How to subsidise the news*

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Abstract

A vibrant media sector generates benefits beyond direct consumption values. This paper develops new policy insights from a simple formal framework that distinguishes media output along two dimensions; "soft" attributes have only private consumption value while "hard" attributes generate a consumption externality. First, I demonstrate that all market settings suffer from a softness bias, that is, a bias towards entertaining over informative news reporting. Second, I show how audience-based subsidies and price regulation can mitigate the resulting inefficiency, but cannot prevent the softness bias. Third, I show how approval-based, vote-based and membership-based subsidies (as in the post-war Netherlands) can implement the first-best in simple contexts. Fourth, I characterise the (constrained) first-best and use the results to address recent debates about "ratings-chasing" in public sector broadcasting.

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1 Introduction

Effective democracy depends on a vibrant media sector that allows citizens to cast well-informed votes. This notion, famously proclaimed by the founding fathers of the American constitution, has garnered strong empirical support in recent work by economists and political scientists. The research identifies a positive social externality associated with consumption of informative media (particularly news and analysis, but culture and education may operate similarly). It also indicates how well-funded media can encourage civic participation and help impose accountability on businesses and other unelected actors. The media may create further social benefits through education, norms and contribution to a society's cultural vitality. This notion underlies many of the calls for policies to subsidise the media, but there is little clarity on how best to design such subsidies. This paper develops new policy insights from a simple formal framework that distinguishes media output along two dimensions ("soft" and "hard"). First, I demonstrate that all market settings suffer from a softness bias, that is a bias towards entertaining (e.g., humorous or sensationalist) over informative news reporting. Second, I show how audience-based subsidies and price regulation can mitigate the resulting inefficiency, but cannot prevent the softness bias. I identify the optimal audience-based subsidies for a range of market structures. Third, I show how vote-based subsidies (similar to those that predominated in post-war Netherlands) can implement the first-best in simple contexts. Fourth, I characterise the (constrained) first-best and use the results to address recent debates about "ratings-chasing" in public sector broadcasting (cf., the 2010 MacTaggart speech of the BBC's outgoing director general, Mark Thompson, discussed below).

Informative news certainly has public goods properties (rivalry is certainly very low, fixed costs can be large and excluding access is sometimes difficult) but these problems apply similarly to entertainment. The fundamental issue addressed in this paper is instead that of the positive externalities created by news consumption. Reporting on information relevant to collective decisions, such as a general election, generates substantial positive consumption externalities (see e.g., Stromberg (2004), Besley and Burgess (2006) and Snyder and Stromberg (2011)). Stromberg and Prat (2005) provide a formal political model which demonstrates how this effect can arise. The rough idea is that, on average, I benefit when my fellow citizens become better informed since they are then more likely to vote for an effective politician.[1] Unfortunately, citizens' private choices on what news to consume often overlook this externality. If media firms produced a homogenous good, a simple policy of subsidising news consumption would suffice (as is well-known from the existing economic literature on externalities). However, news media are far from homogenous. News reporting that focusses on entertainment or the provision of information relevant to private decisions generate minimal consumption externalities. Moreover, when media firms choose how much to invest in producing contents with private and social (external) benefits, they have significant control over the relative sizes of these benefits. This multi-dimensional control of media firms presents an interesting policy challenge for two independent reasons.

The simple reason is that consumption constraints may bind and (in the language of Reith's tripartite public service mission) this creates a tradeoff between media investments "to inform and to educate" (on one side) and investments "to entertain" (on the other side). Notably, this tradeoff exists even if advances in the competitiveness of private media markets remove entertainment as a direct objective of public service broadcasters and media regulators. Indeed, competition can worsen matters: increases in the attractiveness of competing commercial media *can* make it optimal for public media to increase their entertainment focus (they engage in a higher degree of so-called "ratings-chasing"). The analysis identifies relevant conditions and, as explained below, shows that the optimal policy response is non-monotic in the attractiveness of competing commercial media.

The deeper problem is that it is, in general, impossible to define objective criteria for measuring the social relevance of news output. It is relatively easy to enforce criteria that distinguish direct sports programming, comedy and drama, from news reporting, but distinguishing the relevance and informativeness of different news topics and presentations is much more subjective. Relying on the subjective judgement of a government agency can be perilous, because the incumbent government has strong incentives to bias the criteria to favour friendly or uncritical media.[2] Creating independent public bodies (such as the BBC Trust) to oversee public service broadcasting can serve to screen out or limit political influence and business lobbying, but insulation is never perfect. When a public agency oversees private firms with regulatory powers and control over discretionary subsidies, there is the additional risk of lobbying and capture by the affected media firms. This paper therefore

[1] See below for empirical evidence on this channel (especially Stromberg 2004a, 2004b, and Snyder and Stromberg, 2010).

[2] Some media may have a pro-government bias and suppress news about political corruption or ineptitude. Other media may simply be poor at investigative journalism.

investigates what is feasible without relying on the neutrality of any public representatives or agency. When all subjective decisions are dispersed among the citizenry, any would-be influencer (political party, pressure group or lobbyist) would have to capture impracticably large numbers of people. For economists, a natural way to disperse decisions is to have outcomes depend only on the aggregate of individual consumption decisions. I refer to these as market or audience-based mechanisms.

I begin by demonstrating that any such market setting suffers from a media "softness" bias - a focus on style over substance (high graphic quality and humourous presenters) and a distortion of topic choice (discussing celebrities rather than political issues). I define "hard" or informative attributes of media as those which generate positive social externalities, while "soft" attributes are those with only private value, such as graphic quality, sensationalism and entertainment). Since individual consumption choices overlook this externality, media firms overproduce entertainment relative to information. This is consistent with the "softness bias" portrayed in Hamilton's (2004) book on the state of news media and a range of research papers on sensationalist and "human interest" biases in specific news topics such as health reporting.

Next I turn to audience-based subsidies. The simplest and most common way to avoid giving discretion to bureaucrats in an agency is to allocate subsidies as a function of audience share; subsidising media consumption works similarly. Audience-based subsidy of media providers faces a simple but fundamental problem. To attract a large audience, each media provider has an incentive to produce content that people find attractive for private consumption. The softness bias arises exactly as in the unsubsidised market just described. This is not to say that audience-based subsidies cannot improve on the situation with no subsidy. So long as at least some citizens place some private value on informative media (a very weak assumption), subsidies can help because they induce media firms to raise quality in the informative dimension. The problem is that audience subsidies also induce higher quality in the entertainment dimension. Some subsidy is optimal, because raising entertainment above the pure market level initially involves only a second-order inefficiency, while increasing informativeness generates a first-order gain. However, the unavoidable softness bias prevents attainment of the first-best. The optimal solution (when restricting to audience-based subsidies) reflects a tradeoff between improved informativeness and excessive entertainment.

Vote-based media subsidies can implement major improvements, indeed achieving the first-best in simple settings. In voting, citizens have an impact on what media is available to others, as well as to themselves. So voting can induce citizens to internalise the consumption externalities that others have on them. In simple settings, I derive vote-based subsidies that achieve the first-best, while audience-based subsidies fail to do so. While audience subsidies always lead media firms to set entertainment and informative qualities in the ratio defined by their private consumption values, carefully designed subsidy voting can lead firms to set these qualities in proportion to their social values.[3]

Notice that people do not need to think explicitly in terms of externalities; citizens can simply vote for the type of media that person believes their community needs. The question of who would bother to vote in practise is also important. For instance, the citizens who tend to care most about informative news are the most likely to vote over the media subsidy, especially if objective restrictions rule out media outputs, such as pure sports content, that are obviously focused on private-value benefits. Finally, I turn to some practical examples that approximate the subsidy mechanisms proposed here. The Dutch case is relatively uncommon for public television (and was overhauled by the 2000 Concession Act) but internet journalism has recently developed related mechanisms.[4]

An additional contribution of the paper is to characterise the first-best. I present the results as a normative analysis of how an ideal public firm (such as a public service broadcaster or PSB) should respond to its environment. The non-monotonicity of the optimal response to shifts in the opportunity cost of media consumption are surprising, but readily understood.[5] The interesting case is that with binding consumption constraints. In addi-

[3]Careful adaptations are required to cope with heterogenous political preferences when the goal is to attract diverse media products. The final section of the paper investigates a range of alternative vote-based schemes that can deal with selective participation and partisanship. The design of vote-based schemes introduces a range of new questions. I consider schemes based on voting over which media firms should receive entry subsidies, broadcasting subsidies, funding for content production, promotions, eligibility for consumption subsidies, among other options.

[4]The principal aim of this paper is to identify optimal institutions (a normative goal); I do not analyse regulatory politics explicitly but I do identify three broad factors that favour feasibility: (a) citizens have greater common interest over the agency's design than they may have over specific subsidy decisions (and in standard political elections); (b) citizens and other interested parties can mobilise at critical junctures (setting up a subsidy institution or changing its rules) at a much higher benefit/cost ratio than is obtained by mobilising to exert pressure on any individual subsidy decision; (c) some interest groups will sometimes be better off with an unbiased media agency and therefore add their support to its creation.

[5]The voting section of this paper is motivated by the need to treat cases where PSBs are relatively untrustworthy and contractual incentives are impossible. Nonetheless, PSBs may be trustworthy (e.g., scholars typically point to PSBs in the UK and Germany as relatively independent of the party in power). The theory of this paper then provides a clear logic for considering public provision, even in the idealised case of perfect competition for the market (or perfect contestability) with no direct costs of setting up

tion to throwing new light on the relationship between competition and media quality, the results help to answer the much-debated question of how to judge the performance of a public broadcasting service such as the BBC. For instance, how *should* the BBC respond to increased softness of news reporting by competing commercial media? How should it react to increased attractiveness or popularity of these competitors? [6]

In his MacTaggart speech of 2010, Mark Thompson, the general director of the BBC complained that: "*Cultural pessimists are always trying to convince us that ... all the BBC and the other UK PSBs care about nowadays is sensation and ratings-chasing.*" He went on to vehemently reject this claim. At the same time, his speech implicitly recognises the tradeoff between reaching a larger audience and offering greater public service quality (such as informativeness); for example, he berates the US model of PSB for taking the "*dry and lifeless view ... that, if there is any role for public intervention on TV and radio at all, it must never ever include programmes which significant numbers of people might actually want to watch or listen to.*" Similarly, he follows Dennis Potter in rejecting the supposed dichotomy between programmes that "*appeal only to a cultural elite*" and programmes that "*bring in the biggest commercial audiences.*" The results of this paper show that whenever consumption constraints bind, there is indeed a tradeoff between setting a softness ratio close to the social (marginal) values ratio and setting the ratio close to the private (marginal) values ratio which is a more efficient way to attract citizens as consumers.

2 Basic Model

I set up a simple model that distinguishes two types of media attribute: one generating only private benefits for the consumer, the other also generating a social benefit when consumed - that is, a consumption externality. The key actors are the citizens, media firms and a media agency.

audience-based subsidies and price regulation.

[6] What exactly constitutes the public interest has long been an issue of debate. Many aspects of this debate are subjective or empirically involved, but I sidestep them by focussing on "dumbing down" or reducing information content from information that is agreed to further a public interest.

2.1 Media firms

N media firms compete for audience and subsidies. Each firm $n \in N$ sets a reporting plan $r_n = (y_n, z_n)$ where y_n and z_n are scalars representing the two news attributes (abusing notation, N denotes the set of firms $\{1, ..., N\}$). Attribute y generates only private consumption benefits. Attribute z generates both private consumption benefits and a public consumption externality. In line with the focal interpretation, I refer to y as the *soft* or *entertainment* attribute and z as the *hard* or *informational* attribute of the news product. Note that the hard attribute z is not hard in the economic sense of verifiability; instead, I use the colloquial and political science meaning of hardness as a measure of information content or informative quality.[7] I therefore define the "softness" ratio of a reporting plan r as $R \equiv \frac{y}{z}$.[8]

In this model, y and z are attributes of a single news product, so citizens cannot consume the y without the z; similar results hold when citizens can consume separately but still choose to consume y and z together. Softness depends on reporting style and also on content choice. So a high softness ratio might represent an emphasis on style over content, as when the media firm invests heavily in attractive news readers, humorous "anchors", high quality graphics and programmers to present a given news content. Alternatively, high softness may represent a predominance of private interest topics over socially relevant ones; e.g., y may capture investments in gathering content that people find exciting, emotional, or titillating, despite low socio-political relevance (as with disaster reporting or celebrity gossip).

It is costly to implement a reporting plan. A media firm n pays reporting costs $k_n(r_n) \equiv k(r_n) \equiv y_n^2 + z_n^2$ when "active" in the market, which I denote by $a_n \in \{0, 1\}$.[9] So firm n's cost is $a_n k(r_n)$. Note that this is a fixed cost, being independent of the number of consumers,

[7] Political scientists refer to news with limited socio-political relevance as "soft news", while classifying informative and politically-relevant news as "hard news"; moreover, any news product has both elements (affected by quality investments). The intensities y and z of soft and hard news attributes refer to this concept and are not to be confused with the hard-soft terminology of Tirole (1986, 1992); in my model, neither the hard nor the soft news attribute is verifiable.

[8] Recall that y can also represent information (information that only generates private benefits) and z could represent uninformative attributes that nonetheless generate social benefits by inducing actions with positive externalities.

[9] If the cheapest way to entertain an audience is to talk exclusively about celebrities and evade serious issues, then the marginal cost of soft quality y is increasing in the hard quality z; more generally, y and z are cost function complements, making them substitute reporting options, in the special case where a firm simply choices which types of stories to include from a news bundle purchased at fixed cost (from say Associated Press, Reuters or Agence Presse). On the other hand, this marginal cost is decreasing if socially relevant news content facilitates the task of entertaining or making people feel good. I make the neutral assumption of independence - namely, that costs associated with y and z are additive separable.

but for simplicity, in much of the analysis, I assume firms pay no sunk costs in creating a plan r before entering the market. This assumption facilitates market contestability - media firms can compete for the market by offering competing plans. It also highlights the fact that the main results are unrelated to theories of natural monopoly.

Media firms earn revenues from up to three sources: advertising fees, audience charges and subsidies from the media agency. Each media firm sets a fixed price p_n per consumer;[10] $p_n \in \mathbb{R}$ since I initially allow negative pricing (understood as consumption inducements).[11] Advertisers pay a fixed per-capita rate α for audience access. So firm n with audience size X_n earns αX_n in advertising revenues. The media agency can pay subsidies to firms or charge them taxes and entry or broadcasting fees. I denote the transfer of funds from the agency to firm n by τ_n; τ_n is positive in the case of a subsidy. Each firm can opt out to guarantee itself a zero profit (a normalisation). In principle, the transfers τ can depend on audience shares, firms' entry decisions, prices and a citizen-wide vote (with V_n denoting firm n's vote share). Critically, τ_n cannot depend on r_n (else the problem would be trivial). Firms are risk-neutral profit-maximisers, so (in the most general case) firm n chooses a reporting plan r_n, its entry decision a_n and pricing p_n to maximise its expectation of

$$\tau_n \left(\mathbf{V}, \mathbf{a}, \mathbf{p}, \mathbf{X}\right) + \left(\alpha + p_n\right) X_n \left(\mathbf{a}, \mathbf{p}\right) - k \left(r_n\right) a_n \tag{1}$$

where $\mathbf{V}, \mathbf{a}, \mathbf{X}$,$\mathbf{p}$ denote the full vector of votes, entry, audience and prices of all the n firms. In the analysis, I begin with the first-best problem where subsidies can depend on all that each firm does $\tau_n \left(r_n, a_n, p_n\right)$; I denote this first-best outcome by a star $(*)$. Then I treat the unregulated market with no subsidy $\tau \equiv 0$ followed by markets with audience-based subsidies (denoted AS) in which τ_n is a continuous function $\tau_n \left(X_n\right)$ of X_n, with and without price and entry regulation Finally, in section 3.5, I treat vote-based subsidies (denoted VS) which can depend on citizen votes over media firms (V_n in favour of firm n) as well as entry, pricing and audience shares.

[10]The main results are obviously robust to price discrimination (in particular individual-based or first degree discrimination, $p_{t,n}$) since they hold for homogeneous citizens. Also linear pricing is not restriction since consumption utility is linear in $x_{t,n}$.

[11]See subsection 4 for a discussion of the interpretation and for analysis of the two main alternative assumptions: i) zero-pricing where media firms cannot charge consumers; ii) nonnegative pricing where (only) negative prices are ruled out.

2.2 Citizens

As just noted, citizens benefit from media consumption in two ways. They gain "private benefits" from their personal consumption and they gain public benefits from society's aggregate consumption. The public benefit is a social externality of consumption - it is shared by all, independent of individual consumption choices. For instance, the media may indirectly benefit all citizens by enabling them to elect more effective politicians. This public benefit is proportional to aggregate consumption of informative news (see below for a formal derivation and a discussion). Each citizen receives this benefit, independent of whether personally contributing by consuming news from an informative firm (i.e., a firm n with $z_n > 0$). So it represents a social externality of consumption.

There is a continuum - of mass 1 - of citizens. Each citizen's gross private benefit from consuming one time unit from an outlet with reporting plan r is given by $B(r) \equiv (1-\lambda)y + \lambda z$ where $\lambda \in [0,1]$ captures the marginal private benefit from the hard or informative attribute z and $1-\lambda$ is the marginal (private) benefit from the soft or entertainment attribute y.[12] Their "taste for softness" (relative to hardness) is defined by the private marginal rate of substitution and equals the ratio $R^P \equiv \frac{1-\lambda}{\lambda}$ of private ("^{P}") marginal values of y and z. The social benefit from media outlet n depends on z_n and n's audience share. Each citizen dedicates at most one unit of time to media consumption and can only consume from active outlets, so the individual consumption vector $\mathbf{x} = (x_n)_{n \in N}$ must satisfy $\sum_{n \in N} x_n \leq 1$ and $x_n \in [0, a_n]$. Private utility (the direct benefit from consumption) is linear (in consumption) and additively separable (across media firms), so x_n gives utility $x_n B(r_n)$ and each citizen weakly optimally consumes from exactly one outlet or none at all; this "single-homing" solution is uniquely optimal except in knife-edge cases (where multiple outlets are maximally attractive and have no fixed access costs). Indexing citizens by t, with cumulative distribution function $F(\cdot)$, outlet n's audience or audience share is $X_n \equiv \int_t x_{t,n} dF(t)$.[13] This audience share X_n of outlet n generates an externality on all citizens equal to $\gamma z_n X_n$ (both in aggregate and per capita, given the unit citizen mass);[14] $\gamma > 0$ represents the size or importance of

[12]Having $\lambda > 0$ is needed for market-based subsidies to be beneficial but is not needed for the vote-based solutions described later. The case with $\lambda > 0$ applies when the hard attribute z generates private consumption benefits; socially-relevant information may also be privately useful, people may find news entertaining and people may value or feel good about becoming well-informed democratic citizens.

[13]This aggregate measure weights by time $x_{t,n}$ spent accessing outlet n but where consumption intensity is not measurable, one can instead interpret $x_{t,n}$ as an access probability.

[14]The externality's linearity in X_n is a simplifying assumption. Prat and Stromberg (2006) provides a formalisation that draws on Stromberg (2004) and justifies the linear case. See also Besley and Burgess

(positive) consumption externalities (I also comment on the no externality benchmark where $\gamma = 0$). As is already implicit, the consumption externality is additively separable across outlets (as is reasonable, even if news companies' topics overlap, because citizens single-home).

Each citizen t has a direct consumption cost $b_{t,n}$ proportional to t's time $x_{t,n}$ consuming at outlet n and an opportunity cost b_t^{opp} of dedicating any time $(\sum_{n \in N} x_{t,n})$ t spends consuming media. Citizen t chooses (subject to availability and the time constraint) to consume from a media firm n that maximises net private benefits (net of direct costs),

$$B_t(r_n) - b_{t,n} - p_n$$

provided these benefits weakly exceed b_t^{opp} (for uniqueness, I assume consumption when indifferent). In general, $B_t(r_n) = (1 - \lambda_t) y_n + \lambda_t z_n$ but I assume λ is independent of t and suppress t. The direct consumption cost can capture a cost of paying attention but also a preference deviation cost (independent of r) as in the Hotelling "transport" cost model of section 5 and the discussion below of ideological citizens. The opportunity cost is helpful for thinking about the effect of an exogenous media alternative.

Citizens share the tax burden implied by media subsidies to firms (via budget balance); the tax burden is negative if the agency instead extracts rents by taxing entry. For simplicity, taxes are nondistortionary, lumpsum and shared equally among citizens.[15] So each citizen pays $\tau = \sum_n \tau_n(\mathbf{V}, \mathbf{a}, \mathbf{p}, \mathbf{X})$. The overall expected utility of a citizen t is

$$u_t(\mathbf{x_t}, \mathbf{v_t}, \mathbf{X}, \mathbf{V}; \mathbf{r}, \mathbf{a}, \mathbf{p}) = b_t^{opp} + \sum_n \left(x_{t,n}\left[B(r_n) - b_{t,n} - b_t^{opp} - p_n\right] + \gamma z_n X_n - \tau_n(\mathbf{V}, \mathbf{a}, \mathbf{p}, \mathbf{X})\right)$$

Opportunity costs are equivalent to outlet-independent direct costs except for a level effect on citizen utility and surplus. So I set $b_t^{opp} = 0$ in the baseline model. Deferring description and analysis of voting to subsection 3.5, the consumer problem is simply:

$$\max_{\mathbf{x_t}} u_t(\mathbf{x_t}, \mathbf{X}; \mathbf{r}, \mathbf{a}, \mathbf{p}) = \sum_n \left(x_{t,n}\left[B(r_n) - b_{t,n} - p_n\right] + \gamma z_n X_n - \tau_n(\mathbf{a}, \mathbf{p}, \mathbf{X})\right)$$

(2006). Further support for the driving force behind these models are provided in recent empirical papers such as Snyder and Stromberg (2011) and Fergusson (2012).

[15] Taxes $\tau_n(\cdot)$ are continuous in audience shares so individual consumption decisions have negligible impact on tax burdens and taxes do not affect the private consumption choice (just described).

This consumer problem is equivalent to consuming from the media outlet that maximises $B(r_n) - b_{t,n} - p_n$ unless the maximised value is negative (where citizen will not consume at all). Emphasising how the main results are orthogonal to monopoly inefficiencies, the benchline model has homogenous citizens and media firms so citizens look for the outlet n maximising $B(r_n) - b - p_n$.

2.3 Media agency

The media agency is the body charged with implementing the media subsidy scheme. Since I restrict to subsidy schemes with verifiable actions and outcomes (as motivated above and in 2.5 below), the agency simply implements whatever subsidy scheme is chosen (technically, it is a mechanism enforcer rather than a player). The analysis addresses the normative challenge of finding schemes that maximise social surplus. For uniqueness, when there are multiple solutions, I select that which minimises citizen taxes and maximises entry.[16] Notice that these normative results are identical to the positive predictions of optimal subsidy design by an agency that wishes to maximise social surplus but is unable to observe media qualities $\mathbf{r}$. Nonetheless, our basic motivation is to avoid agency discretion that might be abused, so this hypothetical quality-blind, benevolent agency is to be understood as representing the coalition of all citizens that sets a subsidy scheme "behind a veil of ignorance", that is, before observing firms' reporting strategies.

2.4 Timing

For many of the results, timing is very simple indeed. The media agency commits ex ante, then media firms enter and consumers decide what to consume. In the general case, the media agency commits to run the subsidy mechanism at the beginning (stage 0). In stage 0.5, media firms can choose to opt out and earn zero profits (they are excluded from operating in the media market). All firms that opt in (accepting the mechanism) then choose their reporting strategies r. Citizens observe these strategies and decide how to vote v. Firms then decide whether to enter (denoted a) - in which case, they activate their reporting policies r. Firms then set their prices p and citizens respond by consuming (x). Finally, transfers

[16]Except for the entry selection (generically irrelevant), the minimum tax selection is equivalent to either introducing an arbitrarily small distortionary cost of taxing citizens, or adopting a normative analysis that only weights citizens' social surplus (neglecting producer surplus).

are paid in accordance with the subsidy scheme (τ). In brief, the firms and citizens play the following game of complete but imperfect information (preferences are common knowledge but in each stage, the actions are independent and simultaneous):

- **Stage 0:** The agency commits to a subsidy mechanism;
- **Stage 0.5:** Firms participate or not;
- **Stage 1:** Firms set reporting strategies $\mathbf{r}$ (n sets $r_n = (y_n, z_n)$);
- **Stage 1.5:** Citizens vote, determining $\mathbf{v}$ and $\mathbf{V}$ (t sets v_t);
- **Stage 2:** Firms enter market or stay out (n sets $a_n \in \{0, 1\}$);
- **Stage 3:** Firms set prices (n sets $p_n \in R$);
- **Stage 4:** Citizens choose media consumption, t sets $x_t \in [0, 1]^N$;
- **Stage 5:** The agency pays out $\tau_n(\mathbf{V}, \mathbf{a}, \mathbf{p}, \mathbf{X})$ to each firm n and extracts taxes τ from each citizen. Advertisers pay αX_n and citizens, in aggregate, pay $p_n X_n$.

All players observe the outcomes of all previous stages before they act so I solve by backward induction for the Subgame Perfect Equilibria. (Stages 0.5 and 1.5 are so numbered, because they can be neglected in the initial analysis: 0.5 has no impact beyond preventing the agency from giving firms less than a zero expected profit; 1.5 is omitted until the analysis of vote-based schemes.)

2.5 Remarks and interpretation

Timing and commitment. The timing should be understood as a reduced-form of an ongoing set of interactions. In particular, reputation is important in enabling firms to commit in stage 1 to a reporting strategy. In addition, firms can select known editors and commit to hiring a journalistic team and assigning a minimal budget. Such commitments complement the reputation concerns and intrinsic motivations of the journalists, editors and firms. In some scenarios, profit motives and advertising interfere with credibility of desirable commitments. It may then make sense to restrict eligibility (for subsidies) to not-for-profit media firms and to restrict advertising of subsidy recipients (a fairly common practise in public sector broadcasting). I mention (but postpone) two modeling adjustments required to capture some of these issues. First, commitments may involve sunk costs; currently, a firm committing to r_n only pays costs $k(r_n)$ if production plans are activated, i.e. if $a_n = 1$. Second, in some cases, reputations may be relatively exogenous - think of a large firm deciding entry into a small media market (under its brandname). In such a scenario, the challenge is for the subsidy scheme to induce entry of more desirable firms. From a design perspective, this would shift the basic problem from one of moral hazard to one of hidden information ("screening"). The main ideas of the paper remain relevant.

The media agency - capture and feasibility. I restrict to verifiable subsidy schemes (i.e., schemes where the subsidy only depends on contractible variables). This serves as a precaution against the risks of political or business capture. Verifiable schemes rule out agency discretion in judging media quality. An agency could otherwise use its discretion to reward media firms that pay it a bribe or distort reporting to favour political powers that manage to capture the agency. Subjective decisions are instead dispersed among the citizenry, forcing any would-be influencer (political party, pressure group or lobbyist) to try and influence impracticably large numbers of people. Objective actions, such as implementing a well-defined subsidy rule, can be left in the hands of a media agency, because an advanced judicial system can reasonably verify and enforce accordance with the objective criteria. [17]

3 The homogeneous case

In this section there is one type of firm and one type of citizen/consumer.

[17] The paper focusses on the normative issue of identifying optimal rules satisfying these restrictions, but I briefly discuss how a society might set up a media agency and negotiate reasonable subsidy rules. First, citizens could organise to negotiate a set of rules that are subsequently hard to change (e.g., requiring a supermajority or unanimity). Applying the "veil of ignorance" argument, citizens might more readily negotiate these rules before they observe the relevant media firms and possibly start to develop divergent subjective opinions. In fact, even if subjective conflict remains limited throughout, setting up the rules in advance is important for two reasons. First, this enables citizens to commit to appropriate rewards for quality investments by media firms (see below). Second, the paper identifies clear and objective subsidy rules that define unique regulatory/subsidy actions as a function of a pre-specified set of objective outcomes. These objective outcomes may include choices of citizens (what to consume or how to vote within the subsidy rules). Such choices depend on personal subjectivities, but the outcomes are always well-defined (independent of whether citizens agree or disagree). So the transaction costs involved in implementing the rules (each time media firms are evaluated) are minimal compared to the transactions costs involved in setting up a plan from scratch (which is additionally thwarted by agenda-setting and other conflicts).

3.1 First-Best

This section derives the first-best in the baseline model. The main result is that the hard and soft attributes of reporting should be in the same ratio as their marginal social values. I also characterize optimal entry as a threshold on the direct consumption costs b, denoted $\hat{b}^*$, below which entry is optimal. The cutoff $\hat{b}^*$ is equal to the gross social surplus and is proportional to the sum of squares of social returns on entertainment and news (denoted L_γ) plus the value of advertising α.

In the unconstrained first-best, the agency can contract perfectly with firms (over news reporting r, market entry a and prices p) and also with citizens (over their consumption x). I focus on the first-best constrained (only) by non-contractible citizen consumption. Given perfect (i.e., nondistortionary) negative pricing, this constrained first-best is essentially identical to the unconstrained first-best (the consumption incentive compatibility simply reduces the range of optimal prices and transfers), but the constraint may bind if pricing is restricted as shown in section 4.

To maximise social surplus for a given set of active firms, each citizen should consume from any firm that maximises the resulting private and external benefits, $B(r_n) + \gamma z_n$ (the social benefit from t's consumption from multiple firms is additive linear in $\mathbf{x_t}$). By citizen homogeneity, these optimal firms are the same for all citizens. Exactly one such firm (that with lowest cost) should be active because each firm has a fixed cost of production $k(r_n)$. Since firms are also homogenous, I can restrict attention to a single firm and study its optimal reporting strategy r, suppressing index n. If the firm does not enter ($a = 0$), social surplus is zero. Entering without attracting any audience is clearly dominated by non-entry.[18] So consider entry satisfying the consumption constraint, $p \leq B(r) - b$.

By homogeneity, all citizens then consume, so $X = 1$ and citizens' social surplus equals $(B(r) - b - p) + \gamma z - \tau$ while the firm earns profits $(\alpha + p) - k(r) + \tau$. Summing these terms, reporting r should maximise the social surplus:

$$SS = B(r) + \gamma z - b + \alpha - k(r)$$

Recall that $k(r) = y^2 + z^2$ and $B(r) = (1 - \lambda) y + \lambda z$, so the second order conditions are

[18] Social surplus, $SS = -k(r) < 0$ for any $r \neq 0$ and I equate any $r = 0, a > 0$ with non-entry (which is strictly better for any positive fixed cost of entry).

clearly satisfied. The first-order conditions provide the first-best solution:

$$y^* = \frac{1-\lambda}{2}, z^* = \frac{\lambda+\gamma}{2}$$

I denote this by $r^* = (y^*, z^*)$ and emphasise the intuitive result its softness ratio R^* is equal to the ratio R^S of marginal social returns of y and z (for any fixed audience); that is $R^* = R^S = \frac{1-\lambda}{\lambda+\gamma}$. Now r^* generates the optimised social surplus,

$$SS^* = \frac{L_\gamma}{4} + \alpha - b$$

where $L_\gamma \equiv (1-\lambda)^2 + (\lambda+\gamma)^2$ (for future reference, I also define the summed square of private benefits $L \equiv L_0 = (1-\lambda)^2 + \lambda^2$). It is easy to satisfy the consumption constraint by picking any $p \leq \bar{b}^* - b$ where

$$\bar{b}^* \equiv B(r^*) = \frac{(1-\lambda)^2 + \lambda^2 + \lambda\gamma}{2} = \frac{L+\lambda\gamma}{2}$$

is the *gross private benefit* from consuming (one unit of) the first-best media product. Prices and subsidies (or taxes) merely transfer surplus between citizens and firms without affecting social surplus. For uniqueness, I minimise tax on citizens (as explained in 2.3) while giving nonnegative expected profits to the firm (the agency cannot force firms to participate), by minimising the firm subsidy at $\tau = k(r^*) - (\alpha + p)$ and maximising p (subject to consumption compatibility) at $p = p^*(b) \equiv B(r^*) - b$. It only remains to note that entry is optimal ($a^* = 1$ with $r = r^*$) if $b \leq \hat{b}^*$ where

$$\hat{b}^* \equiv \frac{L_\gamma}{4} + \alpha$$

is the *gross (of consumption costs) social surplus* in the first-best; with no entry otherwise ($a^* = 0$). In sum:

Proposition 1. *In the first-best with homogeneity, entry occurs if and only if* $b \leq \hat{b}^* = \frac{L_\gamma}{4} + \alpha$*, and then a single firm enters, offering news with entertainment and information levels,* $y^* = \frac{1-\lambda}{2}$*,* $z^* = \frac{\lambda+\gamma}{2}$*, at a price* $p^* = B(r^*) - b = \frac{L+\lambda\gamma}{2} - b$ *and receiving a subsidy* $\tau^* = k(r^*) - \alpha - p^* = b - \alpha + \frac{\gamma^2 - L}{4}$*. The first-best softness ratio* $R^* = R^S = \frac{1-\lambda}{\lambda+\gamma}$ *and the social surplus is* $SS^* = \hat{b}^* - b$*.*

To anticipate how pricing constraints may lead to divergence of the contrained first-best from this solution, notice also that $p^* \geq 0 \iff b \leq \bar{b}^*$; negative pricing is needed for attaining the unconstrained first-best whenever consumption costs b exceed this gross private benefit, because citizens would then reject free ($p = 0$) consumption of the first-best media output r^*.

3.2 Monopoly

This section analyses what an unregulated monopolist would do. We can restrict attention to a single firm, since the fixed cost of production and citizen homogeneity ensure that a monopolist with many possible firms would activate at most one. There are essentially only two stages, because stages 0, 0.5, 1.5 and 5 are only activated by a media subsidy scheme, and the monopolist controls the stage 1, 2 and 3 (r, a, p) decisions (receiving no interim information). So the monopolist chooses reporting, entry and prices effectively simultaneously, and then consumers decide their consumption response. Throughout the paper, I solve for subgame perfect equilibria (SPE). Starting with the last stage (stage 4), if the firm enters, the unit mass of (homogenous) citizens all consume if reporting quality, weighted by the marginal private values $(1 - \lambda, \lambda)$ to give gross benefit $B(r)$, compensates for the price p and consumption cost b. So aggregate consumption in stage 4 is then $X = 1_{(B(r)-b-p\geq 0)}$ where (throughout the paper) $1_{(\cdot)}$ denotes the indicator function for the event in parenthesis. The resulting monopoly profit is $\pi = (\alpha + p)\, 1_{(B(r)-b-p\geq 0)} - k(r)$; $\tau = 0$ (no subsidies here). So the monopolist either stays out or enters with r and p chosen to maximise $\alpha + p - k(r)$ subject to the consumption constraint $B(r) - b - p \geq 0$. This constraint clearly binds: the monopolist raises p to equal the net (private) consumption benefits, $p = B(r) - b$. Citizens *do* nonetheless gain a surplus from the externality γz because the monopolist cannot extract this surplus. Substituting for p, the monopolist solves $\max_r (\alpha + B(r) - b - k(r))$. Again the second-order conditions are clearly satisfied. The first-order conditions imply $r = \left(\frac{1-\lambda}{2}, \frac{\lambda}{2}\right)$ which gives profits $\pi = \frac{L}{4} + \alpha - b$, zero surplus from direct consumption and an externality surplus from consumption of $\frac{\gamma\lambda}{2}$. Notice at once that the monopolist sets a softness ratio $R = \frac{1-\lambda}{\lambda}$ which is precisely the ratio R^P of marginal private returns from y and z (as defined above in 2.2). Immediately revealing that $R > R^*$.

There is a close parallel with the first-best, by simply neglecting the externality γ. First, $z = \frac{\lambda}{2} < z^* = \frac{\lambda+\gamma}{2}$: the monopolist invests in less hard information because unable to appropriate its external benefits; meanwhile, investment in the soft attribute y is exactly as in the first-best (on account of perfect payoff separability). This explains the excessive softness ratio $R^P < R^*$ just noted. Second, entry occurs for b below the cut-off

$$\hat{b} \equiv \frac{L}{4} + \alpha$$

which is lower than the first-best cut-off $\hat{b}^*$ $(L - L_\gamma = \lambda^2 - (\lambda + \gamma)^2 < 0, \forall \lambda \geq 0, \gamma > 0)$. The monopolist enters less readily, indeed too unwillingly from a social perspective, again because the monopolist does not internalise its positive externality. Third, price equals $\bar{b} - b$ where $\bar{b} \equiv B\left(\frac{1-\lambda}{2}, \frac{\lambda}{2}\right) = \frac{L}{2}$ which is weakly lower than in the first-best with $\bar{b}^* = \frac{L+\gamma\lambda}{2}$ (strictly lower if $\lambda > 0$ as well as $\gamma > 0$).[19]

Proposition 2. *The monopolist enters ($a = 1$) if $b \leq \hat{b} = \frac{L}{4} + \alpha$, in which case it sets $r = \left(\frac{1-\lambda}{2}, \frac{\lambda}{2}\right)$ and $p = \frac{L}{2} - b$, extracting the private consumer surplus $B(r) = \frac{L}{2}$. The monopoly softness ratio equals the ratio R^P of private marginal returns, $R^P \equiv \frac{1-\lambda}{\lambda}$. So the monopolist sets softness ratio exceeding that of the first-best, $R^P > R^*$ for all $\gamma > 0$. The social surplus is $SS = \hat{b} - b + \frac{\gamma\lambda}{2} = \frac{L+2\gamma\lambda}{4} + \alpha$.*

Far from a figment of the monopoly case, the main result – the excessive softness $R = R^P$ – holds more generally in any market setting (as verified shortly). Indeed, the monopolist perfectly extracts the full private consumer surplus (price discrimination is not an issue because citizens are homogeneous). If entry occurs in monopoly as well as in the first-best, the social surplus is lower by one quarter of $L + 2\gamma\lambda - L_\gamma = -\gamma^2 < 0, \forall \gamma > 0$. Note that this is smaller than the difference in entry cut-offs, because the monopolist is obliged to create a positive externality on entering $(\frac{\gamma\lambda}{2})$. This social externality of entry provides a clear role for regulators in a monopoly market to subsidise monopoly entry, seeking to induce entry for any $b \in (\hat{b}, \hat{b} + \frac{\gamma\lambda}{2})$, as I prove next.

3.3 Audience subsidies and price regulation (monopoly)

3.3.1 Audience subsidy (AS) with a monopoly firm

An audience subsidy has τ dependent on X (as shown later, consumption subsidies work equivalently). This can give the monopolist a stronger incentive to attract an audience and greater profits from entry. Absent price regulation, such subsidies cannot influence the

[19] The low price intuitively follows from the low quality (in the hard attribute), but reversing this causal link, subsections 3.3.3 and 3.3.2 identify a role for lower bound price regulation to improve quality levels.

monopolist's reporting qualities on entry, but they can serve to induce entry where otherwise the market would be empty.

As before, the stage 4 consumption decisions yield $X(r, a, p) = a \cdot X(r, p)$ where I define $X(r, p) \equiv 1_{(B(r) \geq b+p)}$. If entering, the monopolist sets r and p to maximise expected profit

$$\tau(X(r, p)) + (\alpha + p) X(r, p) - k(r)$$

As before, the monopolist would never enter without satisfying the consumption constraint $B(r) \geq b + p$ given $\tau(0) \leq 0$ (which is optimal since entry without consumption has no social value).[20] So I restrict attention to $a = X(r, p) = 1$ and the expected profit from entry becomes $\tau(1) + \alpha + p - k(r)$.[21] The optimisation over r, p is exactly as before. The monopolist continues to set $r = (1 - \lambda, \lambda)$ and $p = \frac{L}{2} - b$. The only difference is that the entry constraint is relaxed by the added reward $\tau(1)$.[22]

So entry now occurs for all $b \leq \hat{b} + \tau(1)$. As already hinted in the previous subsection, an optimal audience subsidy for social surplus (without minimising tax transfers) is $\tau(1) = \frac{\gamma\lambda}{2}$ since entry then occurs exactly when the social surplus is (weakly) positive. Now to minimise tax costs, as was done in the first-best, merely requires setting $\tau(1) = k(r) - \alpha - p = \frac{L}{4} - \alpha - \left(\frac{L}{2} - b\right) = b - \alpha - \frac{L}{4}$, subject to a ceiling of $\frac{\gamma\lambda}{2}$.[23] This yields $\hat{b}^{AS} = \alpha + \frac{L+2\gamma\lambda}{4}$ which lies strictly above $\hat{b}$ and strictly below $\hat{b}^*$. The latter inequality reflects the fact that entry is less valuable than in the first-best owing to the impossibility of inducing first-best reporting with only audience subsidies (and entry subsidies add no power either). While the softness bias ($R^{AS} = R^P$) is highly robust, the fact that such subsidies cannot affect reporting at all ($r^{AS} = (1 - \lambda, \lambda)$ as before, is not a robust result, as shown next.

3.3.2 Audience subsidy and price regulation (ASPR)

With price regulation, the agency can impose any price p at the same time as subsidising entry. The arguments of the previous subsection continue to hold but adapted slightly as

[20] Allowing the subsidy τ to also depend on entry directly would allow the agency to induce monopolist entry without a full audience, but this is clearly suboptimal.

[21] When entry is advantageous, full entry is optimal; setting a linear subsidy $\tau(X) = \tau \cdot X$ optimally avoids the risk of partial entry (a nonlinear subsidy $\tau(X) = 0$ for all $X < 1$ would work equally well but be less robust in settings with random effects).

[22] It might seem feasible to induce entry by setting $\tau(0) < 0$ but the monopolist could refuse to participate in the subsidy scheme and not enter, so the entry constraint is relaxed by $\tau(1)$ and not by $\tau(1) - \tau(0)$.

[23] Notice that this subsidy can be negative. This represents a tax on audience share. More plausibly, the agency could charge a fixed license fee to operate in the media market independent of X.

follows. First, given any p, if the monopolist chooses to try to attract an audience, it must provide a gross (private) consumer benefit of $b+p$. It will do so at the lowest possible cost by setting $r = r(b+p)$ where I define the function $r(\cdot)$ by $r(B) \equiv \frac{B}{L}(1-\lambda, \lambda) = \left(\frac{B(1-\lambda)}{L}, \frac{B\lambda}{L}\right)$ for any $B \geq 0$. Notice that the softness ratio remains stuck at R^P. Nonetheless, it is optimal to raise B above $\bar{b} = \frac{L}{2}$ by obliging a price p above $\bar{b} - b$ that forces the monopolist to raise quality above the unregulated monopoly level; the increase in y has only second order costs, while increasing z has first order benefits. The optimal lower bound on the price is easily shown to be $\frac{L+\gamma\lambda}{2} - b$. This leads to a gross consumption benefit of $\bar{b}^{ASPR} = \frac{L+\gamma\lambda}{2}$ which happens to exactly equal $\bar{b}^*$.[24]

Remark: Price regulation improves matters, not because the monopolist sets too high a price (there is no risk of inefficient price discrimination in the homogeneous case), but rather because imposing a minimal price can force the monopolist to raise quality (which can improve the information externality). This is a novel side-result (quite different to the retail price maintenance result which deals with the problem of competing sellers).

3.3.3 Price regulation without subsidy

Subsidies are sometimes politically infeasible. Is price regulation ever advantageous on its own in this setting? The answer is affirmative so long as α is high enough that entry is still attractive. Unable to pay out subsidies, the agency would not regulate such a high minimal price as in the previous subsection, because it cannot then compensate the monopoly firm for having to enter with lower profits (owing to its less privately efficient reporting strategy). Of course, in theory at least, if α (and/or L) is high enough that the monopolist would pay an entry fee, but the agency cannot charge a license or entry fee, an agency concerned only for citizen social surplus could use price regulation *above* that of the last subsection to extract some of the monopoly rents.

3.4 Competition

This subsection considers the case with multiple firms. The main lesson is that softness bias is a general feature of all market settings. I prove this point in a lemma that holds for general market settings, including settings with audience subsidies. This result is sufficient

[24]To see why, note that $z^{ASPR} < z^*$ because the softness bias makes it optimal to raise z only part of the way up to its first-best level, but $y^{ASPR} > y^*$ and in the quadratic setting the two effects cancel out to give the same gross private benefit.

to motivate the investigation of vote-based subsidies. The remainder, subsection 3.4.2, is less important and the reader may wish to skip it.

Nonetheless, if support or vote-based solutions are excluded, one might wish to know the impact of competition on second-best options. I focus on the most competitive SPE where firms compete away all the rents (by raising quality). Indeed, competing firms set higher quality in both entertainment and news than does a monopoly firm. On the other hand, the criterion for entry is the same as for a monopolist, so there may still be a role for subsidy to raise entry.

3.4.1 General result

I first derive the general result that reporting strategies always have softness ratio $R = R^P$. This holds in any market environment, even one with market-based subsidies and price regulation. Reporting by any firm n is then characterised by a single parameter - I use the gross consumption benefit $B_n \equiv B(r_n)$.

The defining feature of a market environment, with or without market-based subsidies and regulations, is that consumers make their consumption decisions privately. As a result, the set of firms' offers, $B(r_n)$ and p_n are sufficient statistics for determining each firm's audience share. These audience shares X_n (together with prices p_n and the exogenous rate of advertising α) are in turn sufficient for determining each firm's sales and advertising revenues and any market-based transfers. So each firms' revenues depend on reporting strategies r only via their implied gross consumer benefit $B(r)$; for a given set of active firms (so costs $k(r_n)$ are sunk), r can affect pricing equilibria but only via the set of firms' gross consumer benefits $B(r_n)$. It follows that in any fixed-entry equilibrium, each firm minimises the cost of providing some value $B(r) = B$. In the preceding entry stage equilibrium, each firm's reporting plan r only affects entry equilibria via implied firm costs $k(r)$ and consumer benefits $B(r)$; moreover, reducing its costs directly benefits any firm that ever enters and strategically benefits that firm by dissuading entry of other firms. So each firm optimally minimises its cost for any given $B(r)$ it may use in subgame perfect equilibrium. Now to minimise the cost of providing $B(r) = B_n$, each firm sets $r_n = r(B_n)$ where the "cost-minimising reporting" function $r(\cdot)$ is the map from $\mathbb{R}_+$ into $\mathbb{R}^2_+$ given by:

$$r(B) \equiv \min_{r:B(r)=B} k(r) = \frac{B}{L}(1-\lambda, \lambda)$$

Notice in particular that $R = R^P$ and the monopoly result of the previous section is just the special case with $B = \frac{L}{2}$, while the subsidised *and* price-regulated monopolist optimally was induced to set $B = \frac{L+\gamma\lambda}{2}$. This result applies to all the market extensions of the model with heterogenous citizens and multiple firms, where citizens nonetheless retain the constant marginal rate of substitution of soft for hard news equal to R^P. I record the result as a Lemma:

Lemma 1. *In market environments with purely audience and price -based regulation and subsidies, firms optimally set their reporting in the ratio* $R \equiv \frac{y}{z} = R^P$*, so that each firm* n *sets* $r_n = r(B_n) = \frac{B_n}{L}(1-\lambda, \lambda)$ *for some* $B_n \geq 0$*; firm* n*'s cost is then* $k(r(B_n)) = \frac{B_n^2}{L}$.

3.4.2 Specific competitive outcomes

Returning now to the specific competitive setting in hand, despite the fixed costs of production, competition "for the market" can be intense with identical citizens even when there are just two firms. So it suffices to consider the duopoly case. I denote the two firms $n = 1, 2$ and characterise their reporting strategies by their simultaneous choices of B_1 and B_2 in stage 1. The firms then choose entry simultaneously in stage 2 and they choose prices (again simultaneously) in stage 3. After this, citizens choose consumption. Solving backwards for subgame perfect equilibria, SPE, citizens consume from the firm offering the best deal: firm 2 if $\Delta B - \Delta p > 0$ (where $\Delta B \equiv B_2 - B_1$, etc.), firm 1 if the converse holds, and either firm if instead $\Delta B - \Delta p = 0$.

Intense competition is a reasonable prediction, because when the firms differ in quality, $\Delta B > 0$ say, the high quality firm can outcompete the low quality one *whenever* both firms enter; concretely, in the unique SPE of the full entry subgame, Bertrand price competition drives price down to the lowest price the low quality firm can afford, namely $p_1 = -\alpha$ (thanks to the advertising), and the high quality firm best responds with the price $p_2 = \Delta B - \alpha$, just attracting all citizens ($X_1 = 0$, $X_2 = 1$); this changes slightly if $B_1 + \alpha < b$ because then firm 1 cannot attract consumers even at $p_1 = -\alpha$ and firm 2 would simply act as a monopolist. Anticipating this, firm 1 would stay out (to avoid the negative profit, $-k(r_1)$) if expecting firm 2 to enter. So long as B_2 is low enough for firm 2's monopoly profit to be positive, firm 2 gains from entry if expecting firm 1 to stay out. The condition is $\underline{B}(b) \leq B_2 \leq \bar{B}(b)$ where $\bar{B}(b)$ and $\underline{B}(b)$ denote respectively the maximal and minimal qualities consistent with a nonnegative monopoly profit:

$$\bar{B}(b) \equiv \sup_B \{B : B - b + \alpha - k(r(B)) \geq 0\} = \frac{L}{2} + \frac{1}{2}\sqrt{L(L + 4(\alpha - b))}$$
$$\underline{B}(b) \equiv \inf_B \{B : B - b + \alpha - k(r(B)) \geq 0\} = \frac{L}{2} - \frac{1}{2}\sqrt{L(L + 4(\alpha - b))}$$

Under this condition, there exists a SPE in which the high quality firm enters and the low quality firm stays out. Unless B_1 is low enough that firm 2 gains a positive duopoly profit,[25] the subgame starting at stage 2 is a coordination game and has a second pure strategy SPE - there only firm 1 enters; see discussion below. Focussing on the more competitive case of SPE in which the more attractive firm enters, it is easy to see that competition drives firm rents to zero. Suppose the highest quality of the two firms is $\underline{B}(b) \leq B < \bar{B}(b)$; both firms setting B below the lower limit is clearly not part of a SPE since either could deviate to some B strictly between the upper and lower limits. If the other firm has lower quality, its profit is zero (nonentry) and it would deviate to a quality just above B which guarantees a positive profit in the continuation subgame where it alone would enter (recall focus on competitive SPE). If both firms have this same quality, at least one gets less than half the monopoly profit at B and could gain by deviating to $B + \varepsilon$ for sufficiently small ε. This gives the result:

Proposition 3. *With two (or more) competing firms, there is no entry unless $b \leq \hat{b}^{comp} = \alpha + \frac{L}{4} = \hat{b}$ as for monopoly. When $b \leq \hat{b}$, in the most competitive subgame perfect equilibria, the two firms competing for the market set identical reporting strategies characterised by $B_1 = B_2 = B^{comp}(b) \equiv \frac{L}{2} + \frac{1}{2}\sqrt{L(L + 4(\alpha - b))}$ and exactly one firm enters, setting the corresponding monopoly price $p = B^{comp}(b) - b$ and earning zero profits.*

This proposition captures the case of a "contestable" markets. This is of course an extreme prediction, but the goal is simply to give examples ranging from monopoly to the most intense competition. Lemma 1 already delivers the main message about market environments. Proposition 3 illustrates how intense quality competition can raise quality beyond the monopoly level: $\bar{B}(b) > \frac{L}{2}\ \forall b < \hat{b}$.

[25]The high quality firm's continuation profit after both firms enter is ΔB and its overall profit is $\Delta B - k(r(B_2))$; this is monotonic decreasing in B_1, negative for B_1 sufficiently close to $B(b)$ but nonnegative at $B_1 = 0$ (indeed positive for all sufficiently small B_1 if $B_2 \in (\underline{B}(b), \bar{B}(b))$).

3.5 Vote-based subsidies (VS)

This subsection shows how vote-based subsidies can implement the first-best in the homogeneous citizen environment. In brief, citizens decide collectively whether to subsidise entry of a media firm after observing its proposed reporting qualities and prices. Each citizen's vote affects the media output available to others and hence those others' consumption. So they jointly determine their mutual externalities (the social benefits from news consumption) as well as their direct gains from consumption (the private benefits). Each citizen can vote independently of private consumption behavior (though private consumption alternatives do depend on the aggregate vote outcome). So the vote choice places a balanced consideration on the private and social benefits of consumption. Given homogeneity, citizens naturally pick what is best for them as a group (see 5 below for solutions with heterogeneity). The challenge is to give media firms an incentive to set socially optimal reporting qualities, avoiding holding up media sunk costs. The vote-based subsidy must credibly commit citizens to reward desirable reporting.

I begin by deriving/describing a simple subsidy scheme that works, even in the case with a single media firm. The agency commits to a subsidy scheme in stage 0. This is a set of rules that determines whether the firm enters the market, what price it sets and the transfer from citizens to the firm, all as a function of citizen voting. Market entry and pricing outcomes are verifiable (for any reporting strategy proposed by the firm). So the subsidy scheme can determine the firm's price p, entry decision a and net transfer τ as a function of citizen voting.[26]

The basic idea is that citizens report (in stage 2) on the firm's media reporting plan r (observed by all citizens once proposed in stage 1) and these reports are used to reward the firm if it sets the desired quality levels. Citizens naturally seek to minimize their tax obligation τ unless they get something in return. That something is the availability of the media firm's reporting proposal r (captured here by the market entry variable, a). So favourable evaluations of r lead to rewards for the firm (a higher subsidy τ) and, compensating the raised citizen taxes τ, a higher probability of media entry. I now demonstrate the scheme with concrete details. I begin with the rules and move quickly to the timing for the vot-

[26]The agency induces entry or non-entry via a sufficiently high or low net entry-contingent transfer (the agency pays an entry subsidy if this net transfer is positive and charges a license fee for entry if it is negative). This transfer can be set as a function of the audience vote held prior to the firm's entry decision. So the agency can essentially determine entry as a function of voting.

ing setting. The rules are that the firm must enter with probability $a(V)$ and will receive $\tau(V, a, X)$.

- **Stage 0:** The agency commits to a subsidy mechanism.
- **Stage 0.5:** The firm participates or not.
- **Stage 1:** The firm sets $r = (y, z)$.
- **Stage 1.5:** Citizens vote; t sets v_t $(V = \int_0^1 v_t dF(t))$.
- **Stage 2:** The firm enters with probability $a(V)$.
- **Stage 3:** The firm sets its price p.
- **Stage 4:** Citizens consume; t sets $x_t \in [0, 1]^N$.
- **Stage 5:** The agency transfers τ(V,a,X) from citizens to the firm.

Each citizen simply votes for or against the media firm and the aggregate vote determines the media subsidy (plus its mirror image, the citizen tax obligation) and the entry (or availability) a of the media firm. Citizen t sets $v_t \in \{0, 1\}$ with $v_t = 1$ representing a favourable ("for"/affirmative) vote; the firm's aggregate vote share is $V \equiv \int_0^1 v_t dt$. For a continuous (and affine) subsidy scheme, I allow $a \in (0, 1)$ to represent the probability of (induced) entry and I propose the following rules:

- If the firm chooses to participate, it must propose a reporting plan r and, after citizens vote, enter with probability $a(V) = V$ setting its price p equal to $\bar{b}^* - b$, in return for a transfer $\tau(V) = \sigma V - \phi$, where σ is a positive constant and ϕ is a positive up-front participation fee (both determined below).
- A nonparticipating firm is not allowed to enter and receives neither a subsidy nor owes any fee, so $a = \tau = 0$ (which implies profits and citizen surplus equal zero).

Since σ is positive, citizens only vote in favour of a media firm if its reporting quality is sufficiently high. The constant σ represents the tax price citizens have to pay for media availability. Raising σ makes citizens more stringent when evaluating r before voting: citizens vote for the media firm if it provides social benefits at least as high as the price σ (in the equilibrium derived below, the media firm just satisfies this demand so σ will equal the net social benefit from media availability). Each citizen benefits from the availability of a media firm in two ways: directly from net private consumption benefits $B(r) - b - p$ and indirectly from the social externality γz, provided the consumption constraint CC is satisfied, i.e. $B(r) \geq b + p$ (so that $X(r,p) = 1$); if CC is broken, both types of benefit disappear and citizens gain nothing from entry. So, if CC is satisfied, each citizen's total gain from media availability (which also equals the aggregate social benefit) is $B(r) - b - p + \gamma z$. This can be written as the gross social benefit, $GSB(r) = B(r) + \gamma z$, less the consumption costs $b + p$.[27] If the firm sets an r and p for which CC is not satisfied (here any $r : B(r) < \bar{b}^*$), citizens would clearly vote against entry to save paying $\sigma > 0$ for nothing; so the firm would earn $\pi = -\phi$ and would prefer nonparticipation. We therefore look for solutions in which CC is satisfied. Conditional on CC holding (i.e., given any $r : B(r) \geq \bar{b}^*$), each citizen votes for media entry if and only if:

$$\sigma \leq GSB(r) - b - p \tag{2}$$

Anticipating this vote response, the media firm chooses between nonparticipation (earning zero profit), participation and a reporting plan r that leads to nonentry (earning profit $-\phi$) and participation with a reporting plan that wins voter support. As just noted, the first alternative dominates the second. (So the firm would never participate and set a reporting strategy r that illicits rejection by voters.) The third alternative implies a profit of $\sigma - \phi - k(r)$. Since $\sigma - \phi$ is a constant, to optimise this alternative, the firm would set r to minimise $k(r)$ subject to satisfying the (conditional) voter support constraint (2); the additional CC condition for voter support is satisfied as we verify after solving this relaxed problem. Because the (conditional) voter support constraint weighs up the full social benefit (externality plus private benefits) of media entry against the threshold σ, this induces the firm to set the attributes of r in the first-best ratio R^*, i.e., r is proportional to the first-best r^* and has magnitude increasing in σ. Concretely, the firm would set $r = r^*(\sigma + b + p)$ where $r^*(GSB) \equiv \frac{GSB}{L_\gamma}(1 - \lambda, \lambda + \gamma)$. Setting $\sigma = \frac{L_\gamma}{2} - b - p$ induces the firm to set $r = r^*$. The consumption constraint CC is indeed satisfied here (weakly), because $B(r^*) = \bar{b}^*$ (recall that the scheme imposes $p = \bar{b}^* - b$).[28] In addition, setting $\phi = \sigma + \alpha + p - k(r^*) = \frac{L_\gamma}{2} - b - k(r^*) = \frac{L_\gamma}{4} + \alpha - b$ guarantees participation without paying rents to the firm. Given $b \leq \hat{b}^*$, this

[27] With heterogeneous citizens, the net social benefit consists of the private benefits $B(r) - b - p$ of those citizens who consume and the (audience-weighted) social externality $\gamma z X(r,p)$)

[28] Imposing a lower price would ensure that CC is satisfied strictly and is compensated perfectly by a corresponding rise in σ. In particular, implementing lower values of r along the ray with ratio R^* would require imposing a lower price but is no problem at all.

optimised fee (ϕ) is indeed nonnegative (the fee equals the firm's expected post-entry profit which equals the full social surplus from media entry at r^* (in equilibrium, citizens' surplus share gross of ϕ is zero since the firm sets r, p to just induce affirmative voting by giving citizens a gross benefit from entry that just covers the price σ).

Proposition 4. *In the homogeneous case, vote-based subsidies can implement the first-based solution with one firm (or more); full subgame perfect implementation can be achieved in an anonymous mechanism.*

- **Anonymity and capture.** Anonymity refers to the fact that all citizens are treated equally and none has significant influence over the outcomes (in the continuum of citizens case, each citizen has negligible power). Given voter homogeneity, it would be possible to implement using just one voter's report on quality r, but this concentrates the discretionary power over subsidy allocation and media selection to that chosen voter. The voter would in effect have the power that we sought to deny from the agency. I avoid this solution, because the voter could be readily influenced by interested parties, just as might the agency. The solution described above shares and therefore diffuses the discretionary power equally among all citizens, minimising the power of any one citizen. This serves to minimise the risk of capture.

- **No need for probabilistic entry.** A range of variants on the above mechanism can also implement the first-best. In particular, suppose randomised entry is not possible. Then a is either 0 or 1. Consider the variant on the above mechanism in which entry is induced only (with $\tau = \sigma - \phi$) when *all* citizens vote for entry, while otherwise the firm does not enter and $\tau = -\phi$. If no citizen plays a weakly dominated strategy, then each votes for entry precisely under the same conditions as described above (because each citizens vote is decisive in exactly one state - that were all other citizens vote for entry). So full implementation is again feasible in subgame perfect equilibrium with a restriction against weakly dominated strategies. Another variant that would work is to have entry and the reward σ paid whenever at least one citizen votes for entry.

  - These solutions are sensitive to error by just one voter, but notice that simply implementing a randomly-selected voter entry choice generates the same results as the above solution without need for any external randomisation device. This "random dictator" solution (which additionally avoids the need to assume citizens avoid weakly dominated strategies) works as follows: each citizen's vote determines entry and subsidy with equal and mutually exclusive probabilities; best-described for a finite number of citizens T, each citizen is then decisive with probability $\frac{1}{T}$. So long as the citizen is chosen at random after "voting", there is no increase in the risk of capture.

  – To choose among these variants in practical situations requires further research. The different ways in which the vote mechanism aggregates individual information affect sensitivity to noise in citizens' observations of reporting quality r and the risks of bad equilibria. Also the mechanism can be adapted to provide better incentives for information-gathering and voting where costly. Competition among multiple media outlets is valuable for a range of reasons not captured in the simplistic model described so far (see further discussion below).

- **Restricted entry.** Is it necessary to block entry? In order to extract monopoly rents (to raise citizen surplus), it is of course valuable to be able to charge a license fee for entry, but is it fundamental to the vote-based solution? In the current model, it is crucial that entry and subsidy be tied to affirmative voting. If the media firm would enter the market even when voting is negative, then citizens would always vote negatively in order to save on paying for subsidies σ to the firm.

- **Do we need price restriction?** So far, I have presented a subsidy scheme that imposes a price p on the firm. This simplifies the analysis, but it is **only** necessary in the special case where the first-best involves a negative price so low that the monopolist makes negative revenues (i.e., $p^* < -\alpha$). The monopolist knows that citizens will only vote for entry if the social surplus of citizens is as high as the control variable σ. So prior to citizen voting, the monopolist has a very strong incentive to commit to set a price low enough to ensure consumption (otherwise there is no hope of a favourable vote). The concern that the monopolist sets too low a price (see the subsections on regulated price monopoly, (3.3.2) and (3.3.3)) is also unfounded, because now the monopolist has to satisfy a voter support constraint which depends on citizens' social surplus and not just their consumer surplus). The only valid concern is that the monopolist might be unable to commit to set sufficiently low prices *after* the citizens have voted. For any r with $\alpha + B(r) - b \geq 0$, self-commitment is trivial since the monopolist's optimal price *after* a favourable vote is to set $p = B(r) - b$ (recall that r is fixed at this point) because this just induces consumption, extracting the private benefits of consumers and generating an ex post profit of $\pi = \alpha + B(r) - b$. The optimal voting mechanism therefore never needs a price restriction if $\alpha + \bar{b}^* - b \geq 0$. This condition is not guaranteed by the condition $b \leq \hat{b}^*$ (for a nontrivial first-best), because $\hat{b}^* = \alpha + \frac{L\gamma}{4}$ exceeds $\alpha + \bar{b}^*$ whenever $L < \gamma^2$ ($\bar{b}^* = \frac{L+\lambda\gamma}{2}$ and $\frac{L\gamma}{4} - \frac{L+\lambda\gamma}{2} = \frac{\gamma^2 - L}{4}$). Intuitively, when the social externality is large enough, it is worth "paying citizens" to consume. In this case, some form of price commitment is needed and if the monopoly does not have price commitment prior to voting, regulation of prices is necessary for the voting solution to give the first-best. In particular, the scheme presented above would work in exactly the same way if the price restriction were removed (the same price would be implemented), so long as the monopolist can self-commit on pricing or $b \leq \alpha + \bar{b}^*$.

- **$p + \sigma$ is unique but p can be reduced.** The restricted price chosen is not unique. Any price lower than this would work equally well (imposed by the regulator), so long as σ is raised by the amount that p falls: in effect, the net transfer $p + \sigma$ from citizens to the firm is all that matters (both in the vote constraint and in the firm's incentive to participate and seek voter support). So the value of $\sigma + p$ *is unique* and p cannot exceed $p^* \equiv \bar{b}^* - b$.

- Entry and subsidy must be tied to an affirmative voting outcome. This is readily achieved by prohibiting entry after a negative vote, or by making the subsidy contingent on entry (the firm always prefers to enter if the subsidy is contingent on entry).

3.6 The Dutch case

In the Netherlands, from right after the second world war up until the EU's "Television without Frontiers" Directive took effect in 2000, media subsidies were paid to public entities as a function of how many members they had.

3.7 Party Political Broadcasting (The British case)

Party Political Broadcasting rules...time proportional to electoral seats. But no checks and balances. Especially desirable when selecting media : media watchdog.

3.8 The tax credit case

Tax rebate. Choose TV channel to receive funds or a charity. Here we need that the quantity of content produced is increasing in the size of the funds. Specifically, here I suppose that when the firm commits to ratio R, the resulting attribute vector is (Rz, z). This is plausible in the not-for-profit or public organization context.

- **Stage 0:** The agency commits to a subsidy mechanism.
- **Stage 0.5:** The firm participates or not.
- **Stage 1:** The firm sets a commitment to reporting ratio R.
- **Stage 1.5:** Citizens voice their approval; t sets v_t ($V = \int_0^1 v_t dF(t)$).
- **Stage 2:** The firm enters with probability $a(V)$.
- **Stage 3:** The firm sets its price p.
- **Stage 4:** Citizens consume; t sets $x_t \in [0,1]^N$.
- **Stage 5:** The agency transfers τ(V,a,X) from citizens to the firm.

Each citizen simply votes for or against the media firm and the aggregate vote determines the media subsidy (plus its mirror image, the citizen tax obligation) and the entry (or availability) a of the media firm. Citizen t sets $v_t \in \{0,1\}$ with $v_t = 1$ representing a favourable ("for"/affirmative) vote; the firm's aggregate vote share is $V \equiv \int_0^1 v_t dt$. For a continuous (and affine) subsidy scheme, I allow $a \in (0,1)$ to represent the probability of (induced) entry and I propose the following rules:

- If the firm chooses to participate, it must propose a reporting plan r and, after citizens vote, enter with probability $a(V) = V$ setting its price p equal to $\bar{b}^* - b$, in return for a transfer $\tau(V) = \sigma V - \phi$, where σ is a positive constant and ϕ is a positive up-front participation fee (both determined below).

4 Restricted pricing and the ratings debacle

This subsection demonstrates robustness of all the main insights to alternative pricing assumptions. It also derives new results that I apply to the ratings chasing debate in the following subsection. So far, the base model allowed media firms to set negative as well as positive pricing. In principle, two-sided markets can involve negative pricing, because one side - here advertisers - can subsidise media consumption (as can a state). Typically, negative prices are interpreted as valuable coupons or other gifts that citizens can only obtain if they read, watch or listen to (i.e., consume) the media product under consideration. These "negative prices" tend to work imperfectly in two respects: first, the per-capita cost of attracting consumers with a negative price is typically greater than the magnitude of the price (e.g., a gift that costs the media firm one euro per consumer is worth less than a euro to marginal consumers); second, the induced media consumption is typically less intensive. Induced consumers may be fairly receptive to advertisements in the media product but may not dedicate sufficient attention to absorb the media output's informational content. In sum, "negative pricing" involves a distortionary cost. When this cost is high, media firms prefer to attract consumers by raising quality (to raise $B(r)$). I therefore now analyse the case where media firms cannot set negative prices. I denote this NNP for nonnegative pricing. There is one other key pricing environment: that in which media firms are entirely unable to charge for consumption. For instance, citizens may gain free access to media content using an unlicensed TV or radio or through pirate sites or direct hacking (to breach internet paywalls). This can force equilibrium prices to zero.[29] I denote this ZP for zero pricing. This case is appropriate for studying free-to-air television and radio and much of the internet where charging for media consumption has proved very difficult and advertising remains the main source of revenues.[30] For expositional clarity I begin with zero pricing.

4.1 Zero pricing and the constrained first-best

When b is low ($b \leq \bar{b}^*$), $p^* \geq 0$ and it is possible to set $p = 0$, raise τ from τ^* to $\tau^* + p^*$, and replicate all other aspects of the unconstrained first-best described in proposition 1. When

[29] Notice that measuring audiences (aggregate consumption at each media firm) for advertising and subsidy purposes remains feasible, since citizens have no incentive to pay the cost of hiding their consumption once consumer prices are set to zero (or sufficiently low). Of course, media companies can sometimes fool advertisers and subsidisers by manipulating measures of their audience (sales); e.g. newspapers have been caught dumping printed copies or giving away supposedly paid-for copies for free (advertisers place greater value on reaching consumers who pay since paying signals interest in the newspaper, that is, more effective consumption, as well as possibly indicating greater wealth). This problem (largely independent of consumer pricing) is rarely severe, but certainly an issue for the audience-based subsidy approach.

[30] The jury is still out on the success of Rupert Murdoch and News International's recent attempt at charging by putting internet-based media products behind a "pay-wall".

b exceeds this cut-off, $\bar{b}^*$, the consumption constraint is binding. To attract an audience, reporting quality must be increased to raise $B(r)$ to b (there being no point in raising $B(r)$ beyond b). Assuming entry is still optimal, the constrained optimal value of r, which I denote by r^{**}, is given by imposing the binding consumption constraint and solving the first-order conditions for y and z:

$$y^{**} = \frac{(1-\lambda)(2b-\lambda\gamma)}{2L} = \frac{1-\lambda}{2}\left(\frac{2b-\lambda\gamma}{L}\right)$$
$$z^{**} = \frac{2\lambda b+\gamma(1-\lambda)^2}{2L} = \frac{\lambda}{2}\left(\frac{2b-\lambda\gamma}{L}\right)+\frac{\gamma}{2}$$

Since $b > \bar{b}^* = \frac{L+\lambda\gamma}{2}$ here, these expressions reveal that $y^{**} > y^*$ and $z^{**} > z^*$. Recalling $r(B)$ defined above as the cheapest way to add consumption benefits B, this reporting strategy can be expressed as, $r^{**}(b) = r^* + r\left(b - \bar{b}^*\right)$. Notice that the softness ratio is now increased: $R^{**}(b) = \frac{1-\lambda}{\lambda+\gamma\left(\frac{L}{2b-\lambda\gamma}\right)} \in \left(R^*, R^P\right)$ since $\frac{L}{2b-\lambda\gamma} \in (0,1)$ on $b > \bar{b}^*$. This makes sense: when r is increased to solve the audience attraction problem, this is done using the cost-efficient ratio R^P which raises R^{**} above R^* to a degree that increases with $b - \bar{b}^*$. Note that R^{**} never reaches R^P since entry ceases when b reaches a finite cut-off $\hat{b}^{**}$, which is given by substituting for r^{**} in the social surplus expression,

$$SS^{**} = \gamma z - y^2 - z^2 + \alpha = \alpha + \frac{\gamma^2}{4} - \frac{(2b-\lambda\gamma)^2}{4L}$$

Entry is optimal when this is nonnegative, which holds for $b \leq \hat{b}^{**} \equiv \frac{1}{2}\left(\gamma\lambda + \sqrt{(4\alpha+\gamma^2)L}\right)$ – the upper root of $SS^*(b) = 0$. This entry cut-off is less than $\hat{b}^*$ from the full-pricing problem, because the binding consumption constraint obliges reporting distortions that reduce the feasible surplus. There is a non-trivial range of entry here, provided of course, that the consumption constraint ever binds in the unconstrained first-best (because there is only a second-order surplus cost in marginally increasing r to deal with b marginally above $\bar{b}^*$): $\hat{b}^{**} > \bar{b}^* \iff \hat{b}^* > \bar{b}^* \iff 4\alpha + \gamma^2 > L$. Entry with r^{**} then occurs for $b \in \left(\bar{b}^*, \hat{b}^{**}\right]$.

Proposition 5. **(a)** *When $4\alpha + \gamma^2 \leq L$, the first-best in the baseline model is unaffected by the inability to set a price; here $\hat{b}^*_{ZP} = \hat{b}^*$.* **(b)** *When $4\alpha + \gamma^2 > L$, $\hat{b}^*_{ZP} = \hat{b}^{**}$ and the first-best is characterised by three ranges: i) on $b \leq \bar{b}^*$, entry is optimal with $r = r^*$ (so $R = R^*$); ii) on $b \in \left(\bar{b}^*, \hat{b}^{**}\right]$, entry is optimal with $r = r^{**}(b)$ which exceeds r^* in both attributes and has a higher softness ratio that is nonetheless below the private values ratio,*

$R = R^{**}(b) \in \left(R^{*}, R^{P}\right)$*; iii) on* $b > \hat{b}^{**}$*, there is no entry.*

4.1.1 Non-Negative Pricing

The first-best under the constraint of nonnegative pricing (NNP) is essentially the same as under zero pricing (ZP). To state every detail: for $b > \bar{b}^{*}$, the solution is identical to that under ZP; for $b \leq \bar{b}^{*}$, the solution is identical to that under full-pricing () but has identical efficiency and reporting quality as under ZP, so the results of proposition 5 remain valid here.

4.2 Public sector broadcasting and the ratings-chasing dêbâcle

The first-best results serve to describe what a public service provider should attempt to do.[31] These results are relevant for evaluating outcomes and for designing incentives for a public provider of media. The analysis can apply to any type of media provider (such as newspapers and the internet), but I refer to the public media provider as a public service broadcaster and denote by the abbreviation, PSB. I do so because public provision is much more widespread in television and radio than in print media (particularly in European countries).

The voting section of this paper is entirely motivated by the need to treat cases where PSBs are relatively untrustworthy and contractual incentives are impossible. Nonetheless, when trustworthiness is reasonable, PSBs may offer important advantages on market outcomes. In particular, the results of this section provide a clear logic for considering public provision even in the idealised case of perfect competition for the market (or perfect contestability) and even when audience-based subsidies and price regulation involve no direct costs. I therefore comment here on how the first-best solution adjusts to changes in the environment. I present the results as a normative analysis of how an ideal public firm (PSB) should respond to changes in the environment.

I begin by describing comparative statics based on the parameters of the baseline model. Then I describe (in the subsection below) how the PSB should respond to competing media output from a private provider. I delay the treatment of public versus private firms to the more general and compelling case with heterogeneous firm locations.

[31] What exactly constitutes the public interest has long been an issue of debate. Many aspects of this debate are subjective or empirical. I sidestep the empirical issues and focus on a public interest defined in utilitarian terms. I focus on the problem of “dumbing down” (associated with “ratings chasing”).

Consider first the case with full-pricing and the results of subsection on page 14.[32] The cost of consumption b has no impact on the results ($r = r^*$) until b increases beyond $\hat{b}^*$ at which point it ceases to be optimal to enter. Consider next the case without pricing (nonnegative pricing is equivalent). Here the results of subsection 5 are relevant. If $4\alpha + \gamma^2 > L$, the solution differs to the case of full-pricing. For $b \leq \bar{b}^*$, $r = r^*$ as in , but for $b \in \left(\bar{b}^*, \hat{b}^{**}\right]$, the consumption constraint binds and entry is optimal with $r = r^{**}(b)$. For higher b, entry is no longer optimal. So as b rises from 0, reporting is initially fixed at r^*, then reporting rises linearly with b along the trajectory, $r^{**}(b) = r^* + r\left(b - \bar{b}^*\right)$. Both entertainment and news are increased to attract the audience and the softness ratio increases from R^* up towards (but never reaching) the private values ratio, R^P, until b reaches $\hat{b}^{**}$ at which point there is no entry.

4.2.1 PSB facing an exogenous incumbent private firm

In his MacTaggart speech of 2010, Mark Thompson, the general director of the BBC complained that: "*Cultural pessimists are always trying to convince us that ... all the BBC and the other UK PSBs care about nowadays is sensation and ratings-chasing.*" He went on to vehemently reject this claim. At the same time, his speech implicitly recognises the tradeoff between reaching a larger audience and offering greater public service quality (such as informativeness); for example, he berates the US model of PSB for taking the "*dry and lifeless view ... that, if there is any role for public intervention on TV and radio at all, it must never ever include programmes which significant numbers of people might actually want to watch or listen to.*" Similarly, he follows Dennis Potter in rejecting the supposed dichotomy between programmes that "*appeal only to a cultural elite*" and programmes that "*bring in the biggest commercial audiences.*"

The results of this paper show that whenever consumption constraints bind, there is indeed a tradeoff between setting a softness ratio close to the social (marginal) values ratio and setting the ratio close to the private (marginal) values ratio which is a more efficient way to attract citizens as consumers.

[32] To interpret negative prices as coupons and gifts is not especially compelling in the case of a PSB. The PSB might use privately valued governmental information to attract some audience, but (unless the government offers free services to informed citizens) such media content works in a similar way to the "entertainment" attribute y. To the extent that there exist sufficient attractive attributes that involve no cost to the government (rather than the assumed cost y^2 associated with y), the consumption constraint would never bind, even without negative pricing. Such attributes would be used fully and there would be no need for a negative price. In this case, the full-pricing would be relevant.

In this subsection, I describe how a PSB such as the BBC should respond to shifts in the reporting strategy of an incumbent, private media firm.[33] The first step is to note that consumption constraints are determined by the sum of direct consumption costs b and opportunity costs b^{opp}. The incumbent media firm, denoted 0, is characterised by its reporting strategy r_0. To avoid the trivial case of irrelevance, I assume its gross consumption benefit $B_0 \equiv B(r_0)$ exceeds any direct consumption cost b. For simplicity, I normalise to $b = 0$. Now, for the BBC, the relevant (total) cost of consumption is the opportunity cost $b^{opp} = B_0$. This adjusts to $B_0 - p_0$ if the incumbent sets a positive price. So the consumption constraints from above apply exactly upon subsituting b by b^{opp}. Focussing on the more interesting cases of NNP or ZP, Proposition 5 and the analogous statement for NNP describe how reporting should respond to changes in r_0 *if entry occurs*. Notice in particular, that only $(b =) B_0 - p_0$ matters - the entertainment ratio of the private firm is irrelevant conditional on entry. However, the entry decision does depend on $R_0 \equiv \frac{y_0}{z_0}$ as well as on B_0 and p_0, as I now show.

The second step is to note the social opportunity cost of entry. The PSB's entry decision depends on whether $\Delta SS \equiv SS(r, r_0) - SS(r_0) \geq 0$; here the first social surplus term denotes the surplus when the PSB enters and offers r alongside the incumbent's fixed offering of r_0. Since b^{opp} is only an opportunity cost, it does not figure in the $SS(r, r_0)$ expression, but it does figure (as $-b^{opp} = -B_0$) in the surplus difference. So far, there is no change relative to the above analysis, but there is an additional term. Since (under homogeneity), $X_0 = 1$ in the default case where the PSB stays out, $SS_0 \equiv SS(r_0) = B_0 + \alpha + \gamma z_0$. Accordingly, ΔSS differs from the SS expressions above in the subtraction of $\alpha + \gamma z_0$.[34] This subtraction reduces the probability of entry and is captured by falls in the cut-off thresholds on B_0. I denote the thresholds by $\hat{B}_0^*(z_0)$ if the consumption constraint does not bind and by $\hat{B}_0^{**}(z_0)$ in the converse case where $B_0 > \bar{b}^*$. It is immediate that $\hat{B}_0^*(z_0) = \hat{b}^* - \alpha - \gamma z_0 = \frac{L_\gamma}{4} - \gamma z_0$ in the unconstrained case. In the constrained case,

$$\Delta SS = \alpha + \frac{\gamma^2}{4} - \frac{(2B_0 - \lambda\gamma)^2}{4L} - (\alpha + \gamma z_0) = \frac{\gamma^2}{4} - \frac{(2B_0 - \lambda\gamma)^2}{4L} - \gamma z_0$$

[33] Here I treat that incumbent as exogenous; this might be relevant if the private firm is mostly focussed on profits from the audience of another country or a large international market; another motivation is to suppose large sunk costs associated with quality reporting (price would remain reactive however); the exogenous case is also useful for considering technological and structural shifts that affect the commercial media market (represented by the incumbent firm). I treat the endogenous private firm case in subsection 5.3.

[34] Advertising surplus α would not be subtracted here if the PSB cared only about the social surplus of citizens and did not put any weight on how entry reduces the incumbent private firm's profits.

Entry is optimal when this is nonnegative, which holds (given that $B_0 > \bar{b}^*$) on $B_0 \leq \hat{B}_0^{**}(z_0) \equiv \frac{1}{2}\left(\gamma\lambda + \sqrt{(\gamma^2 - 4\gamma z_0)L}\right)$.[35,36]

Proposition 6. *In a zero-price context, the optimal behaviour for a Public Sector Broadcaster (PSB), faced with an incumbent firm "0" with strategy fixed at r_0, takes two forms.* **(a)** *For $\gamma^2 - L \leq 4\gamma z_0$, the PSB should enter and set $r = r^*$ if and only if $B_0 + \gamma z_0 \leq \frac{L_\gamma}{4}$.* **(b)** *If $\gamma^2 - L > 4\gamma z_0$, the PSB should enter with $r = r^*$ if $B_0 \leq \bar{b}^*$, enter with $r = r^{**}(B_0)$ if $B_0 \in \left(\bar{b}^*, \hat{B}_0^{**}(z_0)\right]$ and not enter at all if $B_0 > \hat{B}_0^{**}(z_0)$.*

Given the fixed costs of production and citizen homogeneity, a single active firm is socially optimal, but here I have considered an incumbent media firm that has sunk its costs of providing news at reporting level r_0 and cannot change r_0.

In the next section, I show that the result generalises to environments with heterogeneous consumers; the discontinuity (of the optimal gross benefit from the PSB in the gross benefit from the mainstream alternative) may disappear but the nonmonotonicity remains.

The ratings chasing debate. This result is relevant to the debate just described on whether public service broadcasters, such as the BBC, are too "populist". Some critics of the BBC maintain that it has been overly concerned with attracting a broad audience. The BBC replies that to generate large positive consumption externalities, it is necessary to attract a substantial audience. Such an audience *could* be attracted with high quality programming at the first-best ratio R^*, but Proposition 6 shows that it is optimal, when consumption constraints bind, to raise the entertainment ratio to more effectively attract a larger audience. Binding consumption constraints are particularly likely in the heterogeneous citizens models of sections 4 and 5.

At the same time, the result (which I describe here using the natural generalisation to the case where p_0 can be nonzero[37]) provides a sharp rejection of those who would measure all success in terms of audience share or related demand-side statistics such as popularity ratings. In the model, it is never optimal to distort R all the way up to the private values

[35] The range with constrained entry is nontrivial if $\hat{B}_0^{**}(z_0) > \bar{b}^* \iff L < \gamma^2 - 4\gamma z_0$. This is less likely than in the case without an incumbent (fixing b), but can hold if z_0 is not too large.

[36] In the case of full-pricing, the single-starred cut-off is always the relevant one. Pricing requires one last observation: if the incumbent sets a price p_0, this has no impact on the unconstrained cut-off (single star); unless the PSB cares only for citizen social surplus (in which case the cut-off falls by p_0). For the constrained case, $B_0 \leq \hat{B}_0^{**}(z_0, p_0) \equiv p_0 + \frac{1}{2}\left(\gamma\lambda + \sqrt{(\gamma^2 - 4\gamma z_0 - 4p_0)L}\right)$.

[37] Notice that a zero price by the PSB is common even when pricing is feasible and it is always an optimal solution when pricing is constrained nonnegative.

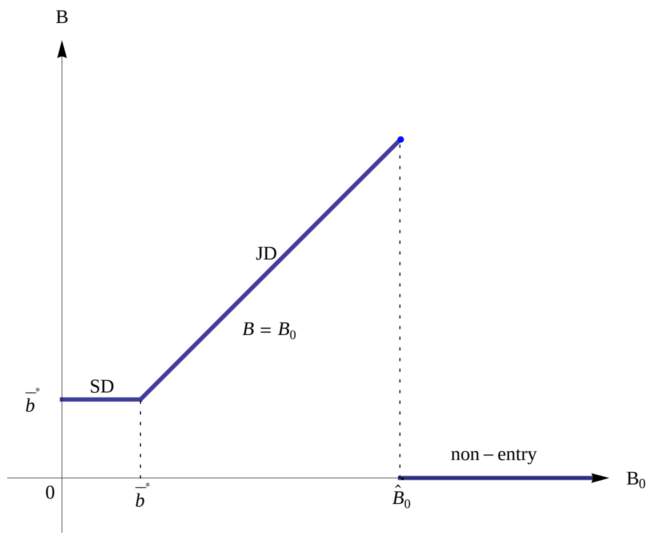

Figure 1: PSB response to changing attractiveness of an exogenous incumbent

ratio R^P (that maximises consumer value for any given production cost). Instead, either $R = R^*$ or $R = R^{**}(B_0 - p_0)$, where the latter increases with $B_0 - p_0$, so its upper bound is $R^{**}\left(\hat{B}_0^{**}(z_0, p_0) - p_0\right) = \frac{1-\lambda}{\lambda+\gamma\sqrt{L/(\gamma^2-4\gamma z_0-4p_0)}}$ which, for any $\gamma > 0$, is strictly less than R^P.

4.3 Monopoly with zero-pricing (ZP)

When $p = 0$ is the only option, the monopolist sets $r = r_{ZP} = r(b)$, so y$=\frac{b(1-\lambda)}{L}$, $z = \frac{b\lambda}{L}$ and the monopolist just attracts an audience at a production cost of $\frac{b^2}{L}$. The monopolist's profit is $\alpha - \frac{b^2}{L}$. So the entry cut-off is now $\hat{b}_{ZP} = \sqrt{\alpha L}$. Consumer surplus is zero and the citizen surplus equals the externality benefit $\gamma z = \frac{b\lambda\gamma}{L}$. In summary,

Proposition 7. *In the absence of subsidies and forced to set zero prices, a monopolist facing homogeneous citizens enters the market if and only if $b \leq \hat{b}_{ZP} = \sqrt{\alpha L}$ and sets a reporting plan, $r_{ZP} = r(b) = \frac{b}{L}(1-\lambda, \lambda)$. The softness ratio then equals $R = R^P = \frac{1-\lambda}{\lambda}$ and the social surplus of citizens is $SSC_{ZP} = \frac{b\lambda\gamma}{L}$. The monopolist earns rents $\alpha - \frac{b^2}{L}$ and the social surplus is $SS_{ZP} = \alpha + \frac{b(\lambda\gamma - b)}{L}$.*

It may be a surprise to note that the surplus is initially increasing in b. This is because reporting quality and hence the externality surplus are increasing in b. The effect is non-monotonic, because spurring higher quality becomes efficiency-reducing once b reaches a threshold (defined as $\bar{b}^*$ in the first-best problem below) and raising b always reduces the first-best surplus.

4.4 Voting in the zero price environment

Voting works as effectively in the context with zero-pricing as in the case with full pricing. In many respects, the derivation is simpler, since price is no longer a choice variable. Citizens take account of the constrained price when they vote, so they value and reward firms that pick the price-constrained optimum reporting strategy.

5 Heterogeneous citizens - linear transport costs and zero prices (LTC and ZP)

This section extends to the case where citizens' consumption costs b_t are uniformly distributed on $[0, \beta]$ where $\beta > 0$ is an exogenous parameter that plays a similar role to b in the baseline model; in particular, $E(b_t) = \frac{\beta}{2}$. Anticipating the Hotelling competition model, notice that this case is equivalent to assuming that firms, if they enter, must locate at $t = 0$ while citizens are located at points $t \sim U[0, 1]$ and face a linear transport cost, $b_t = \beta(t - 0) = \beta t$ for some marginal cost $\beta > 0$. In this case, the demand curve for a single firm depends on $B = B(r)$ and p according to $X(B, p) = \frac{B-p}{\beta}$ if $B \leq \beta$ and $X(B) = 1$ if $B - p > \beta$. With multiple firms at $t = 0$, all citizens prefer the firm or firms that offer maximal private value $B - p$ (gross of transport cost, net of price) and the aggregate demand extends naturally; it can be expressed as $X(\mathbf{B}, \mathbf{p}) = \min\left(\max_n\left(\frac{B_n - p_n}{\beta}\right), 1\right)$.

Notation: Subscript $\cdot_1$ denotes the citizen-firm types of this section: there is 1 type of firm unlike in the next section (indicated with $\cdot_2$) where there are 2 types of firm; this notation takes citizen heterogeneity for granted, since citizen homogeneity only occurs in the baseline case and is indicated by the absence of a subscript.

For any given firm, there are four possible types of r, p, a outcome. First, non-entry which is equivalent to entry with $r = 0$. Second, entry such that audience share is *interior* which I denote by ^{int}. It arises when $\frac{B(r)-p}{\beta} \in (0, 1)$. Third, entry with r, p such that the market is "just covered" which I denote by ^{JC}. This arises when $B(r) - p = \beta$. Fourth, entry where the market is "strictly covered" which I denote by ^{SC}. This occurs when $B(r) - p > \beta$. As quickly becomes clear below, when covering the market (SC or JC), the solutions are essentially the same as in the baseline model with $\beta = \max_t b_t$ playing the role of b (except that the social surplus involves a cost of only $\frac{\beta}{2} = av\,(b_t)$.

5.1 Monopoly (unregulated) in the heterogeneous citizen case

A monopolist never gains from giving rents to the highest cost consumer, so I can immediately rule out strict covering SC and focus on the interior (int) and just covering (JC) solutions. As always, the monopolist sets $r = r\,(B)$ for some B which I now characterise.

5.1.1 Full Pricing

Interior solution. In this case, monopoly profits are $\pi = \pi_I^{int}\,(B,p) = (\alpha + p)\,\frac{B-p}{\beta} - \frac{B^2}{L}$. The first-order conditions[38] for a maximum define the candidate solution, $(B_I^{int}, p_I^{int}) = \left(\frac{\alpha L}{4\beta - L}, \frac{\alpha(L-2\beta)}{4\beta - L}\right)$. $\beta > \frac{2\alpha+L}{4}$ is a necessary and sufficient condition for an interior optimum: the condition is necessary to ensure the candidate solution is indeed interior ($X < 1$) and it is sufficient to guarantee feasibility ($B_I^{int} \geq 0$) and concavity (which both require $\beta > \frac{L}{4}$). The solution generates equilibrium profits, $\pi_I^{int} = \frac{\alpha^2}{4\beta - L} > 0$, audience size, $X = \frac{2\alpha}{4\beta - L}$, consumer surplus, $CS = \frac{(B-p)^2}{2\beta} = \frac{\beta}{2}\left(\frac{2\alpha}{4\beta-L}\right)^2 = \frac{2\alpha^2\beta}{(4\beta-L)^2}$ and social surplus $SS = \frac{\alpha^2(6\beta+2\gamma\lambda-L)}{(4\beta-L)^2}$.

Covering solution. Since a monopolist only considers the just covering solution JC with $p = B - \beta$, this is a corner of the interior problem. Therefore it can only occur when $\beta \leq \frac{2\alpha+L}{4}$. In this case, $\pi_I^{JC} = \alpha + (B - \beta) - \frac{B^2}{L}$, so $B_I^{JC} = \frac{L}{2}$, $p_I^{JC} = \frac{L}{2} - \beta$, $\pi_I^{JC} = \alpha - \beta + \frac{L}{4}$ as in the baseline model. These profits are nonnegative (weakly exceeding $\frac{\alpha}{2}$ since $\beta \leq \frac{2\alpha+L}{4}$). Overall this gives:

Proposition 8. *If $\beta > \frac{2\alpha+L}{4}$, the monopolist sets $B = B_I^{int} = \frac{\alpha L}{4\beta-L} < \frac{L}{2}$ and $p = p_I^{int} = \frac{\alpha(L-2\beta)}{4\beta-L}$; here $SS = SS_I^{int} = \frac{\alpha^2(6\beta+2\gamma\lambda-L)}{(4\beta-L)^2}$. If $\beta \in [0, \frac{2\alpha+L}{4}]$, then the monopolist sets $B = \frac{L}{2}$ and $p = \frac{L}{2} - \beta$, just covering the market; here $SS = SS_I^{JC} = \alpha - \frac{\beta}{2} + \frac{L}{4} + \frac{\gamma\lambda}{2}$.*

For the low β range, this result is essentially identical to that of the monopoly problem in the baseline model. When β is high, the monopolist's inability to extract consumer surplus leads to lower quality as well. The monopolist always enters, but as $\beta \to \infty$, $B \to 0$. Note

[38] $\frac{\partial \pi_I}{\partial B} = 0 \Rightarrow \frac{\alpha+p}{\beta} - \frac{2}{L}B = 0$ and $\frac{\partial \pi_I}{\partial p} = 0 \Rightarrow \frac{-\alpha+B-2p}{\beta} = 0$.

that $\frac{2\alpha+L}{4} < \hat{b} = \frac{L}{4} + \alpha$, which makes sense because there are citizens with higher willingness-to-pay (lower b_t than citizen $t = 1$ with $b_t = \beta$) and the monopolist can extract more rent by forfeiting selling to the lowest demand citizens.

5.1.2 Zero Pricing

With price forced to zero, the monopolist maximises $\pi_{I.ZP}^{int} = \alpha\frac{B}{\beta} - \frac{B^2}{L}$ subject to $B \leq \beta$. For a strict interior solution, the first-order condition is $B_{I.ZP}^{int} = \frac{\alpha L}{2\beta}$ (with second-order condition, $-\frac{2}{L} < 0$, always satisfied) and $B_{I.ZP}^{int} \leq \beta$ requires $\alpha \leq \frac{2\beta^2}{L}$. Maximised profits are then $\pi_{I.ZP}^{int} = \frac{\alpha^2 L}{4\beta^2}$ (always positive). When $\alpha \geq \frac{2\beta^2}{L}$ or $\beta \leq \sqrt{\frac{\alpha L}{2}}$, the optimal solution is at the upper corner: $B = B_{I.ZP}^{cov} = \beta$ and profits are $\pi_{I.ZP}^{cov} = \alpha - \frac{\beta^2}{L}$ (which is strictly positive, indeed no less than $\frac{\beta^2}{L}$). (Again the cut-off for a full audience is at a lower value than the $\hat{b}_{ZP} = \sqrt{\alpha L}$ of the baseline model.)

Proposition 9. *If $\beta > \sqrt{\frac{\alpha L}{2}}$, the monopolist sets $B = B_{I.ZP}^{int} = \frac{\alpha L}{2\beta} < \sqrt{\frac{\alpha L}{2}} < \sqrt{\alpha L}$. If $\beta \in \left[0, \sqrt{\frac{\alpha L}{2}}\right]$, the monopolist sets $B = \beta$, just covering the market.*

5.1.3 Non-Negative Pricing

The solution to the NNP problem is identical to the problem whenever $\beta \leq \frac{L}{2}$. Otherwise, the solution is at the corner with $p = 0$ (by concavity) and therefore identical to the zero pricing problem (ZP).

5.1.4 Key Points

Lemma 1 makes it clear that there is no room for hoping that citizen heterogeneity will resolve the inefficiencies associated with monopoly (or for that matter, competition). Nonetheless, the fact that $r = r(B)$ is increasing in α already suggests that audience subsidies (which have a similar effect as advertising) can now increase reporting if audience shares are initially less than unity. Beforehand, I treat the first-best. Indeed, the purpose of this section is to characterise the first-best to see how the ideal PSB results and the voting theory generalise to settings with heterogeneity.

5.2 First Best

In the first-best, I cannot rule out the strict covering SC solution since, unlike a monopolist, the agency cares (or PSB) cares about citizen welfare.

5.2.1 Full Pricing

Full pricing makes it possible to induce, for any reporting strategy r, any desired audience share X by attracting all the citizens with $t \in [0, X]$; for a given vector r, simply choose p such that $\frac{B(r)-p}{\beta} = X$. Price has no other impact on social surplus.

Lemma 2. *With full-pricing, the first-best reporting level when constrained to provide a given audience share X is $r = Xr^*$.*

The proof is straightforward: pricing permits promotion of the consumption externality without needing to distort $B(r)$ upwards.[39] So the first-best problem is equivalent to picking r and X to maximise $\left(w^S \cdot r - \frac{\beta X}{2} + \alpha\right) X - k(r)$. The first-order condition for r *given* X is $r = Xr^*$ (the second-order condition is clearly satisfied).

Substituting for r, X must maximise $\left(\frac{L_\gamma}{4} - \frac{\beta}{2}\right) X^2 + \alpha X$, subject to $X \leq 1$. The solution is $X = \frac{2\alpha}{2\beta - L_\gamma}$ if $\beta > \alpha + \frac{L_\gamma}{2}$ (this condition is sufficient for the second-order condition to hold) and otherwise, $X = 1$.

Proposition 10. *In the first-best with citizen heterogeneity and full-pricing,* $r_I^* = \min\left(\frac{2\alpha}{2\beta - L_\gamma}, 1\right) r^*$. *This gives a social surplus of* $SS = \frac{\alpha^2}{2\beta - L_\gamma}$ *when* $\beta > \alpha + \frac{L_\gamma}{2}$ *and* $\alpha + \frac{L_\gamma}{4} - \frac{\beta}{2}$ *when* $\beta \leq \alpha + \frac{L_\gamma}{2}$.

5.2.2 Zero Pricing

There are three possible types of solution: *interior* where $\frac{B(r)}{\beta} \in (0, 1)$, "just covered" where $B(r) = \beta$ and "strictly covered" where $B(r) > \beta$. The **market covering solutions** are again the same as in the baseline model with $\beta = \max_t (b_t)$ playing the role of b and the social surplus corrected by addition of $\frac{\beta}{2}$ (since $\beta - av(b_t) = \frac{\beta}{2}$). That is, $r = r^*$ if $\beta \leq \bar{b}^*$ (entry is better than non-entry here, since $\frac{\bar{b}^*}{2} < \hat{b}^*$ for all α even though $\bar{b}^*$ can exceed $\hat{b}^*$) and $r = r^{**}(\beta)$ when $\beta > \bar{b}^*$ and β is small enough or α large enough for market covering

[39] Price has no impact on social surplus beyond the impact on X, because the price terms $+pX$ in the monopoly profit and $-pX$ in the consumer surplus cancel out. Similarly, for maximising citizen surplus, a tax or transfer can compensate citizens (on aggregate) for any increase in price.

to be optimal. I now derive this last set of conditions as the converse to the conditions for an interior solution.

In an **interior solution**, social surplus takes the form, $SS^{int}_{I.ZP} = \frac{B(r)^2}{2\beta} + (\gamma z + \alpha)\frac{B(r)}{\beta} - y^2 - z^2$. Optimising over r yields $r^*_{I.ZP} = \frac{2\alpha L}{K^*_I(\beta)} r^{**}(\beta)$ where $K^*_I(\beta) \equiv 4\beta^2 - 2\beta(L + 2\gamma\lambda) - \gamma^2(1-\lambda)^2$. Denoting the upper root of $K^*_I(\beta) = 0$ by $\hat{\beta}^*_I \equiv \frac{L+2\lambda\gamma}{4} + \sqrt{\left(\frac{L+2\lambda\gamma}{4}\right)^2 + \left(\frac{\gamma(1-\lambda)}{2}\right)^2}$, $\beta > \hat{\beta}^*_I$ is a necessary and sufficient condition for an interior optimum.[40] It only remains to ensure that the candidate solution is interior: $B^*_{I.ZP} < \beta$ holds if and only if advertising is sufficiently low, $\alpha < \hat{\alpha}^*_{I.ZP}(\beta) \equiv \frac{K^*_I(\beta)}{2L}$. This cut-off is increasing in β on the range $\beta > \hat{\beta}^*_1$ (confirming the intuition that high transport costs β always increase the likelihood of an interior solution while advertising α decreases it). The optimised surplus is then $SS^{*.int}_{I.ZP} = \frac{\alpha^2 L}{K^*_1(\beta)} > 0$.

Proposition 11. *The first-best with citizen heterogeneity and zero pricing is characterised by three ranges.*

i) On $\beta \leq \bar{b}^*$, the market is strictly covered, $r = r^{*.SC}_{I.ZP} = r^*$ and $SS^*_{I.ZP} = SS^{*.SC}_{I.ZP} = \hat{b}^* - \frac{\beta}{2}$.

ii) On $\bar{b}^* < \beta \leq \hat{\beta}^*_I$ and on $\beta > \hat{\beta}^*_I$ provided $\alpha \geq \hat{\alpha}^*_{I.ZP}(\beta, \lambda) \equiv \frac{K^*_I(\beta)}{2L}$, the market is just covered, $r = r^{*.JC}_{I.ZP} = r^{**}(\beta)$ and $SS^*_{I.ZP} = SS^{*.JC}_{I.ZP} = SS^{**}(\beta) + \frac{\beta}{2} = \alpha - \frac{K^*_I(\beta)}{4L}$ $(\geq \alpha)$.

iii) On $\beta > \hat{\beta}^*_I$, and $\alpha < \hat{\alpha}^*_{I.ZP}(\beta, \lambda)$, an interior solution is optimal, $r = r^{*.int}_{I.ZP} = \frac{2\alpha L}{K^*_I(\beta)} r^{**}(\beta)$, $X = \frac{2\alpha L}{K^*_I(\beta)}$ and $SS^*_{I.ZP} = SS^{*.int}_{I.ZP} = \frac{\alpha^2 L}{K^*_I(\beta)}$.

5.2.3 Non-Negative Pricing

The solution is the same as with no pricing.

5.2.4 Key Points

Both interior and just covered solutions involve distortions to attract a larger audience. The degree of distortion increases with β just as R^{**} increased with b in the baseline model. The distortion is the same function of β in both interior and just covered solutions: $R =$

[40] The Hessian from the second order conditions is negative definite if and only if $K^*_I(\beta) > 0$ which is equivalent to $\beta > \hat{\beta}^*_I$ with $\hat{\beta}^*_I \equiv \frac{L+2\lambda\gamma}{4} + \sqrt{\left(\frac{L+2\lambda\gamma}{4}\right)^2 + \left(\frac{\gamma(1-\lambda)}{2}\right)^2}$; the positive determinant condition guarantees the remaining conditions since $\hat{\beta}^*_I > \frac{(1-\lambda)^2}{2}$. Notice also that $\hat{\beta}^*_I \geq \frac{L+2\lambda\gamma}{2} > \bar{b}^*$ so there is no need to compare the interior solution and the strict covering solution (their conditions are mutually exclusive).

$R^{**}(\beta) = \frac{1-\lambda}{\lambda+\gamma\left(\frac{L}{2\beta-\lambda\gamma}\right)}$ since both $r^{*.int}_{I.ZP}$ and $r^{*.JC}_{I.ZP}$ are proportional to $r^{**}(\beta)$.[41] Of course, fixing advertising α below $\hat{\alpha}^{*}_{I.ZP}$, interior solutions are associated with higher β and greater distortion.

As in the baseline model where $r^{*} < r^{**}(b)$ for any $b > \bar{b}^{*}$, r^{*}_{I} is lower than $r^{*.JC}_{I.ZP}(\beta)$ for any $\beta > \bar{b}^{*}$ but the reverse may hold for interior solutions when β becomes large.

The current set-up gives an interior solution only when α is strictly positive, but advertising is not necessary if one adds a negative opportunity cost of consumption ($b < 0$ appended onto the transport cost $-\beta t$) or allows for z or y to have zero marginal cost up to some threshold.

5.3 Audience Subsidies

Audience subsidies now have a more continuous beneficial effect than in the baseline model, because they can raise quality given entry (even when prices cannot be regulated), albeit only in the case where the monopoly solution is interior. This subsection is straightforward so I omit the results. In brief, notice that the impact of a linear audience subsidy is equivalent to increasing the advertising parameter α. In particular, in the baseline model with full-pricing (), a monopoly firm enters for any $b \leq \hat{b} = \alpha + \frac{L}{4}$. Adding a subsidy τ, the monopolist enters for any $\hat{b}^{\tau}_{I} = \alpha + \frac{L}{4} + \tau$. Proposition **??** shows that $\tau(b) = b - \alpha - \frac{L}{4}$ and the highest subsidy that the agency ever chooses to pay is given at $b = \hat{b}^{AS} = \alpha + \frac{L}{4} + \frac{\gamma\lambda}{2}$ and gives $\tau(b) = \frac{\gamma\lambda}{2}$; at this subsidy level, $\hat{b}^{\tau}_{I} = \hat{b}^{AS}_{I}$. Notice that under zero pricing (ZP) in the baseline model, a monopolist enters for any $b \leq \hat{b}_{ZP} = \sqrt{\alpha L}$. Given a subsidy τ, the entry condition is $b \leq \hat{b}^{\tau}_{I.ZP} = \sqrt{(\alpha+\tau)L}$ Proposition **??** shows that $\tau(b) = \frac{b^2}{L} - \alpha$ and the highest subsidy that the agency chooses to pay is given at $b = \hat{b}^{AS}_{I.ZP} = \frac{\gamma\lambda}{2} + \sqrt{\alpha L + \frac{\gamma^2\lambda^2}{4}}$ and at this value $\hat{b}_{I.ZP}{}^{\tau(b)} = \hat{b}^{AS}_{I.ZP}$.

5.4 Voting with heterogeneous citizens

Again the constrained first-best is feasible if audience and vote measures are used to incentivize media firms. The following figure demonstrates how it becomes necessary to combine voting with audience subsidies [description and proof to type up]:

[41] Since $\beta > \bar{b}^{*}$ implies $0 < \frac{L}{2\beta-\lambda\gamma} < 1$, $R \in \left(R^{*}, R^{P}\right)$. Note that under the hypothetical constraint to serve an audience share X, the optimum with full-pricing would be to serve $t \in [0, X]$ and set $r = Xr^{*}$, so $R^{*}_{X} = R^{*}$ still, because there is still a full unit mass of citizens affected by the externality.

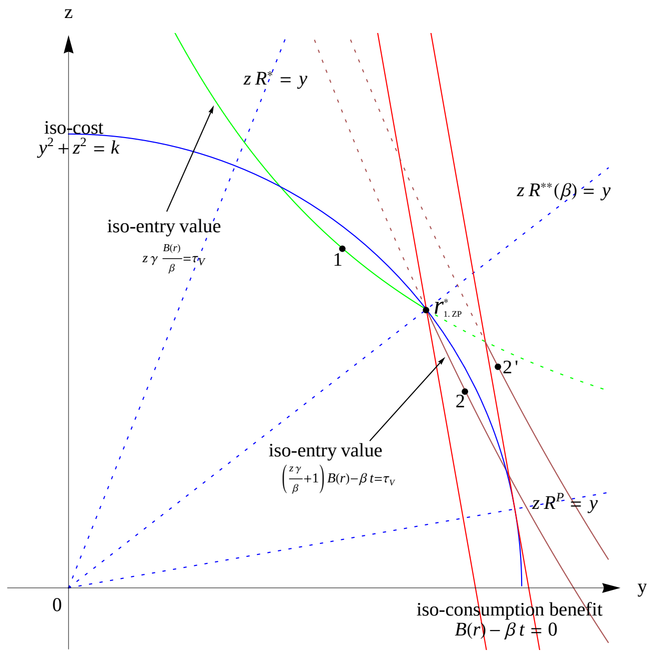

Figure 2: Implementing the FB with monopoly and linear transport cost.
[Indifference curves for consumption (red) and entry (brown for consumers and green for non-consumers).]

6 Conclusion

This paper has developed a model of soft bias in the news media and demonstrated how the optimal market-based incentive schemes can improve matters but cannot avoid the bias. The paper also shows how a vote-based solution could serve to resolve the bias. Finally, I show how constraints against nonnegative pricing affect the constrained first-best and shed light on recent debates and criticims of public service broadcasting. [To be completed.]