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

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Abstract

Many countries levy reduced-rate indirect taxes on newspapers, with proclaimed policy goals of stimulating investment in journalism and ensuring low newspaper prices. However, by taking into account the fact that the media industry operates in two-sided markets, we find the paradoxical result that the consequences of a low-tax regime might be quite the opposite; low investments and high prices. We also show that the low-tax regime tends to increase newspaper differentiation. If the advertising market is relatively small, the newspapers might invest too little in journalism and be too differentiated from a social point of view. In this case a tax increase will be welfare-enhancing.

JEL-Code: D400, D430, H210, H220, L130.

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1 Introduction

Printed newspapers are in most countries either exempted from sales taxes and value-added taxes (VAT), or taxed at a reduced rate (see Gentzkow and Shapiro 2006b).[1] This policy is founded on the belief that media firms are important providers of information, language and culture, and that media pluralism produces socially desirable outcomes.[2] The low-rate regimes in Europe and the US are in particular perceived to increase media differentiation and media pluralism, reduce newspaper prices, and encourage to greater investments in journalism and other quality measures (see European Commission, 2004).

The exemption from value added taxation has come under debate in several European countries. In Denmark, for example, the Ministry of Culture has published a report which discusses the consequences of increasing the VAT rate on newspapers (Rambøll Management Consulting, 2009).[3] The Report points out two main consequences of abolishing the VAT exemption for newspapers. First, it will improve the competitiveness of e.g. electronic newspapers, because the price of paper-based newspapers will increase. Second, and as a direct consequence of the price increase, the consumers who buy paper-based newspapers will be harmed. The Danish report neglects the fact that newspapers serve both advertisers and readers, and thus that they operate in two-sided markets.[4] This neglect means, for example, that the Report's estimation of demand elasticities on the reader side of the market says very little about the consequences of higher newspaper taxes. The interdependence between the reader and the advertising market seems to be missing in public debates

[1] 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 VAT altogether. Newspapers are also either fully or partially exempted from sales taxes in a number of U.S. states.

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

[3] Another example is Norway where a government appointed commission is to investigate whether a zero rated value added tax is still desirable

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

also in other countries that consider the possibility of increasing the VAT rate on newspapers.

In this paper we explicitly take into account the two-sidedness of the newspaper business, and show that low VAT rates on newspapers may actually cause newspaper prices to be higher and investments in journalism lower than what would otherwise be the case. This indicates that the tax exemption of the newspaper industry is counter-productive relative to the stated policy goals. However, we show that the low-rate regime tends to increase newspaper differentiation, which seems to be in accordance with political preferences.

In order to bring forward these results we use a Hotelling-type framework with two competing newspapers and a continuum of consumers uniformly distributed along the unit line. The two-sidedness of the market is taken care of by assuming that the newspapers derive income from two groups of customers, advertisers and readers, and that the advertisers find it more attractive to place ads in a given newspaper the larger its circulation.[5] The newspapers' choice of location on the Hotelling line can be interpreted as describing their profiles. We consider a three-stage game. At stage 1 each newspaper decides on its profile and how much to invest in journalism. At stage 2 the ad level is determined, and at stage 3 the newspapers compete in prices.

A reduction in value-added taxes 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. However, the newspapers might overinvest in journalism from a social

[5] 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).

point of view. Indeed, we show that first-best policy might call for taxation of both newspaper sales and advertising revenue to ensure optimal investments and differentiation. It should be noted, though, that we abstract from the question of whether the market economy is likely to generate too much or too little advertising from a social point of view. According to the informative (and partly the complementary) view of advertising we might expect too few ads in market equilibrium, while the persuasive view typically has the opposite prediction.[6] Clearly, the optimal tax rate on ads might be lower than the one derived in this paper if advertising mainly is informative (and higher if advertising to a large extent is persuasive).

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.[7] This literature typically abstracts from taxation issues. The literature on commodity taxation, on the other hand, does not consider two-sided markets.[8] 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 belief, 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 advertisement 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.

More indirectly related to our paper is the literature on media diversity on 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

[6] See Bagwell (2007) for a thorough discussion.

[7] See for instance Rochet and Tirole (2003, 2006), Crampes, Haritchabalet and Jullien (2009), and Armstrong (2006).

[8] 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).

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 over time it became too costly in terms of reputation and credibility for Republican papers to suppress information. Our relation to this literature is indirect in the sense that we argue that public policy has a strong influence on the diversification strategies of media firms.

The remainder of this paper is organized as follows. The formal model is presented in Section 2, 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, and it compares the optimal tax rates. 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 newspapers 1 and 2 are given by the locations x_1 and $1 - x_2$, respectively, as illustrated in Figure 1. We follow Tabuchi and Thisse (1995) in allowing the firms to locate both inside and outside the Hotelling line (this means that we might have e.g. $x_1 < 0$). Throughout, we assume that newspaper 2 is located

(weakly) to the right of newspaper 1; $(1 - x_2) \geq x_1$. Note that 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, $t > 0$.

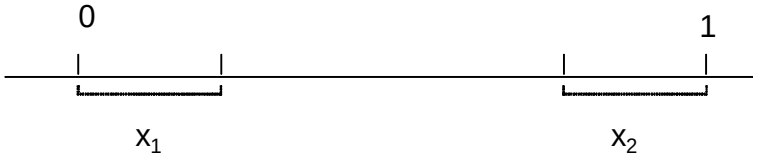

Figure 1: *Location of the newspapers.*

In addition to choosing its profile, each newspaper can also make investments in journalism in order to become more attractive to 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 level of a consumer located at point x who buys newspaper i is given by

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

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.[9]

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

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

[9] 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.

Advertisers may buy inserts in either or both newspapers, and newspaper i's net advertising revenue 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 net advertising revenue 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.[10]

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 $K'(j_i) > 0$ and $K''(j_i) > 0$. In order to 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 ensure that all second-order conditions for profit maximization are fulfilled.

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

[10] 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.

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 if advertising levels and newspaper prices were set simultaneously. This has the implication that the newspapers would actually be completely indifferent to the size of the advertising market and to whether advertising revenue is taxed (see Appendix for a proof).

In our view, these predictions do not ring true. Media firms seem to care about the size of advertising markets, and they are not indifferent to whether advertising revenue is taxed. To capture this, below we model a sequential game with three stages, where at stage 1 each newspaper decides on its 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 also 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 readers. We believe that this fits well with the actual working of the newspaper market, where advertisers buy advertising space based on some anticipation of 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 to 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

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

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 price.

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

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

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, that is, increasing with α and decreasing with β. 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 for 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.[11]

Stage 1. At the first stage the two media platforms determine 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

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

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

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 labeled 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) in equation (9) is negative. Expression (II), on the other hand, is positive (see Appendix for a proof). The reason is that the newspaper acquires 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

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

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 the 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

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

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 the consumers are to shift from a newspaper with low journalistic quality to one with 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 profit-maximizing profile and investment level we set (9) and (10) equal to zero. The first-order conditions for a symmetric equilibrium are then given by

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

and

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

The second term on the right-hand side of equation (12) is equal to zero if the firm does not make any advertising revenue. In this case $x_i^* = -\frac{1}{4}$; in order to soften competition the firms will thus locate outside the Hotelling line (at $x_1 = -1/4$ and $1 - x_2 = 5/4$). This is a standard result in Hotelling models with quadratic transportation costs; see Tabuchi and Thisse (1995), Lambertini (1994, 1997) and

Brekke and Straume (2004). However, it is readily verified from equation (12) that x_i^* is increasing in the size of the advertising market, but that $x_i^* < 1/2$ (so that the newspapers are not perfect substitutes) whenever the second-order condition for quality investment is satisfied (see Appendix).

From equation (13) it can be verified that j_i^* is increasing in the size of the advertising market. To see why, note first that 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 media 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.

Summing up, we have:

Proposition 1 *The newspapers will be less differentiated but will 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 (12) and (13) into (2), (6) and (8):

$$p_i^* = \frac{3}{2}t + c_N(1+\tau) - \frac{[\alpha - c_A(1+T)]^2(1+\tau)}{8\beta(1+T)}, \tag{14}$$

$$A_i^* = \frac{[\alpha - c_A(1+T)]^2}{8\beta(1+T)}. \tag{15}$$

By inspecting equation (14) we may state:

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

Corollary 2 reflects the fact that in order to attract a large number of readers and increase advertising revenue, each media firm accepts a lower newspaper price the bigger is the advertising market.

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

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

Equation (16) 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 the advertising market (i.e., higher α, smaller β).

To see what happens to the newspaper price if the ad valorem tax on the newspaper (τ) goes up, we differentiate equation (14) and obtain

$$\frac{dp_i^*}{d\tau} = c_N - \frac{[\alpha - c_A(1+T)]^2}{8\beta(1+T)}. \tag{17}$$

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 (17). However, newspapers endogenously become less horizontally differentiated when τ increases, so 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 (17).

The net result depends on the relative strength of these two effects and cannot be signed in general, but equation (17) 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 $\alpha > \alpha_1 \equiv 2\sqrt{2\beta(1+T)}c_N + (1+T)c_A$. This condition always holds 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 (16) to find

$$\frac{dj_i^*}{d\tau} = 3\left(1+\tau\right)\phi j_i^2\left(\frac{8}{3}\frac{dx_i^*}{d\tau} - \frac{1}{1+\tau}\right). \tag{18}$$

The larger $dx_i^*/d\tau$, the less differentiated the newspapers will be, and the stronger each newspaper's incentive 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 (16) and (18) we have $dj_i^*/d\tau > 0$ if $\alpha > \alpha_2 \equiv \sqrt{\frac{6\beta(1+T)t}{1+\tau}} + (1+T)\,c_A$.

We can now state:

Proposition 3 *Suppose that the ad-valorem tax on newspapers* (τ) *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 increase 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 upward-sloping curve shows that $dj_i^*/d\tau > 0$ if $\alpha > \sqrt{3} \approx 1.73$.[12] For $\alpha > \frac{4}{5}\sqrt{5}$ a higher ad-valorem tax will thus reduce the newspaper price and increase investments in journalism.

[12] As shown by equation (16), 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 $\alpha = 1.8$.

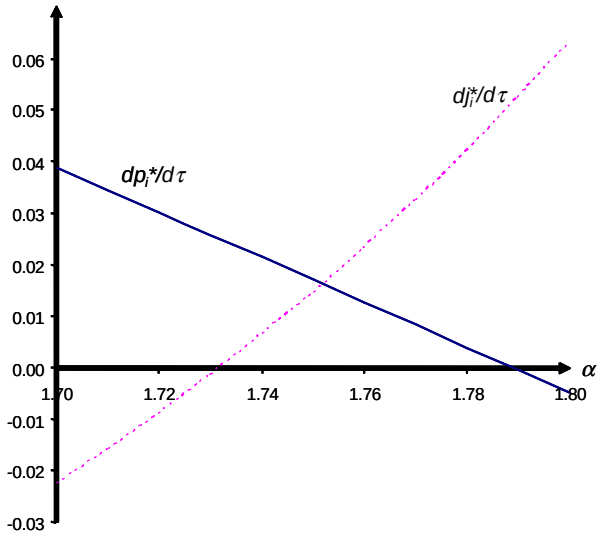

Figure 2: *Value added taxes on newspapers: price and investment responses.*

Let us now 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:

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

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

$$\begin{aligned}\frac{dp_i^*}{dT} &= \frac{\left(1+\tau\right)\left[\alpha - c_A(1+T)\right]\left[2c_A + (1+T)\right]}{1+T} > 0,\\ \frac{dj_i^*}{dT} &= -\frac{4t\beta\left\{\left[\alpha - c_A(1+T)\right]^2 + 2c_A(1+T)^2\right\}}{\phi\left\{12t\beta(1+T) - \left[\alpha - c_A(1+T)\right]^2\left(1+\tau\right)\right\}} < 0.\end{aligned} \tag{19}$$

The effects of taxing advertising can be summarized as follows:

Proposition 4 *Suppose that the ad valorem tax on ads (T) 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.

Having discussed the newspapers' equilibrium quality levels and profiles, and the effects of taxation, we shall now scrutinize the first-best outcome. As in standard Hotelling models, the socially optimal location of the newspapers is given by $x_i = x^{opt} \equiv 1/4$ (since this minimizes aggregate transportation costs). To find the optimal quality levels, we note from equation (1) that reader utility increases by $\partial U_i/\partial j_i = 1$ units if the quality level of newspaper i increases by one unit. The marginal social benefit of a higher journalistic quality of newspaper i is thus equal to $D_i \partial U_i/\partial j_i = 1/2$. Since the marginal costs of investing in journalism equal $K'(j_i) = \phi j_i$, we consequently have $j_i = j^{opt} \equiv 1/(2\phi)$ in optimum.

To see how the market equilibrium compares to this, it is useful to express the first-order conditions for location and investment in journalism as a function of advertising revenue net of taxes. Recalling from equation (15) that $A_i = \frac{[\alpha - c_A(1+T)]^2}{8\beta(1+T)}$, and skipping subscripts, we can use equations (9) and (10) to write

$$x = -\frac{1}{4} + \frac{A\,(1+\tau)}{2t} \tag{20}$$

and

$$j = \frac{4t}{[12t - 8A\,(1+\tau)]\,(1+\tau)\,\phi}. \tag{21}$$

From a social point of view the size of the advertising market is irrelevant both for the optimal location of the newspapers and for investments in journalism. In market equilibrium, on the other hand, we know from Proposition 1 that the newspapers will locate closer to each other and invest more in journalism the larger the advertising market; $dx/dA > 0$ and $dj/dA > 0$. Not surprisingly, we therefore find $x > x^{opt}$ and $j > j^{opt}$ if the advertising market is sufficiently large.

Let us first find what the size of the advertising market must be for the newspapers to choose the socially optimal locations. Setting $x = x^{opt}$ and solving equation (20) with respect to A, yields that the newspapers have the socially optimal locations if

$$A = A_x(\tau) \equiv \frac{t}{1+\tau}. \tag{22}$$

The function $A_x(\tau)$ is shown by the solid curve in Figure 3.[13] Below this curve the advertising market is so small that the newspapers are excessively differentiated ($x < x^{opt}$), while the opposite is true above the curve.

Setting $j = j^{opt}$ we likewise find that the newspapers have the socially optimal quality levels if

$$A = A_j(\tau) \equiv \frac{t}{1+\tau} - \frac{1-\tau}{2(1+\tau)^2}t. \tag{23}$$

The dashed curve in Figure 3 illustrates $A_j(\tau)$. Below this curve the ad market is so small that the newspapers invest too little in journalism, while investments are excessively high above the curve.

[13] We have set $t = 1$ in this figure.

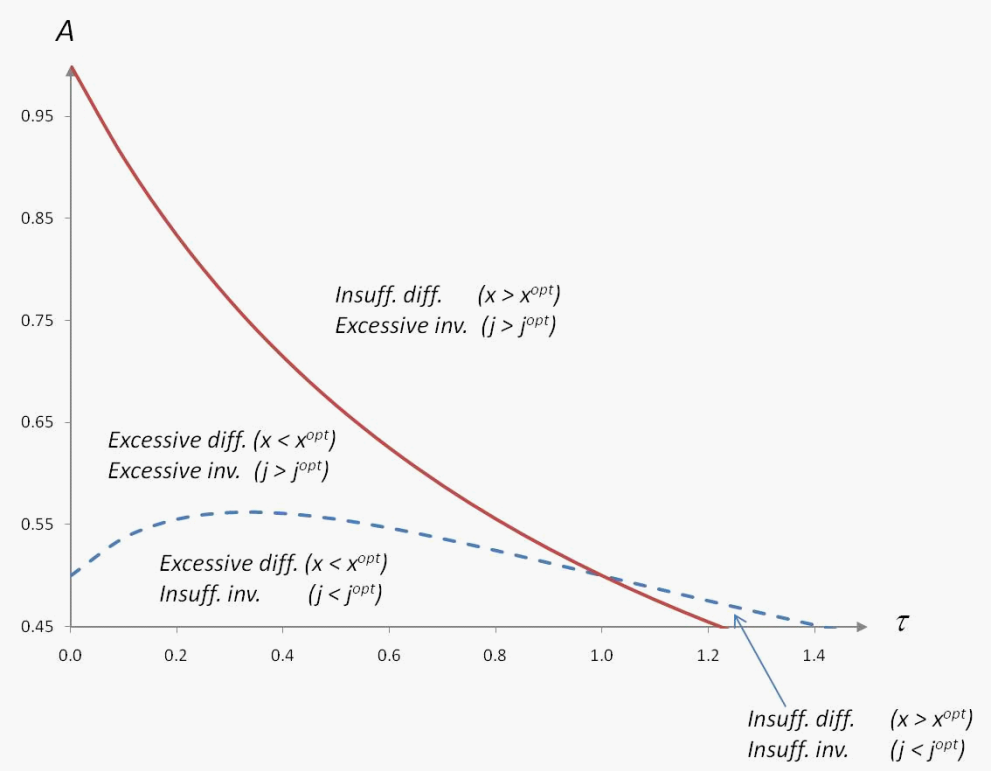

Figure 3: *Advertising market and newspaper taxes.*

In absence of taxes, the newspapers will be insufficiently differentiated if the advertising market is "large". In this case one might expect that the government should optimally set $\tau < 0$. However, this need not be the case. Actually, with our model specifications, a negative VAT on newspaper sales will never be optimal. To see the intuition for this, we may note the following

Lemma 1: *Suppose* $A = A_x(\tau)$, *such that* $x = x^{opt.}$. *In this case* $j = \frac{1}{2\phi}\left(\frac{2}{\tau+1}\right)$.

Recalling that $j^{opt} = 1/(2\phi)$, Lemma 1 says that if the newspapers are optimally located ($x = x^{opt.}$), then they will invest too much in journalism if $\tau < 1$ and too little if $\tau > 1$. Only at $\tau = 1$ will the newspapers have the correct investment incentives. The exact value of τ is of course model specific, but the fact that a positive newspaper tax might be optimal reflects a general point: for any given output, a profit maximizing firm tends to overinvest in quality improvements compared to

the social optimum if it faces strong competition from a close substitute (while the opposite is true if competition is weak, see e.g. Tirole, 1988). Intuitively, the reason for this is that if consumers perceive two products as to be very similar, firms have strong incentives to invest in quality in order to steal customers from each other. To lower the investment incentives, the government might thus impose a tax which reduces the marginal profit of investing.[14]

A necessary condition for the newspapers to make correct investments is thus that $\tau = 1$. We further have:

Proposition 5: *By setting* $\tau = 1$ *and* $T = \left[2t\beta + (\alpha - c_A)\, c_A - 2\sqrt{t\beta\,(\alpha c_A + t\beta)}\right] / c_A^2$ *(with* $T = \frac{\alpha^2}{4\beta t} - 1$ *if* $c_A = 0$*) the government induces the newspapers to choose the socially optimal profiles and investment levels. The optimal tax on advertisements increases with market size.*

Proof: *See Appendix.*

Not surprisingly, we can derive from Proposition 5 that the tax rate on ads should be negative if the ad market is sufficiently small, and that the optimal value of T is increasing in the size of the advertising market.

5 Concluding remarks

Newspapers are based on a two-sided business model where the newspaper creates content that is used to attract readers. The larger the number of readers a newspaper gets 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

[14] The British tabloids' willingness to pay for paparazzi pictures is an indication that newspapers might have too strong incentives to invest in "journalism" to attract readers.

space. By choosing a different profile from its competitor, the firm gains market power and thus earns more revenue from newspaper sales.

Many countries that levy low indirect taxes on newspapers are currently considering whether this policy should be continued. However, the debate typically does not explicitly take into account the fact that newspapers operate in two-sided markets, and that tax policies might work very differently in such markets compared to more traditional markets. Our analysis indicates that there is a strong relationship between the size of the advertising market and the optimal taxation of newspaper sales. If the ad market is large, newspapers tend to be insufficiently differentiated and are likely to make socially excessive investments in order to attract readers. The British tabloids' willingness to pay for paparazzi pictures, for example, may be seen as an indication that newspapers have too strong incentives to cater for the masses. If this is the case, and politicians expect the advertising market to remain strong (after correcting for business cycle effects), it might be unwise to increase taxes on newspapers. If the advertising market becomes significantly smaller, on the other hand, politicians might consider increasing the tax rate on newspapers to avoid excessive differentiation. Lobbyists from the newspaper industry regularly argue that a smaller advertising market calls for low tax rates on newspaper sales in order to avoid unnecessary financial distress for the newspaper industry. Our analysis does not support such a view. First, such a view neglects the importance of balancing revenues from the two sides of the market. Second, it would be highly inefficient to support newspapers in financial distress by giving tax exemption to the whole industry.

Finally, we would also like to stress that media policies need several instruments to achieve several objectives. The present paper illustrates that it might be optimal to tax both newspaper sales and advertising in order to correct for market failures concerning differentiation and investments. However, note that we have not taken into account the possibility that readers may regard ads as a bad (or as a good, for that matter). Neither have we discussed whether newspaper advertising is informative or persuasive. Including such factors in the analysis would clearly affect the optimal tax rates, but would be beyond the scope of the present paper. Instead,

we have pointed out that policy debates which disregard the fact that most printed newspapers operate in two-sided markets might be misleading. More generally, our claim is that the development of theories for two-sided markets underscores the need for more research on media economics, both theoretical and empirical. Also, as competition from the internet, mobile phones and other technologies intensifies, the challenges for media policies are likely to become even more complex.

6 Appendix

Simultaneous pricing and advertising

Suppose that media firms set newspaper prices and ad levels simultaneously. The first-order condition for advertising does not change and is still given by (8). Solving $\partial \pi_i / \partial p_i = 0$ we further find that

$$p_i = \left(c_N - \frac{A_i}{D_i} \right) (1+\tau) + \frac{t\left(1 - x_i - x_{-i}\right)\left(3 + x_i - x_{-i}\right)}{3} + \frac{j_i - j_{-i}}{3}, i = 1, 2. \quad (24)$$

This shows that an increase in A_i/D_i, the equilibrium advertising revenue after taxes per reader, is equivalent to a reduction in newspaper production cost, and will therefore reduce newspaper prices one-for-one. It is well known that the size of the marginal production costs has no effect on firm profitability in standard symmetric Hotelling models. The difference between (6) and this price is equal to $A_i / \left[D_i(1+\tau)\right]$. Accordingly, by inserting for (24) into (5), we find that newspaper profits do not depend on the size of the advertising market:

$$\pi_i = D_i \frac{j_i - j_{-i} + t\left(1 - x_i - x_{-i}\right)\left(3 + x_i - x_{-i}\right)}{1+t}. \; Q.E.D.$$

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

$$\frac{\partial A_i}{\partial D_i} = \left(\frac{\alpha - \beta a_i}{1+T} - c_A \right) a_i. \quad (25)$$

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

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

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

$$\frac{\partial \pi_i^*}{\partial j_i} = \left(\frac{p_1}{1+\tau} - c_N\right)\left(\frac{\partial D_i}{\partial j_i} + \frac{\partial D_i}{\partial p_{-i}}\frac{dp_{-i}}{dj_i}\right) + \frac{\partial A_i}{\partial D_i}\frac{dD_i}{dj_i} - \phi j_i. \tag{26}$$

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 straightforwardly 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

$$\frac{\partial^2 \pi_i}{\partial j_i^2} = -\frac{9t\phi\left(1+\tau\right)\left(1-x_1-x_2\right)-1}{9\left(1+\tau\right)t\left(1-x_1-x_2\right)} < 0, \tag{27}$$

$$0 > \frac{\partial^2 \pi_i}{\partial x_i^2} = -\left\{\frac{\beta t^2\left(5+3x_i-x_{-i}\right)\left(1-x_1-x_2\right)^3\left(1+T\right)}{9t\beta\left(1+\tau\right)\left(1-x_1-x_2\right)^3\left(1+T\right)}\right. \tag{28}$$
$$\left. -\frac{\left(j_i-j_{-i}\right)\left(4\beta\left(1+T\right)\left(j_i-j_{-i}\right) - 3\left(\alpha - c_A\left(1+T\right)\right)^2\left(1+\tau\right)\right)}{36t\beta\left(1+\tau\right)\left(1-x_1-x_2\right)^3\left(1+T\right)}\right\}$$

and

$$\left(\frac{\partial^2\pi_i}{\partial j_i^2}\right)\left(\frac{\partial^2\pi_i}{\partial x_i^2}\right)-\left(\frac{\partial^2\pi_i}{\partial j_i\partial x_i}\right)^2>0 \tag{29}$$

where

$$\left(\frac{\partial^2\pi_i}{\partial j_i\partial x_i}\right)^2=\frac{\left(8\beta\left(1+T\right)\left(\left(j_i-j_{-i}\right)+t\left(1-x_1-x_2\right)^2\right)+3\left(A-c_N\left(1+T\right)\right)^2\left(1+\tau\right)\right)^2}{5184\left(1+\tau\right)^2t^2\left(1-x_1-x_2\right)^4\left(1+T\right)^2\beta^2}. \tag{30}$$

A necessary condition for the second-order conditions to be satisfied is that $\phi > \left[9t\left(1+\tau\right)\left(1-x_1-x_2\right)\right]^{-1}$. Otherwise, the costs of investing in journalism are so low that $\partial^2\pi_i/\partial j_i^2$ is non-negative. Note that a necessary condition for $\partial^2\pi_i/\partial j_i^2$ to be negative, is that $\left(1-x_1-x_2\right)>0$, which in a symmetric equilibrium amounts to $x_i^*<1/2$.

Parameter values Parameter values in Figure 2 and Figure 4: $c_N=0, t=1/2$, $\phi=2$, $c_A=2/5$ and $\beta=1$. In Figure 2 $T=\tau=0$, while $\tau=1$ in Figure 4. Using equations (27) - (30) it can be verified that all second-order conditions are satisfied within the range of α shown in the figures.

Proof of Proposition 5

Solving $A=\frac{\left[\alpha-c_A(1+T)\right]^2}{8\beta(1+T)}=A_x=A_j$ with $\tau=1$ yields the optimal value of T.

Setting $A_x(\tau)=A_j(\tau)$ we immediately find $\tau=1$ (see also Figure 3). Solving $A=\frac{\left[\alpha-c_A(1+T)\right]^2}{8\beta(1+T)}=A_x=t/2$ we arrive at

$$T=\frac{2t\beta+\left(\alpha-c_A\right)c_A-2\sqrt{t\beta\left(\alpha c_A+t\beta\right)}}{c_A^2}$$

with $T=\frac{\alpha^2}{4\beta t}-1$ if $c_A=0$. Differentiation yields

$$\frac{\partial T}{\partial\alpha}=\frac{1}{c_A}\left(1-\frac{t\beta}{\sqrt{t^2\beta^2+t\beta\alpha c_A}}\right)>0,$$
$$\frac{\partial T}{\partial\beta}=-\frac{t}{c_A}\left(\frac{c_A\alpha+2t\beta}{\sqrt{t\beta(c_A\alpha+t\beta)}}-2\right)<0$$

because $c_A\alpha+2t\beta>2\sqrt{t\beta(c_A\alpha+t\beta)}$ is equivalent to $(c_A\alpha+2t\beta)^2-4(t\beta(c_A\alpha+t\beta))=(c_A\alpha)^2>0$, so that T unambiguously increases with the size of the ad market.

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