Media Mergers and Media Bias with Rational Consumers: Extended Version

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ABSTRACT

We present an economic model of media bias and media mergers. Media owners have political motives as well as profit motives, and can influence public opinion by withholding information that is pejorative to their political agenda – provided that their agenda is not too far out of the political mainstream. This is true even with rational consumers who understand the media owners' biases, because the public do not know how much information the news organizations have and so do not know when news is being withheld. This problem can be undone by competition; but competition can be defeated in equilibrium by media mergers that enhance profits at the expense of the public interest. We thus derive a motive for media merger policy that is completely distinct from the motives behind conventional antitrust.

KEY WORDS: Information withholding, market for news, media bias, media mergers, pricing information, entry for buy-out

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1 Introduction

The hand that rules the press, the radio, the screen and the far-spread magazine, rules the country. - Judge Learned Hand, Memorial service for Justice Brandeis, December 21, 1942.

Media consolidation in the United States in recent decades has been dramatic,[3] and particularly so for local media.[4] Recent abortive attempts by the Federal Communications Commission (FCC) to relax merger restrictions have ignited fears by many that consolidation would accelerate, leading to diminished diversity of political expression and weakened public discourse. Some vehement opponents of relaxed merger scrutiny have argued that because of the threat of faster media consolidation 'democracy is in crisis' (Blethen (2004)).[5]

The issues in the controversy are both political and economic: even if the purpose of a media merger is to increase profit, the ramifications can affect how well informed the public is, and as a result, political outcomes. Because of these complications, traditional analysis of mergers as practiced in the industrial organization literature is not adequate to analyze media mergers, and until recently these policy debates have been dominated by non-economists. This paper presents an *economic* model of media bias and media mergers that incorporates these informational and political issues from the outset. We show that if media corporations are motivated by political motives as well as profits, then (provided that

[3]Bagdikian (2000) charts the concentration of the media into the hands of six large firms. This contrasts with 50 firms in 1983, when independent newspapers and broadcast stations were the norm. For example, the dominance of Clear Channel Communications in radio is unprecedented; it owns 1,200 radio stations, reaching 180 million listeners (Hopkins, 2004). The Gannett newspaper chain owns 101 daily newspapers (Gallagher, 2005). Other large chains include the Tribune Company and Times Mirror. AOL/Time Warner is a vast media conglomerate with enormous weight in several media at once (Bagdikian, 2000, p.x).

[4]George and Waldfogel (2000) report that 25% of Metropolitan Standard Areas (MSA's) in the US are served by only one newspaper, while the median MSA is served by only two, with the median HHI equal to 75% (see their Table 1; HHI is the inverse of the 'Paper Equivalents' statistic). For local radio, measuring market shares by ownership rather than by radio stations *per se* and averaging across city markets, Waldfogel and Wulf (2006) report average 2-firm concentration ratios rising from 0.51 in 1995 to 0.63 in 1998, and 4-firm ratios rising from 0.75 to 0.86 (Table 1).

[5]The rise of the internet has clearly done nothing to blunt public concerns about media consolidation. The reason may be that the internet, rather than providing *new* sources of news to compete with old ones, mostly provides alternative circulation routes for *existing* news (such as newspapers' online editions), as well as public fora for discussion of news.

these motives are not too far out of the political mainstream) they can distort information in order to manipulate political outcomes – even if consumers are rational – to the detriment of social welfare; that this problem can be undone by competition; but that competition can be defeated in equilibrium by media mergers that enhance profits at the expense of the public interest; that the market equilibrium can provide too little competition, but (if greed is a sufficiently strong motive) never too much; and that these problems persist even if media owners' political motives become vanishingly small compared with their profit motives. Concern about information withholding provides a rationale for merger restrictions in media industries that is absent in others.

In the remainder of this section, we provide some necessary background on the media industry and its regulatory environment, sketch our model, and discuss other relevant work.

1.1 Background

Media consolidation is a heated political issue in a number of countries. In South Korea, for example, the dominant newspaper oligopoly is politically conservative and often alleged to be partisan in its news coverage; a decades-old political movement for media reform has campaigned for editorial independence, and in 2001 the progressive government clashed bitterly with the conservative publishers, briefly imprisoning several of them (Yang (2002)). In the US, media consolidation was pushed to the center of the public arena by the 2003 decision of the FCC to relax its media merger restrictions. Under US law, any media merger requires the transfer of media licenses, and FCC approval for this transfer effectively creates a merger review process separate from any review by the Justice Department or the Federal Trade Commission. On Monday, June 2, 2003, the commissioners of the FCC voted 3-2 to relax FCC rules for merger approval along several dimensions.[6] The FCC moves generated

[6]For example, previously the FCC had ruled that no single media entity could reach more than 35% of US households via TV, while the new rules raised the cap to 45% (Copps (2003) argues that *de facto* the cap would actually be 90% because of the treatment of UHF channels). The previous rules had prevented

considerable public opposition (including such disparate parties as the liberal moveon.org group, the National Rifle Association, and conservative media critic Brent Bozell), and a public-interest group challenged the new rules in Federal court, resulting in a defeat for the FCC at the hands of the US Third Circuit Court in Philadelphia on June 24, 2004. The rules were sent back to the FCC for review, and have not been reissued since.[7]

Concern about media mergers stems from three characteristics of the media business: (i) Some media corporations have political motivations in addition to a desire for profit. (ii) This can affect the behavior of journalists, because journalists are not generally free to do reporting that conflicts with the agenda of their employers. (iii) It is possible to bias news coverage significantly within conventional journalistic methods (that is, without open fraud or fabrication). Consequently, politically motivated media corporations can tilt the news towards their political interests. We discuss these characteristics in turn.

(i) Media organizations with agendas. Claims that media organizations often have a political agenda are common. Bernard Goldberg (2001) famously argued that the major news media in the US are biased with a liberal political agenda. A rebuttal offered by Alterman (2003) argues that the media's real bias is in protecting its owners' corporate interests. Bagdikian (2000) argues that the proliferation of newspapers in the nineteenth century with different political biases, including many with left-leaning agendas as well as conservative ones, fostered the environment in which pro-labor reforms were enacted, while current corporate control leads to a bias toward corporate-friendly political outcomes. Beyond professional media analysts, American news *consumers* increasingly perceive the presence of political agendas shaping the news they watch and read.[8]

any corporation from owning a TV station and a newspaper in the same market, but the new rules would lift the restriction for markets with at least four TV stations, so allowing three TV stations to be owned by the newspaper publisher.

[7] See Copps (2003) and Labaton (2004) for accounts of this story.

[8] One recent survey (Annenberg (2005, p.3)) reports that 79 percent of the public believe that news providers will practice self-censorship to avoid antagonizing advertisers. Another (PEW (2005, pp.7-8)) reports that "Six-in-ten see news organizations as politically biased, up from 53% two years ago. More than

The presence of news organizations with an agenda beyond profit is underlined by the existence of major news organs that do not make, and are not expected to make, any profit at all. The *New York Post*, owned by Rupert Murdoch's News Corporation, has been estimated to lose between $15 and $20 million annually, and observers argue that "Murdoch appears willing to underwrite Post losses, perhaps for the political bully pulpit it affords him" (Fine (1999)). *The Washington Times* is owned by Sun Myung Moon of the Unification Church and has a mission to promote a conservative point of view to balance what its editors see as liberal bias elsewhere in the media. It has been estimated as having lost a total of $1.7 billion for its owner since its founding (see Ahrens (2002), who documents many ways in which a conservative perspective manifests itself at the paper).

Neither is the idea that a news provider can have an agenda and affect political outcomes by any means new, or limited to the US context. For example, Allen (1984) shows how a German town was converted to Nazism before the Second World War with the aid of the local newspaper. The Big Three newspapers in South Korea, with a combined market share of about 65%, are often accused of actively promoting a conservative political agenda.[9]

Perhaps the most striking example is found in Silvio Berlusconi, the Italian Prime Minister who was narrowly defeated in April 2006. Berlusconi is a television magnate who, while in power, controlled close to 90% of Italian television.[10] He was not reluctant to use

seven-in-ten (72%) say news organizations tend to favor one side, rather than treat all sides fairly; that is the largest number ever expressing that view. And by more than three-to-one (73%-21%), the public feels that news organizations are often influenced by powerful people and organizations, rather than pretty independent."

[9] "Although the media had been freed from government intervention, in many ways it still bore the imprint of the authoritarian era: concentrated ownership, an opaque style of management, and association with vested interests that stood to lose from political reforms urged by progressives. The media has also openly tried to influence elections. The Chosun Ilbo favored the ruling Democratic Liberal Party's Kim Young-Sam in 1992, and in 1997 the JoonAng Ilbo backed the ruling GNP's candidate Lee Hoi-Chang. It was widely believed that these newspapers favored the ruling party's candidates, and that they did not want to see the progressive Kim Dae-Jung elected President."(Yang (2002))

[10] Companies controlled by the Berlusconi family have a 45% share of the Italian commercial TV audience, and 60% of advertising sales (www.ketupa.net/berlusconi.htm). Putting his own 3 stations together with the public RAI stations put the Berlusconi share at approximately 90% of the television audience (though RAI 3 appears to have taken a more independent or even anti-Berlusconi stance) (Stille (2006)).

this power to control content, with a history of bullying both publicly- and privately-owned stations under his control, firing critics and satirists (Stille, 2006), and using his privately-owned stations as a 'fan club' (Economist, 2002). In March and April 2006, one Berlusconi station, RETE4, was fined 450,000 Euros by the Italian broadcasting watchdog for biassing its coverage blatantly in favor of Berlusconi's coalition (Barber (2006)). The imbalance was quite transparent: in one 15-day period in January, Berlusconi's airtime amounted to three hours and 16 minutes, while his challenger Romano Prodi's airtime came to eight minutes (Hunt (2006)).

For a final example, Rupert Murdoch has been known to harbor a political agenda, at one point promising to prohibit his British newspapers from publishing anything favorable to the prospect of the UK joining the Euro zone (Harding (2002)) and recently admitting that he had attempted to sway public opinion on the Iraq War (Szalai, 2007).

In short, news organizations with a political agenda and a willingness to use the news to promote it are by no means a mere theoretical possibility.

(ii) Imperfect independence of journalists from managerial influence.

A political agenda by media owners would be irrelevant if the owners had no way to influence the journalists in their employ, but that is not the case in general. Bagdikian (2000, p.xxv-xxvii) describes as 'The Wall of Separation Between Church and State' the traditional ideal of journalists' independence from media owners and business managers, and then documents recent trends toward reduction of that independence. An important milestone was the rise of Mark Willes as CEO of the Times-Mirror group, which owns the Los Angeles Times. Willes intervened aggressively in journalistic decisions in order to make the paper more attractive to advertisers, and bragged of taking a 'bazooka' to the Wall of Separation. The Sinclair Broadcast Group (owners of the largest chain of TV stations in the US) fired its Washington bureau chief after he criticized the management for what he considered partisan meddling with news programming to influence the 2004 election (Kurtz

(2004)), and in 2001 the publisher of the San Jose Mercury News resigned to protest editorial interference from the paper's parent company, Knight-Ridder (Alterman (2003, p. 25). Overt interference aside, there is considerable evidence that journalists censor themselves to avoid antagonizing the organization that employs them (Alterman (2003, p.24)).

(iii) Feasibility of bias within accepted journalistic standards.

Given that news organizations sometimes have political agendas and are prepared to impose them on the newsroom, we need to know what forms of bias those agendas might create. A reporter may pass on thinly-sourced information that suits that agenda, subjecting contrary information to a higher standard, or may tilt a given set of facts through emphasis or subtle choices of words (see Gentzkow and Shapiro, 2006b). On rare occasions, a reporter may falsify information for news stories. However, none of these methods is really needed to produce the effect. In many cases, all that is needed is the *omission* of information that runs counter to the news organization's agenda. Sins of omission are an important part of accusations of press bias in practice (together with the common and nearly equivalent expedient of hiding an inconvenient fact at the end of a long article, or deep inside the newspaper where it will be seen by few readers), and they will be the focus of our formal model below. As Posner (2005) puts it:

> Not that the media lie about the news they report; in fact, they have strong incentives not to lie. Instead, there is selection, slanting, decisions as to how much or how little prominence to give a particular news item.

For example, proponents of the US-led war in Iraq often complain that the US press, because of a political agenda, systematically omits good news from Iraq, such as successful relations between soldiers and local communities (see Robbins (2004)). On the other hand, some opponents of the war argue that in the run-up to the war the press was too eager to curry favor with the current administration, resulting in the opposite bias. An example is the case

of aluminum tubes purchased by the Iraqi government, which were claimed by US government officials to be useful only for refinement of uranium for weapons. This view was disputed by some experts, including some in the US government agencies themselves, but the *New York Times*, for example, largely omitted these dissenting voices in its pre-war coverage, giving readers the impression that the nuclear interpretation was a matter of consensus.[11] Massing (2004) argues more generally:

> In the period before the war, US journalists were far too reliant on sources sympathetic to the administration. Those with dissenting views, and there were more than a few, were shut out. Reflecting this, the coverage was highly deferential to the White House. This was especially apparent on the issue of Iraq's weapons of mass destruction – the heart of the President's case for war.

Other examples abound. Goldberg (2001) argues that media reports of homelessness tend to suppress information of drug addiction and criminality among the homeless in order to elicit sympathy for them. Sinclair Broadcasting Group refused to air an episode of *Nightline* that listed the names of soldiers killed in the Iraq war (de Moraes (2004) and Alterman (2004)). The editor of the *Washington Times* is open about using 'story selection' to give a conservative tilt to the publication (Ahrens (2002)). The Big Three Korean newspapers are said to "stifle stories critical of their interests"(Yang, 2002).

Thus, news organizations in many cases do have both the motive and the means to skew news coverage in the direction of a political agenda, through means that can be subtle and quiet but nonetheless potentially effective.

1.2 A sketch of our approach.

We present an economic theory of media bias and media mergers to examine the conditions under which the political agendas of news organizations described above offer a rationale for

[11] See *New York Times* (2004) or Massing (2004) for details.

government intervention. In order to do so, we need a model with several elements. First, there must be some variable, x, whose true value is not known to the public and that is relevant to political outcomes. This could be the competence or integrity of a particular politician, the true state of the economy, the financial health of social security, the true situation on the ground in Iraq, and so on.

Second, it must be possible that verifiable, documented information uncovered by a news organization can reveal information about the true value of x.[12] For simplicity, we will assume that either the news organization uncovers information that can publicly prove the value of x, or else it uncovers nothing.

Third, there must be a public-sector decision that will be affected by the public's beliefs about the value of x. Assume that this public sector decision is determined by majority voting (which adds no complication because all voters will be assumed identical).

Fourth, in order to explain the existence of private-sector news organizations, there must be a market demand for news. This is tricky, because news naturally has a public-good quality: unless a citizen expects to be a pivotal voter, which is effectively a zero probability event, becoming a more informed voter yields a negligible payoff in the form of improved electoral outcomes. Thus, we need a device to explain why consumers will pay a positive price for a newspaper (or spend valuable time watching the news on television). One route is to assume some entertainment value to news.[13] We follow a different approach: the assumption made here is that there are private decisions made by each consumer that can be better informed by use of information on x. Further, we assume that one must purchase a newspaper in order to learn what information its publisher is making public about x. (One might hear informally about a story in the paper from friends, but it is necessary to purchase

[12] The most closely related paper, Strömberg (2001), has a slightly different informational role for the press. In his model, the press can communicate the policy stands of politicians to the electorate, rather than states of nature.

[13] A similar device is used in Strömberg (2001). It presents no difficulty to allow papers to have some entertainment value.

the paper and read the story carefully in order to understand the information.) For example, perhaps x is the state of the social security program and the private decision is a decision about retirement planning. Alternatively, x could be the state of terrorist threats, and the private decision concerns travel plans, or x could be the health of the public school system and the private decision is the choice of residential location or public vs. private school. The point is that a desire to learn about x in order to make a more informed private decision generates a market demand for news, and this then through the voting system affects the direction of the public decision. For concreteness, we assume that all news is propagated by newspapers alone, and that newspapers generate revenue only by the purchase price (of course, neither assumption is realistic).

A key feature of our model is the presence of *rational* consumers. We show that even when consumers understand the bias of a news provider, strategic information management can still affect public opinion in a way that is advantageous to that provider. At the heart of our argument is the idea that consumers of news media do not know how much information is possessed by a given news organization at any time, and so if there is a lack of news coming from the organization that is pejorative to the view of that organization's ownership, citizens do not know whether that is because of a genuine lack of information or because information is being withheld. This prevents the familiar 'unraveling' observed in other models, such as the Milgrom (1981) 'persuasion game.' In that game, a sender with private information can send information to or withhold it from a receiver in order to induce the receiver to undertake some action. Because the receiver understands the sender's preferences, she understands that the sender will send only the information most favorable to his case; in this way, the receiver can deduce all of the sender's private information in equilibrium (a similar mechanism is at work in Lipman and Seppi (1995)). In the model we present, uncertainty about how much information the sender (the news organization) has will prevent complete deduction of the sender's information, with the result that a news organization can sometimes manipulate

political outcomes to its advantage. In this respect, the mechanism is similar to the one used in the lobbying model of Bennedsen and Feldmann (2006).

1.3 Related Literature

A number of authors have attempted to measure media bias statistically, although no consensus has emerged regarding the existence or character of bias. D'Alessio and Allen (2000) review studies in the communications literature, finding little robust evidence of aggregate bias. Groseclose and Milyo (2005) propose a measure based on a comparison of media citations of think-tanks with Congressional citations of think-tanks, and find a left-wing bias. Gentzkow and Shapiro (2006b) show how such a result can be interpreted as profit-maximizing behavior rather than bias per se. They distinguish between 'slant,' which indicates how coverage is skewed toward a particular political agenda, and 'bias,' which indicates how a given newspaper's slant differs from its profit-maximizing slant. They also propose a new measure of slant, comparing a newspaper's word choices to the word choices of Republican and Democratic members of Congress. Significantly, Gentzkow and Shapiro find that although the *median* bias in US newspapers is close to zero, there is a large amount of *variance* in the bias as well, so that individual papers show significant bias in one direction or another.[14]

The theoretical literature on media bias, with a couple of exceptions noted below, can be broadly split into two main camps, demand side (in which consumers have a preferred slant, and profit-maximizing news media supply it), and supply side (in which news media with a political agenda impose slant to manipulate political outcomes). One prominent demand-side model is Mullainathan and Shleifer (2005), which analyzes equilibrium slant for newspapers using a location model. In a similar vein, Gabszewicz, Laussel, and Sonnac (2001) analyze

[14] Another relevant empirical literature shows that media effects can have measurable effects on political outcomes: DellaVigna and Kaplan (2006) on the Fox News effect in US elections; Snyder and Strömberg (2004) on US newspapers' effect on the performance of representatives in Congress, and Besley and Burgess (2001, 2002) on the effect of newspapers on government responsiveness to food shortages in India.

the newspapers' location game taking into account the effect of slant on newsstand prices and advertising revenues (if advertising demand is strong, the two newspapers choose identical slant, but if it is weak, they choose maximum differentiation).

Balan, DeGraba, and Wickelgren (2004) proffer a supply-side analysis of bias with owners having preferences for tilting what is read. The consumer demand for newspapers depends on the amount of "persuasion" in each of two newspapers (although the price of the newspapers is exogenous). Newspaper owners' objectives depend on "effective persuasion" plus profit, where effective persuasion is own persuasion offset or abetted by the rival's persuasion.

Two papers model demand-driven slant with consumers who are not intrinsically interested in slanted or biased opinions. In Gentzkow and Shapiro (2006a), slant arises through a reputation game whereby newspapers strive for quality reporting: this can sometimes best be delivered by following people's priors rather than the truth. Chan and Suen (2005) assume that the communication technology offered by newspapers is quite limited in that they can only say whether the true state of nature is above or below a critical threshold. This implies that readers will buy only one newspaper to help decide which party to vote for. Since the optimal choice is the paper closest to their own preferred threshold, the model generates the result that people buy papers offering opinions close to their own political beliefs, and they do so in order to be able to decide more finely between closely competing alternatives.

A type of demand-driven bias is derived in Strömberg (2001 and 2004). A single newspaper decides how much space to devote to issues. Demand for the newspaper is generated from individuals of two types: each gets a benefit when it reads news about its concern, and is more likely to read such news the more space the newspaper devotes to it. Thus, profit-maximizing news media cater more toward serving the informational needs of population segments who are more willing to pay for information.

Our approach overlaps with several of these papers. We share with Balan, DeGraba and Wickelgren (2004) a supply side model whereby owners aim to influence outcomes,

and also a concern for the effects of mergers and merger policy. We share with Strömberg (2004) that the model generates internally a demand for the newspaper. We share with Chan and Suen (2005) and Gentzkow and Shapiro (2006a) that consumers are Bayesian, updating their beliefs after reading reports in the newspaper. To our knowledge, ours is the first model showing how a politically motivated publisher can manipulate political outcomes with rational, Bayesian consumers who know the publisher's bias.

The next section sets out the model in detail. Section 3 determines the information that news organizations will reveal in equilibrium, and what readers infer when nothing is revealed. Section 4 compares equilibrium prices under the different market structures (monopoly and duopoly). Section 5 considers the conditions under which mergers will arise, what the implications are for information dissemination, and the implications for merger policy. Section 6 summarizes.

2 The Model

Let $x \in [0,1]$ represent the variable whose true value is not known to the public. Its value is important to individuals in their private choices, and also for their voting choice. Let the exogenous common prior distribution for x be given by a density $f(x) > 0$ and its associated cumulative distribution function $F(x)$, both defined on $[0,1]$. Denote by $\rho \equiv \int_0^1 xf(x)dx$ the *ex ante* mean value of x, and denote by $\sigma^2 \equiv \int_0^1 (x-\rho)^2 f(x)dx$ the *ex ante* variance of x. Let π be the probability that the news organization uncovers proof of the true value of x. We assume that this is a positive constant that is the same for all news organizations, and that information discovery is perfectly correlated for all active news organizations.

Let the public sector decision be denoted d^{pub}, and assume that it can take the value -1 or 1. Denote the private decision $d^{priv} \in [0,1]$. The typical citizen's preferences are summarized by the following utility function:

$$U^{cit} = -\alpha_1(x - d^{priv})^2 + \alpha_2(x - \beta)d^{pub} - \sum_i p_i n_i, \tag{1}$$

where $\alpha_i > 0$ and $\beta \in [0, 1]$ are constants; p_i is the price of newspaper i; and n_i is a dummy variable indicating purchase of newspaper i (where the index i covers all newspapers available). Clearly, if the citizen knew the value of x, she would want to set $d^{priv} = x$. If $x > \beta$, the citizen would prefer that the political process set d^{pub} equal to 1 while if $x < \beta$, the citizen would prefer that d^{pub} be set equal to -1. More generally, if the posterior Bayesian mean for x is greater (less) than β, the voters will prefer a value of d^{pub} equal to 1 (equal to -1). We normalize the population size to unity.[15]

The usual economic objections to monopoly do not apply in this model. This is because all consumers of news are identical, and under a news monopoly each decides simply to buy or not buy the one available newspaper. Without a downward-sloping demand curve, there can be no conventional deadweight loss from monopoly. Thus, the usual economic analysis of antitrust is not relevant. However, we shall see that a new political-economic rationale for antitrust, based on the political manipulation of information, can arise.

Suppose that there are two possible publishers, labelled A and B. We write the utility function of publisher i as:

$$U^i = \alpha_i(x - \beta_i)d^{pub} + p_i n_i - \delta_i K, \qquad i = A, B,$$

where $\alpha_i > 0$; $\beta_A = 0$; $\beta_B = 1$; δ_i is a dummy variable taking a value of 1 if publisher i operates a newspaper and 0 otherwise; and $K \geq 0$ is the fixed cost required to operate a newspaper.[16] The first term represents the publisher's interest in the public-policy outcome,

[15] The assumption that all citizens are the same does imply that they read both newspapers in equilibrium, as will be seen later. This unrealistic property derives from our aim of eliminating conventional deadweight loss concerns from the model in order to focus on the new form of distortions arising from political management of news. We can allow for heterogeneous voters by treating (1) as representing the preferences of the median voter. None of the analysis changes as long as all voters have the same value of α_1.

[16] The fixed cost K will play a role towards the end of the analysis.

and the second represents his or her profits.[17] (For simplicity, we ignore both the publisher's private decision, variable production costs, and distribution costs, as they have no role in what follows.) Clearly, publisher A would like to see the public decision take the value of 1, regardless of the available information about x, while B would like to see it set equal to -1, regardless of information. The α_i parameter measures the strength of this political motive relative to the profit motive in determining the behavior of news publishers. All of these parameters are common knowledge. This is important, because it means that consumers of the news can take into account the political motivations of the publishers of the news in deciding which news sources to use. We assume that there is no way a publisher can commit publicly and credibly to non-interference in the operation of his or her news organization.

For the moment, we will take the structure of the industry as given. This is either a monopoly by publisher A, a monopoly by publisher B, competition between the two, or no newspaper. The choice between these four will later be endogenized. It will be convenient to denote the structure of the industry by a variable S taking the values A, B, C, and $\emptyset$ representing these four structures respectively. The sequence of events is as follows. Each publisher in the market chooses its price p_i (simultaneously if they are both functioning), then the state x is either revealed to all publishers in the market (with probability π) or is not revealed to them (with probability $(1-\pi)$). In the event that x has been revealed, each publisher then decides whether to print the information or to withhold it. Each consumer then, knowing the biases of the publishers and the prices they are charging but not the content of the newspapers, decides whether or not to purchase a copy of each available newspaper. The Bayesian prior on x is updated with any information revealed in the papers, consumers vote on d^{pub}, and they make their decisions on d^{priv}. Utilities are then realized.

[17] The term $p_i n_i$ represents profit, as the product of cover price and number of subscribers. In practice, newspapers are partly financed by advertising revenues, and for many this revenue source is the dominant one. In this regard, one can think of p_i as the total price per reader paid by advertisers to reach readers. If the ads generate a corresponding nuisance for readers (in the utility function), this is analogous to the subscription price paid in dollars.

We will first take the market structure as exogenous, and study equilibrium information management and then equilibrium pricing. These can be dealt with separately because of the additive structure of preferences. The only point to note about the interaction is that given homogeneous consumers and zero production costs for newspapers, prices will be set so that every consumer will purchase a copy of every newspaper available, and so all information printed in any newspaper will go to all consumers. Afterward, we will discuss endogenous market structure.

3 Equilibrium news content and inferences

Each publisher has a very simple decision to make regarding news management. If that publisher receives information on the value of x, the decision is whether to publish that information in the pages of the newspaper controlled by that publisher, or to keep it quiet. It is worth recalling that it is not possible to falsify news, only (sometimes) to hide it; therefore, if a particular value of x is published, readers will accept it as true.

It is convenient to define the following notation. For a given market structure S, let $g(x; S, \beta, \pi)$ denote the Bayesian posterior density for x, conditional on no news being published regarding x. Let the associated cumulative distribution function be denoted $G(x; S, \beta, \pi)$. In addition, for variables, we will use a tilde to denote the value conditional on no news. Thus, recalling that ρ denotes the *ex ante* mean value of x, we denote by $\widetilde{\rho}(S, \beta, \pi)$ the mean value of x, conditional on no news being published regarding x. Similarly, we denote by $\widetilde{\sigma}^2(S, \beta, \pi)$ the variance of x, conditional on no news being published regarding x.

3.1 Competitive news production

Initially, suppose that both A and B operate (or $S = C$). In this case, of course, A (who would like the public decision to be 1) will trumpet any information revealing that $x > \beta$, while B will bandy any information revealing that $x < \beta$. Therefore, since we assume that

any news is available to both publishers, all of the information will be revealed, and if there is no hard evidence published either way, the public will know that the reason is that such evidence is not available.[18] Thus, in the notation above, $\widetilde{\rho}(C,\beta,\pi) = \rho$, $\widetilde{\sigma}^2(C,\beta,\pi) = \sigma^2$, and $g(x;C,\beta,\pi) = f(x)$ for all x.

3.2 Monopoly news production

Now, suppose that publisher B has been shut down, leaving A as the monopoly news source (so $S = A$). Clearly, A would like to convince the electorate that $x > \beta$ if it is possible to do so, in order to motivate voters to choose $d^{pub} = 1$. Therefore, if in truth the x variable is greater than β, and if the news organization owned by A finds proof of this fact, then it will publish it. This will result in the electorate being certain that $x > \beta$, and selection of $d^{\,pub} = 1$ by the political process.

On the other hand, suppose that $x < \beta$, and the news organization owned by A finds proof of this fact. In that case, it will withhold the information to leave some doubt in the mind of the electorate. Therefore, news consumers will see no hard information regarding x in the pages of the A newspaper. On this basis, they derive their Bayesian *ex post* distribution for x. From the point of view of the consumer, there are two possible reasons for the absence of news. Either no news was discovered (an event with a probability of $(1-\pi)$), or else news was discovered but is being withheld. Given the known bias of publisher A to withhold information that $x < \beta$ the combined probability of these events is $\nu(A;\beta,\pi) \equiv 1-\pi+\pi F(\beta)$.

[18] There are also other Nash equilibria to this game. For example, if A is expected to reveal the value of x no matter what it may be, then B will be unable to manipulate public opinion, and will be indifferent between all available strategy choices. Thus, it is a Nash equilibrium for both publishers to reveal all information. However, revelation of information about x that is prejudicial to one's own preferences regarding d^{pub} is a weakly dominated strategy, and we eliminate such strategies in the equilibrium discussed here.

This implies the Bayesian posterior density, conditional on no news reported, is:

$$\begin{aligned} g(x'; A, \beta, \pi) &= \frac{f(x')}{\nu(A; \beta, \pi)} \qquad \text{if } x' \leq \beta; \\ &= \frac{(1-\pi)f(x')}{\nu(A; \beta, \pi)} \quad \text{if } x' > \beta. \end{aligned}$$

For a value $x' \leq \beta$, the probability that $x < x'$, conditional on no news reported, is equal to:

$$G(x'; A, \beta, \pi) = \frac{F(x')}{\nu(A; \beta, \pi)},$$

and for a value $x' > \beta$, the corresponding probability is equal to:

$$G(x'; A, \beta, \pi) = \frac{\pi F(\beta) + (1-\pi)F(x')}{\nu(A; \beta, \pi)}.$$

It is straightforward to verify that $G(x; A, \beta, \pi) > F(x)$ for all $x \in (0, 1)$, so that $\widetilde{\rho}(A, \beta, \pi) < \rho$ for all $\beta \in (0, 1)$. This is the *suspicion effect*, which works against publisher A's interests. News consumers always know that A withholds news that cuts against his or her interests. When there is no news reported of a sort that decisively affects public policy debates, people rationally wonder if something might be being hidden from them, and they shade their posterior probabilities accordingly. At the same time, it is easy to see that $\widetilde{\rho}(A, \beta, \pi) \to \rho$ as $\beta \to 0$ and as $\beta \to 1$. The former case is one in which the public's preferences are similar to the monopoly publisher's, so that only in rare events (when x is between zero and β) would the publisher withhold information. Consequently, when β is small, the suspicion effect is weak. The latter case is when the public's preferences are extremely different from those of the monopoly publisher. As a result, it is a rare event when the publisher does *not* withhold information (that is, when x is between β and 1). Then the public expects the newspaper to be uninformative, so when they read it and see that it is uninformative, not much is deduced from that fact. Thus, in this case as well, paradoxically, the suspicion effect is weak.[19] The effect is at its strongest in cases in which

[19] The suspicion itself is strong, but its effect is weak because there is little updating of priors.

the public and the publisher have an intermediate degree of divergence in their preferences. This is illustrated in Figure 1.

The publisher has considerable power to mold public opinion due to her ability to withhold information, but because of the rationality of consumers, the monopoly position also comes with the liability that is the suspicion effect. In some instances the latter effect is strong enough that the monopoly power is *detrimental* to the publisher who holds it. In order to see this, we need to know some properties of the $\widetilde{\rho}(A,\beta,\pi)$ function, which is given by

$$\widetilde{\rho}(A,\beta,\pi)=\frac{1}{\nu(A;\beta,\pi)}\left(\int_0^{\beta}xf(x)dx+(1-\pi)\int_{\beta}^{1}xf(x)dx\right), \tag{2}$$

with $\nu(A;\beta,\pi)=1-\pi+\pi F(\beta)$ the probability of observing no news. Properties are indicated in the following result.

Proposition 1 *There is a unique value $\overline{\beta}\in(0,\rho)$ such that $\beta<\overline{\beta}$ implies that $\widetilde{\rho}(A,\beta,\pi)>\beta$ and $\beta>\overline{\beta}$ implies that $\widetilde{\rho}(A,\beta,\pi)<\beta$.*

Proof. The derivative of (2) is

$$\frac{\partial}{\partial\beta}\widetilde{\rho}(A,\beta,\pi)=\frac{\pi f(\beta)}{\nu(A,\beta,\pi)}\left[\beta-\widetilde{\rho}(A,\beta,\pi)\right]. \tag{3}$$

We know that $\widetilde{\rho}(A,0,\pi)=\rho>0$ and $\widetilde{\rho}(A,1,\pi)=\rho<1$. Therefore, by continuity of $\widetilde{\rho}(A,\beta,\pi)$, there exists at least one β such that $\widetilde{\rho}(A,\beta,\pi)=\beta$. Furthermore, by (3), the function $\tilde{\rho}\,(.)$ is decreasing for $\tilde{\rho}>\beta$, and increasing for $\tilde{\rho}<\beta$, with a zero derivative where $\tilde{\rho}=\beta$. (Think by analogy of the behavior of average costs when marginal cost is rising, with here β playing the role of marginal cost and $\tilde{\rho}$ the role of average cost.) Hence $\tilde{\rho}$ falls initially until it reaches the 45-degree line (see Figure 1), which it crosses with zero slope, and then rises without further crossings (since to cross the 45-degree line from below would require $\frac{\partial\tilde{\rho}}{\partial\beta}\geqslant 1$, which cannot be satisfied at the crossing point because (3) implies $\frac{\partial\tilde{\rho}}{\partial\beta}=0$

at any crossing point). This means that the solution, $\overline{\beta}$ is unique. Moreover, recalling that $\tilde{\rho} < \rho$ for all $\beta \in (0,1)$, we conclude in particular that $\overline{\beta} < \rho$. ■

These properties imply that if publisher A's preferences are not too far from those of the general public (in other words, if $\beta \in [0, \overline{\beta})$), the political outcome in the event that no news is published is $d^{pub} = 1$, while if publisher A's preferences are far from the mainstream ($\beta \in (\overline{\beta}, 1]$), the outcome that ensues following silence is $d^{pub} = -1$. The former regime is the one in which the public can be successfully manipulated; in the latter regime it cannot. The latter regime has two sub-cases, so consider the three cases illustrated by Figure 1.

Case I: $0 < \beta < \overline{\beta}$. In this case, if voters received no hard news, they would vote for $d^{\,pub} = 1$ (since $\widetilde{\rho} > \beta$). Thus, we have $d^{\,pub} = 1$ with probability 1. In this case, monopoly is of clear political benefit to publisher A, and is strictly preferred to competition.

Case II: $\overline{\beta} < \beta < \rho$. In this case, the suspicion effect is strong enough that when voters receive no hard news, they vote for $d^{\,pub} = -1$ (since $\widetilde{\rho} < \beta$). Thus, if x is revealed to be high, we will have $d^{\,pub} = 1$ and if x is revealed to be low we will have $d^{pub} = -1$ (publisher A will withhold the information but the outcome will still be $d^{pub} = -1$, since $\widetilde{\rho} < \beta$). Thus, in the event that the publisher learns hard information, the outcome is the same as it would have been under competition. On the other hand, in the event that A does not find hard information about x, the suspicion effect leads to $d^{pub} = -1$, while in the same event under competition it would have led to $d^{pub} = 1$ (since $\widetilde{\rho} < \beta < \rho$). Thus, as regards political outcomes, A is now worse off under monopoly than under competition.

Case III: $\rho < \beta < 1$. In this case, the outcome of the political process is exactly the same as it would have been under competition. Voters choose $d^{pub} = -1$ unless A finds hard evidence that $x > \beta$.

Clearly, in *Case I*, A receives a political advantage from possession of a news monopoly, and would be willing to pay something in order to enjoy that situation. This is true despite the full rationality of the public, and its knowledge of the intentions and bias of the publisher.

The point is that the power to truncate the information available to the public results in an effect on their decisions in the worst-case situations. On the other hand, in *Case II*, A would be better off politically by forfeiting the monopoly. This is the case in which the suspicions of the rational public undo the political intentions of the monopolistic publisher. Note that this is the case in which the public's tastes are farther from those of A. If the publisher's tastes are extremely different from popular tastes, as in *Case III*, the monopoly position will make no difference to the outcome.

Thus, the case in which the monopoly position is most useful to the publisher is that in which his or her tastes are most similar to the population as a whole. If they are very dissimilar, no manipulation is possible. If, though, they are moderately different, a news monopoly will be politically disadvantageous.

The case of a publisher B monopoly is analogous. B withholds information that x is above β. The analogous posterior density conditional on no news being published is:

$$\begin{aligned} g(x; B, \beta, \pi) &= \frac{(1-\pi)f(x)}{\nu(B,\beta,\pi)} \quad \text{if } x < \beta; \\ &= \frac{f(x)}{\nu(B,\beta,\pi)} \qquad \text{if } x > \beta, \end{aligned}$$

with cumulative distribution

$$\begin{aligned} G(x; B, \beta, \pi) &= \frac{(1-\pi)F(x)}{\nu(B,\beta,\pi)} \qquad \text{if } x < \beta; \\ &= \frac{F(x)-\pi F(\beta)}{\nu(B,\beta,\pi)} \quad \text{if } x > \beta, \end{aligned}$$

where $\nu(B,\beta,\pi) = 1-\pi F(\beta)$ is the probability that no news is published by B. The suspicion effect implies that $\widetilde{\rho}(B,\beta,\pi) > \rho$, and $\widetilde{\rho}(B,\beta,\pi)$ reaches its maximum at a value $\beta = \overline{\overline{\beta}} > \rho$. The picture corresponding to Figure 1 then has $\widetilde{\rho}(B,\beta,\pi)$ rising from $\widetilde{\rho}(B,0,\pi) = \rho$ till it reaches the 45 degree line at $\overline{\overline{\beta}} > \rho > \overline{\beta}$, then falling back down to reach $\widetilde{\rho}(B,1,\pi) = \rho$.

4 Equilibrium Pricing

4.1 Monopoly pricing

Again, assume that publisher A has a monopoly on the news. A news monopolist will charge the highest price consumers are willing to pay, which is of course equal to the expected utility the consumer receives from the information contained in the paper. The only benefit for an individual from buying a newspaper is in improving the quality of the consumer's decision-making regarding the private decision, d^{priv}. From (1), the utility deriving from the private decision is equal to:

$$E[-\alpha_1(x - d^{priv})^2|I],$$

where I denotes all the information available to the consumer at the time the decision is made. The first-order condition for this is simply

$$d^{priv} = E[x|I],$$

so the maximized value of this component of utility becomes:

$$-\alpha_1\sigma^2(I),$$

where $\sigma^2(I)$ denotes the expected variance of x conditional on information I. Thus, the information in the newspaper is useful only to the extent that it reduces the conditional variance of x. (Note that at the time a newspaper is purchased, the consumer does not know what information it will reveal, so at the time of purchase I is itself a random variable.)

In the event that the consumer purchases no newspaper, the decision on d^{priv} must be made with no information about x, resulting in utility $-\alpha_1\sigma^2$. In the event that the consumer decides to purchase the newspaper, there are two possible outcomes. There may be no relevant news reported in it, in which case the private decision must be made with an *ex post* variance for x equal to $\widetilde{\sigma}^2(A, \beta, \pi)$, yielding utility of $-\alpha_1\widetilde{\sigma}^2(A, \beta, \pi)$. This occurs

with probability $\nu(A,\beta,\pi)$. On the other hand, there may be news about x in the paper, in which case the value of x is known precisely. This results in utility of zero. Consequently, the expected utility from the private decision when the consumer has chosen to purchase a copy of the paper is equal to $-\alpha_1\nu(A,\beta,\pi)\widetilde{\sigma}^2(A,\beta,\pi)$. Given that the publisher in this situation will set the price so as to extract all of the surplus, this implies that the monopoly equilibrium price of the A newspaper is given by:

$$P_A(A,\beta,\pi) = \alpha_1[\sigma^2 - \nu(A,\beta,\pi)\widetilde{\sigma}^2(A,\beta,\pi)]. \tag{4}$$

Similarly, the monopoly equilibrium price of the B newspaper is given by:

$$P_B(B,\beta,\pi) = \alpha_1[\sigma^2 - \nu(B,\beta,\pi)\widetilde{\sigma}^2(B,\beta,\pi)]. \tag{5}$$

The following result is proved in the Appendix.

Proposition 2 *The monopoly prices are strictly positive for $\beta \in (0,1)$. The monopoly equilibrium price of the A newspaper is strictly decreasing in β, with*

$$P_A(A,0,\pi) = \alpha_1\pi\sigma^2 \text{ and } P_A(A,1,\pi) = 0. \tag{6}$$

The monopoly equilibrium price of the B newspaper is strictly increasing in β, with

$$P_B(B,0,\pi) = 0 \text{ and } P_B(B,1,\pi) = \alpha_1\pi\sigma^2. \tag{7}$$

Thus, the price of a monopoly newspaper is always strictly positive as long as the voters are not at an extreme.[20] This is because the newspaper always imparts some useful information. In addition, we can easily understand the results regarding the limiting behavior of the price as β approaches its limits. First, note that as $\beta \to 0$, the range of values of x for which A will withhold news (that is, $[0,\beta]$) becomes vanishingly small. Therefore, the probability ν that there will be no news in the paper reaches a limit of $(1-\pi)$, the probability that

[20] Any entertainment value would be simply added to the equilibrium price expression.

there will be no news to report. In addition, the difference between the densities f and g will become vanishingly small, so $\widetilde{\sigma}^2(A,\beta,\pi)$ will converge to σ^2. Therefore, from (4), the price of the newspaper will approach the limit of $\alpha_1\pi\sigma^2$. It is important to note that this is the value to the consumer of a newspaper with full disclosure, so this is the maximum possible price a newspaper could possibly have.

Similarly, as $\beta \to 1$, $\nu(A,\beta,\pi) \to 1$ and $\widetilde{\sigma}(A,\beta,\pi) \to \sigma$ so, again from (4), the price of the newspaper will converge to zero. The case of the B-monopolist is parallel.

The point is that the more mainstream are the political views of the monopoly publisher, the less the public will expect that publisher to distort the news, and thus the more informative and valuable the paper will be.

Corollary 1 *For f symmetric ($f(x) = f(1-x)$), $P_A(A,\frac{1}{2},\pi) = P_B(B,\frac{1}{2},\pi)$, and $P_A(A,\beta,\pi) \gtrless P_B(B,\beta,\pi)$ as $\beta \lessgtr \frac{1}{2}$.*

Under symmetry, the more profitable newspaper is the one closer to the mainstream. This is the paper that reveals more information. We now turn to competition.

4.2 Competitive pricing

Prices under competition will be determined by Bertrand competition. This will not in general drive publishers' profits down to zero, because the news sources are not perfect substitutes, owing to the different political biases of the publishers. We assume that consumers simultaneously choose which paper or papers to buy.[21]

To analyze the prices, first note that in any equilibrium, because production costs for newspapers are assumed away and consumers are homogeneous, each publisher will lower her price enough that all consumers will purchase both papers. Each paper will then have a price no greater than the additional utility derived from reading that paper, given that

[21] In particular, they are not able to buy one and check what news it contains before deciding to buy the other. Think for example of taking out long-term subscriptions.

the consumer is already reading the other paper. The price can be pushed all the way up to this additional utility without losing any customers. This implies that the price charged for newspaper i is equal to the utility from reading both papers, minus the utility derived from reading only paper $j \neq i$. By the above discussion, the former utility is equal to $-(1-\pi)\alpha_1\sigma^2$, and the latter utility is equal to $-\alpha_1\nu(j,\beta,\pi)\widetilde{\sigma}^2(j,\beta,\pi)$. Subtracting the latter from the former gives the value below.[22]

Proposition 3 *The price of a newspaper under duopoly is equal to its incremental information value for the private decision:*

$$P_i(C,\beta,\pi) = \alpha_1[\nu(j,\beta,\pi)\widetilde{\sigma}^2(j,\beta,\pi) - (1-\pi)\sigma^2], \qquad i \neq j, i, j = A, B. \tag{8}$$

Using the previous analysis of the monopoly prices, we can see that as $\beta \to 0$, $P_A(C,\beta,\pi) \to \alpha_1\pi\sigma^2$ and $P_B(C,\beta,\pi) \to 0$, while as $\beta \to 1$, $P_A(C,\beta,\pi) \to 0$ and $P_B(C,\beta,\pi) \to \alpha_1\pi\sigma^2$.[23] The monopoly analysis also facilitates deriving further properties via the following Lemma, which follows directly from (4), (5) and (8).

Lemma 1 $P_A(C,\beta,\pi) + P_B(B,\beta,\pi) = P_B(C,\beta,\pi) + P_A(A,\beta,\pi) = \alpha_1\pi\sigma^2$.

Lemma 1 and Proposition 2 enable us now to characterize the duopoly price.

[22] These pricing equations indicate that the price of each paper is equal to its *incremental* contribution to utility, conditional on purchase of the other paper. It remains to check that with this pricing scheme the *sum* of the two prices is no greater than the *total* utility contributed by purchase of *both* papers, so that the consumer receives positive net surplus from buying both papers. Since that total utility contribution is given by $\alpha_1\pi\sigma^2$,the condition to check is that $\sum_i P_i(C,\beta,\pi) \leq \alpha_1\pi\sigma^2$. Using the relevant definitions, this is equivalent to $Q(\pi) \leq R(\pi)$, where $Q(\pi) = \sum_i \nu(i,\beta,\pi)\int_0^1 (x - \widetilde{\rho}(i,\beta,\pi))^2 g(x;i,\beta,\pi)dx$ and $R(\pi) = (2-\pi)\sigma^2$. It is easy to confirm that $Q(0) = R(0)$. Further, $Q'(\pi) = -\int_0^\beta (x - \widetilde{\rho}(B,\beta,\pi))^2 f(x)dx - \int_\beta^1 (x - \widetilde{\rho}(A,\beta,\pi))^2 f(x)dx$. Since $\frac{\partial}{\partial y}\int_\beta^1 (x-y)^2 f(x)dx = 2(y-\rho^+)(1-F(\beta)) < 0$ if $y < \rho^+ \equiv E[x|x > \beta]$, and since $\widetilde{\rho}(A;\beta,\pi) < \rho < \rho^+$, clearly $\int_\beta^1 (x - \widetilde{\rho}(A,\beta,\pi))^2 f(x)dx > \int_\beta^1 (x-\rho)^2 f(x)dx$. By parallel logic, $\int_0^\beta (x - \widetilde{\rho}(B,\beta,\pi))^2 f(x)dx > \int_0^\beta (x-\rho)^2 f(x)dx$. Therefore, $Q'(\pi) < -\sigma^2$. But $R'(\pi) = -\sigma^2$ for all π. Hence, $Q(0) = R(0)$ and $Q'(\pi) < R'(\pi)$ for all π. Therefore, $Q(\pi) \leq R(\pi)$ for all π, with strict inequality for $\pi > 0$.

[23] If paper i also had a net idiosyncratic entertainment value of E_i over and above that of the other paper, then E_i is then simply added to the equilibrium values of prices derived above.

Proposition 4 *The duopoly equilibrium price of the A newspaper is strictly decreasing in* β*, with*

$$P_A(C, 0, \pi) = \alpha_1 \pi \sigma^2 \text{ and } P_A(C, 1, \pi) = 0. \tag{9}$$

The duopoly equilibrium price of the B newspaper is strictly increasing in β*, with*

$$P_B(C, 0, \pi) = 0 \text{ and } P_B(C, 1, \pi) = \alpha_1 \pi \sigma^2. \tag{10}$$

The limit prices are the same as under monopoly because one of the papers is worthless (it never prints any hard information) while the other has full value. Thus, both under monopoly and competition, *a publisher known to be in the political mainstream is profitable, while a publisher far out of the mainstream has trouble generating revenues.*

Corollary 2 *For* f *symmetric* ($f(x) = f(1-x)$)*,* $P_A(C, \frac{1}{2}, \pi) = P_B(C, \frac{1}{2}, \pi)$*, and* $P_A(C, \beta, \pi) \gtrless P_B(C, \beta, \pi)$ *as* $\beta \lessgtr \frac{1}{2}$*.*

This property parallels the monopoly one. The higher profit goes to the paper printing more hard information. Next, we compare welfare under the different market structures. It is straightforward to confirm that citizen utility is higher under competition than under monopoly. First, denote the private portion of citizen utility by:

$$U^{priv}(S, \beta, \pi) \equiv -\alpha_1 E[(x - d^{priv})^2 | S] - \sum_i P^i(S, \beta, \pi) n_i, \tag{11}$$

where $S \in \{A, B, C, \emptyset\}$ denotes the market structure. Then, the logic of profit maximization ensures that the monopolist prices so that each consumer is indifferent between buying the newspaper and not buying it. Thus:

$$U^{priv}(A, \beta, \pi) = U^{priv}(B, \beta, \pi) = U^{priv}(\emptyset, \beta, \pi).$$

Clearly, since under duopoly each citizen has the option of purchasing no newspaper, this implies:

$$U^{priv}(C, \beta, \pi) \geq U^{priv}(A, \beta, \pi) = U^{priv}(B, \beta, \pi). \tag{12}$$

Denote the public part of a citizen's utility by $U^{pub}(S,\beta,\pi) = \alpha_2 E[(x-\beta)d^{pub}|S]$. Since voters have strictly more information under competition than monopoly, we also have

$$U^{pub}(C,\beta,\pi) > U^{pub}(i,\beta,\pi) \text{ for } i = A, B,$$

with the immediate consequence:

Proposition 5 *Citizen welfare is higher under competition than under monopoly.*

This can be used to show a simple fact about the effect of competition on prices:

Proposition 6 *The price of each newspaper is weakly lower under competition than under monopoly.*

Proof. Since each newspaper under competition is priced at its incremental information value, each consumer is indifferent between buying both papers and buying only the A paper:

$$\begin{aligned} U^{priv}(C,\beta,\pi) &= -\alpha_1 E[(x-d^{priv})^2|C] - \sum_i P_i(C,\beta,\pi) \\ &= -\alpha_1 E[(x-d^{priv})^2|A] - P_A(C,\beta,\pi). \end{aligned}$$

Since

$$\begin{aligned} U^{priv}(C,\beta,\pi) &\geq U^{priv}(A,\beta,\pi) \\ &= -\alpha_1 E[(x-d^{priv})^2|A] - P_A(A,\beta,\pi), \end{aligned}$$

this implies that we must have $P_A(A,\beta,\pi) \geq P_A(C,\beta,\pi)$. ■

With the aid of these properties, we now turn to comparing industry profits under the alternative market structures.

5 Equilibrium Market Structure

Here we endogenize market structure and analyze the effects of a rule prohibiting media mergers. It is easiest to do this by first considering market structure if mergers are disallowed, then market structure if mergers are permitted. After doing this, we analyze the welfare effects of a no-merger rule by studying the differences between these two regimes.

5.1 Mergers Disallowed

If mergers are not possible, the equilibrium market structure is simply the Nash equilibrium of an entry game. Define the welfare of publisher i under market structure S by:

$$W_i(S, \beta, \pi, K) = \alpha_i E[x(d^{pub} - \beta_i)|S, \beta, \pi] + (P_i(S, \beta, \pi) - K)\,\delta_i(S), \tag{13}$$

where $\delta_i(S)$ is a dummy variable indicating whether or not publisher i operates a newspaper under structure i (so that $\delta_A(A) = \delta_A(C) = \delta_B(B) = \delta_B(C) = 1$ and $\delta_A(B) = \delta_B(A) = \delta_i(\emptyset) = 0$), and the value of d^{pub} is determined by the political process given S and the realization of x. Recall that $K \geq 0$ is the cost of setting up a newspaper. Obviously, S is determined by entry, with $S = C$ if both enter, $S = i$ if i enters and j does not, and $S = \emptyset$ if neither enters. Then equilibrium entry is determined by the payoffs $W_i(S, \beta, \pi, K)$. Thus, for example, a monopoly with publisher A is an equilibrium outcome if:

$$W_A(A, \beta, \pi, K) \geqslant W_A(\emptyset, \beta, \pi, K) \text{ and } W_B(A, \beta, \pi, K) \geqslant W_B(C, \beta, \pi, K). \tag{14}$$

In the limiting case of a dominant profit motive (that is, with α_A and α_B both small), this means that a publisher enters if and only if it earns positive profits. Thus, an i monopoly is an equilibrium if:

$$P_i(i, \beta, \pi) \geq K \text{ and } P_j(C, \beta, \pi) \leq K, \tag{15}$$

where $i \neq j$. Competition is an equilibrium if $P_i(C, \beta, \pi) \geq K$ for $i = A, B$, and no entry by either publisher is an equilibrium if $P_i(i, \beta, \pi) \leq K$ for $i = A, B$. Clearly, these conditions

determine a unique equilibrium unless (15) is satisfied for both $i = A$ and $i = B$, in which case both an A monopoly and a B monopoly are equilibria. (This can occur under symmetry if β is not too far from 1/2, so that the profitabilities of the two are fairly balanced: see Figure 2.)

Clearly, if $K = 0$ and the profit motive is dominant, the only equilibrium is competition. Figure 2 shows the equilibria for a range of parameter values with $K = 0.001$ and a Beta distribution (in this example, which we will continue in the following sections, we use $f(x) = Ax^4(1-x)^4$, where A is chosen so that the density has a unit integral). The main features can be summarized and generalized as follows.

Proposition 7 *Assume that f is symmetric around 1/2, and consider a dominant profit motive. Then, letting $\tilde{\beta} = \gamma\beta + (1-\gamma)(1-\beta)$ for any $\gamma \in [0,1]$ and for $\tilde{\pi} \leq \pi$.:*

i) If (β, π) generates no entry as an equilibrium market structure, then so does $\left(\tilde{\beta}, \tilde{\pi}\right)$;

ii) If (β, π) generates competition as an equilibrium market structure, then so does $\left(\tilde{\beta}, \pi\right)$;

iii) If $K > 0$, competition cannot be an equilibrium for β close enough to 0 or 1.

The Proposition is illustrated by the specific Beta distribution in Figure 2. Part (i) means that the no-entry region is at the bottom with an upward sloping boundary for $\beta < 1/2$. This follows because under symmetry the A monopoly price is decreasing in β (Proposition 2), and both monopoly prices are increasing in π. Parts (ii) and (iii) mean that the competitive region is in the middle: (ii) follows because the profit of the weaker duopolist always increases if we move β closer to 1/2. Part (iii) follows from the fact that $P^A(C, \beta, \pi) \to 0$ as $\beta \to 1$ and $P^B(C, \beta, \pi) \to 0$ as $\beta \to 0$ (Proposition 4). In other words, if hardly any real news can be generated (π low), neither news source will be profitable; and duopoly is a more likely outcome if neither publisher is a fringe extremist.

A last point about equilibrium structure can be deduced quickly. Recalling that each publisher's revenue equals the incremental value of its information for the private decision

(Proposition 3), it is clear that a publisher will enter if and only if that incremental value exceeds K. This, together with the fact that entry improves the quality of public decision making (effectively a positive externality from entry), implies that if competition is an equilibrium, then it is the market structure that maximizes social welfare.[24] Thus (with a dominant profit motive) *the equilibrium can provide too little competition, but not too much.*

5.2 Mergers Allowed

Now we consider what happens if mergers are permitted. Assume that the game is played in two stages. First, the publishers choose independently whether to enter. If both have entered, they then engage in Nash bargaining to decide whether to merge, and on what terms.

Denote the joint welfare of the two publishers, $W_A(S,\beta,\pi,K) + W_B(S,\beta,\pi,K)$, by $W_{AB}(S,\beta,\pi,K)$. Then if the two publishers have entered, bargaining selects the structure S that maximizes $W_{AB}(S,\beta,\pi,0)$ (since the fixed cost K is by that point sunk and irrelevant) and the bargaining surplus is split between the two parties. Thus, the bargaining payoff to publisher i will be $W_i^{BARG}(\beta,\pi) \equiv W_i(C,\beta,\pi,0) + \max_S \left[W_{AB}(S,\beta,\pi,0) - W_{AB}(C,\beta,\pi,0)\right]/2$.

Then, plainly, in the entry stage, entry is determined as the Nash equilibrium of a game with payoffs $W_i^{BARG}(\beta,\pi) - K$ if both enter, and $W_i(S,\beta,\pi,K)$, $S \neq C$ (which is the same as in the model without mergers) otherwise. The equilibrium is the same as without mergers, unless (i) $W_{AB}(i,\beta,\pi,0) > W_{AB}(C,\beta,\pi,0)$ for $i = A$ or B, and (ii) $W_i^{BARG}(\beta,\pi) > K$ for $i = A, B$. Condition (i) ensures that a merger will occur if both enter, and (ii) ensures that both will enter. A *no-merger rule has bite* if and only if these two conditions are satisfied, because imposing a prohibition on mergers will change the outcome.

If a no-merger rule has bite and $W_i(C,\beta,\pi,K) > W_i(j,\beta,\pi,K)$ for $i,j = A,B$, $i \neq j$,

[24] Adding together the welfare of publishers with the utility of consumers, the price terms disappear, so that the utility from private and public decisions together with the sunk costs K are all that matter.

then in the model without mergers the outcome is competition, but with mergers allowed the outcome is merger to monopoly. In this case, a no-merger rule *preserves competition.* On the other hand, if a no-merger rule has bite but $W_i(C, \beta, \pi, K) < W_i(j, \beta, \pi, K)$ for $i, j = A$ or B, $i \neq j$, then the outcome of the model without merger is entry of only one publisher, while the outcome with mergers allowed is entry by both publishers followed by a merger to monopoly. In this case, a no-merger rule *prevents entry for buyout*; it does not change the final market structure, but it does prevent entry with a pure rent-seeking motive.

In the limiting case with a dominant profit motive, the criterion for a no-merger rule to have bite is that (i) $\Delta(\beta, \pi) > 0$ and (ii) $P_i(C, \beta, \pi) + \Delta(\beta, \pi)/2 > K$ for $i = A, B$, where

$$\Delta(\beta, \pi) \equiv \max\{P_A(A, \beta, \pi), P_B(B, \beta, \pi)\} - (P_A(C, \beta, \pi) + P_B(C, \beta, \pi)) \tag{16}$$

is the relative profitability of monopoly compared to duopoly, or in other words the joint bargaining surplus in the merger stage. Clearly, entry for buyout occurs if these two conditions hold and $P_i(C, \beta, \pi) < K$ for $i = A$ or B; i buys out j if $P_i(i, \beta, \pi) > P_j(j, \beta, \pi)$.

It may initially be surprising that Δ can take negative values. In a conventional oligopoly model, a monopoly is ensured higher profits than a duopoly, because at worst it can always duplicate the behavior of the duopolists. For newspapers with political agendas, that logic does not apply. It is not possible for a monopolist to publish both an A-type newspaper and a B-type newspaper, because it has no way of credibly committing to publish information that is *ex post* injurious to its political interests. Thus, if a newspaper is a monopoly with the editorial bias of its publisher intact, it earns less than it would if it could commit to being as informative as a duopoly would be. This loss-of-variety effect pushes monopoly profits down relative to duopoly profits. Of course, the familiar effect of competitive pricing in a duopoly works in the other direction, so whether duopoly or monopoly profits are higher will be determined by which of these two effects is stronger.

This trade-off can be illustrated with a simple example. Suppose that x has a two-point distribution, taking a value of $\frac{1}{4}$ or $\frac{3}{4}$ with equal probability. Then, if β is between $\frac{1}{4}$ and $\frac{3}{4}$, an A-monopolist will report the value of x if it is equal to $\frac{3}{4}$ but suppress it if it is equal to $\frac{1}{4}$. If the probability of finding news, π, is sufficiently high, this means that news readers would interpret the lack of news as strong evidence that x is indeed equal to $\frac{1}{4}$. With this information, the value to those readers of a B-newspaper in addition to the A-newspaper would be negligible. Parallel logic shows that the value to news readers of an A-newspaper once they had access to the B-newspaper would also be negligible. Therefore, the duopoly price for either newspaper would be close to zero, and a monopoly would clearly be more profitable than duopoly.

What kills duopoly profits in this example is the fact that news readers learn almost everything they need to know even in the absence of news. Thus, the best chance for a duopoly to be relatively profitable is for a lack of news to be relatively uninformative, in other words, for $\widetilde{\rho}$ to be relatively close to ρ. Recalling Figure 1, the situations favoring that outcome are a value of β close to 0 or 1 and a low value of π. The following two propositions respectively confirm that these conditions do indeed favor duopoly profitability.

First, in the absence of fixed costs, mergers are unprofitable when one of the publishers is an extremist, or when there is not much news to be had:

Proposition 8 *Duopoly is more profitable than monopoly (that is, $\Delta(\pi, \beta) < 0$) if β is sufficiently close to 0 or 1, or if π is sufficiently close to 0.*

Thus, duopoly dominates around the bottom and the sides of Figure 2. Second, under a weak sufficient condition, monopoly is more profitable when the publishers are balanced and news is plentiful:

Proposition 9 *If f is symmetric about $\frac{1}{2}$, then in a neighborhood of the point $(\beta, \pi) = \left(\frac{1}{2}, 1\right)$,*

monopoly is more profitable than duopoly (i.e., $\Delta(\frac{1}{2}, 1) > 0$*) provided that:*

$$\frac{2}{3}\sigma^2 > \widetilde{\sigma}^2(A, \frac{1}{2}, 1).$$

In other words, the relevant condition is that the variance of x conditional on $x < \frac{1}{2}$ is no greater than 2/3 of the unconditional variance. Figure 3 shows the shape of $\Delta(\beta, \pi)$ for the Beta distribution used in Figure 2, and shows clearly that indeed the function turns sharply positive (indicating gains from merger) where π is close to 1 and β is close to $\frac{1}{2}$. Figure 4 shows the corresponding equilibrium market structure. In accordance with Propositions 8 and 9, the no-merger rule has bite only near the top-central portion of the box, where the bargaining surplus Δ is at its highest because prices under duopoly are especially low.

There are two separate regions in which the no-merger rule has bite. The first is a subset of what had been the duopoly region in the previous figure, where duopolists will choose to merge if they are allowed to do so; in this region, the no-merger rule preserves competition. Above that lies a second region, which is a subset of what had been the monopoly region in the previous figure; in this region, if mergers are allowed, a second publisher enters, for the sole purpose of receiving and accepting a merger offer from the other publisher. In this region, the no-merger rule prevents entry for buyout.

Putting all of this together, we can summarize the effects of the no-merger rule as follows: *With a dominant profit motive, the no-merger rule is most likely to have bite if news is plentiful (*π *is high) and neither publisher is a fringe extremist (*β *is not too close to* 0 *or* 1*).*

Another striking feature of the equilibrium with mergers allowed is that there is so little merger activity: competition remains as an equilibrium across a large swathe of the parameter space despite no impediment to merging. This points to the distinctive features of the media industry - in a standard differentiated products duopoly we would expect to see merger throughout the parameter range. Here, at least for intermediate values of π, the bias of the magnates and the profit motive together police the market and ensure "diversity of

voices" (which is one of the major stated objectives of the FCC) even though the political motive for setting up a newspaper is arbitrarily small.

5.3 Welfare effects of no-merger rule

The welfare effects of the no-merger rule are clear in the case of entry for buyout: the resulting market structure is the same with or without the no-merger rule. With the no-merger rule, only one publisher enters, so the sunk cost K is paid only once, but it is paid twice under entry for buy-out. Therefore, the no-merger rule unambiguously improves welfare. Entry by the publisher who intends to be bought out is pure rent-seeking. Eliminating it promotes efficiency.

Proposition 10 *If a no-merger rule prevents entry for buyout, it improves welfare.*

If the no-merger rule preserves competition, the welfare effects are more complicated, but in an important special case they are again straightforward. If the publishers have a dominant profit motive, then the no-merger rule can be shown to raise welfare. Ignore the sunk costs K, since they are the same with and without the no-merger rule, and add the joint welfare of publishers $W_{AB}(S, \beta, \pi, 0)$ to that of the citizens to compute total social welfare. The prices cancel out, and all that is left is the utility of the publishers from the public decision and the utility of the citizens from the public and private decisions:

$$E\left[\sum_{i=A,B}\left(\alpha_i(x-\beta_i)d^{pub}\right)-\alpha_1(x-d^{priv})^2+\alpha_2(x-\beta)d^{pub}\right]. \tag{17}$$

The former disappears for a dominant profit motive (as α_A and α_B vanish) so welfare is determined entirely by the utility the citizens receive from the public and private decisions. Switching from a monopoly to competition, as the no-merger rule does in this case, improves this utility by providing more information to the public. Therefore, welfare rises. This, together with Proposition 10, provides the following result.

Proposition 11 *In the case of a dominant profit motive, the no-merger rule unambiguously improves welfare, and strictly so if the rule has bite.*

Note that this holds despite the fact that the usual grounds for merger regulation are absent from this model. In conventional industrial organization models of mergers, the social cost to merger is that it allows for greater monopoly power, so that the gap between price and marginal cost increases, and some consumers whose willingness to pay exceeds marginal production cost are priced out of the market. Here, by contrast, with or without a merger, all consumers purchase all newspapers available on the market (due to the artificial assumption that all consumers are identical). Thus, *the welfare loss from merger does not result from anti-competitive pricing, but rather from the distortion of information due to the political motivation of the publishers, a distortion that is facilitated by monopolization of the market.*[25]

We thus derive a motive for merger review that is completely separate from the motive that drives such review in non-media oligopolies.

5.4 Strong political motives

Most of the discussion in the previous three subsections has focussed on the case of a dominant profit motive. Here we comment briefly on how things change when the *political* motive of the publishers is also strong (so α_A and α_B are no longer vanishingly small). For high enough political weights, the suspicion effect drives the non-existence of a pure strategy equilibrium. High political weights are also instrumental in causing the "wrong" publisher to enter the market: the out-of-the-mainstream publisher may enter because it makes more difference to the political outcome. We assume throughout in what follows that $f(.)$ is symmetric.

[25] Recall that the case of the dominant profit motive is a limiting case in which the political motive of the publishers becomes vanishingly small, but is still strictly positive.

Define the Suspicion Region, $\mathbb{S}$, as the set of (β, π) for which either one or the other publisher is under suspicion, so $\mathbb{S} = \left\{(\beta,\pi) : \beta \in \left(\bar{\beta}(\pi), \overline{\overline{\beta}}(\pi)\right)\right\}$. A is Under Suspicion in the region $\mathbb{S}_A \equiv \left\{(\beta,\pi) : \beta \in \left(\bar{\beta}(\pi), \rho\right)\right\}$ and B is Under Suspicion in the region $\mathbb{S}_B \equiv \left\{(\beta,\pi) : \beta \in \left(\rho, \overline{\overline{\beta}}(\pi)\right)\right\}$.

Suppose for illustration that publisher A is Under Suspicion. Recall this means that the vote will go opposite A's desired direction whenever A is alone in the market and reveals no information. If B is also present, readers know that observing no published information means there *is* no information and they vote according to their priors in this event; their priors favor A's political preference. Likewise, if both publishers are absent, the vote goes A's way. Then, in this regime A's *political* preference is (1) no-one in the market; which is preferred to (2) competition or B alone in the market; followed by (3) A alone in the market. Two states are in second-place indifference because the presence of B means readers will vote against A only when B shows them that the state of the world is adverse (to A's preference). B's political preferences over these outcomes are diametrically opposite A's.

The Suspicion region is the union of the two areas, $\mathbb{S} = \mathbb{S}_A \cup \mathbb{S}_B$, giving a vase-shaped area as portrayed in Figure 5. To show this property, it suffices to show that $\bar{\beta}(\pi)$ is decreasing in π (the boundary slopes down): the analogous property follows immediately that $\overline{\overline{\beta}}(\pi)$ slopes up . Recall that $\bar{\beta}$ is defined by setting $\tilde{\rho}\left(A, \bar{\beta}, \pi\right) = \bar{\beta}$ in (2). The implicit function theorem yields $\frac{d\bar{\beta}}{d\pi} = \frac{1}{\nu\left(A;\bar{\beta},\pi\right)}\left[-\int_{\bar{\beta}}^{1} xf(x)\,dx + \bar{\beta}\left[1 - F\left(\bar{\beta}\right)\right]\right]$. This is necessarily negative since $\int_{\bar{\beta}}^{1} xf(x)\,dx = \left[1 - \bar{\beta}F\left(\bar{\beta}\right)\right] - \int_{\bar{\beta}}^{1} F(x)\,dx$, and so $\frac{d\bar{\beta}}{d\pi}$ has the sign of $\left[\int_{\bar{\beta}}^{1} F(x)\,dx + \bar{\beta} - 1\right]$: given that $F(x) < 1$ for $x < 1$, the integral is less than $1 - \bar{\beta}$.

The intuition for the downward slope is that a higher π (for given β) means that lack of information is more likely to reflect a cover-up. For $\pi = 0$, there is no suspicion because publishers are known to never have anything to report. This means the Suspicion Region starts at $\beta = 1/2$ and opens out upwards. For $\pi = 1$, the suspicion is maximal because readers know that when no information is published, there *is* information and it is necessarily

adverse to the publisher.

Define $V_i(S,\beta,\pi) = E(x-\beta_i)\,d^{pub}$, $i = A, B$, as publisher i's political factor under market structure $S \in \{\emptyset, A, B, C\}$.[26] This means that the political pay-off to i is $\alpha_i V_i(S,\beta,\pi)$, where α_i is the value weighting applied to the political factor. Assume (until further notice) that the political weights are equal for publishers, so $\alpha_A = \alpha_B \equiv \alpha_p$. (Unequal political preferences are treated below.)

Define too $\mathbb{N}_A$ as the area for which voters will vote for A's preferred outcome when A is alone in the market and publishes nothing, so $\mathbb{N}_A \equiv \left\{(\beta,\pi) : \beta \in \left(0, \bar{\beta}(\pi)\right)\right\}$ and analogously for B, so $\mathbb{N}_B \equiv \left\{(\beta,\pi) : \beta \in \left(\bar{\bar{\beta}}(\pi), 1\right)\right\}$. The union of these regions is complementary to the Suspicion Region (see Figure 5).

Proposition 12 *There is always a pure strategy equilibrium outside the Suspicion Region, i.e., for any* $(\beta,\pi) \in \mathbb{N}_A \cup \mathbb{N}_B$.

Proof. Without loss of generality, consider (β,π) in $\mathbb{N}_A$ (i.e., $\beta < \bar{\beta}(\pi)$). Then A's political preferences are (1) A monopoly or no entry, preferred to (2) B monopoly or competition: B's preferences take the reverse ranking. Note that A's preferred outcome is overturned only when B is in the market and offers evidence. Thus $A \underset{A}{\sim} \emptyset \underset{A}{\succ} B \underset{A}{\sim} C$ while $B \underset{B}{\sim} C \underset{B}{\succ} A \underset{B}{\sim} \emptyset$. Equivalently, $V_A(\emptyset,\beta,\pi) = V_A(A,\beta,\pi) < V_A(B,\beta,\pi) = V_A(C,\beta,\pi)$, and similarly for B.

Suppose A would want to enter a virgin market, so $W_A(A,\beta,\pi,K) > W_A(\emptyset,\beta,\pi,K)$.[27] Then, if B does not wish to enter ($W_B(C,\beta,\pi,K) < W_B(A,\beta,\pi,K)$), an A monopoly is an equilibrium. If B would also like to enter ($W_B(C,\beta,\pi,K) > W_B(A,\beta,\pi,K)$), then if A would want to stay (i.e., if $W_A(C,\beta,\pi,K) > W_A(B,\beta,\pi,K)$), competition is an equilibrium. However, should A then want to leave, then B alone is an equilibrium: B's profits are higher when A is absent and its political payoff is higher in than out. Thus, since B was assumed

[26] It is understood here that d^{pub} is determined by the equilibrium inferences of readers under the appropriate market structure, and depends on the parameters x and β, as well as whether there is news.

[27] Recall $W_i(S,\beta,\pi,K) = \alpha_i V_i(S,\beta,\pi) + [P_i(S,\beta,\pi) - K]\,\delta_i(S)$ where $P_i(S,\beta,\pi)$ corresponds to i's gross profit under regime S, and $\delta_i(S)$ is the indicator function that i enters.

to want to enter in this sub-case with A present, it would also want to enter if A were absent (equivalently, to stay in if A left).

There remains the case when A would *not* enter a virgin market ($W_A(A, \beta, \pi, K) < W_A(\emptyset, \beta, \pi, K)$). Then, if B would also not enter ($W_B(C, \beta, \pi, K) < W_B(A, \beta, \pi, K)$), then no entry is an equilibrium. If B would enter a virgin market, then it is clear that A would not subsequently enter: doing so would leave A's political pay-off unchanged while reducing its profit (by the starting condition that it would not have entered a virgin market.) Hence B alone is an equilibrium. ■

Thus we have established that there exists an equilibrium for all possible $(\beta, \pi) \in \mathbb{N}_A$. Either A wants to enter a virgin market or it does not, which are mutually exclusive events. In each subsequent eventuality, we determined an equilibrium for each case.[28]

The suspicion region is addressed next.

Proposition 13 *Within the Suspicion region, $\mathbb{S}$, and as long as duopoly profits are positive there exists no pure strategy equilibrium for α_p ($= \alpha_A = \alpha_B$) large enough.*

Proof. For $\alpha_A = \alpha_B$ large enough, profit motives play an arbitrarily small role, so it suffices to consider political motives as long as these give strict incentives (meaning that profit motives are not decisive). So consider the preferences of A and B within $\mathbb{S}_A$.

As noted above, A's political preference is (1) no-one in the market; (2) competition or B alone in the market; (3) A alone in the market. B's political preferences are diametrically opposite. Since these political preferences dominate, they determine the equilibrium behavior. No-one in the market is not an equilibrium because B would prefer to enter and sometimes be able to swing the outcome. B alone is not an equilibrium because A would enter for the positive profits it gets in $\mathbb{S}_A$ (by assumption in the Proposition), even though

[28]There also remains the possibility of multiple equilibria. These are just restricted to either publisher being a monopoly, as per Figure 2. Monopoly and Competition cannot simultaneously exist generically, and can only arise on the transition boundary between regions. There remains the combination of No Entry and Competition simultaneously existing, which is not possible.

it does not affect the political outcome. A alone is not an equilibrium because A would prefer to leave and avoid being tarred by the Suspicion effect. Finally, Competition is not an equilibrium because B would prefer to leave and have A invoke suspicion on itself. ■

Note that if A's duopoly profits were negative at some point in $\mathbb{S}_A$, then there will be an equilibrium there with only B publishing (and making losses) for α_p high enough. This is an interesting "reversal" case in that the newspaper that would be more informative (A) is pushed out in favor of the paper that is less informative (B), because of the perverse incentives of the suspicion effect.

We next describe with the aid of a sequence of figures the effects of introducing positive political weights. More features arise for small weights, so we start with high weights and describe what happens as they fall.

The case of relatively high (common) political weights is shown in Figure 6, where $\alpha_p = 1$. Since this is a relatively high value of α_p, then as per Proposition 13, the non-existence region takes up almost all the Suspicion region (excepting the tiny monopoly zones for very low π and central β). Another feature that is apparent here and throughout the subsequent figures is the region of low π and intermediate β for which the "wrong" publisher enters the market. The reason is discussed at the end of this section.

As the common α_p is reduced, pure-strategy equilibria are established within the Suspicion Region. The first new regime to appear is with part of the Suspicion Region turning to monopoly in the top and at the sides. This regime is manifested as the "petals" in Figure 7, which is drawn for the case of $\alpha_p = 0.05$. The reason why the pure-strategy equilibrium is first restored here goes back to our earlier findings: Figure 2 illustrates already that there is a region at the top (high π) where profits are relatively low for a disadvantaged entrant. This means that the profit motive for entering is diminished, and so, in the disequilibrium cycle we described, the A monopoly is no longer beset by a B entrant and the A monopolist will be left alone if α_p is not too large.

As the common α_p is further reduced, another type of regime is established within the Suspicion Region. The new feature here concerns the "pistils" of a competitive region appearing in the upper middle area. This region is also illustrated in Figure 7 (for $\alpha_p = 0.05$). The pure-strategy equilibrium is restored in this region because the disequilibrium cycle logic is broken by Competition. Figure 2 already indicates that the equilibrium is competition on a purely profit basis, and B's profits are quite high when π is high for central β. In the cycle argument, competition is beaten by B leaving to trigger suspicion on A. But if profits are high, B is reluctant to leave, even though for high π, when A does not publish, it really is because A is hiding something.

Figure 8 illustrates for $\alpha_p = 0.01$, which shows the further expansion of the regions identified above filling up the suspicion region. For low α_p, competition is re-established through most of the region, as Figure 9 illustrates for the case of $\alpha_p = 0.001$. As α_p gets still smaller, competition is re-established throughout the whole region, as per Figure 2.

We now allow for mergers. Figure 10 illustrates for $\alpha_p = 1$. This Figure is to be compared to Figures 4 and 6 above. Figure 4 illustrates the outcomes when mergers are allowed and political preferences are weak (α_p tends to zero), while Figure 6 shows the same relatively strong political preferences as here but with mergers disbarred. Figure 10 looks the same as Figure 6 except for a region where there is Entry for Buy-Out, which replaces part of the earlier non-existence region. This Entry for Buy-Out region arises for high π values, where the reader knows that absence of news very likely reflects suppressed news. This means that Buy-Out makes little difference politically and is instead economically motivated by profitability.

The non-existence of equilibrium still prevails (over part of the Suspicion Region) despite the introduction of the new option of merger. The logic is similar to that before: the suspicion effect in region $\mathbb{S}_A$ works in a manner that is prejudicial to publisher A and beneficial to B. A entering alone is not an equilibrium due to the suspicion effect. No Entry is not an

equilibrium, because on political grounds (as well as for profits) B prefers to be a monopolist rather than stay out. With no entry, the public decision will be $d^{pub} = 1$ with probability 1, but B can change the outcome to $d^{pub} = -1$ with positive probability. B entering alone is not an equilibrium because A would enter to make it a duopoly. Then the political outcome is unchanged, but A also makes some profit. The option of buy-out cannot reduce A's incentive to enter. Lastly, both entering if they expect no subsequent buy-out (i.e., an outcome of competition) is not an equilibrium. If A is expected to enter, then it is politically *advantageous* for B *not* to enter (unless of course it will be bought out, which is the same political result). That way, when A does not have any hard information to report, the suspicion effect will cause the public to choose $d^{pub} = -1$, an outcome that B would have been unable to achieve without the suspicion effect. Thus, competition is no longer an equilibrium. It remains to argue for the last case considered that if both publishers were present then there would not necessarily be buy-out (that is, the buy-out regime does not expand over the whole suspicion region.)

Clearly, if there were buy-out, the candidate solution is for A is to buy out B in the region $\mathbb{S}_A$. However, while B does want to be shut up (for political reasons, so invoking suspicion on A), A does not want to shut B up for the same reason. With equal political preference weights ($\alpha_A = \alpha_B$), and with a symmetric distribution for $f(.)$, the net surplus gain from shutting B up is zero: the value of what A loses is what B gains.[29] This means that buy-out, conditional on entry, is undertaken purely on economic terms (profitability). This means that if buy-out is the outcome when political preferences are small (as in Figure 4, say), then it is the outcome conditional on entry here. However, this does not mean that the outcome is the same as when political preferences are vanishingly small, because the

[29] In the notation used in the proof of the next Proposition, this means that $V_A(A, \beta, \pi) + V_B(A, \beta, \pi) = V_A(C, \beta, \pi) + V_B(C, \beta, \pi)$. Suppressing B effectively turns all those outcomes where there was no actual news from -1 votes to 1 votes. This means that with probability $(1 - \pi)$, A loses $\int_0^1 x f(x)\, dx$ and B gains $\int_0^1 (1 - x) f(x)\, dx$. Under symmetry of $f(.)$, A loses exactly what B gains.

publisher still decides whether to enter or not, and now the political preferences must be factored in to the entry decision.

Figure 11 illustrates a lower common political weight of $\alpha_p = 0.1$. The Entry for Buy-Out region is similar to that of Figure 10, but there is also the emergence of monopoly regions ("petals") which follow a logic similar to their emergence in Figure 7 above.

Figure 12 takes a value of $\alpha_p = 0.05$, which is the value used in Figure 7. The new feature here over Figure 11 is that there is now both the region where there is entry for buy-out and another region at top center competition changes to monopoly. In both regions a publisher enters and is bought out: the former describes entry that would not have occurred in the absence of a merger buy-out incentive while the latter would have had entry anyway.

Figure 13 next illustrates for $\alpha_p = 0.001$, which is to be compared to Figure 9. This picture shows a central chunk converting by merger to monopoly. Entry for buy-out remains in the very top regions – erstwhile monopolists now face entrants they will wish to buy out.

One eventuality that does not arise for any of the cases above is entry by a single publisher, who is then bought out by its (absent) rival, leaving the market unserved. This particular form of entry-for-buyout we call entry for close-down.

Proposition 14 *Suppose that $\alpha_p = \alpha_A = \alpha_B$, and that mergers are allowed. Then there can be no entry for close-down in equilibrium. For α_p large enough, both publishers are active.*

Proof. In order for there to be entry for close-down, it must be the case that B's benefit from being alone and publishing is less than A's benefit from closing it down. This means that we would have to have $P_B(B,\beta,\pi) + V_B(B,\beta,\pi) + V_A(B,\beta,\pi) < V_A(\emptyset,\beta,\pi) + V_B(\emptyset,\beta,\pi)$, where $P_B(B,\beta,\pi)$ is the gross profit. Since the gross profit is non-negative, it suffices that $V_B(B,\beta,\pi) + V_A(B,\beta,\pi) > V_A(\emptyset,\beta,\pi) + V_B(\emptyset,\beta,\pi)$ for there to be *no* entry for buy-out. Equivalently, we want to show that $V_B(B,\beta,\pi) - V_B(\emptyset,\beta,\pi) > V_A(\emptyset,\beta,\pi) - V_A(B,\beta,\pi)$,

meaning the net benefit to B from publishing is greater than the net benefit to A from shutting B up. These terms net out quite neatly. With no newspaper, the vote goes to A always in $\mathbb{S}_A$ (so $d^{pub} = 1$), and $V_A(\emptyset, \beta, \pi)$ is simply $\int_0^1 xf(x)\,dx$. Likewise, we can write $V_A(B, \beta, \pi) = -\pi \int_0^\beta xf(x)\,dx + (1-\pi)\int_0^\beta xf(x)\,dx + \int_\beta^1 xf(x)\,dx$ (where the first term is the displeasure to A of a contrary vote with each piece of such contrary news happening with probability density $\pi f(x)$, the second is contrary news that is not uncovered and so the vote goes A's way, and the third term is good news for A regardless – and voted that way even though voters are ignorant it happened. Note in particular that A is really happy about the states when x is high and it gets its way - the warmonger goes to war, say - and this drives the result to follow.) Differencing gives $V_A(\emptyset, \beta, \pi) - V_A(B, \beta, \pi) = 2\pi \int_0^\beta xf(x)\,dx$. This is simply the difference that B makes by not publishing: the factor 2 stems from the switch from $d^{pub} = -1$ to $d^{pub} = 1$. With a similar logic, we can write B's benefit from publishing as $V_B(B, \beta, \pi) - V_B(\emptyset, \beta, \pi) = 2\pi \int_0^\beta (1-x) f(x)\,dx$. Thus the desired inequality holds for $\int_0^\beta (1-2x) f(x)\,dx > 0$. Since $f(.)$ is symmetric around $1/2$, this clearly holds as $x < 1/2$ for all $x \leq \beta$ $(< 1/2)$. A similar argument indicates that both publishers will be active if α_p is large enough (so that losses are not a concern). ■

Thus the option of merging will not leave the outcome as entry for close-down. This statement needs to be qualified if the publishers have disparate political preferences: "entry and close-down" can happen for differential political weights. This is illustrated in the next Proposition.

Proposition 15 *Suppose that $\alpha_A > \alpha_B$, and that mergers are allowed. Then there can be entry for close-down in equilibrium in the Suspicion region.*

Proof. Suppose A cares sufficiently about the political outcome. Then, when the suspicion effect operates against A (in $\mathbb{S}_A$), it will prefer there to be no paper in the market to being there alone itself. It also prefers no paper to any situation with B present and pub-

lishing, as long as its own profit is weighted small enough relative to the political outcome (meaning it does not relish competition). Finally, we must establish that B will be closed down. A will do this as long as B derives a small enough pay-off from being active relative to A's payoff from shutting it down. Clearly this can occur if political motives are valued highly enough relative to profit, and A's political motivation is high enough relative to B's. Then B will enter for buyout, and A will pay to take it over and then muzzle it, and A will not operate itself (for fear of the Suspicion effect). ■

Proposition 15 indicates that a weak publisher facing off a strong one is bad for voters if the outcome is total close-down. However, Proposition 14 indicates that strongly politically motivated magnates might enhance welfare. Comparing two publishers who are weakly politically motivated with two who are strongly but equally weighted, the good news is that each has a strong political incentive to be heard and so ensures the electorate is informed. Competition sustains over monopoly because the publisher with the lower profit wants to be heard more than the other publisher wants to close its rival's newspaper down. The publisher cares more precisely about those outcomes where s/he makes a difference – and the other publisher is more ambivalent (weighs them less). Thus politically motivated magnates provide more diversity of viewpoints if they are balanced. They are also going to stay publishing rather than yield to buy-out. Merger policy is not needed for such cases. The concern, and the need for a strong merger policy, is rather in the case of a strongly motivated publisher facing down a weak one. The outcome in this case can be extreme, and might even involve total muzzling by close-down.

As seen above, allowing for a strong political motive changes equilibrium behavior in a number of ways inside the Suspicion Region. It also has effects outside this region. First, and most simply, it expands the range of entry. The boundaries of the "shield-shaped" region in Figure 2 indicating duopoly have spread out in Figures 6 and 10, because at the edges of the region where the out-of-mainstream publisher was just unwilling to enter because it

was unable to break even is now willing to enter in order to achieve some political influence. For example, at the left-hand edge of the duopoly region in Figure 2, publisher B is just indifferent between entering and not. At the same location in Figure 6, publisher B enters because if it leaves the market to A, the political outcome will be $d^{pub} = 1$ with probability 1, but if B enters it can change the outcome to $d^{pub} = -1$ if it discovers a low value of x. Thus, the out-of-mainstream publisher can derive a political benefit from entry that compensates for its financial loss. The *Washington Times* and the *New York Post* come to mind.

Second, for the same reason, the area in which no publisher enters diminishes. Comparing Figures 6 and 10 with Figure 2, there is a section in the bottom-center in which no entry would have occurred if the profit motive was dominant, but the out-of-mainstream publisher enters with a strong political motive (in other words, publisher B if $\beta < \rho$ and publisher A if $\beta > \rho$). Once again, the reason is that the out-of-mainstream publisher can change the political outcome in its favor by entering. This implies though that the market is served by the publisher who both makes the larger loss and provides less information germane to voting and private decision-making.

6 Conclusions

We have presented a model of a media oligopoly in which the owners of the media have both political and profit motives. In some circumstances they can manipulate political outcomes by distorting the information that consumers of news receive. They can do this, *even though news consumers are perfectly rational and know the bias of the publishers*, because the consumers do not know how much information the news organization has. However, there are also conditions under which a media monopoly is politically disadvantageous, because of the suspicion that rational consumers attach to the behavior of a politically-motivated news monopoly. We have characterized equilibrium market structure, identifying conditions under

which mergers occur, and have shown that in our model a ban on mergers improves welfare, even though the usual sources of deadweight loss from conventional oligopoly models have been removed.

It should be emphasized that the results show that media markets are different from other markets in a number of important ways. (i) *Welfare analysis:* As noted above, the media oligopoly provides a possibility of welfare loss that is separate from the deadweight losses found in familiar oligopoly models, because the news organizations distort the information available to citizens, compromising the quality of both public and private decision-making. (ii) *Equilibrium market structure:* Even when mergers are allowed, the two media organizations may not merge to monopoly, for two reasons. First, if the political motive of the media owners is strong, it may be that neither one wishes to relinquish the megaphone that comes from owning a news organization, even if there is a substantial financial cost to keeping it. Second, even if the publishers merely want to maximize profit, they may not merge because joint duopoly profits may exceed monopoly profits. This is not possible in a conventional oligopoly model, because a merged entity always has the option of duplicating the prices and outputs of the duopolists, but in the case of media organizations with a political agenda the news products produced under owners with different agendas are differentiated products, which cannot in general be replicated by a merged entity because the owner cannot credibly commit to produce a news product that is incompatible with his or her own political agenda.

Thus, the problem with media markets can, over part of the parameter space, be self-correcting: the very source of the inefficiency, the political agenda of the media owners, can also provide the equilibrium level of competition that may be enough to rectify the problem. All of these effects, of course, are absent in a conventional oligopoly.

Finally, we have identified a role for merger review in a media oligopoly that is distinct from the role it has in conventional oligopoly. We formalize the idea that the market may not provide sufficient diversity of political viewpoints to provide the first-best-outcome, and

that this conclusion does not rest on any assumption of irrationality on the part of news consumers. In our model, a policy banning media mergers either has no effect or improves welfare. Whether or not this precise result is robust to extensions of the model, the point remains that we have derived a rationale for merger review that is distinct from the traditional rationale in non-merger markets, based not on standard deadweight loss but rather on the need to preserve variety of political viewpoints in the public arena.

7 Appendix

Proof of Proposition 2. First, the limit values can be found by taking the limit of (4) and (5) as β approaches 0 or 1. Next, we prove that A's monopoly price, $P_A(A,\beta,\pi)$, is strictly decreasing in $\beta \in (0,1)$. Recall that $\frac{P_A(A,\beta,\pi)}{\alpha_1} = \sigma^2 - \nu(A,\beta,\pi)\,\tilde{\sigma}_A^2(A,\beta,\pi)$, where $\nu(A,\beta,\pi) = 1-\pi+\pi F(\beta)$. We can write $\sigma^2 = \int_0^1 x^2 f(x)\,dx - \rho^2$, while

$$\tilde{\sigma}_A^2(A,\beta,\pi) = \int_0^\beta x^2 \frac{f(x)}{\nu(A,\beta,\pi)}dx + (1-\pi)\int_\beta^1 x^2 \frac{f(x)}{\nu(A,\beta,\pi)}dx - \tilde{\rho}^2(A,\beta,\pi).$$

Hence

$$\frac{P_A(A,\beta,\pi)}{\alpha_1} = -\rho^2 + \tilde{\rho}^2(A,\beta,\pi)\nu(A,\beta,\pi) + \pi\int_\beta^1 x^2 f(x)\,dx,$$

and so

$$\frac{\partial P_A(A,\beta,\pi)/\alpha_1}{\partial\beta} = 2\tilde{\rho}(A,\beta,\pi)\frac{\partial\widetilde{\rho}(A,\beta,\pi)}{\partial\beta}\nu(A,\beta,\pi) + \tilde{\rho}^2(A,\beta,\pi)\pi f(\beta) - \pi\beta^2 f(\beta).$$

From (3), $\frac{\partial\widetilde{\rho}(A,\beta,\pi)}{\partial\beta} = \frac{\pi f(\beta)}{\nu(A,\beta,\pi)}\left[\beta - \widetilde{\rho}(A,\beta,\pi)\right]$, so the derivative simplifies to

$$\frac{\partial P_A(A,\beta,\pi)/\alpha_1}{\partial\beta} = -\pi f(\beta)\left[\beta - \widetilde{\rho}(A,\beta,\pi)\right]^2, \tag{18}$$

which is clearly negative, as desired. The fact that $P_A(A,1,\pi) = 0$ together with the monotonicity result proves that the A monopoly price is positive for all $\beta \in (0,1)$. The argument for the B monopoly price is parallel. **Q.E.D.**

Proof of Proposition 8.

(i) The case with β close to 0 or 1. Recalling the derivatives of duopoly prices:

$$\frac{\partial P_A(C,\beta)}{\partial \beta} = -\alpha_1 \pi f(\beta)(\beta - \widetilde{\rho}(B,\beta))^2 < 0,$$

for duopolist A, and, for duopolist B:

$$\frac{\partial P_B(C,\beta)}{\partial \beta} = \alpha_1 \pi f(\beta)(\beta - \widetilde{\rho}(A,\beta))^2 > 0.$$

Further, we have the derivatives of monopoly prices as (the first is (18) above):

$$\frac{\partial P_A(A,\beta,\pi)/\alpha_1}{\partial \beta} = -\pi f(\beta)\left[\beta - \widetilde{\rho}(A,\beta,\pi)\right]^2, \quad \text{and}$$

$$\frac{\partial P_B(B,\beta,\pi)/\alpha_1}{\partial \beta} = \pi f(\beta)\left[\beta - \widetilde{\rho}(B,\beta,\pi)\right]^2. \tag{19}$$

Thus, given that:

$$\Delta(\beta,\pi) \equiv \max\{P_A(A,\beta,\pi), P_B(B,\beta,\pi)\} - (P_A(C,\beta,\pi) + P_B(C,\beta,\pi)), \tag{20}$$

we have:

$$\begin{aligned}
\frac{\partial \Delta}{\partial \beta} &= \alpha_1 \pi f(\beta)\left[(\beta - \widetilde{\rho}(B,\beta))^2 - 2(\beta - \widetilde{\rho}(A,\beta))^2\right] \text{ if } P_A(A,\beta) > P_B(B,\beta) \\
&= \alpha_1 \pi f(\beta)\left[2(\beta - \widetilde{\rho}(B,\beta))^2 - (\beta - \widetilde{\rho}(A,\beta))^2\right] \text{ if } P_A(A,\beta) < P_B(B,\beta).
\end{aligned}$$

If β is close to zero, then $P_A(A,\beta) > P_B(B,\beta)$, so $\frac{\partial \Delta}{\partial \beta} < 0$ for small β iff $2(\beta - \widetilde{\rho}(A,\beta))^2 > (\beta - \widetilde{\rho}(B,\beta))^2$. Since $\lim_{\beta \to 0} \widetilde{\rho}(j,\beta) = \rho$ for $j = A, B$, this condition holds. Since it is easy to see that $\Delta(0,\pi) = 0$, this implies that $\Delta < 0$ for β close to 0. By parallel logic, $\Delta < 0$ for β close to 1.

(ii) The case with π close to 0.

Consider the case with $P_A(A,\beta,\pi) > P_B(B,\beta,\pi)$. Using the expressions for the monopoly and duopoly prices, we can write the bargaining surplus as:

$$\Delta(\beta,\pi) = (3-2\pi)\sigma^2 - 2\nu(A,\beta,\pi)\widetilde{\sigma}^2(A,\beta,\pi) - \nu(B,\beta,\pi)\widetilde{\sigma}^2(B,\beta,\pi,) > 0. \qquad (21)$$

If $\pi = 0$, then $\nu_A = \nu_B = 1$ and $\widetilde{\sigma}^2(A,\beta,\pi) = \widetilde{\sigma}^2(B,\beta,\pi) = \sigma^2$, and so $\Delta(\beta,0) = 0$ (duopoly papers and monopoly papers are all worthless, and so the difference in their values is also zero). We are now interested in the derivative of $\Delta(\beta,\pi)$ at $\pi = 0$.

The second term in $\Delta(\beta,\pi)$ in (21) is:

$$-2\int_0^\beta (x-\widetilde{\rho}(A,\beta,\pi))^2 f(x)dx - 2(1-\pi)\int_\beta^1 (x-\widetilde{\rho}(A,\beta,\pi))^2 f(x)dx.$$

The derivative of this with respect to π is:

$$4\frac{\partial\widetilde{\rho}}{\partial\pi}\int_0^\beta (x-\widetilde{\rho})f(x)dx + 4(1-\pi)\frac{\partial\widetilde{\rho}}{\partial\pi}\int_\beta^1 (x-\widetilde{\rho})f(x)dx + 2\int_\beta^1 (x-\widetilde{\rho})^2 f(x)dx,$$

where $\partial\widetilde{\rho}/\partial\pi$ is finite. When $\pi = 0$, $\widetilde{\rho}(A,\beta,0) = \rho$, so the first two terms sum to zero, leaving

$$2\int_\beta^1 (x-\rho)^2 f(x)dx.$$

Applying this logic to the first term of $\Delta(\beta,\pi)$ in (21) as well, we find:

$$\begin{aligned}\frac{\partial\Delta(\beta,0)}{\partial\pi} &= -2\sigma^2 + 2\int_\beta^1 (x-\rho)^2 f(x)dx + \int_0^\beta (x-\rho)^2 f(x)dx \\ &= -\int_0^\beta (x-\rho)^2 f(x)dx < 0.\end{aligned}$$

Therefore, for small positive values of π, $\Delta(\beta,\pi) < 0$, and so joint duopoly profits dominate an A-monopoly. Parallel logic applies when $P_A(A,\beta,\pi) < P_B(B,\beta,\pi)$. **Q.E.D.**

Proof of Proposition 9.

Duopoly profits at the point $\beta = \frac{1}{2}, \pi = 1$ can be written:

$$\begin{aligned}& 2\pi\sigma^2 - P_A(A,\frac{1}{2},1) - P_B(B,\frac{1}{2},1) \\ = \;& 2\pi\sigma^2 - 2P_A(A,\frac{1}{2},1).\end{aligned}$$

The A monopoly is more profitable if and only if:

$$\begin{aligned} P_A(A, \frac{1}{2}, 1) &> 2\pi\sigma^2 - 2P_A(A, \frac{1}{2}, 1), \text{ or} \\ 3P_A(A, \frac{1}{2}, 1) &> 2\pi\sigma^2. \end{aligned}$$

Recall that

$$P_A(A, \beta, \pi) = \sigma^2 - \nu(A, \beta, \pi)\widetilde{\sigma}^2(A, \beta, \pi).$$

Thus, monopoly is more profitable than duopoly if and only if:

$$\begin{aligned} 3\sigma^2 - 3\nu(A, \frac{1}{2}, 1)\widetilde{\sigma}^2(A, \frac{1}{2}, 1) &> 2\pi\sigma^2, \text{ or} \\ (3 - 2\pi)\sigma^2 &> 3\nu(A, \frac{1}{2}, 1)\widetilde{\sigma}^2(A, \frac{1}{2}, 1). \end{aligned}$$

As $\pi \to 1$, $\nu(A, \beta, \pi) \to \frac{1}{2}$, so in the limit monopoly is more profitable than duopoly if and only if $\frac{2}{3}\sigma^2 > \widetilde{\sigma}^2(A, \frac{1}{2}, 1)$. **Q.E.D**.

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