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Abstract

We develop a model in which profits of media firms depend on their audience ratings, and maximizing profits may involve catering to a partisan audience by suppressing information that the partisan audience does not like hearing. While voters are rational, understand the nature of the news suppression bias and update appropriately, important information is lost through bias and can lead to electoral mistakes. We characterize those conditions that give rise to electoral mistakes, showing that heightened political polarization and asymmetric distributions of voter ideologies make electoral mistakes more likely. Even if the median ideology is a centrist and centrist voters gain access to unbiased news, media bias can generate excessive "crossover" voting, which, in turn, can lead to the election of the wrong candidate.

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1 Introduction

Several recent books argue that most major media outlets in the U.S. report the news with a severe bias. Depending on the author's political stance, the deplored bias is either to the left (Goldberg (2003), Coulter (2003)) or to the right (Alterman (2003), Franken (2003)). Media bias is often blamed for the fact that voters' beliefs on key policy issues are sometimes blatantly false. For example, as Table 1 indicates, a large percentage of the U.S. population had mistaken beliefs about facts surrounding the Iraq war. Most strikingly, these beliefs differed substantially between liberals and conservatives, indicating that these groups receive information from different sources, and that some of these sources bias the news by suppressing or de-emphasizing certain events that could be perceived as unfavorable by their respective audiences.

Table 1: Harris Opinion Poll, October 21, 2004
http://www.harrisinteractive.com/harris_poll/index.asp?PID=508

	Total	Bush supporters	Kerry supporters
Saddam Hussein had strong links to Al-Qaeda	62%	84%	37%
Saddam Hussein helped plan and support the hijackers who attacked the US on September 11, 2001	41%	52%	23%
Iraq had weapons of mass destruction when the US invaded	38%	58%	16%

Virág (2007) cites further evidence that conservatives and liberals receive their news from predominantly different sources. For example, the Pew Research Center Poll of October 24, 2004, (http://people-press.org/reports/display.php3?ReportID=230) found that "Seven-in-ten voters who get most of their election news from Fox News support Bush, while just 21% back Kerry. By contrast, voters who get most of their election news from CNN favor Kerry over Bush, by 67%-26%."

The fact that liberals and conservatives have very different news sources could possibly influence their assessments of the candidates and hence electoral outcomes. Many political commentators diagnose a sharp and increasing partisan divide that splits the U.S. electorate. For example, the Economist writes that "the 50-50 nation appears to be made up of two big, separate voting blocks, with only a small number of swing voters in the middle",[1] and that "America is more bitterly divided than it has been for a generation".[2] In contrast, Fiorina, Abrams, and Pope (2004) argue that even though partisans may be more partisan, there is a large center of voters who are largely ambivalent or indifferent and that "there is little evidence that Americans' ideological or policy *positions* are more polarized today then they were two or three decades ago, although their *choices* often seem to be."

We develop a model in which media bias arises endogenously as an optimal choice by profit-maximizing media in response to (some) voters' preferences. Media bias manifests itself as suppres-

[1] "On His High Horse," Economist, November 9, 2002: 25.

[2] "America's Angry Election," Economist, January 3, 2004.

sion of information. That is, media can selectively omit relevant information that conflicts with their viewers' beliefs and preferences, but they cannot "fabricate" news outright.[3] While voters know that media are biased and update rationally, they cannot completely recover the suppressed information. We find that changes in voter *behavior*, as documented above, can be caused by media bias rather than a fundamental change of voters' political preferences. Our model is also designed to address the questions of whether and when media bias causes a failure of information aggregation in elections. Even though voters who listen to biased news will typically have mistaken beliefs, it is far from obvious that the wrong electoral outcomes will occur. For example, as documented by an extensive literature rooted in the Condorcet Jury Theorem, democracies may be able to achieve perfect information aggregation, even when the quality of information of individual voters is poor (see, for example, Feddersen and Pesendorfer (1996)).

First, we identify conditions for some or all media to be biased. For example, if there is sufficient competition some media outlets always find it profitable to provide biased news; and if society is sufficiently polarized then all news media are biased. We then characterize under what conditions electoral mistakes occur. We define an electoral mistake as an outcome in which media bias matters, i.e., the candidate, who would be preferred by the majority if all voters received unbiased news, is not elected. Surprisingly, electoral mistakes can occur even if the median of the preference distribution is a centrist who receives unbiased news.

The most transparent instance of electoral failure arises when the median of the preference distribution receives biased news. For example, suppose there are both conservative and liberal media outlets, each presenting only the negative news about the opposing candidate. Applied to the 2004 U.S. Presidential Elections, a liberal outlet would have focused on the lack of those weapons of mass destruction that provided the rationale of the Bush administration for the Iraq war, while a conservative outlet would have emphasized Kerry's "flip-flopping," illustrated by Kerry's widely-quoted line, "I voted for the 84 Billion before I voted against it." In our model, voters are rational and understand that their news sources are biased. Thus, even though a listener to the conservative news source remains uninformed about the lack of WMDs in Iraq, he understands that some relevant news may not have been reported. If the realized negative news about Kerry's "flip-flopping" outweighs the unobserved (expected) negative news about Bush, then even moderate listeners to the conservative outlet vote for Bush. Similarly, all listeners to the liberal outlet vote for Kerry, as long as the news about the missing WMDs is more important than the expected, but unobserved, weakness of Kerry. In this case, even the ideologically most moderate voters have a strong preference for the candidate favored by the news outlet that they listen to. Thus, media bias is quite likely to influence the election outcome in this scenario: The conservative candidate is elected if and only if the median voter listens to the conservative outlet, which is an electoral mistake if and only if under complete information this voter would have considered the WMD issue to dominate the character issue.

Our model predicts that that there is more than expected bad news about the two candidates,

[3] Groseclose and Milyo (2005) argue that news suppression is by far the more important form of media bias.

then listeners to biased outlets establish strong candidate preferences and vote along partisan lines. If, instead, the negative news about both candidates is less than expected, our model predicts weak candidate preferences and significant cross-over voting. In such a situation moderate leftists or rightists can determine the electoral outcome (in a way that they regret ex-post). This can even be true if the median of the preference distribution is a centrist who receives unbiased news and is thus completely informed.

We find that electoral mistakes are more likely in environments with asymmetric distributions of voter ideologies, for example if most voters are liberals. In this case, providing left-biased news is very profitable for media, and the decisive voter is a (moderate) liberal who may prefer to listen to left-biased news even if unbiased news sources would be available for him.

The fundamental source of possible electoral inefficiency is a problem of failing to internalize positive externalities. While, from an ex-ante perspective, voters would benefit from a better-informed electorate, each individual citizen has virtually no influence on the electoral outcome. As a consequence, the value of news for an individual citizen is primarily given by its entertainment value, and not by its informational value. Depending on political preferences, the consumption value of news may be higher for biased than for unbiased news. Our modeling assumptions correspond to the observation of Posner (2005): "So why do people consume news and opinion? [...] They want to be entertained, and they find scandals, violence, crime, the foibles of celebrities and the antics of the powerful all mightily entertaining. And they want to be confirmed in their beliefs by seeing them echoed and elaborated by more articulate, authoritative and prestigious voices. So they accept, and many relish, a partisan press."

Our paper contributes to three distinct literatures. One literature analyzes whether democratic election aggregate information efficiently. Wittman (1989) argues that democracy leads to efficient outcomes as long as voters do not make systematic mistakes. In his view, elections would be unaffected by media bias when voters are rational. Feddersen and Pesendorfer (1996) and Feddersen and Pesendorfer (1997) consider a common value model in which voters receive stochastically-independent information about the state of the world. They show that information aggregation in large electorates is asymptotically efficient. Martinelli (2006) endogenizes voters' decisions about how much information to acquire. If marginal information acquisition costs are initially zero, then efficient outcomes arise despite the public good provision problem. In contrast to these models, in our paper all citizens listening to the same outlet receive the same information. Even though each individual citizen in our model receives more complete information than in the above models, all listeners to the same media outlet receive the same information. Thus, no law of large numbers result for perfect information aggregation applies to our model.

There is an emerging literature that investigates the sources of media bias. In Baron (2006) bias can arise because journalists have a preference for providing news that is in line with their own political views. As in our model, Mullainathan and Shleifer (2005) assume that media bias is caused by preference for confirmatory news. However, in their paper the bias can be undone by rational agents. Hence, we cannot use their approach for our analysis. Gentzkow and Shapiro (2006) introduce a model in which media firms care about their reputation for accurately reporting news.

Anderson and McLaren (2007) assume that media care both about profits and policy outcomes implemented by voters and consider when media outlets have an incentive to merge.

Della Vigna and Kaplan (2005) and Gerber, Karlan, and Bergan (2006) show empirically that media bias matters for voting behavior. Importantly, Gerber, Karlan, and Bergan (2006) find evidence that voters update rationally from biased news, rather than naively following the political slant of their media sources.[4]

Our preference-based approach to modeling media bias provides a credible and tractable framework of why media bias arises. However, even if media bias is due to other reasons, the analysis of the electoral effects of media bias in our model would still apply, as long as media bias leads to a loss of information that cannot be fully recovered by voters.

2 The Model

There are two political candidates for office, $i = L, R$, where L is interpreted as a liberal and R as a conservative. The winning candidate implements his preferred policy. Candidate i is also distinguished by his valence $v_i \in [0, V]$. Valence is a quality such as integrity or ability that all citizens appreciate in a politicians.

Citizens differ in their political preferences. To capture all of the ways in which media bias can affect electoral outcomes, we distinguish five types of citizens, $\theta \in \Theta = \{l, cl, c, cr, r\}$, where l stands for "left," cl for "center left," c for "center", cr for "center right," and r for "right." Citizens of type θ make up a percentage $\mu_\theta > 0$ of the electorate. The net benefit from candidate L for type c voters is $v_L - v_R$. A type cl's net benefit from candidate L is $b + v_L - v_R$, while the net benefit to a type cr citizen from candidate R is $b + v_R - v_L$, where $b > 0$. Thus, $b > 0$ measures the ideological preference of moderate partisans for their party's candidate. Analogously, the more partisan types l and r receive net benefit from candidates L and R of $B + v_L - v_R$ and $B + v_R - v_L$. We assume that $B > V > b$. Hence, strong partisans always vote according to their ideologies, while the cl and cr types can be swayed to vote for the other party's candidate if they believe his valence is sufficiently higher.

There is a large number of citizens of each type such that the probability of being pivotal in the election is zero. To exclude uninteresting cases, we assume that $\mu_r, \mu_l < 0.5$, so that strong partisans are not decisive on their own. This implies that candidate valences can matter in an election.

Citizens do not directly observe valences. However, $m \geq 2$ media outlets are completely informed about the news stories underlying the candidates' valences, which they can — possibly incompletely — report to their listeners. (The assumption that the media are completely informed about the candidates' valences is a stark and simple way to capture that the media initially have *more* information about valence than voters. The objective of the model is to analyze whether the

[4] In the 2005 Virginia gubernatorial election, voters who were given subscriptions to the Washington Post (which favored the Democrat) and voters who were given subscriptions to the Washington Times (which favored the Republican) both supported the Democrat in greater numbers than a control group that did not receive subscriptions.

media transmit their additional information to voters.)

To ease presentation, we assume that the only relevant news consists of negative news stories about candidates.[5] That is, the valence of candidate $i = L, R$ is $V - n_i$, where $n_i \geq 0$ comprises the negative news about a candidate. For simplicity, we assume that the expected negative news is the same for both candidates, i.e., $E[n_L] = E[n_R] = \bar{n}$. A news story corresponds to a candidate's valence.[6] We assume that a media outlet either reports the story n_i or remains silent. That is, a media outlet can decide to drop a story, but cannot misrepresent one or present only a fraction of the story. This assumption is motivated by the argument of Groseclose and Milyo (2005) that most bias manifests itself as information suppression.

Citizens receive utility from listening to the news in addition to their net benefit from the electoral outcome discussed above. The citizens' "listening" utility are quadratic in listening time t and given by

$$\begin{aligned} u^2_\theta(t, n_L, n_R) &= [\gamma + n_R - n_L]\, t - 0.5t^2,\ \theta = l, cl, \\ u^2_\theta(t, n_L, n_R) &= [\gamma + n_L - n_R]\, t - 0.5t^2,\ \theta = r, cr \\ u^2_\theta(c, n_L, n_R) &= [\gamma + k(n_L + n_R)]\, t - 0.5t^2. \end{aligned} \tag{1}$$

Here, $\gamma > 0$ captures the enjoyment derived from listening to aspects of the news show that are distinct from the political news stories themselves—such as sports, weather, and entertainment. The relevant feature of these preferences is that leftists choose longer listening times if they expect to hear bad news about the conservative candidate, and shorter times if they expect to hear bad news about their own candidate. The reverse is true for conservative listeners. In contrast, pure centrists weigh the news equally, and assuming $k > 0$, prefer more news to less news. We assume that $k < 0.5$. This implies that partisans consume more news if biased appropriately than would centrists hearing unbiased news.

In principle, citizens might listen to news in order to make a better-informed electoral choice; however, since the probability to be pivotal in the election is (essentially) zero for each individual voter, this incentive is very small in large electorates. Rather, we assume that citizens listen to the news as a consumption good: Some news is just interesting or entertaining for citizens, and this provides sufficient motivation for citizens to listen to the news for some time. In this respect, we assume that liberals and conservative citizens, ceteris paribus, prefer to hear news that is positive for their ideologically-closer candidate and negative about the opposing candidate. In contrast, centrists prefer to hear all news.

The game extends over three stages.

Stage 1 Each media outlet announces whether or not it will report negative and/or positive news about each candidate i. Formally, a media outlet's strategy is given by $(\mathfrak{l}, \mathfrak{r}) \in \{0, 1\}^2$, where

[5] In a model of positive and negative campaigning, Polborn and Yi (2006) argue that negative news is often much more informative than positive news.

[6] In a previous draft, Bernhardt, Krasa, and Polborn (2006), we allow for valences to take the form $v_i = V + p_i - n_i$, where p_i is positive news, and media can report both p_i and n_i, and that there may be many stories underlying these components. We also allowed for a continuum of ideological preferences. These generalizations do not qualitatively alter model predictions.

one means that the negative news about the respective candidate is reported, and zero that it is not reported.

Stage 2 Each citizen chooses an outlet and a listening time $t \geq 0$. Let $t_j^*(\theta)$ denote the equilibrium strategy, i.e., the time that a type θ voter listens to outlet j in equilibrium. After choosing his media outlet, citizen θ learns those news reported by the outlet for which $t_j^*(\theta) > 0$, and receives listening utility given by (1).

Stage 3 Citizens update about valences v_L and v_R from the news that they hear, and then vote for their preferred candidate.

The objective of media outlet j is to maximize $T_j = \sum_{\theta \in \Theta} \mu_\theta t_j^*(\theta)$, the aggregate listening time of j's audience. The reason is that outlets make profit from advertising, and advertising revenue is proportional to the aggregate listening time.

2.1 Discussion of the Model

Citizens' media choices and learning. Because a citizen's probability of being pivotal is zero, citizens are interested in news purely for its entertainment value and not for being able to make better electoral choices. The assumption that each citizen listens to only one outlet is natural in a static model where news arrives only once. More generally, learning all the news of the day is costly in practice when outlets are biased. A citizen who listens to a second program in the hope of receiving news suppressed by his first outlet has to listen to many stories that he has already heard (e.g., weather, sports, soft news).[7]

Learning of information by citizens. In our model, citizens learn those news realizations completely that are reported by the news outlets they consume. For simplicity, listening time does not influence the quality of information that a citizen acquires. However, this can be easily generalized, assuming a convex information acquisition technology. For example, our results immediately extend to the case where agents must listen a minimum amount of time to become informed, provided that this threshold time is not too long. Note also that, if some channel switching were to occur in such an environment, the informational status of a channel switcher would remain the same as in our base model, as long as the viewing time on the secondary channel remains below the threshold.

Number of media outlets. The number of media outlets, m, is exogenous in our model, but could easily be endogenized by assuming that there is a fixed cost for operating a media outlet. A free entry condition then determines the number of active media outlets.

[7] To capture this argument formally, we could explicitly model an opportunity cost of listening. If watching different channels for t_1 and t_2 units of time, the opportunity cost would depend on $t_1 + t_2$, while the viewer would receive utility from non-political news (measured by γ in the model) only from the outlet he watches more. It is obvious that, for sufficiently high γ, listening to a single media outlet is the optimal strategy even for centrists.

Commitment to reporting strategy. We assume that media choose a particular reporting strategy before the actual news arrives. Since it is plausible that building a reputation for a particular slant takes time, this sequence of events appears natural. Also note that, once the news arrives, media cannot profit from deviating, since such a deviation does not affect listening times. Hence, there is no time-inconsistency problem with the ex-ante strategy, so that the media's reporting strategy announcements are credible.

An alternative modeling approach would be to assume that citizens have a belief about a media's reporting strategy, and that this belief must be correct in equilibrium. However, a large number of implausible equilibria can be generated by citizens' beliefs. For example, citizens could believe that both media outlets provide right-biased news, resulting in an audience for both channels that is mainly composed of conservatives (which, again, might make it optimal for both media to provide right-biased news). Unless we assume some equilibrium refinements, deviations by one outlet, say to unbiased reporting, need not affect citizens beliefs. Thus, our modeling approach has the virtue of not requiring equilibrium refinements to eliminate implausible equilibria.

Media objective. In our model, if media choose to bias their reporting, then it is because this behavior maximizes profit. This way, we can show that media bias can arise endogenously, even when media care only about profit. This objective is line with a recent comment by talk show host Rush Limbaugh (http://www.npr.org/templates/story/story.php?storyId=7018083), that "my real purpose is to attract the largest audience I can, and hold it for as long as I can, so I can charge confiscatory advertising rates."

In the conclusion, we discuss how predictions are affected in a somewhat modified model in which media outlets have a political agenda and bias the news strategically to affect electoral outcomes.

3 Equilibrium Analysis

Each media outlet has four possible strategies:

- The strategy $(1,1)$ of reporting all news, which we refer to as unbiased reporting;
- the strategy $(1,0)$ of reporting only the bad news about candidate L, which we refer to as right-biased reporting;
- the strategy $(0,1)$ of reporting only the bad news about candidate R, which we refer to as left-biased reporting;
- the strategy $(0,0)$ of reporting no news about candidates. This strategy is dominated by one of the other three strategies, because citizens listen longer if political news is reported.

Thus, in equilibrium media outlets choose either unbiased or biased reporting. Proposition 1 analyzes how polarization and media competition affect equilibrium reporting strategies.

Proposition 1

1. *Suppose there are two outlets and μ_c is sufficiently small. Then both outlets are biased in equilibrium.*

2. *Suppose there are two outlets. If $\bar{n}$ is sufficiently large relative to γ then only biased outlets exist in equilibrium.*

3. *If μ_c is sufficiently large, then there exists at least one unbiased outlet.*

4. *If the number of media outlets m is sufficiently large, then there exists at least one outlet of each type.*

The objective of the proposition is not to provide a complete characterization of all possible equilibria.[8] Rather, we want to demonstrate the existence of more or less informative equilibria, and provide conditions under which these exist. For example, as the third statement of the proposition shows, if the electorate is very centrist (i.e., μ_c is large) then at least one media outlet provides unbiased news. If, instead, polarization is large, i.e., μ_c becomes sufficiently small, then both outlets are biased. An increase in media competition because of lower fixed costs FC can have two effects. First, if all media are originally unbiased, biased media will be introduced. This, in turn, means that types *cl* and *cr* will listen to biased reporting, instead of unbiased reporting, which can have undesirable consequences for elections. Conversely, if all media outlets are originally biased, increased competition will eventually lead to the entry of an unbiased outlet, which is beneficial for electoral outcomes.

4 Electoral Consequences of Media Bias

We now determine how media bias affects electoral outcomes, and under what conditions media bias results in electoral inefficiencies. Because citizens in our model are completely rational and understand the nature of the biases, they update appropriately and then vote for the candidate whom they prefer given their information. However, even though citizens who listen to biased media do not make systematic mistakes regarding the valence of their ideologically-preferred candidate and his opponent, because information is incomplete due to bias, the wrong candidate may get elected.

We say that biased reporting leads to electoral mistakes if the winning candidate is not the candidate who would win were valence full information, i.e., if all media outlets reported all news. Note that when an electoral mistake occurs, some voters necessarily have ex post regret. To ease presentation, we assume without loss of generality that $n_L < n_R$, i.e., candidate L has the higher valence. The following three types of electoral mistakes can then occur.

Definition 1 *1. Type R1 error: Conservatives are a minority ($\mu_r + \mu_{cr} < 1/2$), and Candidate R is elected.*

[8] For example, there exist parameters such that there are two outlets, one of which is biased and the other one unbiased. A more thorough analysis of the possible equilibria is contained in the working paper version, Bernhardt, Krasa, and Polborn (2006).

2. *Type R2 error: Conservatives are a majority ($\mu_r + \mu_{cr} > 1/2$), and cr types would prefer L under complete information ($n_R - n_L > b$), but Candidate R is elected.*

3. *Type L error: Conservatives are a majority ($\mu_r + \mu_{cr} > 1/2$), and cr types would prefer R under complete information ($n_R - n_L < b$), but Candidate L is elected.*

Type R1 covers the case that right-wingers are not a majority of the electorate: Since, by assumption, the left candidate has a higher valence, the desirable outcome in this case is for L to win. Type $R2$ and type L electoral errors can arise when right-wingers are in the majority, and moderate conservatives would prefer a different candidate to the election winner, if they were completely informed.

We now characterize the nature of electoral errors as a function of the amount of bad news about each candidate and the pattern of media bias. Proposition 2 considers the situation when the news about each of the candidates is worse than expected.

Proposition 2 *Suppose that $\bar{n} < n_L < n_R$. Then voters who listen to biased news vote according to the bias of their news outlet—all partisans support their candidate, and centrists vote against the candidate about whom they hear negative news.*

Only type $R1$ and type $R2$ errors can occur. These electoral mistakes occur if and only if one of the conditions below hold.

$R1$*: The median voter is a type c who listens to a right-biased outlet (i.e., if α is the fraction of type c voters who listen to a right-biased outlet and $\alpha\mu_c + \mu_{cr} + \mu_r > 0.5 > \mu_{cr} + \mu_r$).*

$R2$*: Voter cr listens to a right-biased outlet, votes for candidate R but regrets the choice, $\bar{n} - n_L < b < n_R - n_L$, and is decisive, $\mu_r + \alpha\mu_c < 0.5 < \mu_r + \mu_{cr} + \alpha\mu_c$, where α is the percentage of c types that listen to a right-biased outlet.*

Proposition 2 considers a situation in which the bad news about both candidates is substantial. Electoral mistakes can occur when there is too little cross-over voting by *cr* types, or because too many *c* types receive right-biased news. When there is substantial bad news about both candidates, and a partisan listens to biased news, this will reinforce his preference beyond the initial ideological preference b, or B. The reason is that he hears very bad news about the opponent, but does not learn that the news about his own party's candidate is also bad, and possibly worse. As a result, citizens vote in line with the bias of the news that they hear, and may not support the candidate with the higher valence. When the median voter is a centrist listening to right-biased news, this necessarily introduces a mistake. If, instead, the pivotal voter is a *cr* type, and the valence difference exceeds the ideological gain b, then the high valence candidate is again not elected.

This type of electoral mistake is especially likely in settings with significantly asymmetric distributions over ideological types of citizens. For example, with sufficient asymmetry, the median voter is either a *cr* type or a *cl* type who prefers biased news; and even if the median voter is a centrist, there may be too few of them to support the provision of unbiased news. Thus, in a state

like Utah where the median voter is certainly conservative, a liberal candidate could only win if conservative voters learn very bad news about the conservative candidate. Moreover, if a large majority of citizens is conservative, then it is attractive for media to adopt a conservative bias, so that the negative news about the conservative candidate may not reach the median voter. Proposition 2 indicates that in such circumstances, media bias sometimes gives rise to electoral mistakes.

The next proposition considers the case where there is less than expected bad news about the liberal candidate, but more than expected bad news about the conservative. Proposition 3 shows that electoral mistakes again occur due to too little cross-over voting, but because centrists who listen to biased news now always support the higher valence candidate, electoral mistakes are less likely.

Proposition 3 *Suppose that $n_L < \bar{n} < n_R$. Then only type R2 errors can occur. An electoral mistake occurs only if there is too little cross-over voting by cr types who listen to right-biased news, and who regret not voting for L ex-post, i.e., $\bar{n} - n_L < b < n_R - n_L$, and are decisive, i.e., $\mu_r + \mu_{cr} > 0.5$.*

Proposition 3 shows that fewer electoral mistakes occur (relative to the setting of Proposition 2) when one candidate is better than expected and the other is worse. Centrists now vote for their ex post preferred candidate, no matter what their source of news is: Those who listen to left-biased news update unfavorably about R; those who listen to right-biased news update favorably about L; and those listening to unbiased news obviously support the superior candidate. Thus, if the decisive voter is a centrist or left moderate, no electoral mistake can occur in this setting.

Mistakes can only arise when the median voter is a *cr* type who is favorably impressed by the lack of bad news about L, but not to the extent that it induces him to switch his vote, i.e., $\bar{n} - n_L < b$. However, when candidate R is sufficiently worse than expected, i.e. $b < n_R - n_L$, voter type *cr* *should* have voted for L. As in Proposition 2, type R2 errors occur in this setting because voters who are only partially informed are too reluctant to cast a vote for the ideologically disfavored candidate.

Finally, we consider a situation in which both candidates are better than expected. In complete contrast to the cases discussed above, electoral mistakes now only occur when there is too much cross-over voting by *cl* and/or *cr* types. These types only hear the unfavorable news about an opponent, which is less than expected, update rationally, concluding that the high valence opponent is likely to be superior candidate and vote for him. They do not realize that their own party's candidate is also better than expected.[9]

To highlight how cross-over voting can generate electoral mistakes when both candidates are better than expected, Proposition 4 supposes that the number of outlets m is sufficiently large so that an unbiased news outlet exists. As a result, type c voters receive unbiased news, and hence vote for the higher valence candidates.

[9]This description presumes that there are only bad news stories about candidates. With both good news and bad about candidates, a voter who hears little good news about his preferred candidate may also become disaffected, switch over and vote for the opponent.

Proposition 4 *Suppose that $n_L < n_R < \bar{n}$, and that m is sufficiently large to guarantee the existence of an unbiased news outlet. Then type c voters always select the high valence candidate L. However, electoral mistakes can occur if there is too much cross-over voting by cl or cr types. In these cases, the median voter can be type c, but his vote may not be decisive. Electoral mistakes occur if and only if one of the conditions below is satisfied.*

1. *Type L error, no left-biased outlet: Conservatives are in the majority ($\mu_r + \mu_{cr} > 0.5$), type cr voters listen to a right-biased outlet and mistakenly switch over, $n_R - n_L < b < \bar{n} - n_L$, and the switch alters the election outcome.*

2. *Type $R1$ error, no right-biased outlet: Type cr voters listen to an unbiased outlet, cl types listen to a left-biased outlet and switch over, $b < \bar{n} - n_R$, and type cl is decisive, i.e., if $b > n_R - n_L$ then $\mu_{cr} + \mu_r < 0.5 < \mu_{cl} + \mu_{cr} + \mu_r$ and if $b < n_R - n_L$ then $\mu_{cl} + \mu_R > 0.5$.*

3. *Type $R1$ error, all types of outlets: There is switching over of voters in both directions, $b < \bar{n} - n_R$, cr does not regret switching ex-post, $b < n_R - n_L$ and cl is decisive $\mu_r + \mu_{cl} > 0.5$.*

4. *Type $R1$ or type L errors, all types of outlets: There is switching over of voters in both directions, i.e., $b < \bar{n} - n_R$ and both cl and cr regret their choices ex post, i.e., $b > n_R - n_L$, and either cl is decisive, i.e., $\mu_r + \mu_{cl} < 0.5 < \mu_r + \mu_{cr}$, or cr is decisive, $\mu_r + \mu_{cl} > 0.5 > \mu_r + \mu_{cr}$.*

5. *Type L error, all types of outlets: There is switching over of cr voters but not cl voters, $\bar{n} - n_R < b < \bar{n} - n_L$, and candidate L wins but cr voters regret the outcome, i.e., $b > n_R - n_L$ and $\mu_r + \mu_{cr} > 0.5$.*

The results of Proposition 4 are qualitatively different from those of Propositions 2 and 3. Now, with little bad news about an opponent, voters are willing to cross party lines. Indeed, mistakes occur when there is excessive crossing over. Because we assume that centrists receive unbiased news, they always support the higher valence candidate. Nevertheless, even when neither liberals nor conservatives comprise a majority on their own (i.e., the "median" voter is a centrist), type c voters may end up supporting the losing candidate, in which case the wrong electoral outcome occurs. For example, if $\mu_l = .1, \mu_{cl} = .33, \mu_c = \mu_{cr} = \mu_r = .19$, and $b < \bar{n} - n_R$, then both cl and cr types cross over with biased news reporting, and R wins with the 52% vote share from cl and r voters. However, if $b > n_R - n_L$, then both cl and cr types would reverse their votes with full information, and L would win with 62% of the vote. The cases above also show that mistakes can occur when the type c voters support the winning candidate L, but the electorate is primarily conservative. For example, cr voters hear little bad news about L and when $b < \bar{n} - n_L$ this expected valence superiority dominates the impact of their ideological preference, and they cross over and vote for L. This will be a mistake when R also has sufficiently less than expected bad news that $b > n_R - n_L$, so that with full information cr types would vote according to ideology. The full information electoral outcome is reversed when $\mu_r + \mu_{cr} > 0.5$, again indicating that biased news is likely to have bad electoral consequences in settings where the distribution of voters is asymmetric.

Proposition 4 presumes that unbiased news is available. Electoral mistakes are even more likely when only biased news is available. In particular, when the candidates have less bad news than expected, centrists split their vote according to the source of biased news and thus contribute to electoral mistakes. Rather than tediously enumerating all possible ways in which electoral mistakes can occur when there is no unbiased news, we illustrate how errors are caused by type c voters making mistakes.

For example, suppose that type c voters split their listening times evenly between the two biased outlets. Then their votes cancel out. As a result, electoral mistakes can occur without crossover. This happens when cl and cr types vote for their preferred candidates, and $0.5 > \mu_r + \mu_{cr} > \mu_l + \mu_{cl}$. That is, the mistakes occur because half of the type c voters select R because they listen to left-biased news and learn that candidate R has less than expected negative news, but remain uninformed about candidate L. It is even easier to support electoral mistakes in this setting if more type c voters listen to the left-biased outlet and support R.

When the candidates have significantly less bad news than expected about them, mistakes can also occur with crossing over of cl and cr types (i.e., because they hear so little bad news about the candidates). Such electoral mistakes are qualitatively similar to those discussed in Proposition 4, where unbiased news was available.

4.1 Application: Interpreting the 2000 and 2004 U.S. Presidential Elections

We now summarize key facts about recent U.S. presidential elections and relate them to Propositions 2 and 4, showing how our model provides a unifying interpretation of them. In the 2004 U.S. Presidential election, there was substantial negative news about both candidates. Liberal media emphasized the run up to the war in Iraq, while conservative news programs emphasized Kerry's uncertain character. An implication of Proposition 2 is that the electorate should appear strongly divided, with liberals and conservatives having strong preference intensities for their respective candidates. However, this perceived preference polarization is based on the different information that voters received, rather than on an increased polarization of the underlying ideological preferences. In contrast, in the 2000 U.S. Presidential election, negative news about both candidates was relatively insignificant. Proposition 4 predicts that there should have been low preference intensity and significant cross-over voting. An outside political observer may conclude that the candidates have similar valences, and that voters cross over because they are not inspired by their own candidate. We now present evidence supporting the following:

1. The distribution of ideologies has remained stable for many years. The fact that people appear more polarized in some recent elections must therefore be due to some other factor.

2. In the 2004 election, Bush and Kerry supporters held vastly different beliefs about *facts* influenced by the media, relative to their differences in core beliefs (e.g., abortion), which are less influenced by media.

3. Voters held stronger preferences over candidates in the 2004 presidential election than in the 2000 election, turnout was larger, and voting decisions were made earlier.

Stability of the ideological preference distribution. Many political commentators argue that the U.S. electorate is far more polarized today than ever (see, for example, Dan Balz's article in the Washington Post, on March 29, 2005 and the citations from the Economist in the introduction).

However, comparing Gallup polls taken in the weeks before the 2000 and 2004 elections reveals that the percentages of citizens who classified themselves as either very conservative, conservative, moderate, liberal, or very liberal changed only marginally. So, too, the number of registered voters who do not identify themselves as Democrats or Republicans has not changed since 1997 (Pew Research Report, http://people-press.org/reports/display.php3?ReportID=196). More generally, Fiorina, Abrams, and Pope (2004) show through the analysis of surveys and opinion polls that the distribution of political preferences in the U.S. has not changed fundamentally in recent decades.

Our model of media bias and its electoral effects provides a framework that can reconcile the tension between these two apparently conflicting views: Different and biased information that the two camps of voters receive may sometimes create the appearance of a more polarized electorate even though the underlying preference distribution did not change.

Table 2: Exit Polls, 2004 US Elections

	Bush	Kerry
How are things going for the U.S. in Iraq		
well 44%	90%	9%
badly 52%	17%	82%
Abortion should be ...		
mostly or always legal 55%	33%	67%
mostly or always illegal 42%	75%	24%

Different beliefs about facts. Exit polls taken after the 2004 U.S. presidential election reveal that Bush and Kerry supporters disagreed dramatically about facts relevant for the election (see Table 2). Consider the question of whether things were going well in Iraq. In principle, the answer to this question is factual, and if all citizens had listened to truly unbiased news reporting, there should be significant consensus among voters in both camps. However, while roughly 50% of voters thought the war was going well, the electorate split on this question almost exactly along voting lines. A person who believed that things were going well for the U.S. in Iraq was ten times more likely to vote for Bush than for Kerry.

One interpretation consistent with our model is that liberals and conservatives received information from sources with different biases. A study by the Project for Excellence in Journalism

assessing the tone of Iraq war coverage in different news cable news channels supports this view. The study found that Fox was "distinctly more positive than negative. Fully 38% of Fox segments were overwhelmingly positive in tone, more than double the 14% of segments that were negative. [...] On CNN, in contrast, 41% of stories were neutral in tone on the 20 days studied, and positive and negative stories were almost equally likely — 20% positive, 23% negative." Reinforcing this interpretation, we observe that voters are more split on assessment of factual matters—the progress of the war in Iraq—than on social issues, where views are not directly affected by news reporting.

Increased preference intensity in 2004. The Gallup polls taken before the election ask respondents the degree to which they support a candidate. For the 2004 elections the polls reveal stronger preferences than in the previous three presidential elections: for the 2004 elections, 71% of voters indicated a strong preference for their candidate versus 64% for the 2000 elections,[10] and even lower numbers in previous elections. Given that partisans are likely to support their candidate strongly in any election, these numbers indicate that significantly more moderates had strong preferences in the 2004 elections. Stronger preference intensities by moderates correspond to a smaller percentage of undecided voters. The exit polls of the 2000 and 2004 elections support this claim. In 2004, only 11% of voters were undecided until the last week, while the corresponding number for 2000 was 18%. Similarly, the corresponding percentages for being undecided a month before the elections were 22% in 2004 and 31% in 2000.

Higher preference intensity should also generate a high voter turnout if we endogenize participation.[11] Consistent with this view, 64% of all citizens 18-year old and above voted in the 2004 election, compared to 58% in 1996 and 60% in 2000.

The high preference intensity in 2004 is exactly what is predicted by Proposition 2 in an environment with unexpectedly high negative information about both candidates.

4.2 Effects of Media Competition

Within our model, we can investigate the effect of increased media competition, brought about, say, by decreased fixed costs to operate a media outlet. As Proposition 1 shows, if the number of media outlets m is sufficiently large, both types of biased news, as well as unbiased news, will be offered by some outlet. Whether this leads to more electoral mistakes or fewer depends on the initial distribution of media outlets. Clearly, if media were initially unbiased, then increased competition is always detrimental. First, a new entrant may find it beneficial to bias their news, say to the right. Then conservatives will abandon the existing unbiased outlet in favor of the new entrant with its entertaining biased news, which can directly lead to electoral mistakes. This entry can also lead to a more subtle, second-order effect on the extent of biased news. In particular, having lost their conservative listeners, the initially unbiased news channel(s) may be able to increase listening time by providing a liberal slant to the news, which is preferred by liberals to unbiased news. For example, Posner

[10] This number is an average of the three polls that asked this question, weighted by number of respondents.

[11] For example, applied to a costly voting model (see Ledyard (1984), Krasa and Polborn (2005)), the increased payoff difference would increase turnout.

(2005) claims that, "The rise of the conservative Fox News Channel caused CNN to shift to the left. CNN was going to lose many of its conservative listeners anyway, so it made sense to increase its appeal to its remaining viewers, by catering more assiduously to their political preferences."

5 Concluding Remarks

In this paper, we provide an integrated model of media bias and its consequences for information aggregation in elections. In our model, partisan preferences for biased news may make it optimal for news media to pick sides and bias their reporting in a way that favors one candidate over his competitor. If media bias occurs, listeners to the liberal or conservative news outlet are incompletely informed about facts that are unfavorable for "their" candidate. Even if citizens are completely rational and take media bias into account, they cannot recover all of the missing information, which can lead to the election of the wrong candidate.

We characterize the two types of electoral mistakes that can occur due to media bias. For example, if both candidates are plagued by scandals then liberals hear about the conservative candidate's scandals and vice versa. As a result, liberals have a strong preference for the liberal candidate and conservatives for the conservative candidate—electoral mistakes can occur because there is too much voting along party lines. If, instead, there is less extreme news about both candidates, moderates have weak preferences, and mistakes can occur due to excessive cross-over voting.

The fundamental reason for the inefficiency in electoral outcomes is that voters choose to listen to biased media. This effect is likely to be quite stable, even though the population as a whole would be better off if media reported unbiased news. In principle, voters could become completely informed even with two biased media, by listening to both. However, few voters are likely to take advantage of this opportunity because of a fundamental positive externality problem: Each voter has only an infinitesimal chance of being pivotal and, even if he becomes informed and is pivotal, he receives only a tiny fraction of the social benefits. The standard economic response to a positive externality is likely to fail, because a subsidy to news outlets for providing unbiased reporting may be difficult to implement. The best option for society may be to foster a culture in which citizens appreciate learning about both sides of a political debate.

An interesting extension of our model would be to allow for politically-motivated media. To do this, one would have to adjust our model in two ways. First, we need to replace commitment to a news agenda with an equilibrium refinement for media in which the initially announced reporting strategy is not binding, but must correspond in equilibrium to the executed strategy. Second, we need to allow for many news stories, so that a media outlet can "shave" down bad news about its favored candidate. In such a situation, reporting limited bad news about a favored candidate does not imply that all bad news has been reported. Rather listeners would update that the reported news is a lower bound for the actual bad news. In such a setting, the biased outlet would never report bad news about its favored candidate and all of our characterizations extend.

6 Appendix

Proof of Proposition 1.

1. Suppose by way of contradiction that one of the two outlets is unbiased. If the other outlet is also unbiased, then the listening time of one of them is smaller or equal to $0.5(\gamma + \mu_c 2k\bar{n})$. Suppose the outlet switches to biased reporting to the left if $\mu_l + \mu_{cl} > \mu_r + \mu_{cr}$, and to the right, otherwise. The resulting listening time is at least $0.5(1-\mu_c)(\gamma+\bar{n})$. Clearly, if μ_c is sufficiently small, then listening time (and consequently profit) has increased.

   Now suppose that the other outlet is biased, say to the left. For the unbiased outlet, $T_j = (\mu_c + \mu_r + \mu_{cr})\gamma + \mu_c 2k\bar{n}$. In contrast, biased reporting to the right results in $T_j = (\mu_c + \mu_r + \mu_{cr})\gamma + (\mu_r + \mu_{cr})\bar{n}$, which is larger than the previous expression when μ_c is small.

2. This argument follows along the same lines as above, and uses the assumption that $k < 0.5$.

3. With m outlets that are all biased, total listening time for all outlets together is at most $\gamma + (\mu_r + \mu_{cr} + \mu_l + \mu_{cl})\bar{n} + \mu_c 2k\bar{n}$. Let outlet j have the shortest listening time, so that $T_j \leq [\gamma + (1-(1-2k)\mu_c)\bar{n}]/m$ with biased reporting. If outlet j switches to unbiased reporting, then j attracts (at least) all centrist viewers, so that $T_j \geq \mu_c(\gamma + 2k\bar{n})$. If μ_c is sufficiently large, j's listening time increased.

4. Similar to point 3, note that the listening time for the only unbiased outlet, $\mu_c(\gamma + 2k\bar{n})$ is larger than the listening time of the outlet with the shortest listening time if all outlets are biased, $T_j \leq [\gamma + (1-(1-2k)\mu_c)\bar{n}]/m$, if m is sufficiently large.

■

Proof of Proposition 2. Clearly, if all voters listen to unbiased news, then no electoral mistakes can occur. Next, suppose that cl listens to left-biased news. Then he will correctly vote for candidate L, since he receives worse than expected news about R. So, too, type c voters who listen to left-biased news will support L. Thus, no mistakes can occur if these voters are decisive.

Now suppose that the median voter is a type c and listens to unbiased news. Then type cl will listen to left-biased news (if available) and to unbiased news, otherwise. Similarly, type cr listen to either right-biased or unbiased news. If type c is decisive then no mistakes can occur, because c, cl and l all vote for candidate L. The same is true if type cl is decisive. Thus, an electoral mistake could only occur if cr listens to right-biased news, votes for R, i.e., $b + V - \bar{n} > V - n_L \Leftrightarrow b > \bar{n} - n_L$, regrets the decision ex post, i.e., $b + V - n_R < V - n_L \Leftrightarrow b < n_R - n_L$, and is decisive, i.e., $\mu_r + \mu_{cr} > 0.5$.

It now remains to consider cases in which there is no unbiased outlet. First, suppose there are left and right-biased outlets, so that type cl voters listen to left-biased news and type cr voters listen to right-biased news. Suppose that a fraction α of type c voters receive right-biased news,

while the rest receives left-biased news. Then type c voters who hear right-biased news vote for R and those who listen to left-biased news vote for L, as there is more than expected bad news about opponent candidates. Among type c voters, only those that listen to right-biased news can cause mistakes if they are decisive, i.e., if $\alpha\mu_c + \mu_{cr} + \mu_r > 0.5 > \mu_{cr} + \mu_r$. Next note that type cl voters cannot make a mistake, as they vote for L. In contrast, cr voters can make mistakes when as above, $b > \bar{n} - n_L$ but $b < n_R - n_L$ and they are decisive, i.e., $\mu_r + \alpha m u_c < 0.5 < \mu_r + \mu_{cr} + \alpha m u_c$.

Next, suppose that are only left-biased outlets. Then from the optimization of media outlets, it follows that the median voter is never a cr type, as $\mu_l + \mu_{cl} > \mu_r + \mu_{cr}$, else the outlets would offer right-biased news instead. As above, it follows that c and cl types who listen to left-biased media do not make mistakes since $n_L < n_R$. Thus, it remains to consider the case where all outlets are right-biased. Then, as above, the median voter must be c or cr. Mistakes then occur exactly as characterized above. In particular, the cr or c types hear the bad news about L, but not that about R, and ex post, regret their decisions.

This enumeration is exhaustive, and reveals that mistakes only occur when c types who listen to right-biased news are decisive, or when cr types listen to right-biased news, vote for R and regret their choice, ex post. ■

Proof of Proposition 3. The proof mirrors that for proposition 2. The difference is that type c voters now always vote for candidate L, as either they hear good news about L or bad news about R. Hence, only cr type voters can cause an electoral mistake, and they do so in precisely the same circumstances as before. ■

Proof of Proposition 4. If all news is unbiased then no mistakes can occur.

Next, suppose that there are only right-biased and unbiased outlets. Then type c and cl listen to the unbiased news, and vote for L as $n_L < n_R$, while type cr citizens listen to the right-biased news outlet. Thus, cr voters will vote for candidate R if $b + V - \bar{n} > V - n_L$, since they do not learn about candidate R's news and take the expected valence $V - \bar{n}$. cr voters vote for candidate L if the inequality is reversed. Hence candidate L's vote share is $\mu_l + \mu_{cl} + \mu_c$ if $\bar{n} - n_L < b$, and $1 - \mu_r$, otherwise. If type cr voters had complete information, they would vote for R if $b + V - n_R > V - n_L$, i.e., if $b > n_R - n_L$. Thus, type cr voters regret their electoral choice ex-post if $n_R - n_L < b < \bar{n} - n_L$, and their votes are decisive if $\mu_r + \mu_{cr} > 0.5$.

Next, suppose there are only left-biased and unbiased outlets. Then types c and cr listen to an unbiased outlet, while type cl listens to left-biased outlets. cr types vote for candidate R if $b + V - n_R > V - n_L$, i.e., if $b > n_R - n_L$. Again, type c votes for L. Type cl votes for R if $b + V - \bar{n} < V - n_R$, i.e., if $b < \bar{n} - n_R$. Under complete information they would never vote for R since $n_L < n_R$. Thus, electoral mistakes only occur if type cl crosses over to R and is decisive. The conditions on decisiveness depend on whether cr types vote for R or L. If $b > n_R - n_L$ then they vote for R, and cl types are therefore decisive if $\mu_{cr} + \mu_r < 0.5 < \mu_{cl} + \mu_{cr} + \mu_r$. If, instead, $b < n_R - n_L$ then cr types vote for L so that cl types are decisive if $\mu_{cl} + \mu_r > 0.5$.

It remains to consider the possibility that there are outlets of each type, so that cl types listen to left-biased news, c types listen to unbiased news, and cr types listen to right-biased news. Then the above argument show that if type cr votes for candidate R under incomplete (biased) information, he will also vote for R under complete information. Thus, mistakes can only occur because cr types vote for L given biased news, if they would have voted for R given unbiased news, i.e., if $n_R - n_L < b < \bar{n} - n_L$. Similarly, type cl voters will regret their choice ex post if they cross over, voting for R, i.e., if $b < \bar{n} - n_R$ (ex-post they always regret voting for R as $n_L < n_R$).

- Suppose both cl and cr types switch over, i.e., $b < \bar{n} - n_R$ which implies $b < \bar{n} - n_L$. If $b \leq n_R - n_L$ then type cr do not regret ex post having voted for L. Thus, an electoral mistake only occurs if cl is decisive, i.e., if $\mu_r + \mu_{cl} > 0.5$. If $b > n_R - n_L$ then both cl and cr would vote differently under full information. Then, under full information R would have been elected if $\mu_r + \mu_{cr} > 0.5$, while L would have been elected if $\mu_r + \mu_{cr} < 0.5$. With biased news, R is elected if $\mu_r + \mu_{cl} > 0.5$, while L is elected if $\mu_r + \mu_{cl} < 0.5$. Hence, L is mistakenly elected with biased news if $\mu_r + \mu_{cl} < 0.5$ and $\mu_r + \mu_{cr} > 0.5$; and R is mistakenly elected if these inequalities are reversed.

- Now suppose that that $\bar{n} - n_R < b < \bar{n} - n_L$ so that only type cr can potentially mistakenly switch over. Then an electoral mistake occurs if cr would have voted for R under full information, $b > n_R - n_L$, and is decisive, i.e., $\mu_r + \mu_{cr} > 0.5$ (as with biased new only type r votes for R),

- Finally, notice that if $b > \bar{n} - n_L$, then no type switches over. Then, electoral mistakes can only occur if cr types would have voted for L under complete information, i.e., if $b < n_R - n_L$. But, since $n_R < \bar{n}$, both inequalities cannot hold at the same time.

■

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