# Softness bias in the news: optimal subsidies, price floors and competitive threats.

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**Abstract**

A vibrant media sector generates benefits beyond direct consumption values. This paper develops new policy insights with a simple 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 market settings suffer from a softness bias, a bias towards entertaining over informative news reporting. Second, audience-based subsidies and price regulation can mitigate the consequences, but cannot evade softness bias. The minimum price is a novel regulatory result. Third, I characterise the constrained first-best and use the results to address recent debates about "ratings-chasing" in public sector broadcasting. Competitive media alternatives can reduce welfare; public media should initially respond by increasing quality but should eventually abandon market share.

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# 1. Introduction

Effective democracy depends on a vibrant and independent media sector that allows citizens to cast well-informed votes. This idea has won strong support in recent empirical research that demonstrates positive social externalities with consumption of media, especially informative news. Implicit in many political economy models and explicit in Downs's (1957) discussion of informational free-riding, or "rational ignorance," these externalities underlie calls for policies to subsidise the media.[1] Nonetheless, the policy challenge of finding good strategies for promoting valuable media consumption has received little attention.

In this paper, I develop new policy insights from a simple framework that distinguishes media output along two dimensions ("soft" and "hard"), where only consumption of hard news generates positive externalities. Formal analysis of this consumption externality generates novel policy implications. The model highlights two critical features of the externality. First, the relevant qualities, informativeness and entertainment, of news media are notoriously subjective, precluding contractual verifiability. Second, consumption of news media is only effective in creating social externalities when the consumer pays attention to the content and this attention is rarely verifiable, precluding payment for attentive consumption.

The first feature alone generates a softness bias in any market environment, even one with subsidies and price regulation. Citizens' private media choices often neglect the positive externalities from becoming better informed and voting for more effective politicians. From a social perspective, consumer choices are biased away from hard news with positive externalities towards softer news attributes that only generate private benefits. Media firms therefore underspend on hard news.

This softness bias materialises in two ways: a focus on style over substance (e.g., high graphic quality and humorous presenters) and/or a distortion of topic choice (e.g., discussing celebrities rather than political issues). Softness bias is much discussed and documented.[2] But existing models only consider one-dimensional variation in the quantity of hard versus soft news topics (as when media outlets choose their horizontal locations). Multidimensionality is critical for my result that (given non-verifiable qualities) audience-based subsidies (including consumption subsidies) and regulating price cannot evade the softness bias.

If news were one-dimensional, consumption or production subsidies could be used, as in standard externality theory, to implement any desired consumption levels. However, with multidimensional news quality, a subsidy that raises hard news consumption, will also raise

[1] The argument for media subsidy grounded in traditional public goods theory (rather than media consumption externalities) is less broadly accepted. Informative news does have standard public goods properties (rivalry is certainly very low, fixed costs can be large and excluding access is sometimes difficult), but so do entertainment media, making calls for public subsidy more controversial there, with scholars pointing out that technological changes have made certain fixed costs much smaller (see e.g., Armstrong (2005), Armstrong and Weeds (2007)). By contrast, this paper provides a theoretical justification of media subsidy that applies even in perfectly competitive or contestable markets.

[2] Direct measurement is difficult but papers using citizen awareness as an indicator of news consumed and categorising journalist human capital expenditures may help test the predictions developed below. The predictions are 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.

soft news consumption. For instance, an audience subsidy motivates firms to cater more strongly to consumer interests. These interests may include some degree of hard news, but they are inherently biased. As a result, a subsidy that raises hard news consumption to its socially efficient level leads to a socially excessive level of soft news consumption. Subsidies can mitigate the consequences of soft bias, but cannot evade the bias.

Price regulation plays a novel role in the optimal subsidy scheme (and can operate as a substitute instrument alone). Surprisingly, the optimal regulation may impose a minimal price, rather than the standard price cap regulation aimed at preventing firms from using excessive prices to extract rents. The logic behind this price floor result is that consumers will be more discriminating and insist on higher quality goods if the price is high. Again, qualities will remain soft biased, but raising both hard and soft news qualities is beneficial since marginal increases in soft news have first-order benefits and only cause second-order inefficiencies. The logic is relevant beyond the media market, but quite distinct from the logic of retail price maintenance; there, the underlying problem is in service quality and stems from seller competition, whereas my minimal price result holds with a monopoly seller and addresses the endogeneity of product, not service, quality.

One stylised fact suggests practical relevance of this insight: many countries offer media subsidies to daily newspapers but free, for-profit dailies, such as the market leading *Metro* are very rarely (if ever) eligible to receive public subsidies (they are instead purely advertising-funded). Excluding free dailies from public subsidies makes sense, because high audience shares are a poorer signal of quality for a firm with a zero cover price than for a firm that charges a high price.

Turning to the second key feature, an inability to measure effective consumption essentially precludes negative pricing. This generates a separate reason for softness bias. Distorting quality upwards (relative to the first best) is a good way to induce effective consumption. Moreover, raising the qualities of soft and hard news attributes in the ratio corresponding to consumers' private preferences is the most cost-efficient way to do so. As a result, adopting the language of Reith's tripartite public service mission, there is a legitimate tradeoff between investments "to inform and to educate" on one side and investments "to entertain" on the other. This tradeoff exists even if private media markets are perfectly competitive.

Indeed, I show how competition from alternative media firms, strong on entertainment but weak on hard news, can decrease welfare. I also show that a public service broadcaster may optimally dumb down or raise its soft bias in response to increased attractiveness of such competitive threats. The optimal response is non-monotonic and somewhat subtle, but the simple model clarifies the intuitive nature of the tradeoffs.

The media literature on advertising treats the similar problem of attracting consumers with content so that they observe the ads. Armstrong (2005) and Armstrong and Weeds (2007) discuss this point informally in the context public service broadcasting. They rightly question whether "hammocking" news programmes between entertaining films can be effective, given how easily people can now switch channels or pre-record and skip to the most attractive content. However, my model avoids this problem by endogenising the quality of the news programmes themselves. Concretely, news shows are typically consumed as a package.

Indeed, the soft and hard attributes are quite inseparable in the case of style and substance: e.g., to enjoy the delivery style of a news anchor, you have to watch the show and will be exposed to its content. Again multi-dimensionality is important.

There are many related papers on subsidising the media and some on media quality. A distinguishing feature of my study is to model the consumption externality explicitly and to model multidimensional quality. An important strand in the media literature studies the link between media competition, pricing and advertising. Anderson and Coate (2005) provide the key welfare analysis of media competition in a broadcasting market. Work by Anderson and Gabsewicz (2006), Armstrong (2006), Peitz and Valletti (2008), Choi (2006) and Crampes et al. (2009) demonstrate how the nature of price and advertising competition in this two-sided market affects entry, advertising levels and media diversity. Several of these papers have horizontal location. A few consider endogenous quality, but none have multi-dimensional quality which is key to my analysis. Moreover, the focus is on advertising and private consumer surplus, not consumer-on-consumer externalities. The closest link is the comparison of market efficiency under different pricing régimes (free-to-air or no pricing versus pricing) which plays a role in some results that I describe below.

Some authors have discussed informally the problem of inducing consumption of news. I discussed Armstrong and Weeds above and their concerns about hammocking, which motivates my focus on the bundle of attributes model. Multi-dimensional quality choices are central to my media bias, but there are papers studying the impact of subsidies in models with one-dimensional quality variation (between hard and soft news). For instance, Leroch and Wellbrock (2011) build on the insight of Spence (1975) that a monopolist chooses quality in response to the preferences of the marginal consumer. Since subsidisation may shift who is the marginal consumer, Leroch and Wellbrock (2011) show, assuming tastes for news decrease with opportunity cost, that media subsidies will lower quality. My model rules out any Spencian effect by assuming fixed marginal preferences for (both types of) quality. My focus on bias between multiple qualities is orthogonal to the Spencian literature (and arises, as I prove below, in perfectly competitive settings too). Allowing for Spencian effects could introduce new and interesting results as to the optimal way to combine subsidy and price regulation. Indeed, allowing for a price floor can mitigate the concern of Leroch and Wellbrock (2011). Other related work include papers on competition between public and private media outlets. I touch on this in the constrained-first best analysis, but my focus is on the optimal use of softness bias under a consumer sovereignty constraint, rather than strategic competition effects.

The social externality of consumption is central to all the results. I do not need to provide a formal micro foundation thanks to the work of Prat and Strömberg (2005) whose foundation in fact justifies the exact linear externality expression that I use in the model below; see also Besley and Burgess (2002). Prat and Strömberg (2005) provide an explicit model of this electoral channel for accountability. The basic idea is that a more informed citizenry select and induce more dedicated politicians. [3] But news quality (for a given population subgroup)

[3] An informed populace is similarly beneficial in other (non-electoral) channels of political accountability, as well as for direct democracy.

is fixed and only the quantity of people who consume varies. So the media choice is effectively one dimensional for each subgroup.x

The paper also relates to work on influence and capture. A major motive for considering audience subsidies and price regulation is that relying on the subjective judgement of a public media agency can be perilous, because the incumbent government has strong incentives to bias the criteria to favour friendly or uncritical media and there are important risks of business capture.[4] Independent public bodies (such as the BBC Trust) that oversee public service broadcasting can limit political influence and business lobbying, but insulation is never perfect. When a public agency oversees private firms, paying discretionary subsidies, there is the additional risk of lobbying and capture by the affected media firms. A natural solution is to disperse all subjective decisions across the citizenry, by using audience share as an objective aggregate measure; ny would-be influencer (political party, pressure group or lobbyist) would then have to capture impracticably large numbers of people.

This work builds on a large literature in media economics, see in particular Anderson and Coate (2005). It adds a formal model of a new type of bias to a range of existing works on media bias, including Balan et al. (2004), Baron (2006), Besley and Prat (2006), Dyck and Zingales (2003), Ellman and Germano (2009), Hamilton (2004), Mullainathan and Shleifer (2005), Patterson and Donsbagh (1996), Reuter and Zitzewitz (2006), Strömberg (2001), Strömberg (2004).

The next subsection describes related empirical evidence. Section 2 presents the model. In section 3, I solve the model with unrestricted pricing for first-best, monopoly, competition, optimal subsidies and price regulations. This section demonstrates the fundamental nature of soft bias in markets and optimal policy responses to mitigate the problem. In section 4, I present the normative question of how a public service broadcaster should use soft bias as a way to increase consumption when negative pricing is infeasible and the impact of competitive threats. I also solve the market and optimal regulation questions of section 3 in the context with no pricing. Section 5 concludes.

## 1.1 Empirical evidence on consumption externalities.

Famously proclaimed by the founding fathers of the American constitution, the idea that the media play a crucial role in democracy (as well as economic well-being) 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. Most papers focus on news and analysis, but some work identifies how culture and education also generate externalities. The evidence 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.

The early work of Sen (1982) suggested that media restrictions have been an indirect cause of famines in the sense that politicians are more responsive to food shortages in regions with a

[4] 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.

free press. Besley and Burgess (2002) provide strong supportive evidence. Stromberg (2001, 2004a, and especially 2004b) provides theory and evidence for the idea that media access empowers citizens to pressure their political representatives to serve their region with better public goods. Glaeser et al. (2004), Gentzkow et al. (2009) and Acemoglu and Robinson (2012) offer historical evidence that the media played a key role in reducing political corruption during the Progressive era, early $20^{th}$ century in the United States. Stromberg (2004b) used technological restrictions, the availability of radio antennae, to identify the role of radio access.

Most recently, following Ansolabehere et al. (2006), a number of papers have used the imperfect overlap between economic and political geographies to identify the impact of variation in news informativeness (in terms of information relevant to regional politics) on political outcomes.[5] Ansolabehere et al. (2006) studied how television coverage of state politics affects the incumbent's advantage. More relevant to this paper, Snyder and Stromberg, 2010, show that access to relevant news improves political outcomes.[6] Fergusson (2014) further demonstrates that the electorate are more likely to punish politicians that appear to be captured by special interests (proxied by concentrated campaign contributions from Political Action Committees) when able to access more relevant media (namely, when the electorate is served by in-state, rather than out-of-state media market). For other recent approaches, see Ferraz and Finan (2008) using public release of audits in Brazil and Banerjee et al. (2010) who use a controlled field experiment to assess how voting behaviour varies with voter informedness in an election in Delhi, India.

# 2. Basic Model

I set up a simple model of the media sector that distinguishes two types of media attribute, one having only private consumer benefits while the other also generates a social benefit via a positive consumption externality. Each media product is characterised by a reporting vector $r = (y, z)$ where $y$ offers only private consumption value and $z$ generates the consumption externality. Concretely, an aggregate audience $X$ of people consuming one unit of media product $r$ generates a private benefit $B(r) = (1 - \lambda) y + \lambda z$ per consumer, and a consumption externality $\gamma z X$ on each individual, whether a consumer or a non-consumer; $\lambda \in [0, 1]$ is a taste parameter, $\gamma > 0$ parameterises the importance of the externality.

In line with the focal interpretation, I refer to $y$ as the *soft* or *entertainment* attribute and $z$ as the *hard* or *informative* attribute of the news product. Prat and Stromberg (2006) model informative media that, when consumed, benefit all citizens by enabling selection of more effective politicians. Their model generates precisely the above consumption externality (here represented by $\gamma > 0$) where each citizen benefits from aggregate information consumption independent of whether personally contributing by consuming hard news. They also derive the above linear private benefit from hard news. I simply add the soft news attribute.

[5] Electoral boundaries are determined by past political institutions, while the boundaries of media markets are determined by distinct economic factors.

[6] Politicians are more dedicated to their electorate in that Congressional representatives spend more time serving on constituency committees, are less likely to simple toe the party line when voting in Congress, and succeed in bringing home more "pork" to their electorate; electoral participation also rises.

The ratio $R \equiv y/z$ measures the product's "softness." In part, softness depends on how information is presented; media firms choose high softness when they emphasise style over substance. For instance, a firm might invest in quality audiovisuals and attractive news presenters, instead of paying for journalistic research. In addition, softness depends on how media firms select their news stories and discussion topics. For example, softness is high when a media firm focuses on sensational, emotional and amusing stories, by investing in reporting natural disasters, "human interest" events and celebrity gossip, however low their social or political relevance may be. Beyond the soft/hard news interpretations, $y$ can be privately-relevant information and $z$ any content that influences consumers' social behaviour. For instance, high softness could represent a predominance of topics mainly relevant to individual decisions over more socially relevant topics or morally persuasive discussions.

**Media firms** $N$ media firms compete for audience and subsidies. Each firm $n \in \{1, ..., N\}$ chooses its content or reporting strategy $r_n = (y_n, z_n)$ and incurs the cost $k_n(r_n) \equiv k(r_n) \equiv y_n^2 + z_n^2$, independent of how many consumers access the content. I discuss alternative cost structures below to emphasise that the fixed costs play no role in the main results. I assume $k(r)$ is additively separable in $y$ and $z$ to simplify the analysis.[7]

Media firms earn revenues from up to three sources: consumer and advertiser payments and subsidies from the media agency. Each media firm sets a (subscription, copy or access) price $p_n \in \mathbb{R}$ per consumer; consumer tastes are private information so there is no price discrimination, but the main bias result holds even with price discrimination. I initially allow negative pricing (understood as consumption inducements) but later treat the important cases where negative prices or any pricing are effectively infeasible. Advertisers pay media firms a fixed per-capita rate $\alpha$ for audience access.[8] So firm $n$ with audience $X_n$ earns $\alpha X_n$ in ad revenues and $p_n X_n$ in consumer revenues. In addition, the media agency transfers $\tau_n$ to firm $n$; $\tau_n$ can be positive (subsidies) or negative (taxes such as an entry or broadcasting fee). Firms are risk-neutral profit-maximisers, so each firm $n$ picks its reporting $r_n$ and pricing $p_n$ to maximise its expectation of

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

where $\mathbf{X}, \mathbf{p}$ denote the vector of audiences and prices. Each firm can guarantee a non-negative expected profit by opting out of the mechanism (and market).

**Consumers** There is a unit mass of consumers, indexed by $t$ with cumulative distribution function $F(t)$. Each consumer $t$ has a unit demand for a news product, so $t$ consumes one news product or none at all:[9] $t$ picks a media product $n$ that maximises the net (private) benefit $B_t(r_n) - p_n$, provided this exceeds $t$'s opportunity cost, denoted by $b_t$. Consumers

[7]In general, soft and hard attributes may be complementary (e.g., humour may facilitate news absorption) or substitutes (e.g., editors may choose between privately and socially relevant topics).

[8]Advertising is not the focus of the study, but can be endogenised by assuming competitive merchants and single-homing consumers. For interior solutions, $\alpha > 0$ is necessary in the specific heterogeneity model, but advertising is not crucial. Even with linear transport costs, if $y$ or $z$ have zero marginal cost up to some threshold or if people enjoy content that is costless to produce so that the support of $b_t$ effectively shifts down to $[-a, \beta - a]$ for some $a > 0$.

[9]This "single-homing" also arises when each consumer has one unit of time and benefits from media proportional to time spent consuming, (sub)additively across different news products.

may also differ in their tastes for softness or (private) marginal rate of substitution, equal to the ratio $\frac{1-\lambda_t}{\lambda_t}$ of marginal values of soft $y$ and hard $z$ news, but I fix $\lambda$ in the main analysis. Notice that $\lambda > 0$ when hard news $z$ generates private consumption benefits. For instance, socially-relevant news may be privately useful or entertaining and people may value being informed participants in democracy. Also, in a finite community, people, especially altruists, would internalise part of their contribution to the social benefit. In the homogenous baseline, $b_t = b$ and $\lambda_t = \lambda$.

Each consumer gains the public benefit $\gamma z_n X_n$ from aggregate consumption $X_n$ of $n$'s hard news $z_n$; $n$'s audience share $X_n = \int_t x_{t,n} dF(t)$ where $x_{t,n} \in \{0, 1\}$ denotes $t$'s consumption from $n$. These public benefits are additively separable across firms (a natural assumption given single-homing). In addition, consumers pay lump-sum taxes to cover any media subsidies (they receive lump-sum transfers if the media agency extracts production rents on net). Denoting these taxes by $\tau$ per capita, consumer $t$ gains overall utility:

$$u_t\big(\mathbf{x_t}, \mathbf{X}; \mathbf{r}, \mathbf{p}\big) = b_t - \tau + \sum_n \big(x_{t,n}[B(r_n) - b_t - p_n] + \gamma z_n X_n\big) \tag{2}$$

An important feature of the model is that $y$ and $z$ are attributes of a single product and they cannot be consumed separately. This is a natural assumption when one interprets $y$ as the style used to present informative content $z$, but all we need is that people choose to consume $y$ and $z$ as a bundle. For example, people tend to watch their favourite evening news show as a single package, perhaps because they seek a consistent style and a news overview that avoids duplication.

**Media agency** The agency implements the media subsidy scheme. I assume that the agency can commit to a subsidy scheme, before media firms sink their costs of market entry. Except in the constrained first-best analysis of a benevolent "public service broadcaster", I rule out schemes that are contingent on reporting quality $r$.

**Constraint:** *Subsidies $\tau_n$ and price regulations can depend on $\mathbf{X}$ and $\mathbf{p}$ but not on $\mathbf{r}$.*

**Motivation** The simplest motivation is to assume the agency cannot observe news quality $r$ and that news quality is not verifiable (in a court of law). The constraint then follows immediately, but my principal motivation is different.[10] I *do* assume that news quality is not verifiable; this captures the notorious subjectivity of the quality and relevance of information to political choice, as well as the subjectivities inherent in many questions of taste (such as attractiveness and humour). However, instead of also relying on an agency inability to observe $r$, I assume that citizens cannot trust the agency with discretion over which media firms to support. This reflects the concerns that politicians, pressure groups and businesses might seek to influence media reporting via the agency, and media firms might bribe the agency to win subsidies.

Imposing an objective subsidy scheme (i.e., restricting to dependence on objective vari-

[10] Agency ignorance of $r$ lies in some tension with perfect observation of $r$ by consumers. Nonetheless, this simple motivation gains in coherence, if each consumer instead observes $r$ with significant noise; the consumer opinion reflected in audience shares may largely aggregate this noise away, while surveying all consumer information remains too costly.

ables) prevents the agency from rewarding media that pay it a bribe or distort their reporting to favour interested parties that manage to capture the agency.[11] Note that when a subsidy scheme uses audience shares as quality signals, subsidies *do* depend on subjective evaluations, but only of consumers, each of whom has negligible influence. Dispersing subjective discretion over the citizenry in this way makes capture impractical.

The analysis addresses the normative challenge of finding schemes that maximise social surplus. The idea is that citizens may pressure for or vote for politicians offering these schemes, but it is technically equivalent to consider a benevolent agency choosing the scheme under the above constraint. To obtain a unique solution, I select the scheme that maximises entry and minimises citizen taxes (as is optimal when taxes are distortionary or producer surplus is discounted).

**Timing** The subsidy scheme is set at the very beginning and with full commitment. Next, media firms simultaneously invest in reporting. After observing each other's reporting qualities, they set their consumer prices. Consumers observe these options and decide what to consume, if anything. Finally, transfers are paid according to the subsidy scheme ($\tau$). That is, the firms and citizens play the following game of complete but imperfect information, which I solve for Subgame Perfect Equilibria:

**0.** The subsidy scheme $\tau(\mathbf{X}, \mathbf{p})$ is fixed.

**1.** Each media firm $n$ sets its reporting strategy $r_n = (y_n, z_n)$.

**2.** Each media firm sets its price $p_n \in R$.

**3.** Each individual $t$ chooses media consumption $\mathbf{x_t} \in [0,1]^N$.

**Focal cases.** The case of **homogeneity** (one type of consumer and one type of firm) most clearly highlights the main insights. But for an environment with smooth comparative statics, I also consider **heterogeneity** in consumer ($t$) opportunity costs $b_t$, with a uniform distribution on $[0, \beta]$, some $\beta > 0$. Notice that $E(b_t) = \frac{\beta}{2}$ and $b_t$ can be viewed as a taste parameter with $B(r)$ defined as the private consumption benefit *gross* of any "transport" cost, instead of an opportunity cost.[12] In either case, the demand curve for a single firm offering reporting $r$ at price $p$ is:

$$X(r,p) = \begin{cases} \frac{B(r)-p}{\beta} & \text{if } 0 \leq B(r) - p \leq \beta \\ 1 & \text{if } B(r) - p > \beta \end{cases} \tag{3}$$

This form of heterogeneity fixes consumers' marginal rate of substitution between $y$ and $z$. This highlights the softness bias since all consumers agree on the optimal $y/z$ ratio and it simplifies the analysis. In particular, with homogenous firms, a single media firm is optimal (saving on fixed costs of production), both in the first-best and for a monopolist.

[11] I discuss the political economy question of how such objective schemes might get enforced in this scenario in a companion paper; one possibility is that citizens mobilise to impose agency rules that save them having to stay mobilised or re-mobilise every time they observe media qualities; another possibility is that a political party gains support by offering such rules to self-commit against media influence.

[12] Up to a shift in utility levels, the model is equivalent to the Hotelling line with firms locating at $t = 0$ and consumers uniformly distributed on $t \sim U[0,1]$, facing linear transport cost $b_t = \beta(t-0) = \beta t$.

**Price restrictions.** Negative prices are potentially relevant in this two-sided market where advertisers pay to reach consumers, so I allow for unrestricted pricing, where each firm can set any price $p_n \in \mathbb{R}$ on consumption of its media content. But it is often difficult to measure media consumption as opposed to inattentive access. For example, coupons bundled in a newspaper are a classic example of a negative price, but if consumers take the paper only to access its coupons, ignoring the newspaper's articles (and ads), there is no meaningful consumption. Also coupons may cost firms more than they are worth to consumers. So negative pricing can be infeasible or impractical. This motivates the case $NNP$ of "non-negative pricing." Transactions costs of policing price evasion can even make positive pricing impractical.[13] This motivates the case $NP$ of "no pricing."[14]

# 3. Outcomes with unrestricted consumer pricing

This section derives the benchmarks from the first-best, with and without consumption constraints, and then for unregulated markets, with monopoly and competition, followed by regulation and subsidies. The goal is to understand softness bias in markets and the nature of optimal subsidy and price regulation responses. I focus on the case where consumer pricing is, a priori, unrestricted (all prices are feasible, $p_n \in \mathbb{R}$).

## 3.1 First-Best

I characterise the first-best where the agency can contract perfectly with firms (over news reporting $r$) and with consumers (over their consumption $x$). The first-best softness ratio equals the ratio of marginal social values $R^S = \frac{\lambda+\gamma}{2}$. The optimal entry decision is a simple threshold on consumers' opportunity costs.

**Homogeneity** If entry is optimal, everyone should consume from a single firm, $x = X = 1$ and citizen surplus is $(B(r) - p) + \gamma z - \tau$ and producer surplus equals the firm profit, $\alpha + p + \tau - k(r)$. So first-best reporting $r^*$ maximises social surplus,

$$SS = B(r) + \gamma z + \alpha - k(r) \tag{4}$$

$B(r) + \gamma z$ is the gross private benefit from consumption plus the consumption externality. Since $k(r) = y^2 + z^2$ is quadratic and $B(r) = (1-\lambda)y + \lambda z$ is linear, $y^* = \frac{1-\lambda}{2}$, $z^* = \frac{\lambda+\gamma}{2}$;

$$r^* = \left(\frac{1-\lambda}{2}, \frac{\lambda+\gamma}{2}\right) \tag{5}$$

Defining $L_\gamma \equiv (1-\lambda)^2 + (\lambda+\gamma)^2$, the social surplus from $r^*$ is,

$$SS^* \equiv \frac{L_\gamma}{4} + \alpha \tag{6}$$

$\hat{b}^* \equiv SS^*$ is the upper threshold on opportunity cost that makes entry optimal. In summary,

[13] The jury is still out on the success of Rupert Murdoch and News International's move to place internet-based media products behind a "pay-wall".

[14] Audience-based subsidies may involve measurement costs too, but note that measuring audiences (aggregate consumption at each media firm) for advertising and subsidy purposes becomes easier when prices are zero since citizens then have no incentive to pay the cost of hiding their consumption. Nonetheless, audience-based subsidies (similar to advertising) are less effective when media firms can manipulate measures of their audience sales (e.g., by dumping copy or giving away supposedly paid-for copies.

**Proposition 1.** *In the first-best with homogeneity, if* $b \leq \hat{b}^* = \frac{L_\gamma}{4} + \alpha$*, a single firm enters and offers news with entertainment and information levels,* $y^* = \frac{1-\lambda}{2}$ *and* $z^* = \frac{\lambda+\gamma}{2}$*. The softness ratio is* $R^* = \frac{1-\lambda}{\lambda+\gamma}$ *and social surplus equals* $SS^* = \hat{b}^*$*.*

Notice that the softness ratio $R^*$ equals the ratio $R^S \equiv \frac{1-\lambda}{\lambda+\gamma}$ of marginal social returns on $y$ and $z$, for any fixed audience.

**Heterogeneity** Since a single firm remains sufficient, the first-best problem is equivalent to picking $r \geq 0$ and $X \in [0,1]$ to maximise,[15]

$$SS_{int} \equiv \left( B(r) + \gamma z - \frac{\beta X}{2} + \alpha \right) X - k(r) \tag{7}$$

This rescales the reporting quality gains of the homogenous problem (4) by $X$, so $r = Xr^*$ is optimal for a given audience share $X$. Substituting into (7), $X$ maximises $\left(\frac{L_\gamma}{4} - \frac{\beta}{2}\right) X^2 + \alpha X$, giving interior solution, $X^*_{int} = \frac{2\alpha}{2\beta - L_\gamma}$ if $\beta > \hat{\beta}^* \equiv \alpha + \frac{L_\gamma}{2}$, and otherwise $X = 1$.

**Proposition 2.** *In the first-best with citizen heterogeneity, if* $\beta > \hat{\beta}^* = \alpha + \frac{L_\gamma}{2}$*,* $r = r^*_{int} = \frac{2\alpha}{2\beta - L_\gamma} r^*$*, and the social surplus is* $SS^*_{int} = \frac{\alpha^2}{2\beta - L_\gamma}$*. Otherwise,* $r = r^*$ *as in the homogenous case and* $SS = \hat{b}^* - \frac{\beta}{2} = \alpha + \frac{L_\gamma}{4} - \frac{\beta}{2}$*.*

In contrast to the homogenous case where the audience drops from 1 to 0 when $b$ exceeds $\hat{b}^*$, provoking non-entry, $X^*_{int}$ decreases smoothly with the opportunity cost parameter $\beta$.[16] Quality naturally falls in parallel, as the fixed cost of quality is spread over a smaller audience.

## 3.2 Unregulated monopoly

This subsection derives the softness bias and under-entry that characterise unregulated monopoly. With homogenous consumers, or equivalently perfect price discrimination, absent the consumption externality ($\gamma = 0$), monopolists act efficiently since able to extract all private rents. However, with $\gamma > 0$, unable to extract consumers' benefits from the social externality, the monopolist underinvests in hard news and is biased towards not entering, so there is underconsumption. Heterogeneity exacerbates both problems and also lowers soft news quality by limiting extraction of private consumer rents.

**Homogenous consumers** As in the first-best, the monopolist enters with a single firm or not at all. If $r > 0$, it maximises price $p$ subject to inducing consumption: $p = B(r) - b$ and $x = X = 1$. The resulting profit $\pi = \alpha + p - k(r) = \alpha + B(r) - b - k(r)$ is maximised at

$$r = r^m \equiv \left( \frac{1-\lambda}{2}, \frac{\lambda}{2} \right)$$

Unable to extract the external benefits from hard news, the monopolist only internalizes the marginal private value $\lambda$ from $z$, neglecting its marginal external value $\gamma > 0$. This generates underinvestment in hard news: $z^m = \frac{\lambda}{2} < z^* = \frac{\lambda+\gamma}{2}$ from (5). Reporting is softer than in the first-best: the monopolist's softness ratio $R^m$ equals the ratio $R^P \equiv \frac{1-\lambda}{\lambda}$ of marginal private returns from $y$ and $z$, which exceeds the marginal social ratio $R^S = R^* = \frac{1-\lambda}{\lambda+\gamma}$.

[15] $\frac{\beta X}{2}$ is the average opportunity (or transport) cost for the $X$ consumers with $b \leq X$.

[16] In this model of heterogeneity, entry always occurs because the fixed cost $k(r)$ of serving a small mass $m$ of consumers with opportunity cost $b_t \leq m$ is proportional to $m^2$.

The monopoly price $p = B^m - b$ where the gross private consumer benefit $B^m \equiv B(r^m) = B\left(\frac{1-\lambda}{2}, \frac{\lambda}{2}\right) = \frac{L_0}{2}$, where I define $L_0 = (1-\lambda)^2 + \lambda^2$, the sum of squared private benefits ($L_0 = L_\gamma$ at $\gamma = 0$). Since $\lambda > 0$ and $z^m < z^*$, the first-best content $r^*$ generates a higher gross private benefit, $B^* \equiv \frac{L_0+\gamma\lambda}{2} > B^m$. The monopoly profit is

$$\pi^m = \frac{L_0}{4} + \alpha - b$$

Neglecting its social externality, the monopolist only enters when $b$ is below

$$\hat{b}^m \equiv \frac{L_0}{4} + \alpha \tag{8}$$

This entry threshold is less than the first-best cut-off $\hat{b}^* = \frac{L_\gamma}{4} + \alpha$ by the sum of the surplus $\gamma^2/4$ lost from softness bias and the social externality $\frac{\gamma\lambda}{2}$ from monopoly entry.

**Proposition 3.** *Under homogeneity, a monopolist enters if $b \leq \hat{b}^m = \frac{L_0}{4} + \alpha$, setting $r^m = \left(\frac{1-\lambda}{2}, \frac{\lambda}{2}\right)$ and $p^m = \frac{L_0}{2} - b$. This extracts the private consumer benefit $B^m = B(r^m) = \frac{L_0}{2}$ but consumers gain an externality surplus $\frac{\gamma\lambda}{2}$. The social surplus is $SS^m \equiv \hat{b}^m + \frac{\gamma\lambda}{2} = \frac{L_0}{4} + \frac{\gamma\lambda}{2} + \alpha$.*

**Corollary 3.1.** *The monopolist enters less than is optimal and underinvests in hard news; the softness ratio equals the private marginal returns ratio: $R^m = R^P = \frac{1-\lambda}{\lambda} > R^*, \forall \gamma > 0$.*

Even taking $r = r^m$ as given, entry is suboptimally low because $r^m$ has a positive externality surplus, $\gamma z_m = \frac{\gamma\lambda}{2}$. As we show in section 3.4, an audience subsidy can fix that entry problem, but not the excessive softness $R = R^P$. Far from a figment of the monopoly case, softness bias is general to any market setting (see 3.3 on competition and Lemma 1).[17]

Moving in that direction, notice that a monopolist facing any distribution of consumer opportunity costs will always set $r$ to minimise the cost $k(r)$ of providing any given (private) benefit $B$. This is so, because varying $r$ with $B(r)$ fixed has no impact on these consumers, whence demand $X$ and revenues $pX$ depend only on $B(r)$ and $p$. The monopoly problem reduces to picking $B$ and $p$, with $r$ automatically defined by this cost minimisation:

$$r(B) \equiv \underset{\{r \in \mathbb{R}_+^2 : B(r) = B\}}{\arg\min} k(r) = \frac{B}{L_0}(1-\lambda, \lambda) \tag{9}$$

This costs $k(B) = \frac{B^2}{L_0}$. Softness bias remains fixed at $R = R^P$. Also $r(B)$ increases strictly with $B$. So $B$ serves as a measure of media quality, here and whenever $r = r(B)$ for some $B$.

**Heterogenous consumers** When $\beta$ is small, $B = \frac{L_0}{2} = B^m$ as before.[18] But when $\beta$ exceeds the threshold $\hat{\beta}^m \equiv \frac{L_0}{4} + \frac{\alpha}{2}$, heterogeneity leads to an interior solution where, using equations (9) and (3), the monopolist picks $B, p$ to maximise,

$$\pi^m_{int}(B, p) = (\alpha + p)\frac{B - p}{\beta} - \frac{B^2}{L_0}$$

The solution, useful for investigating regulation below, follows directly:

[17] Homogeneity and unrestricted pricing already make it clear that monopoly pricing cannot be to blame.

[18] For $\beta \leq \hat{\beta}^m$, the monopolist behaves essentially the same as with homogeneity, except its price $p = p^m = \frac{L_0}{2} - \beta$ only extracts the *marginal* consumer's rent, leaving an average private consumer surplus of $\frac{\beta}{2}$.

**Proposition 4.** *With heterogeneity and $\beta > \hat{\beta}^m = \frac{\alpha}{2} + \frac{L_0}{4}$, the monopolist sets $r = r(B)$ with $B = B^m_{int} = \frac{\alpha L_0}{4\beta - L_0} < \frac{L_0}{2}$ and $p = p^m_{int} = \frac{\alpha(L_0 - 2\beta)}{4\beta - L_0}$, giving audience $X^m_{int} = \frac{2\alpha}{4\beta - L_0}$ and social surplus $SS^m_{int} = \frac{\alpha^2(6\beta + 2\gamma\lambda - L_0)}{(4\beta - L_0)^2}$. As always, $R = R^P$.*

As with the first-best, because the fixed costs are spread over a smaller audience, quality is lower than with homogeneity at the same average opportunity cost, $b = \frac{\beta}{2}$ (unless $\beta > 2\hat{b}^m$ in which case homogeneity results in non-entry). Heterogeneity now prevents the monopolist from appropriating the full private consumer surplus, exacerbating the distortions caused by neglect of the social externality. (In the homogenous case, there was under-entry, here the audience served is too small, because $B$ is too small, even given $R = R^P$.)

## 3.3 Competition

I begin with the general result that competition cannot avoid softness bias. This result holds with any market-based subsidies and price regulations (maintaining the assumption that, unlike audience $X$ and price $p$, reporting quality $r$ is not verifiable). Competition may induce firms to further consumers' private interests, but these interests are biased towards soft news (relative to the collective interest). Next, I illustrate with homogeneity in an idealised, fully contestable market. There, competition benefits consumers by lowering prices and raising consumption $X$, but cannot resolve the softness bias and under-entry problems of monopoly.[19,20] As an alternative to discussing contestability, one can consider the perfect competition between firms with costs that are proportional to the audience served, $k_n = k(r_n)X_n$, instead of fixed costs. This generates identical results to contestability. While implausible for media products, it clearly demonstrates softness bias is robust even to perfect competition.

### 3.3.1 The general softness bias result

Maintaining the assumption that consumers share the fixed softness preference $R^P$ ($\lambda$ is fixed), I now generalise the monopoly softness result to any market environment where regulations and subsidies are market-based, that is, dependent only on market outcomes. Firms' reporting strategies then only affect outcomes via consumers' private consumption decisions and other firms' strategic reactions. Briefly stated (details in Appendix), consumers only care about the set of benefits, $B_n - p_n$, offered by active firms. Therefore, controlling for gross benefits $B_n$, competing firms only respond to each others' costs $k_n = k(r_n)$ *if* these costs have commitment effects on future pricing or entry choices. These strategic effects reinforce each firm's direct private benefit from lowering its cost, because low costs have a deterrence effect.[21] So all firms (weakly) gain from minimising their cost $k_n$ of providing a given benefit $B_n$. So using equation (9), we have:

[19] Audience subsidies with non-distortionary taxes also achieve these benefits as we see below.

[20] Reporting quality $r$ is the same as in monopoly. More generally, it may rise or fall (but softness bias remains). First, quality may fall when competition lowers the audience per firm and hence scale economies. Second, quality may rise if firms compete over quality with prices fixed, as with rigid price commitments or when constrained by non-negativity. Third, applying the insights from Spence (1975), quality can rise or fall, depending on whether marginal consumers are more or less willing to pay for quality. Note that audience-based subsidies can then similarly affect quality by shifting the characteristics of marginal consumers (Leroch and Wellbrock (2011) describe a specific case where a (one-dimensional) quality falls with per-copy subsidies).

[21] High marginal costs could yield a "puppy-dog" benefit in price competition but the high fixed cost cannot.

**Lemma 1.** *In market environments, with only market-based subsidies and regulations, given a private softness preference $R^P$, firms optimally report with softness $R = R^P$; each $n$ picks a gross benefit $B_n \geq 0$ and sets $r_n = r(B_n) = \frac{B_n}{L_0}(1-\lambda, \lambda)$ at cost $k(B_n) = \frac{B_n^2}{L_0}$.*

In sum, in market extensions of the model to any number of firms and any citizen heterogeneity that maintains the marginal rate of substitution between soft and hard news, $R^P$, all firms share the softness bias, $R^P$. Usefully, any firm $n$'s reporting strategy is characterised in one dimension, by its implied private consumption benefit, $B_n$. Generalising to heterogenous consumer tastes for softness complicates, but the logic remains; certainly, we would have $R \geq \min R^P$.

### 3.3.2 A perfectly contestable market equilibrium

I illustrate the general softness bias result here (the derivation can be skipped). In the simple one-shot timing of the baseline model, the only equilibria with multiple firms involve mixed strategies with inefficient duplication of fixed costs. To give competition its best chance, I present a market where firms can coordinate perfectly and consumers are homogenous. In the standard model of contestability, an incumbent firm must fix its choices, $r, p$, in the face of a threat of entry by flexible competitors that can enter and exit at no cost (they pay production costs only while active). To preempt entry, the incumbent must offer the most attractive consumer prospect $B - p$ consistent with non-negative profits. This implies $r = r^m$ and $p = p^0(r^m) = \frac{L_0}{4} - \alpha$, where the "0" denotes the price that gives zero profits.

For a simple derivation in the one-shot model, I suppose that firms commit to $r_n, p_n$ at no cost in stages 1 - 2 (which can be simultaneous), but now only pay their reporting costs $k(r_n)$ if they enter the market, which they decide in a new stage 2.5 after observing each other's reporting and pricing strategies and just before consumer choice in stage 3.[22]In 2.5, the firms play an anti-coordination game. Using Lemma 1, stages 1-2 equate to choices of $(B, p)$. A $(B, p)$ choice implying losses even as monopoly entrant is weakly dominated. So, focusing on monopoly profitable choices of $(B, p)$ $(\alpha + p - k(B) \geq 0)$, if one firm $n$'s choice has $B - p$ strictly larger than all other firms, it always weakly gains from entry (strictly so, if $\alpha + p - k(B) > 0$). This competition for the market readily generates the following result.

**Proposition 5.** *With two or more firms competing for the market under ideal contestability, entry only occurs if $b \leq \hat{b}^m$. All pure strategy equilibria then involve at least two firms committing to reporting strategies characterised by $B = B^m$ and prices $p = p^0(r^m) = k(B^m) - \alpha$. Exactly one such firm enters and it earns zero profits.*

This idealistic result is only presented as an extreme possibility for illustration of the general point that competition cannot resolve softness bias. While competition benefits the consumers, and can raise welfare in the heterogenous consumer case (e.g., if non-negative price constraints bind, then competition raises quality), these advantages can be achieved using subsidies and price regulation of a monopolist (see below). This justifies the focus

[22]Price rigidity is important here. If prices were flexible after entry is fixed, monopoly would result. Entry can be sequential provided firms first observe each other's price and reporting commitments; equivalently, firms must be unable to commit to stay in the market.

on regulating a monopolist in settings where audience subsidies are feasible. Of course, competition is also important: in a model with further information asymmetries and distortionary taxation, competition has important advantages over subsidies and regulation that may dominate fixed cost duplication concerns.

## 3.4 Audience subsidies and price regulation

I assume that subsidies and price regulation can be implemented at no cost, so it is sufficient to subsidise and regulate a single media firm (firms' cost functions are public information). Regulators can verify both prices $p$ and audience shares $X$. Only reporting quality $r$ is non-verifiable, but I begin by studying an audience-based subsidy $\tau(X)$. Then I consider regulations that restrict or dictate pricing $p$ as well. A subsidy $\tau$ that increases with audience share $X$ increases the monopolist's incentive to enter the market and attract a large audience.[23] With homogenous consumers, such subsidies do not increase reporting quality (unless there was no entry absent subsidy). However, price regulation can induce higher quality. Surprisingly, a minimal price or price floor is optimal, in contrast to the typical price cap regulation. Moreover, this holds true even with heterogenous consumers, where the higher prices exclude some consumers. I discuss the causes of this novel price floor result below. I also show that this form of price regulation is optimal even when subsidies are infeasible.

### 3.4.1 Audience subsidy with homogenous consumers

Here, audience subsidies induce the monopolist to internalise the consumption externality from monopoly reporting $r^m$. Subsidies cannot improve quality given entry, but can induce entry where otherwise the market would be empty.

If entering (accepting $\tau(\cdot)$), the monopolist sets $r$ and $p$ to maximise expected profit,

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

It is clearly optimal to either induce entry with a full audience or have no entry. A subsidy $\tau(\cdot)$ that induces the monopolist to attract the maximal audience, $X\left(r,p\right)=1$ implies expected profit $\tau(1)+\alpha+p-k\left(r\right)$, which must be weakly positive. Setting, say, $\tau(X)=0, \forall X<1$ or a linear subsidy $\tau\left(X\right)=\tau\cdot X$ with $\tau=\tau(1)$ both rule out intermediate audience choices. So without loss (even for heterogeneity), I adopt the linear subsidy with $\tau$ as intensity or slope and $\tau_0$ as constant, here zero.

As before, the monopolist maximises this profit, setting $r=r^m=\left(\frac{1-\lambda}{2},\frac{\lambda}{2}\right)$ and $p=p^m=\frac{L_0}{2}-b$ (Lemma 1 applies with $B=\frac{L_0}{2}$ and $p=B-b$). With $\tau_0=0$, the monopolist's problem is identical to that with $\alpha$ raised by $\tau$. So the only novelty is that the subsidy $\tau$ relaxes the entry constraint to $b\leq\hat{b}^m+\tau$. The minimal required subsidy is $\tau=k(r^m)-\alpha-p^m$. Subsidising up to the social surplus externality $\frac{\gamma\lambda}{2}$, generates $\hat{b}^{AS}=\hat{b}^m+\frac{\gamma\lambda}{2}$, where $AS$ denotes

[23] Market entry subsidies are less effective than consumption subsidies except in the special case of homogeneity. Production subsidies operate similarly to consumption subsidies. If the production cost $k(r)$ were verifiable, then subsidising this cost can raise $r$ (with homogeneity, this is just as with price regulation below, and with heterogeneity, it permits further gains in combination with price regulation). Of course, to be consistent with non-verifiability of soft and hard quality, I assume the cost components $y^2$ and $z^2$ are not separately verifiable, so $R=R^P$ would remain.

"audience subsidy" solution. So $\hat{b}^{AS} > \hat{b}^m$, reflecting internalisation of the monopolist's entry externality. But $\hat{b}^{AS} = \hat{b}^* - \frac{\gamma^2}{4} < \hat{b}^*$, because entry is more valuable in the first-best where there is no softness bias.

**Proposition 6.** *With consumer homogeneity, audience subsidies raise entry ($b \leq \hat{b}^{AS} = \hat{b}^m + \frac{\gamma\lambda}{2} = \alpha + \frac{L_0}{4} + \frac{\gamma\lambda}{2}$), but not quality, given entry; $r^{AS} = r^m$ and $p^{AS} = p^m$.*

In this specific setting, subsidies cannot even raise the quality or influence the price after entry occurs. The implicit softness bias ($R^{AS} = R^P$) is highly robust, but the complete insensitivity of quality is not, as we see in the next two subsections (on heterogeneity and price regulation).

### 3.4.2 Audience subsidy with heterogenous consumers

With heterogenous consumers, audience-based subsidies can induce any desired audience share $X \in [0, 1]$ even when the monopolist controls price $p$.[24] The interesting case, an interior optimum, arises for $\beta > \hat{\beta}^{AS} = \alpha + \gamma\lambda + \frac{L_0}{2}$. Suppressing the constant term $\tau_0$, which can be used to extract the monopolist's expected profit ( $-\tau_0$ is the entry fee), raising the subsidy slope $\tau$ is again equivalent (for the monopolist) to increasing $\alpha$. So choosing $\tau$ allows the scheme to pick any desired audience share $X$ with quality and price moving as in Proposition 4: $p(X) = \frac{(L_0 - 2\beta)X}{2}$ and $B(X) = \frac{L_0 X}{2}$ (note that $\hat{\beta}^{AS} > \hat{\beta}^m$).

The social surplus is the sum of consumer surplus, $\frac{\beta X^2}{2}$, producer surplus, $(\alpha + p(X))X - \frac{B(X)^2}{L_0}$, externality surplus, $\gamma\frac{\lambda B(X)}{L_0}X$. So the agency picks $X$ to maximise

$$\begin{aligned} SS_{int} &= \left(\frac{\beta X}{2} + \frac{\gamma\lambda B(X)}{L_0} + \alpha + p(X)\right) X - \frac{B(X)^2}{L_0} \\ &= \frac{X^2}{4}\left(L_0 + 2\gamma\lambda - 2\beta\right) + \alpha X \end{aligned} \tag{10}$$

The solution is straightforward and summarised here.

**Proposition 7.** *With consumer heterogeneity and $\beta > \hat{\beta}^{AS} = \alpha + \gamma\lambda + \frac{L_0}{2}$, the optimal audience subsidy raises quality, price, audience and surplus; $r = r(B_{int}^{AS})$ and $B_{int}^{AS} > B^m$. $B_{int}^{AS} = \frac{\alpha L_0}{2(\beta - \gamma\lambda) - L_0}$, $p_{int}^{AS} = \frac{\alpha(L_0 - 2\beta)}{2\beta + \gamma^2 - L_\gamma}$, $X_{int}^{AS} = \frac{2\alpha}{2\beta + \gamma^2 - L_\gamma}$, $SS_{int}^{AS} = \frac{\alpha^2}{2\beta + \gamma^2 - L_\gamma} = \frac{\alpha^2}{2(\beta - \gamma\lambda) - L_0}$, $R_{int}^{AS} = R^P$.*

This illustrates how subsidies can raise quality as well as audience share; the fixed quality of the homogenous case is not robust. Nonetheless, the softness bias is unchanged. So surplus is still lower than in the first-best and audience share remains less than in the comparable first-best ($X_{int}^* = \frac{2\alpha}{2\beta - L_\gamma}$ on $\beta > \hat{\beta}^* \equiv \alpha + \frac{L_\gamma}{2}$ which guarantees all solutions are interior).[25]

### 3.4.3 Audience subsidy and price regulation (ASPR) with homogeneity

While even the combination of audience subsidies and price regulation cannot induce first-best reporting, adding price regulation helps to mitigate the softness bias by raising the overall quality level. Imposing a price $p$ forces the monopolist to stay out or provide a

[24] This is clear using $\tau(X') = 0, \forall X' \neq X$, but also true with linear subsidies.

[25] Notice that $p_{int}^{AS} < -\alpha < p_{int}^m$, because the monopolist sets an excessive price to extract consumer rent when unregulated and the audience subsidy motivates it to reduce price, as well as raise quality, in order to raise its audience subsidy.

consumer benefit $B \geq b + p$. So a monopolist that enters sets $r = r(B)$ with $B = b + p$. Forcing a higher price $p > p^m$ forces higher quality ($B > B^m$), provided the subsidy ensures entry is profitable. This is indeed optimal, because marginally increasing hard news quality $z$ (from its second-best level $z^m < z^*$) has first-order benefits, while a marginal increase in $y$ (from its first-best level $y^m = y^*$) has only second-order costs. Formally, $z = z(B) = \lambda \frac{B}{L_0}$ and the social surplus $SS = B - b + \alpha + \gamma\lambda \frac{B}{L_0} - \frac{B^2}{L_0}$ is maximised at $B = B^{ASPR} = \frac{L_0+\gamma\lambda}{2}$ (exactly equal to $B^*$ by coincidence).[26] The optimal lower bound on price is $\underline{p}^{ASPR} = \frac{L_0+\gamma\lambda}{2} - b$.[27] The increased efficiency implies more entry: $\hat{b}^{ASPR} = \hat{b}^{AS} + \frac{(\gamma\lambda)^2}{4L_0} > \hat{b}^{AS}$.

**Proposition 8.** *With audience subsidy, the optimal price regulation is a binding minimum price* $\underline{p}^{ASPR} = p^m + \frac{\gamma\lambda}{2}$. *This forces higher quality and increases entry:* $B^{ASPR} = \frac{L_0+\gamma\lambda}{2} = B^* > B^{AS} = B^m$ *and* $\hat{b}^{ASPR} = \hat{b}^{AS} + \frac{(\gamma\lambda)^2}{4L_0} > \hat{b}^{AS}$ *(*$\hat{b}^{ASPR}$ *remains below* $\hat{b}^*$ *if* $\lambda < 1$*).*

Price regulation improves matters here, not because the monopolist sets too high a price (there is no risk of inefficient rent extraction in the homogeneous case), but rather because the price floor forces the monopolist to raise quality, partially redressing the information externality. Usually, regulators instead impose price caps on monopolists that use high prices to inefficiently extract consumer rent. Homogeneity rules out this problem. I now show that price floors can remain optimal even with heterogeneity.

### 3.4.4 Audience subsidy and price regulation (ASPR) with heterogeneity

Even with consumer heterogeneity, where fixing quality, higher prices would adversely affect consumption, the agency still prefers to impose a binding price floor when quality is endogenous. Adding the instrument of price regulation allows the media agency to effectively choose the audience size $X$ *and* price $p$ to maximize social surplus, knowing that the monopolist will choose $B = p + \beta X$ and $r = r(B)$. So the agency sets $p$ and $X$ to maximise the social surplus with (10) now in the form,

$$SS_{int} = \left( \frac{\beta X}{2} + \frac{\gamma\lambda(p + \beta X)}{L_0} + \alpha + p \right) X - \frac{(p + \beta X)^2}{L_0}$$

Maximising over $p, X$ gives first-order conditions,

$$\begin{aligned} (\gamma\lambda + L_0) X - 2(p + \beta X) = 0 \Leftrightarrow 2p = (L_0 + \gamma\lambda - 2\beta)X \\ \text{and} \quad \alpha L_0 + p(L_0 + \gamma\lambda - 2\beta) = \left(2\beta^2 - \beta L_0 - 2\gamma\lambda\beta\right) X \end{aligned}$$

$$\begin{aligned} \text{Substituting for } p \text{ gives } \; 2\alpha L_0 &= \left(2\beta(2\beta - 2\gamma\lambda - L_0) - (\gamma\lambda + L_0 - 2\beta)^2\right) X \\ &= \left((2\beta - 2\gamma\lambda - L_0) L_0 - \gamma^2\lambda^2\right) X \end{aligned}$$

This condition for an interior solution is $\beta > \hat{\beta}^{ASPR} \equiv \alpha + \gamma\lambda + \frac{L_0}{2} + \frac{\gamma^2\lambda^2}{2L_0} = \alpha + \frac{L_\gamma}{2} - \frac{\gamma^2(1-\lambda)^2}{2L_0}$. It also ensures that for any $\gamma > 0$, $p_{int}^{ASPR} > p_{int}^{AS}$, so that price regulation still takes the form of a lower bound.

**Proposition 9.** *For any* $\gamma > 0$*, the optimal price regulation, combined with audience subsidies, takes the form of a price floor, even in the heterogenous case; the ability to regulate*

[26] Softness bias makes it optimal to raise $z$ only part of the way up to its first-best level ($z^{ASPR} < z^*$), but also implies $y^{ASPR} > y^* = y^m$ and the two effects on $B$ exactly cancel in the quadratic setting.

[27] The required audience subsidy rises to $\tau = b - \alpha - \frac{L_0}{4} + \frac{(\gamma\lambda)^2}{4L_0}$ $(= k(r) - \alpha - p = \frac{(B^{ASPR})^2}{L_0} - \alpha - (\frac{L_0+\gamma\lambda}{2} - b))$.

*price raises quality, audience and social surplus: with $\beta > \hat{\beta}^{ASPR}$ giving an interior solution,* $p^{ASPR}_{int} = \frac{\alpha L_0(L_0+\gamma\lambda-2\beta)}{L_0(2\beta+\gamma^2-L_\gamma)-(\gamma\lambda)^2}$*;* $B^{ASPR} = \frac{\alpha L_0(L_0+\gamma\lambda)}{L_0(2\beta+\gamma^2-L_\gamma)-(\gamma\lambda)^2}$*;* $X^{ASPR}_{int} = \frac{2\alpha L_0}{L_0(2\beta+\gamma^2-L_\gamma)-(\gamma\lambda)^2}$*;* $SS^{ASPR}_{int} = \frac{\alpha^2}{L_0(2\beta+\gamma^2-L_\gamma)-(\gamma\lambda)^2}$.

The inequalities $p^{ASPR}_{int} > p^{AS}_{int}, B^{ASPR}_{int} > B^{AS}_{int}, X^{ASPR}_{int} > X^{AS}_{int}, SS^{ASPR}_{int} > SS^{AS}_{int}$ are immediate by direct comparison with proposition 7 (using $2\beta + \gamma^2 - L_\gamma = 2(\beta - \gamma\lambda) - L_0$). In addition, it is immediate from proposition 4 that these values are also higher than for an unregulated, unsubsidised monopoly.

The endogeneity of quality continues to motivate upward price regulation (a price floor). One might still wonder whether audience subsidies (that can compensate if not promote high quality) are necessary for the price floor result. I turn to this question next.

### 3.4.5 Price regulation without subsidy

Price regulation is sometimes feasible even when budgetary restrictions make subsidies politically infeasible, so I now study price regulation without subsidies. Here price regulation is weaker but still pushes price above the monopoly level. Whenever the unregulated market is strictly profitable ($b < \hat{b}^m$), price regulation remains strictly advantageous.

If the unregulated market's profitability can compensate having to set $B = B^{APSR}$ ($b < \hat{b}^m - \frac{\gamma^2\lambda^2}{4L_0}$), the agency can impose the minimal price $p^{ASPR}$ from subsection 3.4.3 and nothing changes. If profitability is lower but still non-negative, the agency cannot impose such a high minimal price (the monopolist would not enter). Instead, given concavity of $SS(B)$ in $B$, it imposes the highest price consistent with entry. A monopolist selling at price $p$ sets quality $B = p + b$ at cost $(p + b)^2/L_0$, so this highest price is the upper root of $p + \alpha = \frac{(p+b)^2}{L_0}$:

$$p^+ = \frac{L_0}{2} - b + \frac{1}{2}\sqrt{L_0(L_0 + 4(\alpha - b))}$$

$p^+$ gives $B^{PR}(b) = p^+ + b = \bar{B}(b) \equiv \frac{L_0}{2} + \frac{1}{2}\sqrt{L_0(L_0 + 4(\alpha - b))}$ (which is a real number for any $b \leq \hat{b}^m$, given that $b > \hat{b}^m - \frac{\gamma^2\lambda^2}{4L_0}$). Also $\bar{B}(b) < B^{ASPR}$ as expected.

**Proposition 10.** *With price regulation but no audience subsidy, under homogeneity, social surplus is maximised by imposing a price floor,* $\underline{p} = \min\left(\frac{L_0+\gamma\lambda}{2} - b, \bar{B}(b) - b\right)$*. This achieves the quality from* $B = B^{ASPR}$ *if* $b \leq \hat{b}^m - \frac{(\gamma\lambda)^2}{4L_0}$ *but* $B^{PR}(b) = \bar{B}(b)$ *if* $b \in (\frac{L_0}{4} + \alpha - \frac{(\gamma\lambda)^2}{4L_0}, \hat{b}^{AS}]$.

In sum, price floors remain optimal, as a way to force quality upwards, whenever market entry is feasible; the optimal price is the highest price consistent with entry, unless the monopolist would enter even with the price floor, $p^{ASPR}$, in which case that is the optimal price floor (and the inability to subsidise makes no difference). So quality is weakly lower than with subsidies, but price floors remain optimal.[28]

**Heterogeneity** Finally, the price floor result is partially robust to consumer heterogeneity in that price floors are still optimal for some parameters. Forcing the price downwards is

[28] If instead the agency only cared about the total surplus of citizens, it might conceivably extract rents by using $p^+ > p^{ASPR}$ to induce $\bar{B}(b) > B^{ASPR}$ on $b < \hat{b}^m - \frac{(\gamma\lambda)^2}{4L_0}$. However, while budget constraints and tax distortions may restrict positive subsidies, charging a license or entry fee is usually feasible (whenever price regulation is feasible). Moreover, the citizens prefer to extract rents in this way once quality reaches $B^{ASPR}$. So I would still predict that quality is weakly higher with subsidies than without.

obviously pointless with homogeneity, since the monopolist then keeps consumer surplus at zero by lowering quality. With heterogeneity, this downward quality concern remains important, but if $\beta$ is high so that demand responds little to quality, then obliging a monopolist to keep price low may be a dominant concern. Under the conditions for an interior solution, $p_{int}^{PR}$ which can be less than $p_{int}^{m}$, implying a price floor is optimal. For instance, even in the one-dimensional setting without softness bias considerations ($\lambda = 1$), if $\beta$ is sufficiently large ($\beta \geq \sqrt{5} + 14$), the optimal price regulation is a minimal price.

The literature on regulation (see Sappington, 2005, Armstrong and Sappington, 2006, Sappington and Weisman, 2010, for recent surveys) is well aware that placing too tight a price cap on monopolists can lead to quality problems. However, I am unaware of any paper showing that a price floor may be optimal. It is therefore a surprise that even with $\gamma = 0$ (no consumption externality) and in a simple linear demand setting, it may be optimal to impose a price floor.[29]

**Concluding remarks on price floors** This model identifies a strong motive for imposing a lower bound on price, which can arise with or without audience subsidies and even with consumer heterogeneity. Notice in addition that, since effective competition removes the monopoly tendency to excessive pricing, we can expect more use of price floor regulation against competing firms than against monopoly.[30]

# 4. Restricted pricing and softness bias in the constrained first-best

As argued above, negative pricing is often infeasible or impractical. When consumption constraints bind, a media firm may prefer or be obliged to raise quality in order to attract consumers. All the main insights of the model are robust to such alternative pricing scenarios, but some interesting new effects arise. I begin with some interesting consequences for the "constrained first-best" problem where media firms can be controlled perfectly, but media consumption is decided privately. In particular, when consumption constraints bind, it is optimal to adopt a degree of softness bias relative to the first-best. So, for instance, a benevolent public service broadcaster (PSB) should make the news more attractive and informative than in the first-best, particularly focusing on attractiveness; that is, it should raise its degree of softness. Indeed, it should bias towards softness more, as competing media options become more attractive, but only when the competitive threat is relatively weak. The optimal policy may reverse when the threat is too strong and certainly if the competitor offers informative content with strong positive externalities. I also show that social surplus falls when commercial competitors are attractive but uninformative.

Concretely, I show that quality should, initially, increase in response to competitive threats in the softness ratio $R^P$ and not $R^*$. The results of this section have direct implications

[29] Notice that advertising is not necessary, being equivalent to having a cost function that is still quadratic but now with a negative linear coefficient..

[30] In fact, in duopoly competition in a Hotelling linear transport cost setting, firms set $L_0/6$ while a monopolist with two firms (also at the two ends of the Hotelling line) would set $L_0/4$, absent regulation. So forcing price upwards is more valuable in the case of competition.

for the policy debate on "ratings chasing," and "dumbing down" of media content. For expositional clarity, I begin with no pricing since the non-negative pricing equilibria are simple combinations of this and the unrestricted pricing equilibria. For the constrained first-best, non-negative pricing ($NNP$) is essentially the same as for ($NP$), so I omit it.[31,32]

## 4.1 The constrained first-best

In what I call the "constrained first-best," firms' choices (quality and prices) are contractible (subject to non-negative profits), but citizen consumption $x$ is not. To set the stage, I quickly describe the constrained first-best with unrestricted pricing. There, the social planner can induce any desired consumption level at no distortionary cost.[33] The consumption constraint simply adds a lower bound on the firm subsidy and an upper bound on consumer price; these bind given the Lexicographic preference for tax minimisation assumed above (which guarantees a unique characterisation).

Under **homogeneity**, the constrained first-best is just the first-best (see in proposition 1) with price $p^* = B(r^*) - b = \frac{L_0+\gamma\lambda}{2} - b$ and subsidy $\tau^* = k(r^*) - (\alpha + p^*) = b - \alpha + \frac{\gamma^2 - L_0}{4}$. Notice that $p^* < 0$ if consumer (opportunity) costs $b$ exceed the gross private benefit from first-best reporting,

$$B^* \equiv B(r^*) = \frac{(1-\lambda)^2 + \lambda^2 + \gamma\lambda}{2} = \frac{L_0 + \gamma\lambda}{2} \tag{11}$$

Negative prices occur (with entry) whenever $b \in (B^*, \hat{b}^*]$, which can be non-empty.

Under **heterogeneity**, with an interior solution, the constrained first-best price is always negative: $p = p^*_{int} \equiv -(\alpha + \gamma z^*_{int})$. This price induces consumers to internalise their positive advertising externality $\alpha$ on producers and their positive consumption externality $\gamma z^*_{int} = \frac{\alpha\gamma(\lambda+\gamma)}{2\beta - L_\gamma}$ on the community.

**Constrained first-best with no pricing and homogenous consumers** When $b$ is low ($b \leq B^*$), it is possible to set $p = 0$, raise $\tau$ from $\tau^*$ to $\tau^* + p^*$, and replicate all other aspects of the constrained first-best with unrestricted pricing, just described. When $b$ exceeds this cut-off, $B^*$, the consumption constraint is binding. To attract an audience, reporting quality must be increased to raise $B(r)$ to $b$. If entry is still optimal, the constrained optimal value of $r$, which I denote by $r^{**}$, is given by imposing the binding consumption constraint, $B(r) = b$, and solving the first-order conditions for $y$ and $z$ to maximise (4):

$$y^{**} = \frac{(1-\lambda)(2b - \gamma\lambda)}{2L_0} = \frac{1-\lambda}{2}\left(\frac{2b-\gamma\lambda}{L_0}\right)$$
$$z^{**} = \frac{2\lambda b + \gamma(1-\lambda)^2}{2L_0} = \frac{\lambda}{2}\left(\frac{2b-\gamma\lambda}{L_0}\right) + \frac{\gamma}{2}$$

[31] For example, to state every detail for the case with homogeneoity: for $b > B^*$, the solution is identical to that under $NP$; for $b \leq B^*$, the solution is identical to that for unrestricted pricing, but as this has identical efficiency and reporting quality to $NP$ on this range, the results for $NP$ remain sufficient; that is, proposition 11 remains valid with $NNP$.

[32] For the monopoly case, no pricing, can be better or worse than non-negative pricing. As we will see, it depends on whether a price cap of zero added to a price floor of zero, raises surplus or not.

[33] Distortionary taxation limits the optimal degree of externality subsidization, but all results generalise.

Since $b > B^* = \frac{L_0+\gamma\lambda}{2}$ here, these expressions reveal that $y^{**} > y^*$ and $z^{**} > z^*$. Using $r(B)$ defined above (9) as the cheapest way to add consumption benefits $B$, this reporting strategy can be expressed as,

$$r^{**}(b) = r^* + r(b - B^*) \tag{12}$$

implying a softness ratio,

$$R^{**}(b) = \frac{1-\lambda}{\lambda + \gamma\left(\frac{L_0}{2b-\gamma\lambda}\right)}$$

Now $R^{**}(b) \in (R^*, R^P)$ since $\frac{L_0}{2b-\gamma\lambda} \in (0,1)$ on $b > B^*$. 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 $b - B^*$. 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,

$$SS^{**} = \gamma z - y^2 - z^2 + \alpha = \alpha + \frac{\gamma^2}{4} - \frac{(2b-\gamma\lambda)^2}{4L_0}$$

Entry is optimal when this is non-negative, which holds for $b \leq \hat{b}^{**} \equiv \frac{1}{2}\left(\gamma\lambda + \sqrt{(4\alpha+\gamma^2)L_0}\right)$ – the upper root of $SS^*(b) = 0$. This entry cut-off is less than $\hat{b}^*$ from the unrestricted-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 $B^*$): $\hat{b}^{**} > B^* \iff \hat{b}^* > B^* \iff 4\alpha + \gamma^2 > L_0$. Entry with $r^{**}$ then occurs for $b \in \left(B^*, \hat{b}^{**}\right]$. I focus on this case since the constrained first-best and first-best are essentially equivalent in the other case.

**Proposition 11.** *Given $4\alpha + \gamma^2 > L_0$, the constrained first-best has entry threshold $\hat{b}^{**}$ and $r = r^*$ on $b \leq B^*$, but $r = r^{**}(b) = r^* + r(b - B^*)$ on $b \in (B^*, \hat{b}^{**}]$. Softness $R = R^{**}(b) \in (R^*, R^P)$ rises from $R^* = R^S$ towards but not reaching $R^P$ as $b$ rises above $B^*$.*

In sum, 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. I now use these results to investigate how a benevolent media firm, such as a public service provider or PSB, should respond to changes in consumer's opportunity costs.

**Best responding to a commercial media threat when consumers are homogenous** Comparative statics for the impact of changes in $b$ are immediate from the previous subsection. To see how the PSB should respond to competing media output from a private provider, I assume that consumers either consume the PSB content or the competitor's content (but not both). If the commercial outlet offers sufficient quality, $B_0 \equiv B(r_0)$ exceeds any other opportunity costs (this adjusts to $B_0 - p_0$ if the incumbent sets a non-zero price for access) and so the relevant opportunity cost of consumers is $B(0)$. It is also necssary to take account of the social opportunity costs, not only the private ones of consumers. I treat the case where the private provider supplies too little informative content. Denoting its reporting by $r_0$, I assume $z_0 < z^*$. For instance, if it is a commercial media firm, it would set $R = R^P$. It might have a lower or higher level of attractiveness than the PSB. In particular, it is interesting to suppose that the PSB initially has an advantage from state investments in technology, so that the quality and attractiveness of the commercial competitor, $B_0$, starts low, but is growing over time. I also simplify by supposing that the private firm does not react strategically to the PSB's strategy.[34]

To simplify the discussion, I initially suppose the competitor has no information externality at all, $z_0 = 0$, as when its information is purely of private value or only relevant to a different country's democratic processes.[35] With unrestricted pricing, the results from page on page 10 apply: $r = r^*$ until $b$ increases beyond $\hat{b}^*$ at which point it ceases to be optimal to enter, from a perspective that ignores the profits of the commercial firm. Taking account of the advertising lost by that company on entry, the PSB would exit not when $b = B_0$ surpasses $\hat{b}^*$ but when $B_0$ passes $\hat{b}^* - \alpha = \frac{L_\gamma}{4}$.

The case with no pricing is more interesting. Here the results of proposition 11 are relevant. If $4\alpha + \gamma^2 > L_0$, then as $b = B_0$ rises from 0, reporting is initially fixed at $r^*$. Then reporting rises linearly with $b = B_0$ along the trajectory, $r^{**}(b) = r^* + r(b - B^*)$. Both entertainment and news are increased to attract the audience and the softness ratio increases from $R^*$. Softness never reaches the private values ratio, $R^P$, because when $b$ reaches $\hat{b}^{**}$, the PSB optimally exits the market. Again, this cut-off value for exit is reduced by $\alpha$ if the lost ad profits of the commercial competitor figure in the welfare calculation of the PSB. Figure 4.1 depicts the optimal response function, characterised by Proposition 11. Notice that only $(b =)\, B_0 - p_0$ matters affects the PSB strategy given entry ($p(0) = 0$ in the figure), but the entry decision does also depend on $R_0 \equiv \frac{y_0}{z_0}$ when $z(0)$ can differ from 0. The social opportunity cost of entry includes both $\alpha$ and $\gamma z_0$.

More generally, 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 $r_0$. The opportunity cost does not figure in the $SS(r, r_0)$ expression, but it does figure as $B_0$ in the surplus difference. $SS_0 \equiv SS(r_0) = B_0 + \alpha + \gamma z_0$. So $\Delta SS$ differs from the $SS$ expressions above in the subtraction of $\alpha + \gamma z_0$. 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 $B_0 > B^*$. 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,

$$\Delta SS = \alpha + \frac{\gamma^2}{4} - \frac{(2B_0 - \gamma\lambda)^2}{4L_0} - (\alpha + \gamma z_0) = \frac{\gamma^2}{4} - \frac{(2B_0 - \gamma\lambda)^2}{4L_0} - \gamma z_0$$

[34] The private firm might be focussed on profits from the audience of another country or a large international market or it might face large costs of adapting its technology, at least in the short run. Given the fixed costs of production and citizen homogeneity, a single active firm is socially optimal, but I assume the commercial media firm has sunk its costs of providing news at reporting level $r_0$ and cannot change this (or wishes to sink these costs anyway to serve a distinct market.

[35] E.g, private TV channels were often from foreign countries for consumers living near borders in the early days of terrestrial radio and television (especially for countries with only a state provider). More generally, commercial channels tend to have lower political information when $R^P$ is very high.

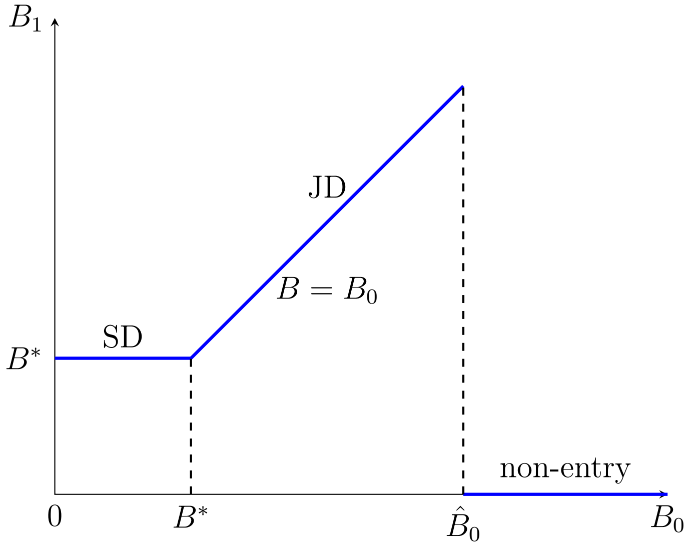


Figure 1: Optimal response to increases in the attractiveness of a competing media outlet

Entry is optimal when this is non-negative, which holds (given that $B_0 > B^*$) on $B_0 \leq \hat{B}_0^{**}(z_0) \equiv \frac{1}{2}\left(\gamma\lambda + \sqrt{(\gamma^2 - 4\gamma z_0)L_0}\right)$.[36,37]

**Proposition 12.** *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 $\gamma^2 - L_0 \leq 4\gamma z_0$, the PSB should enter and set $r = r^*$ if and only if $B_0 + \gamma z_0 \leq \frac{L_\gamma}{4}$.* **(b)** *If $\gamma^2 - L_0 > 4\gamma z_0$, the PSB should enter with $r = r^*$ if $B_0 \leq B^*$, enter with $r = r^{**}(B_0)$ if $B_0 \in \left(B^*, \hat{B}_0^{**}(z_0)\right]$ and not enter at all if $B_0 > \hat{B}_0^{**}(z_0)$.*

One might be concerned about the robustness of the non-monotonicity in view of the discontinuity created by homogeneity. The next section investigates. The discontinuity in the figure disappears but the non-monotonicity remains.

**Constrained first-best with no pricing and heterogenous consumers** As always, the interesting new case arises when $\beta$ exceeds a lower bound, here

$$\hat{\beta}_{NP}^* \equiv \frac{L_0 + 2\gamma\lambda}{4} + \sqrt{\left(\frac{L_0 + 2\gamma\lambda}{4}\right)^2 + \left(\frac{\gamma(1-\lambda)}{2}\right)^2}$$

However, it is also now necessary to impose an upper bound on $\alpha$ of $\hat{\alpha}_{NP}^*(\beta, \lambda) \equiv \frac{K^*(\beta)}{2L_0}$ to rule out a corner solution in which the market is just covered.[38] Suppressing the subscript *int*, the result is summarised by,

[36] The range with constrained entry is nontrivial if $\hat{B}_0^{**}(z_0) > B^* \iff L_0 < \gamma^2 - 4\gamma z_0$. This is less likely than in the case without an incumbent (fixing $b$), but can hold if $z_0$ is not too large.

[37] In the case of unrestricted-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, $B_0 \leq \hat{B}_0^{**}(z_0, p_0) \equiv p_0 + \frac{1}{2}\left(\gamma\lambda + \sqrt{(\gamma^2 - 4\gamma z_0 - 4p_0)L_0}\right)$.

[38] This and the standard strict covering solution in which $r = r^*$ play a role in understanding how a benevolent media provider (such as a public service broadcaster or PSB) should respond to competitive threats, but I focus on the interior case for now.

**Proposition 13.** *For $\beta > \hat{\beta}^*_{NP}$, and $\alpha < \hat{\alpha}^*_{NP}(\beta, \lambda)$, in the constrained first-best with citizen heterogeneity, $r^*_{NP} = \frac{2\alpha L_0}{K^*(\beta)} r^{**}(\beta)$, $X^*_{NP} = \frac{2\alpha L_0}{K^*(\beta)}$ and $SS^*_{NP} = \frac{\alpha^2 L_0}{K^*(\beta)}$.*

When instead $\beta \leq B^*$, the market is strictly covered, denoted $SC$, and the first-best reappears: $r^{*SC}_{NP} = r^*$ with $SS^{*SC}_{NP} = \hat{b}^* - \frac{\beta}{2}$. When instead $B^* < \beta \leq \hat{\beta}^*_{NP}$ or $\beta > \hat{\beta}^*_{NP}$ and $\alpha \geq \hat{\alpha}^*_{NP}(\beta, \lambda) \equiv \frac{K^*(\beta)}{2L_0}$, the market is just covered, denoted $JC$ and then $r = r^{*JC}_{NP} = r^{**}(\beta)$ with $SS^*_{NP} = SS^{*JC}_{NP} = SS^{**}(\beta) + \frac{\beta}{2} = \alpha - \frac{K^*(\beta)}{4L_0}$ ($\geq \alpha$ as $K^*$ is negative on this range).

Both interior and just covered solutions involve distortions to attract a larger audience. The degree of distortion increases with $\beta$ just as $R^{**}$ increased with $b$ in the baseline model. The distortion is the same function of $\beta$ in both interior and just covered solutions: $R = R^{**}(\beta) = \frac{1-\lambda}{\lambda + \gamma\left(\frac{L_0}{2\beta - \gamma\lambda}\right)}$ since both $r^*_{NP}$ and $r^{*JC}_{NP}$ are proportional to $r^{**}(\beta)$.[39] Of course, fixing advertising $\alpha$ below $\hat{\alpha}^*_{NP}$, interior solutions are associated with higher $\beta$ and greater distortion.

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

I now apply this result to the same question of best responding to a commercial competitor that I considered above. Again a graph, Figure 2, is helpful for seeing what happens. The model must be adapted slightly to generate continuity effects. Concretely, I suppose that the competitor is located at one end of a Hotelling line, while the PSB is located at the other. Consumer demand for the PSB depends on a transport cost reflecting variation in tastes, as well as the opportunity cost from consuming the commercial competitor, which itself involves a transport cost varying among consumers. The adaptation is straightforward and relegated to the Appendix which derives in detail, the function, $B_1(B_0, z_0)$. The key points are that the PSB initially produces $r^*$, strictly dominating (marked $SD$ on the figure) the competitor and therefore ignoring it, until the competitor becomes a threat at least for consumers whose ideal point is most distant from the PSB, which happens when the competitor sets $B_0$ above $B^* - \beta$. Then the PSB optimally "just dominates" (marked $JD$). Here it raises its softness as it grows, but eventually, it abandons the goal of attracting all consumers and starts to share the market, "overlapping" (*over*) with the competitor. When the competitor is extremely attractive, the PSB should simply take consumers who dislike the comptetitor. This is called *touch* in that the demands of each just touch each other.

## 4.2 Monopoly with no consumer pricing

**Homogenous consumers** When $p = 0$ is the only option, the monopolist sets $r = r_{NP} = r(b)$, so y$=\frac{b(1-\lambda)}{L_0}$, $z = \frac{b\lambda}{L_0}$ and the monopolist just attracts an audience at a production cost of $\frac{b^2}{L_0}$. The monopolist's profit is $\alpha - \frac{b^2}{L_0}$. So the entry cut-off is now $\hat{b}_{NP} = \sqrt{\alpha L_0}$. Consumer surplus is zero and the citizen surplus equals the externality benefit $\gamma z = \frac{b\gamma\lambda}{L_0}$. In summary,

**Proposition 14.** *With no subsidies, no pricing and homogeneous consumers, if $b \leq \hat{b}^m_{NP} = \sqrt{\alpha L_0}$, a monoplist sets $r^m_{NP} = r(b) = \frac{b}{L_0}(1-\lambda, \lambda)$; that is, $B^m_{NP} = b$, giving a social surplus of citizens, $SSC^m_{NP} = \frac{b\gamma\lambda}{L_0}$, monopoly rents $\alpha - \frac{b^2}{L_0}$ and social surplus $SS^m_{NP} = \alpha + \frac{b(\gamma\lambda - b)}{L_0}$.*

[39] Since $\beta > B^*$ implies $0 < \frac{L_0}{2\beta - \gamma\lambda} < 1$, $R \in (R^*, R^P)$. Note that under the hypothetical constraint to serve an audience share $X$, the optimum with unrestricted-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.

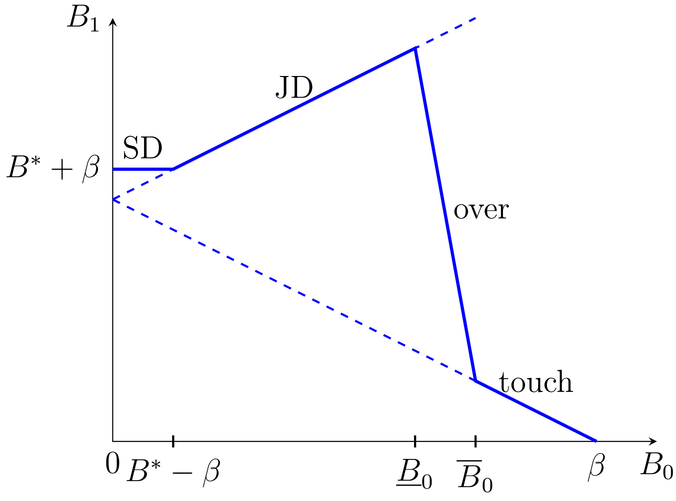


Figure 2: Optimal response to attractiveness of a competing media outlet, with heterogeneity

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.

**Heterogenous consumers** With price forced to zero, the monopolist maximises $\pi_{NP}^{int} = \alpha\frac{B}{\beta} - \frac{B^2}{L_0}$ subject to $B \leq \beta$. For a strict interior solution, the first-order condition is $B_{NP}^{int} = \frac{\alpha L_0}{2\beta}$ (with second-order condition, $-\frac{2}{L_0} < 0$, always satisfied) and $B_{NP}^{int} \leq \beta$ requires $\alpha \leq \frac{2\beta^2}{L_0}$. Maximised profits are then $\pi_{NP}^{int} = \frac{\alpha^2 L_0}{4\beta^2}$ (always positive). When $\alpha \geq \frac{2\beta^2}{L_0}$ or $\beta \leq \sqrt{\frac{\alpha L_0}{2}}$, the optimal solution is at the upper corner: $B = B_{NP}^{cov} = \beta$ and profits are $\pi_{NP}^{cov} = \alpha - \frac{\beta^2}{L_0}$ (which is strictly positive, indeed no less than $\frac{\beta^2}{L_0}$). (Again the cut-off for a full audience is at a lower value than the $\hat{b}_{NP} = \sqrt{\alpha L_0}$ of the baseline model.)

**Proposition 15.** *If $\beta > \sqrt{\frac{\alpha L_0}{2}}$, the monopolist sets $B = B_{NP}^{int} = \frac{\alpha L_0}{2\beta} < \sqrt{\frac{\alpha L_0}{2}} < \sqrt{\alpha L_0}$. If $\beta \in \left[0, \sqrt{\frac{\alpha L_0}{2}}\right]$, the monopolist sets $B = \beta$, just covering the market.*

**Non-Negative Pricing** The solution to the $NNP$ problem is identical to the unrestricted pricing problem whenever $\beta \leq \frac{L_0}{2}$. When $\beta$ is larger, the solution is at the corner with $p = 0$ (by concavity) and therefore identical to the no pricing problem ($NP$).

## 4.3 Audience subsidy with no consumer pricing

In the homogenous consumer model, audience subsidies again have a continuous beneficial effect on quality. I omit the details since a linear audience subsidy is equivalent to increasing the advertising parameter $\alpha$. So with subsidy $\tau$, the monopolist enters if $b \leq \hat{b}_{NP}^{\tau} = \sqrt{(\alpha + \tau) L_0}$. Optimally, $\tau(b) = \frac{b^2}{L_0} - \alpha$ and the agency pays this until $b$ reaches $\hat{b}_{NP}^{AS} = \frac{\gamma\lambda}{2} + \sqrt{\alpha L_0 + \frac{\gamma^2\lambda^2}{4}}$. At this value, $\hat{b}_{NP}{}^{\tau(b)} = \hat{b}_{NP}^{AS}$.

The heterogenous case works similarly and is omitted.

# 5. Conclusion

In this paper, I developed a model of soft bias in the news media. I derived four sets of results. First, market settings quite generally suffer from a softness bias, a bias towards entertaining over informative news reporting. Second, audience-based subsidies and price regulation can mitigate the resulting inefficiencies, but cannot evade the soft bias. Third, price regulation may take the form of a price floor (despite the lack of seller competition). Heterogeneity may be an advantage when pricing is restricted and I derive a novel price regulation result. Fourth, I characterised the soft bias that is optimal in the constrained first-best. I used these results to address recent debates about "ratings-chasing" in public sector broadcasting and I showed how competitive media alternatives can reduce welfare; public media should initially respond by increasing quality but eventually abandon market share. This paper was originally a longer paper called "How to subsidise the news," now split in two. The companion paper investigates non-market solutions to the softness bias.

In his MacTaggart speech of 2010, Mark Thompson, the BBC director general 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 section 4 are relevant to this ratings chasing debate: are public service broadcasters, such as the BBC, are too "populist"? Some critics of the BBC maintain that it has overly focused on 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 12 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 more plausible heterogeneous citizens models.

# 6. Appendix

*Proof of Proposition 1.* The above text presents the main steps of the proof, so I only fill in missing details here. To maximise social surplus for a given set of firms, each citizen should consume from a firm that maximises the resulting private and external benefits, $B(r_n) + \gamma z_n$ and by citizen homogeneity, this is citizen independent. 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, we can restrict attention to a single firm and study its optimal reporting strategy $r$, suppressing index $n$. If the firm does not enter ($r = 0$), there is no social surplus. Entering without attracting any audience is clearly dominated by non-entry.[40] □

*Proof of Proposition 2.* Subsituting $r = Xr^*$ into social surplus expression (7) gives,

$$SS_{int} = \left(\left(\frac{L_\gamma - \beta}{2}\right) X + \alpha\right) X - X^2 \frac{L_\gamma}{4} = \left(\frac{L_\gamma - 2\beta}{4}\right) X^2 + \alpha X \tag{13}$$

so $X^*_{int} = \frac{2\alpha}{2\beta - L_\gamma}$ which lies in (0,1) precisely when $\beta > \hat{\beta}^*$, which also guarantees the second-order condition for a maximum, $\beta > \frac{L_\gamma}{2}$. □

*Proof of Proposition 3.* See text in body of paper. The second-order condition is obviously satisfied (quadratic with negative square term). □

*Proof of Proposition 4.* The first-order conditions for the monopolist's optimisation problem in the case of an interior solution are $\frac{\partial \pi}{\partial B} = 0 \Rightarrow \frac{\alpha + p}{\beta} - \frac{2}{L_0} B = 0$ and $\frac{\partial \pi}{\partial p} = 0 \Rightarrow \frac{-\alpha + B - 2p}{\beta} = 0$. This gives the candidate solution, $(B^{int}, p^{int}) = \left(\frac{\alpha L_0}{4\beta - L_0}, \frac{\alpha(L_0 - 2\beta)}{4\beta - L_0}\right)$. $\beta > \frac{2\alpha + L_0}{4}$ 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 ($B^{int} \geq 0$) and concavity (which both require $\beta > \frac{L_0}{4}$). The solution generates equilibrium profits, $\pi^{int} = \frac{\alpha^2}{4\beta - L_0} > 0$, audience size, $X = \frac{2\alpha}{4\beta - L_0}$, consumer surplus, $CS = \frac{(B-p)^2}{2\beta} = \frac{\beta}{2}\left(\frac{2\alpha}{4\beta - L_0}\right)^2 = \frac{2\alpha^2\beta}{(4\beta - L_0)^2}$ and social surplus $SS = \frac{\alpha^2(6\beta + 2\gamma\lambda - L_0)}{(4\beta - L_0)^2}$.

To derive the consumer surplus expression, notice that it can be expressed as,

$$\frac{(B-p)^2}{2\beta} = \frac{\beta}{2}\left(\frac{2\alpha}{4\beta - L_0}\right)^2$$

For the covering solution, note first that a monopolist only considers the just covering solution $JC$ with $p = B - \beta$. So this is a corner of the interior problem. Therefore it can only occur when $\beta \leq \frac{2\alpha + L_0}{4}$. In this case, $\pi^{JC} = \alpha + (B - \beta) - \frac{B^2}{L_0}$ so $B^{JC} = \frac{L_0}{2}$, $p^{JC} = \frac{L_0}{2} - \beta$, $\pi^{JC} = \alpha - \beta + \frac{L_0}{4}$ as in the baseline model. These profits are non-negative (weakly exceeding $\frac{\alpha}{2}$ since $\beta \leq \frac{2\alpha + L_0}{4}$). □

*Proof of Lemma 1.* Since consumer utilities only depend on the set of *active* firms' offers via $B_n - p_n$, this set of net values alone determines audience shares. Together with prices $p_n$ and the exogenous advertising rate $\alpha$, the audience shares $X_n$ are in turn sufficient for determining each firm's sales, ad revenues and any market-based subsidies. So, taking market entry as given, firms respond to shifts in each others' reporting strategies $r_n$ only in so far as they affect implied gross benefits $B_n$; once sunk, the costs $k(r_n)$ do not affect the set of possible pricing equilibria. In variants of the baseline model that allow firms to enter or exit after observing each others' reporting commitments, for a fixed $B(r)$, a lower cost $k(r)$ makes it more likely that the firm enters, which has the beneficial strategic effect of deterring entry by other firms. So endogenising entry only strengthens the incentive to minimise $k(r)$. In markets with multiple entry, or pricing, equilibria, Markov perfection rules out counter-intuitive equilibria where firms strategically benefit from higher costs. So it is weakly dominant for each firm to minimise its cost $k(r)$ of providing any given gross private benefit $B(r)$. □

[40] Social surplus, $SS = -k(r) < 0$ for any $r \neq 0$.

*Proof of Proposition 7.* The proof in the text uses the fact that $\beta > \hat{\beta}^{AS} \Rightarrow \beta > \hat{\beta}^{m} = \frac{L_0}{4} + \frac{\alpha}{2}$. The omitted inequalities for $p$ and $X$ are readily verified directly, but notice that they also follow automatically from the fixed linear relationship between $B, p, X$ in the monopolist's optimal strategic response to an imposed audience share and fixed subsidy. It remains only to fill in some missing steps in the derivations of subsidy and social surplus. The total subsidy required is given by,

$$\begin{aligned}
\tau(X_{int}^{AS}) &= k(B_{int}^{AS}) - (\alpha + p)X_{int}^{AS} \\
&= \frac{(B_{int}^{AS})^2}{L_0} - \left(\alpha + \frac{\alpha(L_0 - 2\beta)}{2(\beta - \gamma\lambda) - L_0}\right) \frac{2\alpha}{2(\beta - \gamma\lambda) - L_0} \\
&= \frac{\alpha^2 L_0}{(2(\beta - \gamma\lambda) - L_0)^2} - \left(\frac{-2\alpha\gamma\lambda}{2(\beta - \gamma\lambda) - L_0}\right) \frac{2\alpha}{2(\beta - \gamma\lambda) - L_0} \\
&= \frac{\alpha^2(4\gamma\lambda + L_0)}{(2(\beta - \gamma\lambda) - L_0)^2} \qquad (14)
\end{aligned}$$

The social surplus is

$$\begin{aligned}
SS_{int}^{AS} &= \left(\frac{(L_0 + \gamma\lambda - \beta)X_{int}^{AS}}{2} + \alpha\right) X_{int}^{AS} - \frac{(B_{int}^{AS})^2}{L_0} \\
&= \left(\frac{\alpha(L_0 + \gamma\lambda - \beta) + 2\alpha(2(\beta - \gamma\lambda) - L_0)}{2(\beta - \gamma\lambda) - L_0}\right) \frac{\alpha}{2(\beta - \gamma\lambda) - L_0} - \frac{\alpha^2 L_0}{(2(\beta - \gamma\lambda) - L_0)^2} \\
&= \frac{\alpha^2(2(\beta - \gamma\lambda) - L_0)}{(2(\beta - \gamma\lambda) - L_0)^2} \\
&= \frac{\alpha^2}{2(\beta - \gamma\lambda) - L_0} \qquad (15)
\end{aligned}$$

which is strictly positive since $\hat{\beta} > \gamma\lambda + \frac{L_0}{2}$. $\square$

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