Public Choice
https://doi.org/10.1007/s11127-017-0496-y

Politics, entertainment and business: a multisided model of media

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Received: 29 March 2017 / Accepted: 22 December 2017

Abstract We offer a model of media as a multisided platform, providing entertainment and news to viewers, commercial opportunities to advertisers, and political influence to politicians, thanks to the presence of influenceable voters among the media audience. We characterize a political economic equilibrium, determining simultaneously media choices and politicians' electoral positions. We show that as the value of political influence increases, the media transitions from catering to commercial advertisers to selling political influence, resulting in policy choices that hurt influenceable voters.

Keywords Media effects · Three-sided platform · Mass media

> People mainly read, watch plays, movies and television, and listen to speeches or the radio because they get some direct satisfaction from it, i.e., they are "entertained." ...Therefore, the information or opinion-changing material is really a by-product, but a very important by-product.
> If the management of the media wishes to push some idea, whether because they are devoted to it or because someone will give them some quid pro quo, they must accept somewhat smaller circulation in return. (Tullock 1967, pp. 83, 97)

1 Introduction

Through a purely economic lens, mass media firms can be conceptualized as two-sided platforms. On the one hand, they provide a flow of entertainment and news to viewers or readers, often at prices that are subsidized by other activities, or even for free, as in the case of broadcast TV. On the other hand, media firms provide, at a price, a platform for

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Published online: 10 January 2018

advertisers, thereby contributing to creating trade opportunities. Because of their role as purveyors of news and commentary, media firms also are bound to have an important influence on public opinion and political behavior. This influence creates the opportunity, and the temptation, for a mutually advantageous relationship with politicians, in which media firms use their clout to favor particular politicians or parties in exchange for favorable regulation of media outlets or their business partners, over or under the table payments, and other forms of compensation. Peddling political influence, however, is not costless for a media firm. At the margin, political peddling may detract from the entertainment value of the firm, lead to a loss of audience, and reduce commercial revenue.

In this paper, we study the problem of a profit-maximizing media firm that exploits its political influence as a three-sided platform. As in the case of broadcast TV, we assume that the firm provides entertainment for free to viewers. The size of the audience is determined by the nuisance created by commercial advertising and political peddling. Citizens' tolerance of nuisance is negatively correlated with wealth, so that viewership is concentrated among the poorer citizens. The media firm also provides, at a price, space to advertisers, who can appropriate some of the gains from trade opportunities with viewers. Potential advertisers differ in terms of the quality of their trading opportunities, so that for any given price set by the firm for commercial ads, the marginal advertiser is determined by the quality of her exchange opportunity and the media's reach. Finally, we assume that the media firm exploits its political clout by conducting an auction to allocate favorable coverage among competing politicians. The amount of peddling by the media firm is a choice variable that increases the value of the firm's favors to politicians, but reduces the firm's audience and thereby other sources of revenue.

The treatment of politics in our model is highly stylized. Two competing politicians are vote-maximizers, and compete in an election by offering policies on the real line. The role of public policy is to set the level of public spending, from which poorer citizens benefit more. Citizens who are active viewers may be influenced by the media firm to vote for the politician favored by the firm, regardless of their policy interests, introducing a possible gap between the median preferences of citizens and the effective median voter. Thus, by virtue of the fact that poorer citizens are a large fraction of the media audience, profit maximization by the media firm may create political distortions, even if neither the firm nor the politicians have policy preferences.

We use the model to illustrate the effect of an increase in political rents available to politicians from the media's allocation decisions through the greater willingness of politicians to pay for the media's political peddling. Starting from an initial scenario in which the main source of revenue for the media is commercial advertisement, the availability of more political rents reduces commercial advertisement, increases political peddling, and reduces the size of the media's audience. When the influence of media on active viewers' political preferences is maximal, the media firm finds itself at a corner in terms of inframarginal political influence. At that point, the implications of changes in political rents are reversed partially—an increase in political rents reduces commercial advertising, but it also expands the media's audience. Intuitively, the media firm reacts now to the politician's greater willingness to pay for influence on viewer-voters by attempting to increase the size of the audience. In the final scenario, the media's main source of revenue is politics, and commercial advertisement takes on a subordinate role.

In a comparative statics exercise, a gradual rise in the media's political role from negligible to overwhelming, can be called the "road to dystopia" as the media is co-opted increasingly as an instrument of social control. The comparative statics exercise illustrates

that that road is consistent with purely profit-maximizing behavior by the media firm and rent-seeking behavior by politicians.

A burgeoning literature exists on the political economy of media. The literature has focused on topics such as the bias of media conglomerates (DellaVigna and Kaplan 2007; Durante et al. 2017; Gentzkow et al. 2011; Groseclose and Milyo 2005), the sources of bias in either reputational incentives or other supply factors (Bernhardt et al. 2008; Gentzkow and Shapiro 2006), in the cognitive limitations of viewers and other demand sources (Duggan and Martinelli 2011; Mullainathan and Shleifer 2005), the importance of media for the control of politicians (Besley and Prat 2006; Leeson 2008) and the importance of media for economic development and institutional change (Coyne and Leeson 2004, 2009). Chan and Stone (2013) show theoretically that media proliferation may help keeping the electorate informed even when citizens engage in selective partisan reading. Evidence of a quid pro quo between politicians and media is reported by Mcmillan and Zoido (2004) as well as Di Tella and Franceschelli (2011). The literature is summarized from different perspectives by Prat and Stromberg (2013) and Gentzkow and Shapiro (2015).

Two sided-markets are the object of attention of a growing body of research in industrial organization, including the influential contributions of Armstrong (2006), Rochet and Tirole (2003, 2006), and Weyl (2010). This literature has focused on the existence of externalities in which agents in one side of the market benefit from the participation of agents or the transactions conducted by agents on the other side of the market. Closer to our work is the model of broadcast media offered by Anderson and Coate (2005); as in their work, we assume that viewers or readers are fully subsidized by the other sides of the market, and that advertisers appropriate the rents created by trade opportunities. We extend their framework to include politics as another side of the media activities and transactions, creating a bridge between the political economy and the industrial organization literatures on media. Such a unified perspective currently is absent, in spite of early remarks by Tullock (1967).

The remainder of this paper is organized as follows. In Sect. 2 we present a political economic model of a monopolist media firm. In Sect. 3 we characterize the profit-maximizing behavior of the media firm. In Sect. 4 we study the comparative statics implications of changes in political rents on commercial advertising and political outcomes. In Sect. 5 we offer concluding remarks and discuss possible extensions and implications for new media (online) platforms.

2 The model

2.1 Citizens, politicians, and media

The agents in the model are a continuum of *citizens* (or *viewers*), a continuum of *advertising firms*, two *politicians* and a single *media firm*.

Each viewer has an idiosyncratic endowment ω_1 of a consumption good, the numeraire; viewers' endowments are distributed according to a function F over the interval $(\underline{\omega}_1, \overline{\omega}_1)$. If an advertiser meets a viewer, the advertiser realizes all the benefits from trade and makes profits equal to ω_2 units of the numeraire.[1]

[1] We do not specify details of the trade between viewers and advertisers as it is not the focus of the current paper; see for instance Anderson and Coate (2005). The assumption that advertisers appropriate all the gains form trade is immaterial. Otherwise, the value of watching the media for viewers has to be amended to include not only an entertainment but also a commercial motive.

The two politicians compete in an election to provide a public good over which citizens have heterogeneous preferences. The preferences of citizens over the quantity of the public good supplied are Euclidean, with single-peaked utilities given by $X(\omega_1) \equiv \alpha - \beta(\omega_1)$ where $\alpha \in \Re$ and $0 < \beta < 1/2$. That is, the public good is an income-inferior good.

The media firm facilitates trade between viewers and advertising firms, and vote-getting by politicians, acting as a monopoly in a three-sided market (see Fig. 1). The media firm: (*i*) offers entertainment for free to viewers, (*ii*) sets a price for commercial ads, which are offered to advertising firms, and (*iii*) sets a political ad space and auctions it off between the two politicians.[2]

In line with the public choice tradition, starting with the work of Tullock (1975, 1980) and Hillman and Samet (1987), we assume that the media firm conducts an all-pay auction, with both politicians providing rents to the firm, and the firm allocating its political influence to the politician that contributes the most. As is well known, in any equilibrium the expected revenue obtained by the auctioneer (in our case, the media firm) is equal to the value of the object for the auction winner (one of the two politicians).[3]

The total ad space sold by the firm, a, is equal to the sum of the mass of advertisers who buy commercial ads, a_c, and the political ad space, a_e. The firm's operating cost is zero, so the firm's payoff is given by its revenue,

$$pa_c + b_1 + b_2,$$

where p is the price of commercial ads, in units of the numeraire, and b_i is the bid submitted by politician i. Note that we treat the market for commercial ads, wherein the media firm faces a large number of small players, differently from the market for political influence, which is a contest between the two politicians.

Watching the media provides viewers with a payoff that is declining in the total ad space sold by the media firm (because of the nuisance aspect of advertising and political peddling) and in their endowments (because media watching is assumed to be an inferior good). In particular, if the total ad space sold is $a \in [0, 1]$, then a viewer's payoff from watching the media, which may be positive or negative, is

$$w(\omega_1, a) = 1 - \lambda\omega_1 - \gamma a,$$

where $0 < \lambda \leq 1/2$ and $\gamma > 0$ are preference parameters.[4]

Trade between a viewer and an advertiser can happen only if the viewer watches the media, i.e., if the viewer becomes an *active* viewer, and the advertiser posts an ad with the media firm, i.e., if the advertiser becomes an *active* advertiser. If the fraction of viewers who are active is v, then the probability that an active advertiser meets a viewer is $v\sigma$, where σ is an idiosyncratic parameter representing the quality of the advertiser, with

[2] In practice, media can both slant the content of news and provide explicit or implicit political propaganda. In terms of the model, what is important in either case is that it yields electoral benefits for politicians and a nuisance for viewers.

[3] The actual format of the auction is not important–since the value of the political space for politicians is common knowledge, and is the same for both politicians, a first prize auction, a second price auction, or simply a posted price would lead to the same results. See Fang (2002) and Bikhchandani et al. (2013).

[4] Our assumption that media's entertainment value is larger for poorer consumers is consistent with evidence that the number of hours spent watching TV is negatively correlated with income; see, e.g., Dooe (2013), who uses US data from the General Social Survey (NORC 2014). Similarly, TV watching in Mexico is concentrated in the lower socioeconomic levels, with the most watched programs being news and soap operas (IBOPE AGB 2009).

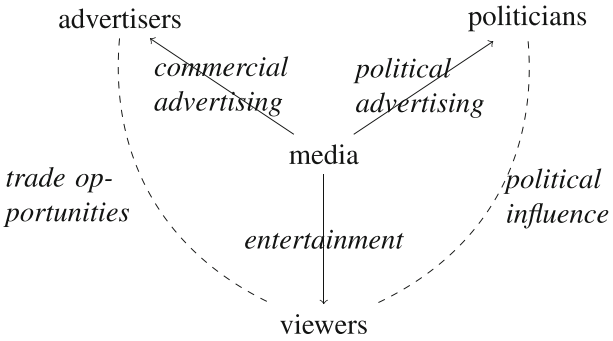

Fig. 1 Media as a three-sided market

distribution G over the interval (0, 1). That is, the effectiveness of posting an ad depends on the media's audience and on idiosyncratic characteristics of the advertiser.

Politicians compete by committing simultaneously to provision levels of the public good. The winner of the election is the politician who obtains most votes, with ties broken randomly. During the election, a fraction of active viewers are swayed to vote for the politician who wins the auction of political ad space. In particular, if the media firm auctions off ad space equal to a_e, a fraction $\min\{\delta a_e, 1\}$ of active viewers vote for the winner of the auction independently of the politicians' proposals. That is, a fraction of active viewers just vote for the politician favored by the media, and the rest vote based on their own preferences. The parameter $\delta > 0$ measures the media's political influence. We refer to citizens who are swayed by political ads as *influenced voters*. Politicians payoffs are given by their electoral reward, which is equal to their share of votes in the election multiplied by r, where $r > 0$, minus their bids.

In sum, payoffs to viewers are given by

$$\omega_1 - |x - X(\omega_1)| + \iota w(\omega_1, a)$$

where $x \in \Re$ is the level of the public good chosen by the election's winner, and ι is an indicator function that takes the value one if the viewer is active and zero otherwise.

Expected payoffs to advertising firms are given by

$$\omega_2 v\sigma - p$$

if the advertising firm becomes active and zero otherwise.

We assume that the viewers' endowment distribution F is strictly increasing, differentiable and log-concave over $(\underline{\omega}_1, \overline{\omega}_1)$, and that the advertisers' quality distribution G is strictly increasing, continuously differentiable and convex over (0, 1). These assumptions guarantee that the equilibrium path of the model is unique. Log concavity of F is a reasonable representation of a declining density of the distribution of wealth. Convexity of G implies convexity of the demand function for commercial advertisement holding active viewership constant.

2.2 Strategies and equilibrium

The media firm, politicians, advertising firms, and citizens play a multistage game, as outlined in Fig. 2. In the first stage of the game, the media firm sets a price p for commercial ad space, and a political ad space a_e to be auctioned. In the ad market stage, advertisers decide whether or not to buy commercial advertising space, while politicians

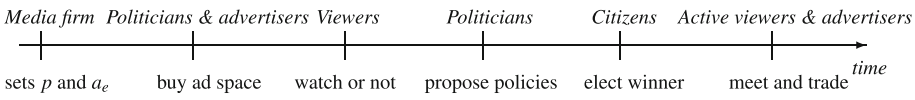

Fig. 2 Timeline

bid for the political ad space. In the viewership stage, citizens decide whether or not to watch or the media. In the electoral competition stage, the two politicians simultaneously propose levels of the public good to citizens. In the voting stage, uninfluenced citizens decide which of the two politicians to vote for, while influenced citizens vote for the politician who won the political ad space auction. After voting, active advertisers and active viewers are randomly matched. Finally, consumption takes place, and payoffs are realized.

Subgame perfect equilibrium for this game is a profile of strategies that induces a Nash equilibrium at every subgame; that is, at every stage, after every possible previous history, players play best responses to other players' actions. Note that at the voting stage, best response behavior does not impose any constraint on the behavior of citizens; since there is a continuum of them, a single citizen never is decisive. As customary in modeling two-candidate elections with a continuum of voters, we require that citizens (who are not influenced): (*i*) vote for the politician whose policy they prefer, and (*ii*) in case of indifference, split their votes exactly between the two candidates. We refer to a subgame perfect equilibrium satisfying (*i*) and (*ii*) as a *political economic equilibrium.*

3 Political economic equilibrium

In this section, we study the equilibrium of the model just described. Note that since citizens anticipate that advertisers will appropriate all gains from trade, the marginal active viewer is given by $w(\omega_1, a) = 0$, or equivalently, $\omega_1 = (1 - \gamma a)/\lambda$, so that the fraction of active viewers in equilibrium is $F((1 - \gamma a)/\lambda)$. The gain from posting an ad for an active advertiser of quality σ is then $\omega_2 \sigma F((1 - \gamma a)/\lambda)$. Note also that the marginal advertiser's quality is $\sigma = G^{-1}(1 - a_c)$. Thus, the marginal willingness to pay for advertising in equilibrium is given by

$$P(a_c, a_e) \equiv \underbrace{\omega_2}_{\text{gains from trade}} \quad \underbrace{G^{-1}(1 - a_c)}_{\text{marginal advertiser quality}} \quad \times \quad \underbrace{F((1 - \gamma(a_e + a_c))/\lambda)}_{\text{fraction of active viewers}}. \tag{1}$$

$P(a_c, a_e)$ is the *inverse demand function* for commercial advertising; it tells us the price set by the media firm if the firm targets a level of commercial advertising equal to a_c, given that the firm has chosen a political ad space equal to a_e. From our assumptions on F and G, the indirect demand P is log concave, and the indirect demand per viewer, $\omega_2 G^{-1}(1 - a_c)$, is concave.

Let

$$\pi(a_c) \equiv a_c G^{-1}(1 - a_c) \tag{2}$$

for $0 \leq a_c \leq 1$. Note that $\omega_2 \pi(a_c)$ is the revenue per viewer $a_c P(a_c, a_e)/F((1 - \gamma a)/\lambda)$ obtained by selling commercial advertisement. From our assumptions on G, π is strictly concave, with $\pi'(0) = 1$ and $\pi'(1) = -1$.

Let us also define

$$C(a_c, a_e) \equiv 1 - \underbrace{\min\{\delta a_e, 1\}}_{\text{media influence}} \times \underbrace{F((1-\gamma(a_c+a_e))/\lambda)}_{\text{fraction of active viewers}} \tag{3}$$

and

$$H(x|a_c, a_e) \equiv \frac{1 - F(X^{-1}(x))}{C(a_c, a_e)}. \tag{4}$$

As shown in the proof of Theorem 1 below, $C(a_c, a_e)$ and $H(x|a_c, a_e)$ are, respectively, the mass of uninfluenced voters and the distribution of their ideal policies regarding public good provision, along the equilibrium path of play in the ensuing subgame after the firm chooses a_e and p satisfying $p = P(a_c, a_e)$. The distribution function $H(x|a_c, a_e)$ has a compact support, so it has a unique median given by $H(x|a_c, a_e) = 1/2$.

We have

Theorem 3.1 *(i) A political economic equilibrium exists. (ii) In the political economic equilibrium, the media firm sets the political ad space at a_e^* and the price for commercial ads at $p^* = P(a_c^*, a_e^*)$, where a_c^* and a_e^* solve*

$$\max_{\substack{a_c \geq 0 \\ 0 \leq a_e \leq 1/\delta}} \{(\underbrace{\omega_2 \pi(a_c)}_{\substack{\text{comercial revenue} \\ \text{per viewer}}} + \underbrace{\delta r a_e}_{\substack{\text{political revenue} \\ \text{per viewer}}}) \times \underbrace{F((1-\gamma(a_c+a_e))/\lambda)}_{\text{fraction of active viewers}}\}.$$

(iii) Along the equilibrium path, both politicians propose the median of the distribution function $H(x|a_c^*, a_e^*)$, and uninfluenced voters split their votes equally between the two politicians.

Proof See the "Appendix". □

Intuitively, in order to maximize profits the media firm needs to keep track of the impact of commercial advertising and political peddling on commercial revenue per viewer, political revenue per viewer, and the fraction of active viewers. We can characterize equilibrium behavior by making use of the first-order conditions associated to the problem of the media firm described in Theorem 3.1 (ii), since the maximand of the problem is log-concave. Let $\overline{a}_c$ be the unique solution to the problem

$$\max_{0 \leq a_c \leq 1} \pi(a_c) \times F((1-\gamma a_c)/\lambda). \tag{M$'$}$$

We denote by $\overline{a}_c$ the target commercial advertisement for the media firm when the firm is unable or unwilling to sell political ads.

Similarly, let $\overline{a}_e$ be the unique solution to the problem

$$\max_{0 \leq a_e \leq 1/\delta} a_e \times F((1-\gamma a_e)/\lambda). \tag{M$''$}$$

Now $\overline{a}_e$ is the optimal amount of political advertisement for the media firm when the firm is unwilling to sell commercial ads. If $\overline{a}_e < 1/\delta$, the media firm is willing to influence the voting behavior of only some active viewers, while if $\overline{a}_e = 1/\delta$, the political influence of the media is strong enough for the media firm to be willing to influence the voting behavior of all active viewers.

It is easy to verify that

$$0 < \min\{\overline{a}_c, \overline{a}_e\}, \quad \overline{a}_c < 1 \quad \text{and} \quad \max\{\overline{a}_c, \overline{a}_e\} < (1 - \lambda\underline{\omega}_1)/\gamma.$$

The first inequality follows from $\pi'(0) = 1$ and the assumption that $\underline{\omega}_1 < 1/\lambda$, so that some viewers are active and the firm makes positive profits if advertising is sufficiently triffling; the second inequality follows from $\pi(1) = 0$, and the third inequality follows from $F(\underline{\omega}_1) = 0$. To avoid dealing with corner solutions such that all viewers are active, we further impose

$$\min\{\overline{a}_c, \overline{a}_e\} > (1 - \lambda\overline{\omega}_1)/\gamma. \tag{A}$$

Under assumption A, $F((1 - \gamma\overline{a}_e)/\lambda) < 1$ and $F((1 - \gamma\overline{a}_c)/\lambda) < 1$.

We show[5]

Theorem 3.2 *If the media engages in both commercial advertising and political peddling, then a_c^* and a_e^* satisfy*

$$\underbrace{\omega_2\pi'(a_c)}_{\substack{\text{marginal comercial}\\ \text{revenue per viewer}}} = \underbrace{(\omega_2\pi(a_c) + \delta r a_e)}_{\substack{\text{revenue per viewer}}} \underbrace{(\gamma/\lambda)D\ln F((1 - \gamma(a_c + a_e))/\lambda)}_{\substack{\text{change in viewership with}\\ \text{respect to marginal increase in ads}}} \leq \underbrace{\delta r}_{\substack{\text{marginal political}\\ \text{revenue per viewer}}},$$

for $a_e^* \leq 1/\delta$, where the inequality in the expression above holds strictly only if $a_e^* = 1/\delta$.

Theorem 2 states that the media firm equates the marginal increase in revenue obtained by selling more commercial advertising per viewer to the marginal reduction in commercial and political revenue owing to the negative effect of commercial advertising on viewership. If political influence is not complete, that is, $a_e^* < 1/\delta$, the media firm also equates marginal commercial revenue to marginal political revenue.

Proof The problem of the firm in Theorem 3.1 can be rewritten as:

$$\max_{\substack{a_c \geq 0\\ 0 \leq a_e \leq 1/\delta}} \ln(\omega_2\pi(a_c) + \delta r a_e) + \ln F((1 - \gamma(a_c + a_e))/\lambda).$$

The Kuhn–Tucker conditions for the problem are

$$\frac{\omega_2\pi'(a_c^*)}{\omega_2\pi(a_c^*) + \delta r a_e^*} \leq (\gamma/\lambda)D\ln F((1 - \gamma(a_c^* + a_e^*))/\lambda) \tag{5}$$

with equality if $a_c^* > 0$, and

$$\frac{\delta r}{\omega_2\pi(a_c^*) + \delta r a_e^*} \geq (\gamma/\lambda)D\ln F((1 - \gamma(a_c^* + a_e^*))/\lambda) \text{ if} \tag{6}$$

$$\frac{\delta r}{\omega_2\pi(a_c^*) + \delta r a_e^*} \leq (\gamma/\lambda)D\ln F((1 - \gamma(a_c^* + a_e^*))/\lambda) \text{ if} \tag{7}$$

The statement of the theorem corresponds to the solution to the system (5)–(7) for the case $a_c^* > 0$, $a_e^* > 0$. □

[5] We use D to denote the differential operator.

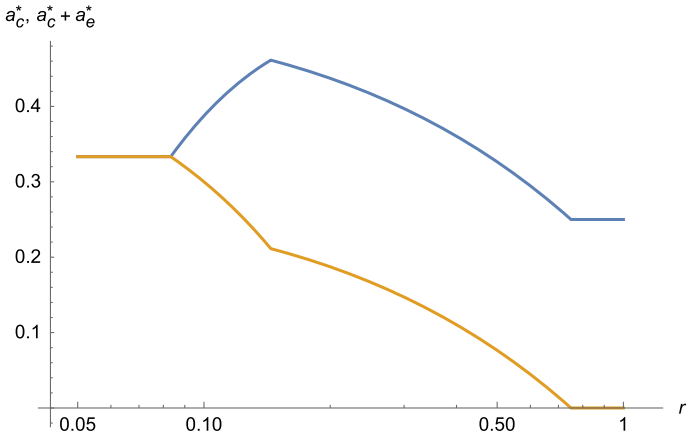

Fig. 3 Commercial advertising and total nuisance for varying political rents

To illustrate Theorem 3.2, we depict in Fig. 3 commercial advertising and total audience nuisance for varying levels of political rents in the context of a calculated example.[6] Commercial advertising is weakly decreasing and political peddling is weakly increasing in the value of rents; viewers's total nuisance is increasing for low values of political rents and decreasing afterwards. As shown in the next section, these are general results.

Assumption A allows a clean characterization of the firm's profit-maximizing decision in terms of marginal conditions. It implies that in equilibrium some viewers are inactive. For instance, if $\overline{a}_e = 1/\delta < (1 - \lambda\overline{\omega}_1)/\gamma$, so that assumption A fails, then for large enough political rents we have an extreme dystopian scenario, in which all viewers are active and politically influenced by media. In that case, political advertising is given by $a_e = 1/\delta$, so as to influence all active viewers, and commercial advertisement is given by the residual

$$a_c = (1 - \lambda\overline{\omega}_1)/\gamma - 1/\delta,$$

so as to keep a full audience for the media firm.

In the extreme dystopian scenario, the media firm's main objective is to control the political behavior of all potential viewers, with commercial revenue being pursued only insofar as it does not reduce the media's audience. Complete indifference of politicians to viewers' actual policy interests is induced by the behavior of the media firm, even if the sole objective of the firm is maximizing profits.

4 Comparative statics

In this section we investigate the effects of varying political rents on the equilibrium behavior of the media and politicians. The effects on the behavior of politicians, in particular, highlight our main message that a media firm may have an important and unintended impact on policy decisions as a by-product of profit maximization. Note that a

[6] For the Figure, we let F be a uniform distribution on $[\underline{\omega}_1, \overline{\omega}_1] = [1, 2]$, let $\omega_2 = 1$, and let G be a standard uniform distribution. We also let the income parameter and the nuisance parameter of the viewers' payoffs be given by $\lambda = \gamma = 1/2$, and the political influence of media be given by $\delta = 4$. We can calculate $\overline{a}_c = 1/3$ and $\overline{a}_e = 1/4$.

reduction in the value of commercial advertising would have the same implications as an increase in political rents, so we can treat the term r as the value of political rents relative to commercial advertising.

We consider first the effects of political rents on equilibrium advertisement. From Theorem 3.2, political advertisements are zero if political rents are small, and completely crowd out commercial advertisement if political rents are large. For the intermediate case, when both commercial and political messages are sent, we can show:

Proposition 4.1 *(i) If $a_c^* > 0$ and $0 < a_e^* < 1/\delta$, then a marginal increase in political rents strictly reduces commercial advertisement, strictly increases political advertisement, and strictly increases total advertisement. (ii) If $a_c^* > 0$ and $a_e^* = 1/\delta$, then a marginal increase in political rents strictly reduces commercial advertisement and total advertisement.*

Proof Theorem 3.1 states that the solution of the media firm's problem is unique for any given value of political rents $r > 0$. We can define with a slight abuse of notation $a_c(r)$, $a_e(r)$, and $a(r)$ to be, respectively, the equilibrium commercial advertisement, electoral advertisement, and total advertisement, as a function of r. We are interested in changes in these variables in response to changes in r.

Let the initial value of political rents be r', and suppose first that $a_c(r') > 0$ and $0 < a_e(r') < 1/\delta$. From Theorem 3.2, for r in a neighborhood of r',

$$\delta r = \omega_2 \pi'(a_c(r)), \tag{8}$$

$$\frac{\omega_2 \pi(a_c(r)) - \delta r a_c(r)}{\delta r} = \frac{1}{(\gamma/\delta) D \ln F((1 - \gamma a(r))/\lambda)} - a(r). \tag{9}$$

Note that $a_c(r)$ is given implicitly by Eq. (8) near r'. Since π is strictly concave, it follows from equation (8) that $a_c(r)$ is a decreasing, continuous and differentiable function. Similarly, $a(r)$ is defined implicitly by Eq. (9) and $a_c(r)$.

We claim that the expression on the left-hand side of Eq. (9) strictly declines with r. To see this, differentiating the denominator of this expression with respect to r we get $(\omega_2 \pi'(a_c) - \delta r) a_c'(r) - \delta a_c(r)$; the claim follows from using Eq. (8). Since the expression on the right-hand side of Eq. (9) is strictly decreasing in $a(r)$, for Eq. (9) to hold, $a(r)$ must be strictly increasing. Since $a_c(r)$ is strictly decreasing, and $a(r)$ is strictly increasing, $a_e(r)$ must be strictly increasing.

Now suppose that $a_c(r') > 0$ and $a_e(r') = 1/\delta$. After an increase in r, $a_e(r)$ remains constant and equal to $1/\delta$. Hence, $a_c(r)$ is given implicitly by

$$\frac{\omega_2 \pi'(a_c(r))}{\omega_2 \pi(a_c(r)) + r} = (\gamma/\lambda) D \ln F((1 - \gamma(a_c(r) + 1/\delta))/\lambda). \tag{10}$$

From concavity of π and log concavity of F, it is simple to verify that an increase in r reduces a_c. □

In case (i) of Proposition 4.1, both political and commercial advertisement are interior solutions, and an increase in political rents increases the price of political advertisement and thus leads the firm to provide more political and less commercial advertisement. In case (ii), political advertisement is at an upper bound, influencing all active viewers to vote for the winner of the auction of political ad space, but the firm can increase the price of political advertisement by reducing commercial advertisement and thus increase the mass of active viewers.

Next we turn to the effect of political rents on politicians' behavior. It can be demonstrated that the incentives for politicians deciding which public goods' policy to propose are shaped by the mass of viewers who are influenced by the media, that is

$$\delta a_e^* F((1-\gamma(a_c^*+a_e^*))/\lambda).$$

From Theorem 3.2, the mass of influenced viewers remains constant after changes in political rents if they are so low that the media firm runs is no political ads, or so large that no commercial ads are run. We can show:

Proposition 4.2 *If $a_c^* > 0$ and $a_e^* > 0$, a marginal increase in political rents strictly increases the mass of influenced viewers.*

Proof As in the proof of Proposition 4.1 (i), the equilibrium choices of political and total advertisement can be written as functions of political rents, $a_e(r)$ and $a(r)$, and are strictly increasing and differentiable.

Let the initial value of political rents be r', and suppose first that $a_c(r') > 0$ and $0 < a_e(r') < 1/\delta$. Differentiating the expression for the mass of viewers influenced by the media with respect to r, and rearranging terms, we find that the mass of influenced viewers increases after a marginal increase in r if

$$a_e'(r)/a'(r) > (\gamma/\delta) D \ln F((1-\gamma(a_c^*+a_e^*))/\lambda) a_e(r).$$

The left-hand side of this inequality is larger than one because political advertisement is increasing but commercial advertisement is decreasing in r. Thus, political advertising is increasing more than total advertisement. With respect to the right hand side, using Eq. (9) we have

$$(\gamma/\delta) D \ln F((1-\gamma a(r))/\lambda) a_e(r) = \frac{\delta r a_e(r)}{\omega_2 \pi(a_c(r)) + \delta r a_e(r)} < 1.$$

Now suppose that $a_c(r') > 0$ and $a_e(r') = 1/\delta$. From Proposition 4.1 (ii), $a_e(r)$ remains constant and $a(r)$ is reduced after a small increase in r, so the mass of influenced viewers increases. □

Lastly, we consider the effect of political rents on the location of the policy proposed by the two candidates in equilibrium, the median of $H(x|a_c^*, a_e^*)$. As in previous cases, we need to consider only the intermediate case in which both political and commercial ads are run. We refer to the *effective median voter* as the viewer whose ideal point is equal to the median of $H(x|a_c^*, a_e^*)$.

Proposition 4.3 *If $a_c^* > 0$ and $a_e^* > 0$, a marginal increase in political rents strictly reduces the equilibrium policy choice.*

Proof See the "Appendix". □

For very low political rents the media firm does not engage in political advertisement, so the effective median voter is given by x^0 satisfying $F(X^{-1}(x^0)) = 1/2$. That is, without political advertising the effective median voter and the median citizen coincide. Proposition 4.3 implies that further increases in political rents strictly reduce the public spending proposals adopted by politicians.

5 Final remarks

We have developed a tractable model of a dominant broadcast media firm, illustrating the conflict between two different objectives of the firm from a profit-maximizing perspective, namely revenue from commercial advertising and rent extraction from political influence.

The political influence of commercial media and its implications for regulation are the object of attention of a growing literature, referred to in the introduction. Prat (2014), in particular, argues that media political power cannot be measured on the basis of market shares for media viewers, and suggests new measures to evaluate the impact of media conglomerates on the attention shares of individual voters. We propose an alternative and complementary perspective, based on the idea that the media's political power is exercised in order to extract rents. The market for political peddling is the market that measures the power of the conglomerate. The economic value of the political power of the media conglomerate may be zero when the nuisance created by peddling suppresses the commercial revenue of the media sufficiently. Otherwise, the economic value of political power is given at the margin by the interaction between the politicians' willingness to pay to attract voters and the number of viewers that can be influenced by the media conglomerate. Given a profit motive for political peddling, a natural measure of political power is the amount of money that politicians transfer to the media conglomerates. That number can easily be calculated when the transfers are advertisements paid for by politicians. However, when the transfers are disguised as regulatory favors that benefit the media conglomerate, measurement becomes more difficult. The event studies literature (MacKinlay 1997) may offer a venue, allowing us to assess how changes in the regulatory framework faced by media firms impact their stock market prices.

The paper is also related with the multisided platform literature referred to in the introduction. As in those models, cross network effects emerge between the different sides of the market. Using the terminology of Weyl (2010), in our model viewers are heterogenous in their values of network membership, with the values being correlated with income. Viewers, however, are homogenous in the (negative) value they assign to interactions with advertisers and politicians. Advertisers, in turn, are homogenous with respect to network membership value, which is zero in the absence of viewers, but are heterogenous in their values of interaction with viewers, with the value being correlated with the quality of the advertiser. Politicians are homogenous both in their value of membership, which is zero in the absence of viewers, and in the value they assign to interaction with viewers. Finally, there no direct interactions arise between politicians and commercial advertisers. The homogeneity of the interaction value for politicians together with the heterogeneity in the interaction value for advertisers imply that competition for space among politicians is stronger than among commercial advertisers. These are, of course, simplifying assumptions; for instance, partisanship can be introduced in the model by allowing advertisers and viewers to be heterogenous in the values they assign to interaction with politicians.

We have left several important topics for further work. One such is the programming decisions of media firms. Programming may shape the viewership, and rent extraction and commercial revenue may point on different directions in terms of the targeted audience for the media. In particular, rent extraction may point in the direction of maximizing electoral impact, which should favor a larger, presumably poorer audience, while commercial revenue may favor catering to relatively more affluent citizens. Of course, one way through which media conglomerates attend to different audiences is by offering different channels;

one insight from a political economic perspective is that such diversified offer may respond not only to purely commercial decisions. Programming is a timely topic to the extent that new media are very effective in tailoring their content to viewers.

For the purpose of the presentation, we have assumed throughout that viewership is concentrated in poorer citizens. This is of course, unnecessary for media to have an impact on policy decisions in the context of the model–all that is necessary is that viewership is not distributed independently of policy preferences. The audience for new media, in particular social media in which the content is partly provided by viewers, is not likely to be concentrated in low income groups. It may be the case that the transition from the old broadcast media to new media as a source of information and entertainment may lead to policy distortions in the opposite direction of that explored in this paper, that is away from the interests of relatively better-off citizens.

Another important topic we have left out is competition between several media firms. Competition and collusion among platforms are challenging topics and the object of attention of ongoing research in industrial organization. The study of media conglomerates from both an industrial organization and a political perspective is, we believe, an exciting area of research and one that can bring about both a better understanding of the economic and political role of media conglomerates–both old and new–in the workings of modern democracies.

Acknowledgements We thank David Levine, Tom Palfrey, Andrea Mattozzi, Stephane Wolton, two anonymous referees, and several seminar audiences for comments and suggestions.

Appendix

Proof of Theorem 3.1 To characterize equilibrium behavior, we proceed backwards from the last stages of the game. Citizens can anticipate a consumption level equal to their initial endowment of good 1, that is ω_1, regardless of whether they are active or inactive, since all the gains from trade are appropriated by advertisers. Given their expected consumption levels, at the voting stage the ideal levels of the public good for citizens are given by $X(\omega_1)$. Given their Euclidian preferences over levels of the public good, in any political economic equilibrium uninfluenced citizens at the voting stage vote for the politician whose proposal is closer to their ideal public good level, splitting their votes exactly in case of indifference, while influenced viewers vote for the winner of the political auction.

At the electoral competition stage, the bid paid by the winner of the political auction is already a sunk cost, so that both politicians seek to maximize their vote shares. Moreover, since influenced voters' behavior is predetermined by the result of the political auction, both politicians seek to maximize their votes among uninfluenced voters. It is simple to check that in equilibrium both politicians offer policies that are medians of the ideal levels of the public good among uninfluenced citizens. This is because, if any politician expects to obtain less than half the votes, then the politician can adopt the policy choice of the other politician and obtain half the votes. In particular, if the median is unique, politicians offer the same policy.

At the watching stage, viewers' optimal behavior and correct expectations about their consumption levels imply that in equilibrium, for any previous history, they watch the media if and only[7] if $1 - \lambda\omega_1 - \gamma a \geq 0$, or equivalently, if and only if

[7] For simplicity, we have viewers and advertisers becoming active whenever they are indifferent. This is without loss of generality, since on the equilibrium path the sets of indifferent viewers and advertisers are zero measure.

$$\omega_1 \leq \frac{1-\gamma a}{\lambda} = \frac{1-\gamma(a_c+a_e)}{\lambda}.$$

The equilibrium fraction of active viewers, then, for any history at the watching stage is given by

$$F((1-\gamma(a_c+a_e))/\lambda).$$

At the ad market stage, advertisers' optimal behavior and correct expectations about decisions of other advertisers and future decisions of viewers imply that in equilibrium, for any choice of a_e and p by the firm, an advertiser becomes active if

$$F((1-\gamma(a_c+a_e))/\lambda)\sigma\omega_2 - p \geq 0,$$

or equivalently if

$$\sigma \geq \frac{p}{\omega_2 F((1-\gamma(a_c+a_e))/\lambda)}.$$

Thus, the equilibrium fraction of active advertisers is given by the solution to

$$a_c = 1 - G\left(\frac{p}{\omega_2 F((1-\gamma(a_c+a_e))/\lambda)}\right).$$

For $a_c > 0$, we can rewrite this expression as

$$p = \omega_2 G^{-1}(1-a_c)F((1-\gamma(a_c+a_e))/\lambda) = P(a_c, a_e). \tag{11}$$

Note that for every $0 \leq a_e < (1-\lambda\underline{\omega}_1)/\gamma$ and every $0 < p \leq \omega_2 F((1-\gamma a_e)/\lambda)$, there is a unique solution $a_c \in [0, (1-\lambda\underline{\omega}_1)/\gamma - a_e)$ to Eq. (11); that is the level of commercial advertising in the unique equilibrium of the subgame following the firm's decision (p, a_e). If the firm sets $p = 0$, all advertisers become active in the ensuing subgame, since they are at least indifferent between buying an ad or not. If the firm sets instead $p \geq \omega_2 F((1-\gamma a_e)/\lambda)$, the level of commercial advertising in the ensuing subgame is zero.

At the ad market stage as well, equilibrium behavior in the auction and correct expectations about decisions of advertisers and future decisions of viewers imply that politicians bid

$$b_1 = b_2 = r\min\{\delta a_e, 1\}F((1-\gamma(a_c+a_e))/\lambda). \tag{12}$$

(This is the value of winning the political auction, when politicians anticipate correctly that regardless of who wins the political auction, they will split equally the votes of non influenced citizens.)

It is easy to see that $p = 0$ cannot be revenue-maximizing. Similarly, choosing any price $p > \omega_2 F((1-\gamma a_e))/\lambda)$ is revenue equivalent to setting $p = \omega_2 F((1-\gamma a_e))/\lambda)$. Thus, we can write the problem of the firm as choosing both political and commercial advertising under the constraint

$$a_c + a_e \leq (1-\lambda\underline{\omega}_1)/\gamma.$$

Since increasing a_e is detrimental for the firm for $a_e \geq 1/\delta$, we can further restrict our attention to

$$a_e \leq 1/\delta.$$

Given the choices of advertisers and viewers along the equilibrium path in the subgame following a firm's choice of a_e and p, it is tedious but straightforward to verify that the distribution of ideal levels of the public good for non influenced voters is given by $H(a_c, a_e)$ if $p = P(a_c, a_e)$.

Using Eqs. (11) and (12) and the objective of the firm, the profit maximization problem for the firm, then, can be written as

$$\max_{a_c, a_e} \{(\overline{\omega}_2 \pi(a_c) + \delta r a_e) \times F((1 - \gamma(a_c + a_e))/\lambda)\} \tag{M}$$

subject to

$$0 \leq a_c \leq 1, \quad 0 \leq a_e \leq 1/\delta \quad \text{and} \quad a_c + a_e \leq (1 - \lambda \underline{\omega}_1)/\gamma.$$

Since the expression for the objective of the firm in (M) is continuous and differentiable, and the choice set for a_c and a_e is compact, a solution for the problem of the firm exists and moreover it satisfies the usual first order conditions.

To show that the solution to problem M is unique, observe that, by assumption B, $\omega_2 \pi(a_c) + \delta r a_e$ is a concave function of a_c and a_e, which in turn implies that it is also a log-concave function of a_c and a_e. Similarly, since F is log-concave, $F((1 - \gamma(a_c + a_e))/\lambda)$ is a log-concave function of a_c and a_e. Since the product of log-concave functions is log-concave, it follows that the objective function in problem M is log-concave as well, and therefore has a unique maximum. To check that $a_c + a_e \leq (1 - \lambda \underline{\omega}_1)/\gamma$ is never binding, note that if the inequality is not strict, the value of the objective function is zero, but the firm can make positive profits by setting a_e and a_c close enough to zero, since by assumption $\underline{\omega}_1 < \lambda$. Similarly, $a_c \leq 1$ is never binding, since the value of the objective function in M can be increased by reducing a_c and increasing a_e pari passu whenever $a_c = 1$, given that $\pi'(1) < 0$ but $\delta r > 0$. Thus, the problem of the firm can be formulated as in part (ii) of the theorem, and it has a unique solution. The remainder of the equilibrium path can be obtained retracing our steps. In particular, substituting $P(a_c^*, a_e^*)$ for p in the ideal points of voters we obtain that the distribution of ideal points is given by $H(x|a_c^*, a_e^*)$, as described by part (iii) of the theorem. By construction, the equilibrium path is unique, as required by part (i) of the theorem. □

Proof of Proposition 4.3 For any pair $x', x'' \in \mathfrak{R}$ such that $x' < x''$, let

$$m(r|x', x'') \equiv (H(x''|a_c(r), a_e(r)) - H(x'|a_c(r), a_e(r)))C(a_c(r), a_e(r)),$$

and for any $x' \in \mathfrak{R}$ let

$$m(r| - \infty, x') \equiv (H(x'|a_c(r), a_e(r))C(a_c(r), a_e(r)),$$
$$m(r|x', +\infty) \equiv (1 - H(x'|a_c(r), a_e(r)))C(a_c(r), a_e(r)),$$

where $a_c(r)$ and $a_e(r)$ are the equilibrium choices of commercial and political advertisement as a function of r. Intuitively, $m(r|x', x'')$ is the measure of the set of uninfluenced voters with ideal points in the interval $(x', x'']$, given that the level of political rents is r. Similarly, $m(r| - \infty, x'')$ and $m(r|x', +\infty)$ are the measure of the sets of uninfluenced voters with ideal points respectively weakly below and strictly above x'.

Let $x(r)$ denote the median of $H(x|a_c(r), a_e(r))$, that is the equilibrium policy choice as a function of political rents. It is easy to see that

$$m(r|-\infty, x(r)) = m(r|x(r), +\infty)$$

and moreover, $x > x(r)$ if and only if

$$m(r|-\infty, x) > m(r|x, +\infty).$$

Now suppose that for the initial value of political rents r' we have $a_c(r') > 0$, $a_e(r') > 0$, and $x(r') < X((1-\gamma a(r'))/\delta)$; that is, in the initial situation the median voter is an inactive viewer. If r'' is larger than but close enough to r', it must be that $x(r'') < X((1-\gamma a(r''))/\delta)$. Thus,

$$m(r''|-\infty, x(r')) = m(r'|-\infty, x(r')),$$

because all citizens with ideal points below $x(r')$ are inactive viewers, whose ideal points are unaffected by changes in advertising. However,

$$\begin{aligned} m(r''|x(r'), +\infty) &= F(X^{-1}(x(r'))) - \delta a_e(r'') F((1-\gamma a(r''))/\lambda) \\ &< F(X^{-1}(x(r'))) - \delta a_e(r') F((1-\gamma a(r'))/\lambda) \\ &= m(r'|x(r'), +\infty). \end{aligned}$$

where the inequality in the second line follows from Proposition 4.2. Hence,

$$m(r''|x(r'), +\infty) < m(r'|x(r'), +\infty) = m(r'|-\infty, x(r')) = m(r''|-\infty, x(r')),$$

so that $x(r') > x(r'')$.

Suppose instead that for the initial value of political rents r' we have $a_c(r') > 0$, $a_e(r') > 0$, and $x(r') > X((1-\gamma a(r'))/\delta)$; that is, in the initial situation the median uninfluenced voter is an active viewer. Note that this implies $a_e(r') < 1/\delta$; otherwise all the active viewers would be influenced. If $r'' > r'$ is larger than but close enough to r', it must be that $x(r'') > X((1-\gamma a(r''))/\delta)$. We can calculate

$$m(r''|x(r'), +\infty) = \frac{1-\delta a_e(r'')}{1-\delta a_e(r')} m(r'|x(r'), +\infty),$$

because all voters with ideal points above $x(r')$ are active viewers, and the fraction of active viewers who are uninfluenced decreases from $1-\delta a_e(r')$ to $1-\delta a_e(r'')$. From Proposition 4.1 (i) we have $a(r'') > a(r')$ implying $X((1-\gamma a(r''))/\delta)) > X((1-\gamma a(r'))/\delta))$. Thus,

$$\begin{aligned} m(r''|-\infty, x(r')) &= m(r''|-\infty, X((1-\gamma a(r'))/\delta)) \\ &\quad + m(r''|X((1-\gamma a(r'))/\delta), X((1-\gamma a(r''))/\delta)) \\ &\quad + m(r''|X((1-\gamma a(r''))/\delta), x(r')) \\ &= m(r'|-\infty, X((1-\gamma a(r'))/\delta)) \\ &\quad + \frac{1}{1-\delta a_e(r')} m(r'|X((1-\gamma a(r'))/\delta), X((1-\gamma a(r''))/\delta)) \\ &\quad + \frac{1-\delta a_e(r'')}{1-\delta a_e(r')} m(r'|X((1-\gamma a(r''))/\delta), x(r')) \\ &> \frac{1-\delta a_e(r'')}{1-\delta a_e(r')} m(r'|-\infty, x(r')). \end{aligned}$$

Hence,

$$m(r''|-\infty, x(r')) > m(r''|x(r'), +\infty),$$

so that $x(r') > x(r'')$. □

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