Rational Expectations and Media Slant

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Abstract

We study media slant in a model of job choice and voting. We define slant as the relative emphasis on reporting on the different dimensions of the policy space when citizens are imperfectly informed about the candidates’ positions. Citizens use media reports in order to decide whom to vote for and what sort of jobs to take. We show that media favoring a candidate will put some emphasis on the policy dimension in which information potentially unfavorable to this candidate may emerge if and only if citizens are ex ante biased against this candidate. We also show that it is better for citizens that the media favors the candidate against whom citizens are ex ante biased if and only if incentives for taking highly productive jobs are large. “Balanced” media, giving equal coverage to policy dimensions, may be worse than partisan media favoring either candidate.

Keywords: rational expectations, politico-economic equilibrium, media slant, multidimensional policy space

JEL: D72, D83

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1 Introduction

We study media slant in a model of voting and job choice. In the model, citizens must decide whether to support the challenger or the incumbent in an upcoming election, and, based on their expectations about postelection policies, what sort of jobs to take. Citizens are imperfectly informed about the challenger position. Each citizen reads a newspaper (or views a newscast or visits a news website) that provides information about the challenger’s position. We assume, however, that news reporting simplifies the complexities of economic policy, so information is necessarily lost in the process of reporting. We further assume that this filtering of information is systematic in emphasizing some aspects of public policy over others. We define as slant the relative emphasis by news reporting on the different aspects of public policy.

We adopt a citizen-candidate approach (see Osborne and Slivinski (1996) and Besley and Coate (1997)), where the policy positions of the incumbent and challenger are fixed positions in a two-dimensional policy space. We model public policy as a level of government expenditure, which corresponds to the level of a costly public good, and an income tax rate.\textsuperscript{1} We assume that the position of the incumbent is known to citizens, and for simplicity we specify that the incumbent occupies the traditionally conservative position of small government (i.e., low income taxes and low government expenditures). The position of the challenger, however, is unknown to citizens. This is the subject of news reporting.

Although we posit a multidimensional policy space, we assume news reporting is one-dimensional. That is, the systematic filtering of information performed by the media outlet must project the two-dimensional world onto a one-dimensional spectrum. The orientation of this single reporting dimension corresponds to a particular slant on the news. Thus, the media outlet may put more weight on reporting the challenger’s position that public good provision be increased by some amount, or it may put more weight on reporting the challenger’s position that income taxes should be increased.\textsuperscript{2} As a

\textsuperscript{1}We assume the budget must be balanced, with any deficit (or surplus) being collected (or distributed) by a lump-sum tax (or refund).

\textsuperscript{2}This is consistent with the conclusion of McCombs and Shaw (1972) that “the mass media set the agenda for each political campaign, influencing the salience of attitudes
consequence, a citizen does not learn the challenger’s position precisely from reading the news, but only receives a noisy signal. We assume that voters are rational: they are aware that news is reported with a slant; they update their beliefs with respect to the challenger’s position using Bayes rule; and their expectations about the job choices and votes of others are correct.

We establish the existence and the uniqueness of a rational expectations equilibrium in this model. In equilibrium, each citizen must anticipate the job choices of others in order to evaluate her expected utility from the challenger, as the revenue generated by income taxation will depend on aggregate income. Once the expected utility for the challenger is calculated, we assume that each citizen votes for the candidate offering the highest expected utility.\(^3\) But this expected utility will also depend on the citizen’s own job choice: the challenger who seeks to finance public good provision through income taxes rather than lump-sum taxation will be more appealing, ceteris paribus, to someone with a low income than to someone with a high income. And the citizen’s optimal job choice will depend on her expectation of postelectoral policies. If it is known that the incumbent will win, implying low income taxes, then the citizen will have the incentive to take the higher paying job. In short, in equilibrium each citizen must make her job choice and cast her vote jointly and must do so in light of the joint choices of others.

After characterizing the rational expectations equilibrium for every possible slant, we investigate the optimal slant for a partisan media outlet. We show that if citizens do not care much about the public good that the challenger would provide, then pro-incumbent media would report only on the position of the challenger with respect to income taxes, which would lead the incumbent to win with probability one. If citizens do care much about the public good, then pro-challenger media would report only on the position of the challenger with respect to income taxes, which would lead the challenger to win with probability one. That is, if citizens are ex ante biased in favor of one candidate, media can get this candidate elected with probability one by neglecting to report on the policy dimension in which information potentially unfavorable to this candidate may emerge.

We also show that if citizens do not care much about the public good toward the political issues” (p.177).

\(^3\) Though we assume a continuum of citizens, the spirit of this assumption is that voters do not use weakly dominated strategies.
that the challenger would provide, pro-challenger media would report only on the position of the challenger with respect to public good provision, which would lead the challenger to win with positive probability. If citizens do care much about the public good, then pro-incumbent media would pick an interior slant (putting positive weight on both policy dimensions) that would allow the incumbent to win with positive probability. That is, if the media favors the candidate against whom voters are ex ante biased, media must put some emphasis on the policy dimension in which information potentially unfavorable to this candidate may emerge, in the hope that voters’ beliefs are overturned.

We then consider the socially optimal level of slant. If the investment needed to obtain a high-paying job is small compared to the wage differential, then it is socially optimal for the media to report only on the position of the challenger with respect to public good provision. The intuition is that all citizens will take high-paying jobs, which is socially optimal, even if the challenger is expected to win the election, as long as no information is revealed about the intended level of income taxes. Moreover, the information revealed about the position of the challenger with respect to public good provision allows citizens to vote in the challenger if and only if the intended level of public good provision is better than no provision. In this case, pro-challenger media is better than pro-incumbent media if citizens do not care much about the public good, and pro-incumbent media is better than pro-challenger media if citizens do care much about the public good. That is, if the investment needed to obtain a high paying job is small, it is better that the media is partial to the candidate against whom citizens are biased ex ante, as this media will be more interested in revealing useful information to voters.

If the investment needed to obtain a high-paying job is large compared to the wage differential, our conclusions are somewhat reversed. If citizens do not care much about the public good, then it is socially optimal for the media to report only on the position of the challenger with respect to income taxes, therefore guaranteeing that the incumbent wins the election. If citizens do care much about the public good, then it is socially optimal for the media to choose an interior slant, and pro-challenger media becomes more attractive than pro-incumbent media. The intuition is that citizens take low-paying jobs whenever they anticipate the challenger to win the election, so it makes
sense to maximize the probability of the incumbent winning the election unless citizens care enough about the public good. That is, if the investment needed to obtain a high-paying job is large, it is better that the media is partial to the candidate in whose favor citizens are biased ex ante. That is, our rational expectation model can accommodate circumstances akin to a “confirmation bias” from the viewpoint of society.

Social welfare is not single-peaked in media slant, so an intermediate slant between those favored by partisan media is not necessarily better for voters. “Balanced” media in particular, giving equal coverage to both policy dimensions, is generally worse than either pro-challenger or pro-incumbent media and, strikingly enough, it may be worse than both partisan media.

The paper is organized as follows. In Section 2, we review the growing literature on the role of the media. In Section 3, we present the model with exogenous slant and a homogenous citizenry. In Section 4, we define our equilibrium concept and state our existence and uniqueness result. In Section 5, we explore the implications of partisan media for slant. In Section 6, we take up the issue of the socially optimal slant. In Section 7, we briefly consider extensions of the model to media outlets with different slants.

## 2 Related Literature

Our definition of “slant” is more general than that usually given in the literature. The term is often explained as the omission of information toward a particular end. Indeed, Hayakawa (1964) defines the term as “the process of selecting details that are favorable or unfavorable to the subject being described” (p.13). Groseclose and Milyo (2005) also define “bias” as the selective omission of facts.\footnote{They write that “for every sin of commission, such as those by (Stephen) Glass or (Jayson) Blair, we believe that there are hundreds, and maybe thousands, of sins of omission” (p.1205). Although the authors use the term “bias,” they offer “slant” as an equivalent term.} We define “slant,” in contrast, as an orientation that systematically distorts news. The mechanism through which this occurs may be as simple as the omission of facts, but it can be more subtle and nuanced, resulting from the choice of phrasing, the emphasis of some details over others, the ordering of facts, etc. In fact, our definition appears
to be consistent with examples used by other authors, which seem to al-
lude to a more nuanced enterprise. For example, Mullainathan and Shleifer 
(2005) offer an illustration of slant by juxtaposing two possible stories about 
a small increase in the unemployment rate. The difference between these two 
stories is more than simply a discrepancy between two lists of facts; rather, 
the stories differ in wording, emphasis, and framing.\footnote{One story begins, 
"Recession Fears Grow: New data suggest the economy is slipping 
into a recession," and the other begins, "Turnaround in Sight: Is the economy poised for 
an imminent turnaround?" See Mullainathan and Shleifer (2005), pp.1032–1033.} 
Our formalization at-
ttempts to capture the more subtle form of slant by a systematic filtering, or 
projection, that at once simplifies political reality and emphasizes one policy 
dimension than the other. Our formalization of slant is reminiscent of the 
idea of framing introduced by Hammond and Hume (1995) in the spatial 
model of voting, following suggestions by Riker (1990). As opposed to this 
earlier work, we present a fully rational model in which voters understand 
the process through which news about economic policy are framed.

The phenomenon of media slant, or bias, is rapidly becoming a topic of 
interest in the literature. Evidence for the existence of media slant is provided 
by Groseclose and Milyo (2005), Puglisi (2006), and Lott and Hassett (2004), 
and a number of other papers provide various theoretical explanations for 
slant. Focusing on the demand side, Mullainathan and Shleifer (2005) assume 
that readers hold beliefs they like to see confirmed. In contrast, Baron (2006) 
and Bovitz et al. (2002) focus on the supply side, analyzing the incentives of 
reporters and editors to manipulate the news. Gentzkow and Shapiro (2006) 
also focus on the supply side, demonstrating that a media outlet’s concern for 
reputation can lead to the censoring of unexpected stories. Chan and Suen 
(2004) consider a media outlet with policy preferences that can falsify reports 
about the true state of the world to achieve preferred outcomes. Bernhardt et 
al. (2006) combine both sides of the market, assuming that two media firms 
compete for patronage from citizens who have a preference for stories about 
their favorite candidate. Besley and Prat (2004) consider the possibility of 
government capture of the media.\footnote{Though not explicitly concerned with the media, Virag (2006) and Glaeser, Ponzetto, 
and Shapiro (2005) show the possibility of divergence of party platforms when voters 
are only informed of the position of their preferred candidate. This assumption can be 
rationalized if there are two media outlets, each reports the position of one candidate, and 
each voter patronizes only the outlet covering her candidate.}
In all of the forgoing theoretical models, the nature of the decision facing media outlets is either to lie by falsely reporting their signal or to simply suppress their information. Only Mullainathan and Shleifer (2005) and Chan and Suen (2004) model the media’s decision as a continuous variable, allowing in principle the possibility of capturing the subtleties of slant, but in both of those papers the media, after observing a signal of a one-dimensional state variable, simply sends a one-dimensional announcement that has no necessary connection to the true state. Thus, news stories are not informative, per se, beyond the strategic inferences drawn by readers. In Gentzkow and Shapiro (2006) and Baron (2006), the media outlet has a binary choice of stories and, similarly, makes reports that have no meaning beyond the strategic information they convey. In other papers, news stories do have content in the sense that reports are verifiable, and the media outlet can choose not to report its information. In contrast, the media outlet in our model may choose from a continuum of orientations, and while some information is lost in the process of reporting, a story is a noisy signal with meaningful content.

A final point of differentiation of the above models is their treatment of the citizen’s decision. In Gentzkow and Shapiro (2006), Baron (2006), Stromberg (2004), and Bovitz et al. (2002), the reader is assumed to use information from the news to make a private decision. Thus, readers will be willing to pay a positive amount for the news. This is also true in Bernhardt et al. (2006) and Mullainathan and Shleifer (2005), where readers receive intrinsic utility from reading the news. In Besley and Prat (2006) and Chan and Suen (2004), readers use information obtained from the news to make a voting decision. In our model, each citizen uses information to jointly make a private decision and cast a vote, but in so doing they use information from the news to predict the actions of other citizens, a strategic aspect not present in other models.

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7Gentzkow and Shapiro (2006) do assume, however, that readers can confirm or disconfirm a story with some probability. The latter authors suggest that the media outlet in their model can employ subtler forms of bias by a suitable labelling of news stories. But that interpretation is limited by the assumption that there are only two possible stories.  
8Puglisi (2004) also assumes that all reports are verifiable, but the media outlet’s actions are determined by spin exerted by an incumbent politician.
3 Exogenous Slant

We consider an election between an incumbent (I) and a challenger (C). We posit a simple model of the economy, in which public policy has two components: a level of public good provision, $g$, and an income tax rate, $t$. Thus, the set of policies is the two-dimensional space $\mathbb{R}_+ \times [0, 1]$, with typical element $(g, t)$. As will be discussed below, income tax revenue is used to finance the public good, with any deficit (or surplus) being collected (or distributed) by a lump sum tax (or refund). The incumbent and the challenger are committed to implement some policies $(g^I, t^I)$ and $(g^C, t^C)$, respectively, in case either wins the election. The incumbent’s policy is known to citizens, but the challenger’s policy is not. To fix ideas, we assume that the challenger favors more taxation and a larger level of the public good. Citizens have some prior beliefs about the challenger’s policy, represented by a uniform distribution over $[g, g^I] \times [t, t^I]$, with $g \geq g^I$ and $t \geq t^I$.

There is a unit mass of citizens, who for simplicity are ex ante identical. Citizens can learn about the challenger’s policy by reading a unique media outlet. The media outlet does not directly report the challenger’s policy, but rather it reports the projection of the challenger’s policy on a straight line in the policy space going through the incumbent’s policy, $(g^I, t^I)$, with negative slope. The slope of this line corresponds to media slant. Thus, we assume that the process of reporting the challenger’s position necessarily involves some simplification, in that the multidimensional policy space is collapsed into a one-dimensional statistic. That such simplification indeed takes place is not controversial, as the complexities of real world policy cannot be precisely conveyed in a media report. Furthermore, we assume that this simplification is systematic, in that it takes the form of a projection. Though we do not model the mechanism underlying slant explicitly, we view it as arising from the media outlet’s choice of editorial board or the hiring and firing of journalists. For now, we assume the level of slant is exogenously fixed and known to the citizenry. When we endogenize slant, in Section 5, we assume that the media’s choice of slant is observed by the citizenry prior to economic and voting decisions. This implicitly assumes that slant can only be adjusted slowly or at substantial cost, as is consistent with our interpretation.

After reading the news, and before the election, citizens must decide
whether to take a high-paying job or a low-paying job. If the policy \((g, t)\) is adopted, then the utility of a citizen from taking the high-paying job is

\[ u(g) + (1 - t)w^H + \tau - e, \]

and the utility of the citizen from taking the low-paying job is

\[ u(g) + (1 - t)w^L + \tau. \]

The function \(u\) represents the utility citizens derive from the public good, while the constants \(w^H > 0\) and \(w^L > 0\) represent the wage earned in the high-paying and the low-paying job, respectively. The constant \(e\) is a fixed cost, e.g., the cost of education, involved in acquiring the skills required for the high-paying job. We assume \(0 < e < w^H - w^L\). The term \(\tau\) represents a lump-sum transfer to each citizen and is obtained from the policy \((g, t)\) using the government budget-balance condition:

\[ \tau = -c(g) + t(w^H P(H) + w^L P(L)). \]

The function \(c\) represents the per capita cost of providing the public good, and \(P(H)\) and \(P(L)\) are the fraction of citizens who take high-paying and low-paying jobs, respectively. Of course, these fractions are determined endogenously by the behavior of all citizens.

For convenience, we maintain the following parametric assumptions.

(A1) \((g^I, t^I) = (0, 0)\);

(A2) \((g, t) = (0, 0)\) and \((\bar{g}, \bar{t}) = (1, 1)\);

(A3) \(u(g) = c(g) = 2bg - 3g^2\), where \(0 < b < 3/2\).

Assumption (A1) is tantamount to a normalization, and assumption (A2) fixes the idea that the incumbent holds the traditionally conservative position of small government. Assumption (A3) provides a convenient functional form for the net benefit of the public good in terms of a parameter \(b\), which measures the value of the public good. It implies that \(\int_{g}^{\bar{g}} (u(g) - c(g))dg\) is strictly concave in \(g, \bar{g}\). This implies, in turn, that the rational expectations equilibrium described in Theorem 1 has a simple cutoff structure. It is simple to verify that the optimal level of public good provision is \(g^* = b/3\), and that
the net benefit from $g = 2b/3$ units of the public good is equal to zero: beyond that, the per capita cost of the public good outweighs the per capita benefit, and the citizens would on average be better off with no public good.

Recall that the media reports the projection of the challenger’s policy on a negatively sloped line in $\mathbb{R}^2$ going through the origin $(0, 0)$. We denote the absolute value of the slope of this line by $\sigma$, where $\sigma \in \mathbb{R}_{++} \cup \{0, \infty\}$, and we refer to it as the slant of the media. For a fixed $\sigma$, we refer to the set of points in the unit square with a common projection as a news story. Thus, a story is a line segment, denoted $s$, contained in the unit square. We write $(\underline{g}(s), \underline{t}(s))$ and $(\overline{g}(s), \overline{t}(s))$, with $\underline{g}(s) \leq \overline{g}(s)$ and $\underline{t}(s) \leq \overline{t}(s)$, to indicate the lower and upper endpoints, respectively, of the story $s$. We use the obvious notation

$$s = [(\underline{g}(s), \underline{t}(s)), (\overline{g}(s), \overline{t}(s))]$$

to describe a story by its endpoints. Figure 1 illustrates a story $s$ and its projection (what we could call the news report) $r(s)$ on the line $y = -\sigma x$.

We denote the set of stories given slant $\sigma$ by $S^\sigma$. For any $\sigma$, the set of stories $S^\sigma$ is completely ordered according to the partial order $\succeq$ (with
asymmetric part $\succ$) given by

$$s' \succ s \iff t(s) \geq t(s') \text{ and } g(s) \leq g(s').$$

That is, $s' \succeq s$ indicates that the story $s'$ is located “to the southeast” of story $s$. We denote by $\underline{s}$ the story containing the point $(0,1)$ and by $\overline{s}$ the story containing the point $(1,0)$. Note that, if $\sigma \in \mathbb{R}_{++}$, then the stories $\underline{s}$ and $\overline{s}$ reveal the exact location of the challenger’s policy.

### 4 Equilibrium Analysis

We first examine a citizen’s optimal job choice. This will depend on the probabilities that the incumbent and the challenger win the election, $P(I|s)$ and $P(C|s)$, from the point of view of a citizen after reading the news report $r(s)$. These probabilities are determined by the behavior of all citizens, but they are taken as given by any individual citizen. The optimal job choice will also depend on the fractions of citizens who take high-paying and low-paying jobs, $P(H|s)$ and $P(L|s)$, following story $s$. In a rational expectations equilibrium, the probabilities $P(I|s)$ and $P(C|s)$ and the fractions $P(H|s)$ and $P(L|s)$ will be anticipated correctly by each citizen.

When the incumbent is re-elected, a citizen with the high-paying job receives the high wage less the necessary investment, $w^H - e$. In this case, the level of public good and the income tax are both zero. When the challenger is elected, the citizen pays income tax $tw^H$, receives utility $u(g) - c(g)$ from the public good, and is taxed the lump sum $\tau$. Thus, the citizen’s expected utility is

$$P(I|s)(w^H - e) + P(C|s)E^\sigma[(1-t)w^H - e + u(g) - c(g) + t(w^H P(H|s) + w^L P(L|s))|s],$$

where $E^\sigma$ is the expectations operator. (For notational convenience, from now on we drop the superscript $C$ when referring to the challenger’s policy. And when not central to the discussion, we drop the superscript $\sigma$ on $E$, leaving the dependence on slant implicit.) Simplifying the previous expression, we have

$$w^H - e + P(C|s)E[u(g) - c(g) - tw^H + t(w^H P(H|s) + w^L P(L|s))|s].$$
Similarly, if a citizen takes a low-paying job, then the citizen’s expected utility is
\[ w^L + P(C|s)E[u(g) - c(g) - tw^L + t(w^H P(H|s) + w^L P(L|s))|s]. \]
Thus, a citizen will be willing to take a high-paying job if and only if
\[ 1 - \frac{e}{\Delta w} \geq P(C|s)E[t|s], \]
where \( \Delta w = w^H - w^L \), and will be willing to take a low-paying job if and only if the inequality is reversed. Note that \( 1 - e/\Delta w > 0 \) follows from our parametric assumptions. Thus, if the incumbent wins with probability one after story \( s \), i.e. \( P(C|s) = 0 \), then every citizen prefers the high-paying job.

After making their job choices, citizens decide which party to support in the election. Citizens vote sincerely. Since a citizen with a high-paying job receives utility \((1-t)w^H - e\) regardless of which candidate wins, the inequality characterizing when the citizen is willing to support the incumbent reduces to
\[ tw^H \geq E[u(g) - c(g) + t(w^H P(H|s) + w^L P(L|s))|s], \]
or equivalently,
\[ E[u(g) - c(g)|s] - \Delta w P(L|s)E[t|s] \leq 0. \]
The citizen will be willing to support the challenger when the inequality is reversed. Similarly, a citizen who has taken a low-paying job is willing to support the incumbent if and only if
\[ tw^L \geq E[u(g) - c(g) + t(w^H P(H|s) + w^L P(L|s))|s], \]
or equivalently,
\[ E[u(g) - c(g)|s] + \Delta w (1 - P(L|s))E[t|s] \leq 0. \]
Note that the incentive to support the incumbent is larger for a citizen with a high-paying job than for a citizen with a low-paying job, but even citizens with high-paying jobs may support the challenger.

Given slant \( \sigma \) and any story \( s \in S^\sigma \), we say that the pair \( P(C|s), P(L|s) \in [0,1]^2 \) is a rational expectations outcome at \( s \) if the actions of individual
citizens induced by $P(C|s)$, $P(L|s)$, $E[u(g) - c(g)|s]$, and $E[t|s]$ are consistent with their beliefs about $P(C|s)$ and $P(L|s)$. We will show that, generically, there are only three possible types of rational expectations outcomes. We consider these in turn.

**Type 1.** Suppose the challenger wins the election and all citizens take a low-paying job, i.e., $P(C|s) = 1$ and $P(L|s) = 1$. Given the preceding analysis, this is a rational expectations outcome if and only if

$$E[t|s] \geq 1 - \frac{e}{\Delta w} \quad \text{and} \quad E[u(g) - c(g)|s] \geq 0.$$  

**Type 2.** Similarly, $P(C|s) = 1$ and $P(L|s) = 0$ is a rational expectations outcome if and only if

$$E[t|s] \leq 1 - \frac{e}{\Delta w} \quad \text{and} \quad E[u(g) - c(g)|s] \geq 0.$$  

**Type 3.** Suppose $P(C|s) = 0$ and $P(L|s) = 0$. Recall that when the incumbent wins with probability one, all citizens prefer the high-paying job, so this is a rational expectations outcome if and only if

$$E[u(g) - c(g)|s] \leq 0.$$  

Other rational expectations outcomes are conceivable, but they rely on razor’s edge conditions on the parameters of our model. Because such equilibria are not robust, we preclude them with the following maintained assumption. With it, rational expectations outcomes other than Types 1–3 can occur only after a negligible (i.e., measure zero) set of stories, and they are therefore inconsequential to our analysis.

(A4) $e/\Delta w \notin \{1/2, 3/4\}$ and $b \neq 1$.

Given slant $\sigma$, a rational expectations equilibrium is a pair of functions $P(C|\cdot): S^\sigma \to [0,1]$ and $P(L|\cdot): S^\sigma \to [0,1]$ such that $P(C|s), P(L|s)$ is a rational expectations outcome for almost every story $s \in S^\sigma$. In the interest of parsimony, we will not distinguish between equilibria that differ only on a set of measure zero stories. The next theorem, which is proved in the Appendix, establishes the existence and uniqueness of a rational expectations equilibrium.
Theorem 1 For any given $\sigma$, there is a unique rational expectations equilibrium. It is characterized by a pair of stories, $s_C^\sigma$ and $s_L^\sigma$, such that

$$P(C|s) = \begin{cases} 0 & \text{if } s \succ s_C^\sigma \\ 1 & \text{if } s_C^\sigma \succ s \end{cases} \quad \text{and} \quad P(L|s) = \begin{cases} 0 & \text{if } s \succ s_C^\sigma \text{ or } s \succ s_L^\sigma \\ 1 & \text{if } s_C^\sigma \succ s \text{ and } s_L^\sigma \succ s \end{cases}$$

Moreover, for $\sigma \in \mathbb{R}_{++}$, the stories $s_C^\sigma$ and $s_L^\sigma$ solve

$$E[u(g) - c(g)|s] = 0 \text{ and } E[t|s] = 1 - \frac{e}{\Delta w},$$

respectively.

The equilibrium has a simple “cutoff” structure, given by the two stories $s_C^\sigma$ and $s_L^\sigma$. If a story $s$ is realized to the southeast of $s_C^\sigma$, i.e., $s \succ s_C^\sigma$, then citizens learn that the challenger intends to implement an excessively high level of the public good. That is, $E[u(g) - c(g)|s] < 0$, so that only Type 3 rational expectations outcomes are possible: citizens decide to vote in favor of the incumbent, and since the incumbent will not impose income taxes, citizens all take the high-paying job. In the remaining case of $s_C^\sigma \succ s$, we
may have stories realized to the southeast of \( s_L^a \), i.e., \( s_C^a \succ s \succ s_L^a \). Then citizens learn that the challenger intends to implement a level of the public good that they like more than the status quo, and citizens anticipate that the income tax implemented by the challenger will be moderate. That is, \( E[t|s] < 1 - e/\Delta w \), so that only Type 2 outcomes are possible: citizens all vote for the challenger and take high-paying jobs. Finally, after news located to the northwest of both \( s_C^a \) and \( s_L^a \), citizens learn that the challenger intends to implement a level of the public good that they like, but they also learn that the challenger intends to finance the provision of the public good with high labor taxes. That is, \( E[t|s] > 1 - e/\Delta w \), so that only Type 1 outcomes are possible: citizens all vote for the challenger and take low-paying jobs. The structure of equilibrium is illustrated in Figure 2.

The exact form of the equilibrium found in Theorem 1 depends on the solutions to the two equations

\[
E[u(g) - c(g)|s] = 0 \quad \text{and} \quad E[t|s] = 1 - \frac{e}{\Delta w},
\]

and these solutions in turn depend on parameter values. The solution to the first equation depends on whether \( b < 1 \) or \( b > 1 \). That is, it depends on the value of the public good. It is straightforward but cumbersome to derive the closed form of \( s_C^a \) in these two cases.

(i) If \( b < 1 \),

\[
s_C^a = \begin{cases} 
\left[ \left( \frac{-3\alpha + 2b + \sqrt{4b^2 - 3\alpha^2}}{6}, 0 \right), \left( \frac{3\alpha + 2b + \sqrt{4b^2 - 3\alpha^2}}{6}, 1 \right) \right] \quad & \text{if } 0 \leq \sigma \leq b \\
\left[ (0, 1 - \frac{b}{\sigma}), (b, 1) \right] \quad & \text{if } b \leq \sigma < \infty \\
\left[ (0, 1), (1, 1) \right] \quad & \text{if } \sigma = \infty
\end{cases}
\]

(ii) If \( b > 1 \),

\[
s_C^a = \begin{cases} 
\left[ \left( \frac{-3\alpha + 2b + \sqrt{4b^2 - 3\alpha^2}}{6}, 0 \right), \left( \frac{3\alpha + 2b + \sqrt{4b^2 - 3\alpha^2}}{6}, 1 \right) \right] \quad & \text{if } 0 \leq \sigma \leq \tilde{\sigma} \\
\left[ \left( \frac{b - 1 + \sqrt{b^2 + 2b - 3}}{2}, 0 \right), \left( 1, \frac{3 - b - \sqrt{b^2 + 2b - 3}}{2\sigma} \right) \right] \quad & \text{if } \tilde{\sigma} \leq \sigma < \infty \\
\left[ (0, 0), (1, 1) \right] \quad & \text{if } \sigma = \infty
\end{cases}
\]

\[9\] This intermediate region disappears if \( s_L^a \succeq s_C^a \).
where the value of $\sigma$ is given by the expression

$$\hat{\sigma} = \frac{3 - b - \sqrt{b^2 + 2b - 3}}{2}.$$  

This is the level of slant such that the cutoff $s^C_L$, includes the point $(1, 1)$, i.e., it is the maximum level of slant such that citizens, after a report on a challenger with position $(g, t) = (1, 1)$, expect nonpositive utility from the challenger’s public good level.

The solution to the second equation depends on the returns to the high-paying job relative to the cost of human capital investment.

(iii) If $e/\Delta w < 1/2$,

$$s^\sigma_L = \begin{cases} 
[(0, 0), (0, 1)] & \text{if } \sigma = 0 \\
[(0, 1 - \frac{2e}{\Delta w}), \left(\frac{2e\sigma}{\Delta w}, 1\right)] & \text{if } 0 < \sigma \leq \frac{\Delta w}{2e} \\
\left(0, 1 - \frac{e}{\Delta w} - \frac{1}{2\sigma}\right), \left(1, 1 - \frac{e}{\Delta w} + \frac{1}{2\sigma}\right) & \text{if } \frac{\Delta w}{2e} \leq \sigma \leq \infty
\end{cases}$$

(iv) If $e/\Delta w > 1/2$,

$$s^\sigma_L = \begin{cases} 
[(1, 0), (1, 1)] & \text{if } \sigma = 0 \\
\left(1 - 2\sigma + \frac{2e\sigma}{\Delta w}, 0\right), \left(1, 2 - \frac{2e}{\Delta w}\right) & \text{if } 0 < \sigma \leq (2 - \frac{2e}{\Delta w})^{-1} \\
\left(0, 1 - \frac{e}{\Delta w} - \frac{1}{2\sigma}\right), \left(1, 1 - \frac{e}{\Delta w} + \frac{1}{2\sigma}\right) & \text{if } (2 - \frac{2e}{\Delta w})^{-1} \leq \sigma \leq \infty
\end{cases}$$

Theorem 1 describes the equilibrium outcome after almost every story for every slant. With the closed form calculated above, we can make positive predictions about the slant for different objective functions of the media outlet as well as welfare comparisons. We take up these issues in the following sections.

5 Partisan Media

In this section, we derive the optimal slant under the assumptions that the media outlet seeks to maximize the probability that one candidate or the other wins the election. We assume that the choice of slant takes place and
is publicly observed prior to the citizens’ job choices and votes. Thus, we take a long run view of slant as a variable that can only be adjusted slowly or at substantial cost. It would be implausible, for example, for a media outlet to replace its editorial board and alter its orientation to manipulate the beliefs of citizens immediately prior to an election.

5.1 Pro-Incumbent Media

Assume the media is biased in favor of the incumbent, in the sense that it chooses slant with the objective of maximizing the probability of the incumbent winning the election. The following result states that the optimal slant depends on the value of the parameter $b$. If $b < 1$, i.e., if citizens care little about the public good that the challenger will presumably deliver, then the optimal choice for pro-incumbent media is to conceal all information about the public good level, adopting the slant $\sigma = \infty$. In this case, the incumbent wins the election with probability one. The reason is that, absent any information about the level of public good that the challenger intends to implement, voters will be turned away by the possibility that the challenger will provide too much of the public good.

If $b > 1$, i.e., if the value of the public good is high, then the best a pro-incumbent media can do is to choose an interior slant that reveals information about the intended level of the public good in proportion to the payoff that voters receive from the public good, hoping that this level will be high enough to discourage voters. In this case, the incumbent wins the election with probability decreasing in $b$ and going from $1/2$ when $b$ is close to one to 0 when $b$ is close to $3/2$.\(^{10}\)

**Proposition 1** The probability that the incumbent wins is uniquely maximized at $\sigma = \infty$ if $b < 1$ and at $\sigma = \hat{\sigma}$ if $b > 1$. If the media is biased in favor of the incumbent, then the incumbent wins with probability one if $b < 1$ and with probability $1 - b/3 - (1/6)\sqrt{4b^2 - 3\hat{\sigma}^2}$ if $b > 1$.

**Proof.** Suppose $0 < b < 1$. Using the first line of Theorem 1(iii), if $0 \leq \sigma \leq b$, then the probability of the incumbent winning the election is the area of

\(^{10}\)Recall that $\hat{\sigma}$ is the maximum level of slant such that citizens, after a report on a challenger with position $(g, t) = (1, 1)$, expect nonpositive utility from the challenger’s public good level.
the trapezoid to the right of \( s^C_C \). This area is \( 1-b/3-(1/6)\sqrt{4b^2-3\sigma^2} \), which is increasing in \( \sigma \). Using the second line of Theorem 1(iii), if \( b \leq \sigma < \infty \), then the probability of the incumbent winning is one minus the triangle to the left of \( s^C_C \). This area is \( 1-b^2/(2\sigma) \) and is increasing in \( \sigma \). Using the third line of Theorem 1(iii), if \( \sigma = \infty \), then the probability of the incumbent winning is 1. Thus, if \( 0 < b < 1 \), then the probability of the incumbent winning the election is maximized at \( \sigma = \infty \).

Suppose \( 1 < b < 3/2 \). Using the first line of Theorem 1(iv), if \( 0 \leq \sigma \leq \hat{\sigma} \), then the probability of the incumbent winning the election is the area of the trapezoid to the right of \( s^C_C \). This area is \( 1-b/3-(1/6)\sqrt{4b^2-3\sigma^2} \), which is increasing in \( \sigma \) and achieves a maximum of

\[
1-b/3-(1/6)\sqrt{4b^2-3\sigma^2} = 1 - \frac{b}{3} \left( 1 - \frac{1}{6} \sqrt{\frac{5}{2}b^2 + 3b - \frac{9}{2} + \frac{3(3-b)}{2}} \right) \sqrt{b^2 + 2b - 3}
\]

at \( \sigma = \hat{\sigma} \). Using the second line of Theorem 1(iv), if \( \sigma \leq \sigma < \infty \), then the probability of the incumbent winning the election is the area of the triangle to the right of \( s^C_C \), which is strictly decreasing in \( \sigma \). Using the third line of Theorem 1(iii), if \( \sigma = \infty \), then the probability of the incumbent winning is 0. Thus, if \( 1 < b < 3/2 \), then the probability of the incumbent winning the election is maximized at \( \sigma = \hat{\sigma} \).

5.2 Pro-Challenger Media

Assume that the media outlet is biased in favor of the challenger, in the sense that it chooses slant with the objective of maximizing the probability of the challenger winning the election. An argument similar to the proof of the previous proposition delivers the following result.

**Proposition 2** The probability that the challenger wins is uniquely maximized at \( \sigma = 0 \) if \( b < 1 \) and at \( \sigma = \infty \) if \( b > 1 \). If the media is biased in favor of the challenger, then the challenger wins with probability \( 2b/3 \) if \( b < 1 \) and with probability one if \( b > 1 \).

If the value of the public good is high, then the optimal media slant from the point of view of the challenger is \( \sigma = \infty \), which conceals all information about the level of the public good that the challenger intends to provide. In
this case, the challenger wins the election with probability one. On the other hand, if the value of the public good is low, then the optimal media slant from the point of view of the challenger is $\sigma = 0$, which perfectly reveals the intended level of the public good, in the hope that the revealed policy position will be low enough to attract voters. In this case, the challenger wins the election with probability increasing in $b$ and going from zero when $b$ is close to zero to $2/3$ when $b$ is close to one.

Figure 3 contrasts the probability of the challenger winning the election with a pro-challenger media and with a pro-incumbent media for different values of $b$. The significant gap between the two probabilities is an indication of the power of the media to influence the result of the election. For comparison purposes, the dashed line represents the probability that the challenger wins the election when the media is balanced in the sense of adopting a slant equal to 1, which implies covering both dimensions of the policy space with the same weight.

Figure 3: Probability of Challenger Winning the Election: Pro-Challenger (thin line), Pro-Incumbent (thick line) and Balanced Media (dashed line)
6 Welfare

In this section, we compare pro-incumbent, pro-challenger, and balanced media from the point of view of social welfare. To obtain a benchmark, we first characterize the socially optimal level of slant. For simplicity in the presentation, in the remainder of the section we make the following assumption:\footnote{\label{footnote:A5}As it is clear from the proofs of propositions 3 and 4, assumption (A5) is not needed for most of our results and it allows in a few instances to overlook situations in which the net gain for high-paying jobs or the relative cost of education are very small.}

\begin{align*}
(A5) \quad \triangle w - e \geq 7/18 \quad \text{and} \quad (e/\triangle w)^2(\triangle w - e) \geq 1/24.
\end{align*}

Note that, from the viewpoint of social welfare, income tax in itself is irrelevant to the extent that tax proceeds are returned to citizens as lump-sum transfers. Of course, if citizens anticipate a high income tax, then they will take low paying jobs, which reduces social welfare. Also, from the viewpoint of social welfare, the public good level \( g \) that the challenger intends to implement is better than the status quo if and only if \( u(g) - c(g) > 0 \), i.e., if and only if \( 0 < g < 2b/3 \). Thus, social welfare is maximized when citizens take high paying jobs regardless of who wins the election and the challenger wins the election if and only if \( 0 < g < 2b/3 \). For any given slant \( \sigma \), social losses with respect to this maximum can be measured as

\[
\text{Social losses} = (\triangle w - e) P(L|\sigma) + \int_{0 < g < 2b/3} (u(g) - c(g)) \, dg \, dt + \int_{2b/3 < g < 1} (c(g) - u(g)) \, dg \, dt,
\]

where \( I(\sigma) \) is the area in the unit square where the incumbent wins the election, and \( C(\sigma) \) is the area where the challenger wins the election.

The first term in the right-hand side of the above equation is the loss due to the (ex ante, before learning the news) probability that citizens take low paying jobs, and it is equal to the area in the unit square such that low paying jobs are adopted, \( P(L|\sigma) \), multiplied by the loss \( \triangle w - e \). The second term is the loss due to failing to adopt the challenger’s proposed level of the public good when in fact this level would be better than the status quo, and it is equal to the net benefit of the public good, integrated over the area in
the unit square such that $0 < g < 2b/3$ and the challenger is defeated. The third term is the loss due to adopting the challenger’s proposed level of the public good when in fact this level is worse than the status quo, and it is equal to the net loss due to the public good, integrated over the area in the unit square such that $2b/3 < g < 1$ and the challenger wins the election.

Since social losses change continuously with the slant $\sigma$, and the set of possible slants $\mathbb{R}_{++} \cup \{0, \infty\}$ is compact, there exists an optimal slant $\sigma^*$ for any given parameter values $\Delta w$, $e$ and $b$. Proposition 3 below provides the optimal slant for different parameter values.

**Proposition 3** (i) If $e/\Delta w < 1/2$, the unique socially optimal slant is $\sigma^* = 0$ for all $b$. (ii) If $e/\Delta w > 1/2$, there are some $b', b''$ satisfying $1 < b' \leq b'' < 3/2$ such that the unique socially optimal slant is $\sigma^* = \infty$ if $b < 1$, $\sigma^* = \tilde{\sigma}$ if $1 < b < b'$, $\sigma^* = 0$ if $b' < b < b''$, and $\sigma^* = (2 - 2e/\Delta w)^{-1}$ if $b'' < b < 3/2$.

(See the proof in the Appendix.) If the cost of education is small compared to the salary premium of high-paying jobs, then it is socially optimal for the media to report only on the public good ($\sigma^* = 0$). The reason is that in the absence of information about income taxes, citizens invest in education. Thus, reporting only about the public good reduces social losses to zero, since the challenger wins the election only if it intends to implement a level of public good provision with positive net benefits for citizens.

If the cost of education is large and citizens do not care much about the public good, then it is socially optimal for the media to report only on income taxes ($\sigma^* = \infty$) if $b$ is smaller than one and to choose the slant $\tilde{\sigma}$ if $b$ is slightly above one. Intuitively, if the cost of education is large, citizens will not acquire education if the challenger gets elected, so if citizens do not care much about the public good it is socially optimal to maximize the probability of the incumbent winning the election. Finally, if the cost of education is large and citizens care much about the public good, then the optimal slant is either 0 or $(2 - 2e/\Delta w)^{-1}$, determined according to the trade-off between providing the public good, which requires electing the challenger, and giving incentives for citizens to take high-paying jobs, which requires electing the incumbent.

Using the previous results, we can rank the different media objectives according to the expected utility of citizens.
Proposition 4  (i) If $e/\Delta w < 1/2$, then if $b < 1$, pro-challenger media is socially optimal, and pro-incumbent media is better for citizens than balanced media, and if $b > 1$, pro-incumbent media is better for citizens than balanced media, which in turn is better than pro-challenger media. (ii) If $e/\Delta w > 1/2$, there are some $\overline{b}, \underline{b}$ satisfying $1 < \underline{b} \leq \overline{b} < 3/2$ such that if $0 < b < \underline{b}$ then pro-incumbent media is socially optimal and balanced media is better for citizens than pro-challenger media, and if $\overline{b} < b < 3/2$ then pro-challenger media is better than balanced media which in turn is better than pro-incumbent media.

(See the proof in the Appendix.) Figures 4 and 5 illustrate Proposition 4 for the case of a small education cost ($e/\Delta w < 1/2$) and the case of a large education cost ($e/\Delta w > 1/2$), respectively.\footnote{We adopt the parameter values $e/\Delta w = 1/4$ for Figure 4, $e/\Delta w = 2/3$ for Figure 5, and $\Delta w - e = 1$ for both figures.} In each figure, we represent citizens’ expected welfare under pro-challenger, pro-incumbent and balanced media as a fraction of expected welfare under the optimal slant.

Consider first the case of a small education cost. From Proposition 3, in this case it is socially optimal for the media to report only on the public good. When citizens care little about the public good ($b < 1$), this is exactly the optimal slant for a pro-challenger media, so pro-challenger media is better for citizens than pro-incumbent media. When citizens care enough about the public good ($b > 1$), though, the optimal slant for a pro-challenger media is to report only on income taxes, so the ordering of pro-challenger and pro-incumbent media from the viewpoint of social welfare is reversed.

Consider now the case of a large education cost. From Proposition 3, in this case it is socially optimal for the media to maximize the probability that the incumbent gets elected when citizens care little about the public good. In particular, the optimal slant is $\sigma = \infty$ for $0 < b < 1$ and $\sigma = \hat{\sigma}$ for $1 < b < b'$ for some $b' > 1$. Thus, pro-incumbent media is socially optimal for $b < b'$ for some $b' > 1$. Also from Proposition 3, if citizens care enough about the public good, then the socially optimal slant is equal to $(2 - 2e/\Delta w)^{-1}$ which gives more weight than $\hat{\sigma}$ to information about the public good. Thus, pro-challenger media is better than pro-incumbent media for $b$ close enough to $3/2$.

Balanced media implies a slant that is intermediate between the slants favored by pro-incumbent and pro-challenger media in every case depicted in
Figure 4: Welfare under Pro-Challenger (thin line), Pro-Incumbent (thick line), and Balanced Media (dashed line) for Small Education Cost

Figure 5: Welfare under Pro-Challenger (thin line), Pro-Incumbent (thick line), and Balanced Media (dashed line) for Large Education Cost
Figures 4 and 5. Figure 4 illustrates nicely that social welfare is not single-peaked in slant. If the cost of education is small and citizens do not care much about the public good, pro-incumbent media would report only on the income tax dimension, therefore guaranteeing that the incumbent would win the election with probability one and all citizens would choose high-paying jobs. Pro-challenger media, on the other hand, would report only on the public good dimension, therefore guaranteeing that not only all citizens would choose high-paying jobs but also that the challenger would win the election if and only if the intended level of provision of the public good were better than no provision. Balanced media would report on both policy dimensions with equal weight, provoking the challenger to win in some circumstances in which the intended level of provision of the public good were worse than no provision, and in some circumstances in which the expectation of the challenger winning would lead citizens to take low-paying jobs. Thus, there can be no general presumption that balanced media is a “good compromise” between media with opposite partisan objectives.

7 Multiple Slants

We have assumed so far that all citizens have access to a single news source, or alternatively to different media sharing the same slant, perhaps because a similar slant allows media outlets to maximize advertisement revenues, as proposed by Hamilton (2004) to explain nonpartisan reporting on U.S. politics from the 1870s to the early 1990s.

Of course, if citizens have access to at least two media with different slants, they can pinpoint exactly the policy position of the challenger. This would not necessarily be better for citizens than having access to a single news source. It is simple to check that if citizens can pinpoint exactly the position of the challenger, they will vote for the challenger and choose high-paying jobs if $t < 1 - e/\Delta w$ and $g < 2b/3$, will vote for the challenger and choose low-paying jobs if $t > 1 - e/\Delta w$, $\Delta w - e < b^2/3$ and $g \in (b/3 - \sqrt{b^2/9 - (\Delta w - e)/3}, b/3 + \sqrt{b^2/9 - (\Delta w - e)/3})$, and will vote for the incumbent and choose high-paying jobs in the complement of the closure of the set just described. Thus, social losses as defined in the previous section will be positive, since citizens do not vote for the challenger whenever $g <$
and may take low-paying jobs with positive probability. Recall that social losses are zero with a single news source under the optimal slant if \( e/\Delta w < 1/2 \).

More interestingly, we can consider that it may be hard for most or all citizens to read and understand news reports with different slants. To analyze a situation in which citizenry may split into audiences of media outlets with different slants, we need to model not only the job and voting decisions of individuals after reading the news, but also the ex ante choice of media outlets. Since each vote is negligible, citizens will choose the outlet that leads to a better job decision. But since reading the newspaper that is read by the majority allows a voter to infer which party is going to win the election, there are potentially multiple equilibria.

To get a grip of the issues involved, suppose that there are two newspapers, 1 and 2, with exogenously given slants \( \sigma_1 = 0 \) and \( \sigma_2 = \infty \). That is, newspaper 1 informs only about the public good dimension and newspaper 2 only about the tax policy dimension. Citizens must decide whether to read one newspaper or the other but cannot read both. It is easy to check that there is an equilibrium in which every citizen reads newspaper 2. However, there is also an equilibrium in which every citizen reads newspaper 1 if and only if either \( e/\Delta w \leq 1 - 2b/3 \) or \( e/\Delta w > 1/2 \). If \( e/\Delta w \leq 1 - 2b/3 \), a would-be reader of newspaper 2 would find it optimal to take a high-paying job even if she knew the income tax rate intended by the challenger is equal to 1, so the would-be deviator could not learn anything useful from reading newspaper 2. If instead \( e/\Delta w > 1/2 \) and \( e/\Delta w > 1 - 2b/3 \), a would-be reader of newspaper 2 would find it optimal to take low-paying jobs for high enough income taxes, but would still be worse off than a reader of newspaper 1 who knows if the challenger or the incumbent will win the election and who uses this information to take a low or a high-paying job. This example illustrates both the existence of multiple equilibria and the possibility that the private motivation leads all citizens to listen to media with similar slants.

8 Appendix

Proof of Theorem 1: There are three additional types of rational expectation outcome that are not accounted for in Section 4.
**Type 4.** Suppose \( P(C|s) = 1 \) and \( 0 < P(L|s) < 1 \). A necessary condition for this to be a rational expectations outcome is that citizens are indifferent between taking high-paying or low-paying jobs. That is,

\[ E[t|s] = 1 - e/\Delta w. \]

**Type 5.** Suppose \( 0 < P(C|s) < 1 \) and either \( P(L|s) = 1 \) or \( P(H|s) = 1 \). In either case, a necessary condition for this to be a rational expectations outcome is that citizens are indifferent between supporting the challenger and the incumbent. That is,

\[ E[u(g) - c(g)|s] = 0. \]

**Type 6.** Suppose \( 0 < P(C|s) < 1 \) and \( 0 < P(L|s) < 1 \). We assume that citizens choose their actions independently.\(^{13}\) The only value of \( P(C|s) \) that can be induced by independent actions on the part of citizens is the one corresponding to an electoral tie, i.e., \( P(C|s) = 1/2 \). Using \( 0 < P(L|s) < 1 \), we find that a necessary condition for this to be a rational expectations outcome is

\[ E[t|s] = 2 \left( 1 - e/\Delta w \right). \]

It is simple to check that there are no other possible rational expectations outcomes. If citizens expect \( P(C|s) = 0 \), for example, then all citizens take the high-paying job, so there is no story such that \( P(C|s) = 0 \) and \( P(L|s) > 0 \) is a rational expectations outcome.

Note that

\[ E[t|s] = (t(s) + \bar{t}(s))/2. \]

It is easy to check that \( s' \succ s \) implies \( E[t|s] > E[t|s'] \), with strict inequality unless \( t(s) = t(s') = 0 \) and \( \bar{t}(s) = \bar{t}(s') = 1 \). Equivalently, \( s' \succ s \) implies

\[ E[t|s] > E[t|s'] \text{ or } E[t|s] = E[t|s'] = 1/2. \]

\(^{13}\)Since in our setup there is a continuum of citizens, there is a technical difficulty defining “independent” actions whenever a positive measure of citizens adopt mixed strategies. The independence notion we require is that there is no subset of citizens with positive measure who cast correlated votes. The idea is that if the probability of the challenger winning the election is strictly between zero and one and different from \( 1/2 \), then it is necessarily the case that a set of citizens with positive measure cast correlated votes.
Using assumption (A4) \((e/\Delta w \neq 1/2)\), we find that the equation \(E[t|s] = (1 - e/\Delta w)\) holds for at most one story \(s\), so Type 4 rational expectations outcomes can occur only for a measure zero set of stories. Similarly, assumption (A4) \((e/\Delta w \neq 3/4)\) implies that \(E[t|s] = 2(1 - e/\Delta w)\) holds for at most one \(s\), so Type 6 rational expectations outcomes can occur only for a measure zero set of stories.

We now argue that \(E[t|s] = 1 - e/\Delta w\) has at most one solution. Suppose \(\sigma > 0\), and note that \(E[t|s] = 1\) and \(E[t|\bar{s}] = 0\). Using assumption (A4) \((e/\Delta w \neq 1/2)\), we get that if \(\sigma > 0\), then the equation \(E[t|s] = 1 - e/\Delta w\) has a unique solution \(s^0_L\). Suppose \(\sigma = 0\). If \(e/\Delta w < 1/2\), then we have \(E[t|s] = 1/2 < 1 - e/\Delta w\) for all \(s\). Thus, \(P(L|s) = 0\) for all \(s\), which we represent by letting

\[
\begin{align*}
s^0_L &= [(0, 0), (0, 1)].
\end{align*}
\]

For \(0 < \sigma \leq \Delta w/(2e)\), it is simple to check that

\[
\begin{align*}
s^0_L &= [(0, 1 - 2e/\Delta w), (2e\sigma/\Delta w, 1)]
\end{align*}
\]

solves \(E[t|s] = 1 - e/\Delta w\). Similarly, for \(\Delta w/(2e) \leq \sigma \leq \infty\), it is simple to check that

\[
\begin{align*}
s^0_L &= [(0, 1 - e/\Delta w - 1/(2\sigma)), (1, 1 - e/\Delta w + 1/(2\sigma))]
\end{align*}
\]

solves \(E[t|s] = 1 - e/\Delta w\). If \(e/\Delta w > 1/2\), then we have \(E[t|s] = 1/2 > 1 - e/\Delta w\) for all \(s\). Thus, \(P(L|s) = 1\) for all \(s\) if \(E[u(g) - c(g)|s] > 0\), which we represent by letting

\[
\begin{align*}
s^0_L &= [(1, 0), (1, 1)].
\end{align*}
\]

For \(0 < \sigma \leq 1/(2 - 2e/\Delta w)\), it is simple to check that

\[
\begin{align*}
s^0_L &= [(1 - 2\sigma + 2e\sigma/\Delta w, 0), (1, 2 - 2e /\Delta w)]
\end{align*}
\]

solves \(E[t|s] = 1 - e/\Delta w\). The remaining case is similar to the argument given above.

Now we turn to the expression \(E[u(g) - c(g)|s]\). Note that \(u(g) - c(g) > 0\) if and only if \(0 < g < 2b\), and \(u(g) - c(g) < 0\) if and only if \(2b < g \leq 1\). Suppose \(\sigma \in \Re_{++}\). Then

\[
\begin{align*}
E[u(g) - c(g)|s] &= \frac{1}{\bar{g}(s) - g(s)} (b\bar{g}(s)^2 - \bar{g}(s)^3 - bg(s)^2 + g(s)^3) \\
&= b(\bar{g}(s) + g(s)) - (\bar{g}(s)^2 + g(s)\bar{g}(s) + g(s)^2),
\end{align*}
\]
which is strictly concave as a function of $g$ and $\bar{g}$. Moreover, $\bar{g}(s)$ and $g(s)$ are weakly increasing in $s$, with at least one of them increasing strictly as we consider news stories to the southeast, except possibly if $g(s) = 0$ and $\bar{g}(s) = 1$. Note also that $E[u(g) - c(g)|s]$ is positive for news stories close enough to $s$ and is negative for news stories close enough to $\bar{s}$. By assumption (A4) ($b \neq 1/3$), it follows that if $g(s) = 0$ and $\bar{g}(s) = 1$, then $E[u(g) - c(g)|s] \neq 0$. Thus, there is at most one solution, which we denote $s^*_C$, to $E[u(g) - c(g)|s] = 0$. Moreover,

$$E[u(g) - c(g)|s] \geq 0 \iff s \leq s^*_C$$

for every story $s$.

Suppose $\sigma = 0$, so news stories are fully revealing about $g$. Thus, $E[u(g) - c(g)|s] > 0$ if and only if $s^*_C \succ s$, where

$$s^*_C = [(2b/3, 0), (2b/3, 1)].$$

Suppose $\sigma = \infty$, so that no information about $g$ is revealed by any story. Then

$$E[u(g) - c(g)|s] = \int_0^1 (u(g) - c(g)) \, dg = b - 1. $$

Thus, if $b < 1$, then we have $E[u(g) - c(g)|s] < 0$ for every $s$, which we represent by

$$s^\infty_C = [(0, 1), (1, 1)],$$

while if $b > 1$, then we have $E[u(g) - c(g)|s] > 0$ for every $s$, which we represent by

$$s^\infty_C = [(0, 0), (1, 0)].$$

Note the implication that Type 5 rational expectations outcomes can occur only for a measure zero set of stories.

From the analysis of Section 4, it follows that if $P(C|\cdot), P(L|\cdot)$ is a rational expectations equilibrium of Type 1, 2, or 3, then

$$P(C|s) = \begin{cases} 0 & \text{if } E[u(g) - c(g)|s] < 0 \\ 1 & \text{if } E[u(g) - c(g)|s] > 0 \end{cases}$$

and

$$P(L|s) = \begin{cases} 0 & \text{if } E[t|s] < 1 - e/\Delta w \quad \text{or} \quad E(u(g) - c(g)|s) < 0 \\ 1 & \text{if } E[t|s] > 1 - e/\Delta w \quad \text{and} \quad E(u(g) - c(g)|s) > 0 \end{cases}$$

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for almost every \( s \in S^\sigma \). With the foregoing analysis, the existence and uniqueness of rational expectations equilibrium follows, as well as its characterization in terms of the cutoff stories \( s_C^\sigma \) and \( s_L^\sigma \).

**Proof of Proposition 3**: Suppose \( e/\Delta w < 1/2 \), as in case (iii) following Theorem 1. In this case, citizens are predisposed to taking high-paying jobs regardless of who wins the election, in the absence of information about the income tax level intended by the challenger. By setting \( \sigma = 0 \), news are unrevealing about the income tax level, so that every citizen takes a high-paying job. Moreover, news are perfectly revealing about the level of the public good that the challenger intends to implement, so that citizens vote for the challenger if and only if the net benefit of the public good is positive. Thus, if \( e/\Delta w < 1/2 \), then social welfare is maximized by setting \( \sigma = 0 \). In fact, it is uniquely maximized at that slant since for any other slant the sum of the second and third terms of the social losses equation is positive. This finishes the proof of part (i) of the proposition.

Now suppose \( e/\Delta w > 1/2 \) and \( b < 1 \). Using cases (i) and (iv) following Theorem 1 we get that if \( b < 1 \) then \( s_L^\sigma > s_C^\sigma \), for all \( \sigma \). Thus, citizens take low-paying jobs whenever they anticipate the challenger will win the election. Consider any slant \( \sigma \) in \([0, b]\). The expected welfare is

\[
W(\sigma) = (\Delta w - e) \left( 1 - b/3 - \sqrt{b^2/9 - \sigma^2/12} \right) + \int_{t=0}^{1} \int_{g=0}^{-\sigma/2 + b/3 + \sqrt{b^2/9 - \sigma^2/12} + \sigma t} (2bg - 3g^2) \, dg
\]

or equivalently

\[
W(\sigma) = (\Delta w - e) \left( 1 - b/3 - \sqrt{b^2/9 - \sigma^2/12} \right) + (2b^2/9) \sqrt{b^2/9 - \sigma^2/12} + 2b^3/27 + ba^2/18.
\]

Thus,

\[
W'(\sigma) = (\Delta w - e)(b^2/9 - \sigma^2/12)^{-1/2} \sigma/12 - (\sigma b^2/54)(b^2/9 - \sigma^2/12)^{-1/2} + ba/9.
\]

It is straightforward to check that \( b < 1 \) implies \( W'(\sigma) > 0 \). Thus, no slant in \([0, b]\) can be optimal.
Now consider any slant $\sigma$ in $[b, \infty]$. The expected welfare is

$$W(\sigma) = (\Delta w - e) \left(1 - b^2/2\sigma\right) + \int_{t=1-b/\sigma}^{1} \int_{g=0}^{-\sigma+b+\sigma t} (2bg - 3g^2) \, dg$$

or equivalently

$$W(\sigma) = (\Delta w - e) \left(1 - b^2/2\sigma\right) + b^4/12\sigma.$$ 

Thus, $W'(\sigma) \geq 0$ iff $\sqrt{6(\Delta w - e)} \geq \varepsilon$. Since $\Delta w - e \geq 1/6$ (from assumption A5), it follows that if $e/\Delta w > 1/2$ and $b < 1$ then the optimal slant is $\infty$.

Finally, suppose $e/\Delta w > 1/2$ and $b > 1$. Consider first any slant $\sigma \in [0, \hat{\sigma}]$. Using cases (ii) and (iv) following Theorem 1 we get that $s_L^\sigma > s_C^\sigma$. Defining $B = b/3 + \sqrt{b^2/9 - \sigma^2/12}$, the expected welfare is

$$W(\sigma) = (\Delta w - e)(1 - B) + \int_{t=0}^{1} \int_{g=0}^{-\sigma/2+B+\sigma t} (2bg - 3g^2) \, dg \, dt$$

or equivalently

$$W(\sigma) = (\Delta w - e)(1 - b/3 - (b^2/9 - \sigma^2/12)^{1/2}) + 2b^3/27 + 2(b^2/9 - \sigma^2/12)^{3/2}.$$ 

It follows that $W(\sigma)$ is convex. Thus, $W(\sigma)$ is maximized in the interval $[0, \hat{\sigma}]$ by $\sigma$ equal to either 0 or $\hat{\sigma}$. Note in particular

$$W(0) = (\Delta w - e)(1 - 2b/3) + 4b^3/27.$$ 

Now consider any slant $\sigma \in [\hat{\sigma}, \hat{\sigma}(2 - 2e/\Delta w)^{-1}]$. Using cases (ii) and (iv) following Theorem 1 we get that $s_L^\sigma > s_C^\sigma$. The expected welfare is

$$W(\sigma) = (\Delta w - e)\hat{\sigma}^2/2\sigma$$

$$+ \int_{0}^{1} \int_{0}^{1} (2bg - 3g^2) \, dg \, dt - \int_{t=0}^{(1-\hat{\sigma})/\sigma + g/\sigma} \int_{g=1-\hat{\sigma}}^{1} (2bg - 3g^2) \, dg \, dt$$

or equivalently

$$W(\sigma) = (\Delta w - e)\hat{\sigma}^2/2\sigma + b - 1 - ((b - 3/2)\hat{\sigma}^2 + (1 - b/3)\hat{\sigma}^3 - \hat{\sigma}^4/4)/\sigma.$$ 

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Since the expression in brackets is negative for any $b \in (1, 3/2)$, we have that $W(\sigma)$ is strictly decreasing. Thus, $W(\sigma)$ is maximized in the interval $[\hat{\sigma}, \hat{\sigma}(2 - 2e/\Delta w)^{-1}]$ by $\sigma$ equal to $\hat{\sigma}$. Note in particular

$$W(\hat{\sigma}) = (\Delta w - e)\hat{\sigma}/2 + b - 1 - [(b - 3/2)\hat{\sigma} + (1 - b/3)\hat{\sigma}^2 - \hat{\sigma}^3/4].$$

Next consider any slant $\sigma \in [\hat{\sigma}(2 - 2e/\Delta w)^{-1}, (2 - 2e/\Delta w)^{-1}]$. Using cases (ii) and (iv) following Theorem 1 we get that $s_C^p \succ s_L^p$. The expected welfare is

$$W(\sigma) = (\Delta w - e)(2 - 2e/\Delta w)^2\sigma/2 + b - 1 - [(b - 3/2)\hat{\sigma}^2 + (1 - b/3)\hat{\sigma}^3 - \hat{\sigma}^4/4]/\sigma.$$

Thus, $W(\sigma)$ is increasing if

$$(\Delta w - e)(2 - 2e/\Delta w)^2/2 > [(b - 3/2)\hat{\sigma}^2 + (1 - b/3)\hat{\sigma}^3 - \hat{\sigma}^4/4]/\sigma^2,$$

which is satisfied for any slant in $\sigma \in [\hat{\sigma}(2 - 2e/\Delta w)^{-1}, (2 - 2e/\Delta w)^{-1}]$ if

$$(\Delta w - e)/2 > -(b - 3/2) + (1 - b/3)\hat{\sigma} - \hat{\sigma}^2/4$$

or equivalently

$$\Delta w - e > -b/2 + 3/4 - b^2/12 - (b/12 - 1/4)\sqrt{b^2 + 2b - 3}. $$

The right-hand side in the inequality above is strictly decreasing in $b$, so that a sufficient condition for $W(\sigma)$ to be increasing for any $b \in (1, 3/2)$ is $\Delta w - e \geq 1/6$. Thus, from assumption (A5), $W(\sigma)$ is maximized by $\sigma = (2 - 2e/\Delta w)^{-1}$ in the interval $[\hat{\sigma}(2 - 2e/\Delta w)^{-1}, (2 - 2e/\Delta w)^{-1}]$.

Finally consider any slant $\sigma \in [(2 - 2e/\Delta w)^{-1}, \infty]$. Using cases (ii) and (iv) following Theorem 1 we get that $s_C^p \succ s_L^p$. The expected welfare is

$$W(\sigma) = (\Delta w - e)(1 - e/\Delta w) + b - 1 - [(b - 3/2)\hat{\sigma}^2 + (1 - b/3)\hat{\sigma}^3 - \hat{\sigma}^4/4]/\sigma.$$

Since the expression in brackets is negative, $W(\sigma)$ is strictly decreasing. Thus, $W(\sigma)$ is maximized in the interval $[(2 - 2e/\Delta w)^{-1}, \infty]$ by $\sigma$ equal to $(2 - 2e/\Delta w)^{-1}$. Note in particular

$$W((2 - 2e/\Delta w)^{-1}) = (\Delta w - e)(1 - e/\Delta w) + b - 1 - [(b - 3/2)\hat{\sigma}^2 + (1 - b/3)\hat{\sigma}^3 - \hat{\sigma}^4/4](2 - 2e/\Delta w).$$
Finally, welfare under balanced media is open. From Proposition 1 and cases (i) and (iii) after Theorem 1, it follows that welfare under pro-incumbent media is given by
\[ W((2 - 2e/\Delta w)^{-1}) \]
To see this, note that \( \hat{\sigma} \) changes continuously with \( b \) and if \( b \) is close to one, then \( \hat{\sigma} \) is close to one. Thus, for \( b \) close to one, \( W(0) \) is close to \( (\Delta w - e)/3 + 4/27 \), \( W(\hat{\sigma}) \) is close to \( (\Delta w - e)/2 + 1/12 \), and \( W((2 - 2e/\Delta w)^{-1}) \) is close to \( (\Delta w - e + 1/6)(1 - e/\Delta w) \). The desired result follows from assumption (A5). Next, we claim that if \( b \) is close to \( 3/2 \) then \( W((2 - 2e/\Delta w)^{-1}) \) is larger than \( W(0) \) and \( W(\hat{\sigma}) \). To see this, note that for \( b \) is close to \( 3/2 \), \( W((2 - 2e/\Delta w)^{-1}) \) is close to \( (\Delta w - e)(1 - e/\Delta w) + 1/2 \) while \( W(0) \) and \( W(\hat{\sigma}) \) are close to \( 1/2 \). Finally, it is tedious but straightforward to verify that \( W(0) - W(\hat{\sigma}), W((2 - 2e/\Delta w)^{-1}) - W(\hat{\sigma}) \) and \( W((2 - 2e/\Delta w)^{-1}) - W(0) \) are increasing in \( b \) for \( 1 < b < 3/2 \) under assumption (A5). Thus, the cutoff points \( b', b'' \) in the statement of the proposition are well-defined. This finishes the proof of part (i) of the proposition.

**Proof of Proposition 4:** Suppose first \( e/\Delta w < 1/2 \) and \( b < 1 \). From Proposition 3(i) and Proposition 2 it follows that pro-challenger media is optimal. From Proposition 1 and cases (i) and (iii) after Theorem 1, it follows that welfare under pro-incumbent media is given by \( W(\infty) = \Delta w - e \).

With respect to balanced media, we have that if \( b \leq 2e/\Delta w \) then \( W(1) = (\Delta w - e)(1 - b^2/2) + b^4/12 \), and if \( b \geq 2e/\Delta w \) then \( W(1) = (\Delta w - e)(1 - 2(e/\Delta w)^2) + b^4/12 \). Thus, \( W(\infty) > W(1) \) if \( b \leq 2e/\Delta w \) and \( \Delta w - e \geq 1/6 \) or if \( b \geq 2e/\Delta w \) and \( (e/\Delta w)^2(\Delta w - e) \geq 1/24 \). Using Assumption (A5) we obtain \( W(\infty) > W(1) \). This partially proves part (i) of the proposition.

Next suppose \( e/\Delta w < 1/2 \) and \( b > 1 \). From Proposition 1 and cases (ii) and (iii) after Theorem 1, it follows that welfare under pro-incumbent media is
\[ W(\hat{\sigma}) = (\Delta w - e)(1 - 2\hat{\sigma}(e/\Delta w)^2) + b - 1 - [(b - 3/2)\hat{\sigma}^2 + (1 - b/3)\hat{\sigma}^3 - \hat{\sigma}^4/4]/\hat{\sigma}. \]
Similarly, from Proposition 2, it follows that welfare under pro-challenger media is
\[ W(\infty) = (\Delta w - e)(1 - e/\Delta w) + b - 1. \]
Finally, welfare under balanced media is
\[ W(1) = (\Delta w - e)(1 - 2(e/\Delta w)^2) + b - 1 - [(b - 3/2)\hat{\sigma}^2 + (1 - b/3)\hat{\sigma}^3 - \hat{\sigma}^4/4]. \]
Since the expression in brackets is negative, \( \hat{\sigma} \) is smaller than one and 
\( e/\Delta w < 1/2 \), we get \( W(\hat{\sigma}) > W(1) > W(\infty) \). This finishes the proof of 
part (i) of the proposition.

Next suppose \( e/\Delta w > 1/2 \) and \( b < 1 \). From Proposition 3(ii) and Propo-
sition 1 it follows that pro-incumbent media is optimal. From Proposition 
2 and cases (i) and (iv) after Theorem 1, it follows that welfare under pro-
challenger media is

\[
W(0) = (\Delta w - e)(1 - 2b/3) + 4b^3/27.
\]

Similarly, welfare under balanced media is

\[
W(1) = (\Delta w - e)(1 - b^2/2) + b^4/12.
\]

Thus, \( W(1) > W(0) \) if \( \Delta w - e > b^2(4/27 - b/12)/(2/3 - b/2) \). Since the 
expression in the right-hand side of this inequality is increasing in \( b \), it follows 
that \( W(1) > W(0) \) if \( \Delta w - e \geq 7/18 \). This partially proves part (ii) of the 
proposition.

Last, suppose \( e/\Delta w > 1/2 \) and \( b > 1 \). From Proposition 3(ii) and Propo-
sition 1 it follows that there is some \( \tilde{b} \in (1, 3/2) \) such that if \( 1 < b < \tilde{b} \) 
then pro-incumbent media is optimal. We claim that for \( b \) close enough to 
1, balanced media is better for citizens than pro-challenger media. To see 
this, from Proposition 2, welfare under pro-challenger media is \( W(\infty) \), which 
is close to \( (\Delta w - e)(1 - e/\Delta w) \) for \( b \) close to 1. Similarly, since \( \hat{\sigma} \) is close 
to 1 when \( b \) is close to 1, welfare under balanced media \( (W(1)) \) is close to 
\( (\Delta w - e)/2 + 1/12 \) for \( b \) close to 1. The desired result follows.

Finally, we claim that for \( b \) close enough to 3/2, pro-challenger media 
is better for citizens than balanced media which in turn is better than pro-
incumbent media. Note that \( \hat{\sigma} \) is close to 0 when \( b \) is close to 3/2. Thus, 
for \( b \) close to 3/2, welfare under pro-challenger media is close to \( (\Delta w - e)(1 - e/\Delta w) + 1/2 \), welfare under balanced media is close to \( (\Delta w - e)(2 - 2e/\Delta w)^2/2 + 1/2 \) and welfare under pro-incumbent media is close to 1/2. 
The desired result follows. This and the previous claim finish the proof of 
part (ii) of the proposition.
References


