth telling (see Gentzkow and Shapiro, 2008). It is then clear that there are two different effects at hand and it is not a simple matter to console the traditional Industrial Organization (IO) view of too much differentiation with the benefits of truth telling. The latter seems to indicate that media pluralism and even polarization past the social optimum in standard IO models is good. It is certainly a challenge for future research to try and bring together these two strands of research in a unified framework.

6   Appendix

Proof that $\frac{\partial A_i}{\partial D_i} \frac{dD_i}{dx_i} > 0$ *(equation (9))*

Differentiating equation (8) with respect to D_i we find that

$$\frac{\partial A_i}{\partial D_i} = \left(\frac{\alpha - \beta a_i}{1 + T} - c_A \right) a_i. \tag{20}$$

Inserting (6) into (2) it further follows that

$$\frac{dD_i}{dx_i} = \frac{1}{6} \frac{t \left(1 - x_1 - x_2 \right)^2 - j_i + j_{-i}}{t \left(1 - x_1 - x_2 \right)^2}.$$

In a symmetric equilibrium $(x_i = x_{-i}$ and $j_i = j_{-i})$ we consequently have

$$\left(\frac{\partial A_i}{\partial D_i} \frac{dD_i}{dx_i} \right) \Bigg|_{sym} = \left(\frac{\alpha - \beta a_i}{1 + T} - c_A \right) \frac{a_i}{6} > 0.$$

15

Proof that $\frac{\partial \pi_i^*}{\partial j_i} > 0$ (equation (10))

Differentiating π_i with respect to j_i and using the envelope theorem (which implies that $\frac{\partial \pi_i}{\partial p_i} \frac{\partial p_i}{\partial j_i} = 0$) we have

$$\frac{\partial \pi_i^*}{\partial j_i} = \left(\frac{p_1}{1+\tau} - c_N \right) \left(\frac{\partial D_i}{\partial j_i} + \frac{\partial D_i}{\partial p_{-i}} \frac{dp_{-i}}{dj_i} \right) + \frac{\partial A_i}{\partial D_i} \frac{dD_i}{dj_i} - \phi j_i. \tag{21}$$

We further find

$$\left(\frac{\partial D_i}{\partial j_i} + \frac{\partial D_i}{\partial p_{-i}} \frac{dp_{-i}}{dj_i} \right)\bigg|_{sym} = \frac{1}{3t\left(1 - 2x_i\right)} > 0$$

and

$$\frac{\partial A_i}{\partial D_i} \frac{dD_i}{dj_i}\bigg|_{sym} = \left(\frac{\alpha - \beta a_1}{1+T} - c_A \right) \frac{a_i}{2t\left(1 - 2x_i\right)} > 0.$$

The two first terms on the right-hand side of (10) are thus positive. Q.E.D.

Second-order conditions

The second-order conditions for the third and the second stage are straightfordwardly calculated. However, the second-order conditions for the first stage are more complex (and will obviously not be satisfied if ϕ is too small), and require that

$$\frac{\partial^2 \pi_i}{\partial j_i^2} = -\frac{9t\phi\left(1+\tau\right)\left(1 - x_1 - x_2\right) - 1}{9\left(1+\tau\right)t\left(1 - x_1 - x_2\right)} < 0, \tag{22}$$

$$0 > \frac{\partial^2 \pi_i}{\partial x_i^2} = -\left\{ \frac{\beta t^2 \left(5 + 3x_i - x_{-i}\right)\left(1 - x_1 - x_2\right)^3 \left(1+T\right)}{9t\beta\left(1+\tau\right)\left(1 - x_1 - x_2\right)^3 \left(1+T\right)} \right. \tag{23}$$

$$\left. - \frac{\left(j_i - j_{-i}\right)\left(4\beta\left(1+T\right)\left(j_i - j_{-i}\right) - 3\left(\alpha - c_A\left(1+T\right)\right)^2 \left(1+\tau\right)\right)}{36t\beta\left(1+\tau\right)\left(1 - x_1 - x_2\right)^3 \left(1+T\right)} \right\}$$

and

$$\left(\frac{\partial^2 \pi_i}{\partial j_i^2} \right) \left(\frac{\partial^2 \pi_i}{\partial x_i^2} \right) - \left(\frac{\partial^2 \pi_i}{\partial j_i \partial x_i} \right)^2 > 0 \tag{24}$$

where

$$\left(\frac{\partial^2 \pi_i}{\partial j_i \partial x_i} \right)^2 = \frac{\left(8\beta\left(1+T\right)\left(\left(j_i - j_{-i}\right) + t\left(1 - x_1 - x_2\right)^2\right) + 3\left(A - c_N\left(1+T\right)\right)^2 \left(1+\tau\right)\right)^2}{5184\left(1+\tau\right)^2 t^2 \left(1 - x_1 - x_2\right)^4 \left(1+T\right)^2 \beta^2}. \tag{25}$$

A necessary condition for the second-order conditions to be satisfied is that $\phi > [9t (1 + \tau) (1 - x_1 - x_2)]^{-1}$. Otherwise, the costs of investing in journalism are so low that $\partial^2 \pi_i / \partial j_i^2$ is non-negative.

Parameter values Parameter values in Figure 2: $T = \tau = c_N = 0$, $t = 1/2$, $\phi = 2$, $c_A = 4/10$ and $\beta = 1$. Using equations (22) - (25) it can be verified that all second-order conditions are satisfied within the range of α shown in the figure.

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