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"Political Accountability, Electoral Control, and Media Bias"

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Political Accountability, Electoral Control, and Media Bias[*]

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Abstract

Are anti-establishment mass media really useful in preventing politicians from behaving dishonestly? This paper proposes a voting model for analyzing how differences in the direction of media bias affect politicians' behavior. In particular, the probability of corruption by an incumbent is *higher* (than that in the case of no media bias) *if and only if* the mass media have some degree of "*anti*-incumbent" bias (i.e., information favorable to the incumbent is converted into unfavorable news about him or her with a positive probability), provided that the incumbent is less likely to be opportunistic than a challenger. This result holds irrespective of the degree of "*pro*-incumbent" bias (i.e., information unfavorable to the incumbent is converted into impressive news about him or her with a positive probability). We also show that media bias *never* increases voter welfare. Our results thus suggest that society should make an effort to eliminate media bias per se rather than promote antagonistic media.

"The basis of our government being the opinion of the people, the very first object should be to keep that right; and were it left to me to decide whether we should have a government without newspapers, or newspapers without a government, I should not hesitate for a moment to prefer the latter." (Thomas Jefferson, 3rd U.S. President (1801-1809), 1787)[1]

"Nothing can now be believed which is seen in a newspaper. Truth itself becomes suspicious by being put into that polluted vehicle." (Jefferson, 1807)[2]

1   Introduction

It has long been recognized that media organizations play a pivotal role in democratic societies. As the first quote above by Thomas Jefferson–then the future President of the United States–claims, citizens need information about politicians' behaviors to judge the politician's quality of work. An important point here is that it is the media that convey most information about politicians' behaviors to the general public, behaviors ranging from taking a bribe secretively to elaborating complicated economic policies. The general public gains awareness and understanding of these behaviors from being exposed to media reporting. This is because, as Downs (1957, Ch.12) emphasizes, gathering such information independently is extremely expensive for each voter, in comparison to the benefit dispersed among them: thus, voters have little incentive to gather such information independently.

While the presence of media organizations significantly saves the cost of information acquired by each voter, it may also yield a biased report about politicians' behaviors (i.e., "*media bias*"), as Downs (1957, Ch.11) points out. Tocqueville (1840, Part 2, Ch.6) also mentioned this possibility by claiming, "I shall not deny that in democratic countries newspapers frequently lead the citizens to launch together in very ill-digested schemes," although he believed that "[t]he evil which they produce is ... much less than that which they cure." However, it is unclear whether the media are really effective in monitoring politicians' behaviors; the complaints expressed by the then President Jefferson in the second quote above may suggest that the contemporary media worked well to check Jef-

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[1] Letter to Edward Carrington, January 16, 1787.
[2] Letter to John Norvell, June 11, 1807.

(A) "The falsification or creation of stories in the American news media is a widespread problem."

	2004	2005	2008
Strongly agree	37%	40%	44%
Agree	24%	25%	22%
Disagree	24%	20%	19%
Strongly disagree	12%	11%	11%

(B) "It is important for our democracy that the news media act as a watchdog to the government."

	2004	2005	2008
Strongly agree	49%	50%	51%
Agree	28%	24%	25%
Disagree	11%	11%	8%
Strongly disagree	10%	11%	11%

(http://www.firstamendmentcenter.org/pdf/SOFA2008survey.pdf))

Table 1: Public's Perception about Mass Media (Source: the 2008 State of the First Amendment Survey (http://www.firstamendmentcenter.org/pdf/SOFA2008survey.pdf))

ferson's actions, or it may merely imply that the media excessively constrained Jefferson's active role in politics.[3]

Complaints are also raised by the general public. Among a number of surveys conducted, the State of the First Amendment Surveys 2004, 2005 and 2008 in the U.S.[4] show that more than 60 percent of the respondents agree that "the falsifications or creation of stories in the American news media is a widespread problem" (Table 1 (A)). However, the same surveys reveal that nearly 80 percent affirm that "it is important for our democracy that the news media act as a watchdog to the government" (Table 1 (B)).[5] This ambivalence in the public's attitude toward mass media (expressed by Jefferson as well) leads us to study how effective mass media are in monitoring the government.

It is thus important to ask the following questions: *Should mass media be given a free hand to enjoy the "freedom of press"? Are anti-establishment mass media really useful*

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[3] After his retirement as President, he even wrote (in a letter to Nathaniel Macon, January 12, 1819) "[a]dvertisements contain the only truths to be relied on in a newspaper."

[4] The survey's webpage is http://www.firstamendmentcenter.org/sofa_reports/index.asp.

[5] Baron (2006) also cites a survey in 1999 by the American Society of Newspaper Editors that shows that 78% of the citizens doubted that media reporting is biased.

in preventing politicians from behaving dishonestly? These questions should be asked in consideration of voters because, although mass media sometimes oust politicians in the middle of their terms, the voters hold ultimate power as final judges in elections. This paper proposes a coherent framework for considering the effects of media bias on politicians' behaviors in a model of retrospective voting. In particular, we focus on the differences in the *direction* of media bias, i.e., *pro-* and *anti-*incumbent bias. Our analysis suggests that to promote anti-incumbent bias is not as meaningful as to get rid of pro-incumbent bias. This result thus casts doubt on the widely held view that anti-incumbent bias is good to prevent politicians from corrupt behavior.

Our model presented below considers a situation where voters are uncertain about the character of a politician in office (Figure 1). In particular, we assume that there are two types of politicians: (*i*) the "opportunistic" politician who pursues his or her own interest, and (*ii*) the "ethical" politician who pursues the public interest. While a politician knows to which type he or she belongs, voters do not know whether the incumbent is opportunistic or ethical. The opportunistic type, who thinks of performing a dishonest action, must consider the possibility that this action, if exposed to the public, will affect his or her chance of getting reelected in the next election. While voters do not directly observe whether the incumbent has performed an unwarranted action, they obtain information regarding the incumbent's behavior *through the media*. They use this information to vote for either the incumbent or challenger in the upcoming election. However, *the media may be biased* in the sense that they may not convey what they have actually observed to the voters. In this framework, we first show that, without such media bias, there exists (generically) a unique perfect Bayesian equilibrium, where the opportunistic incumbent performs a dishonest action with a positive probability, if the private rent from it is moderate.

We next incorporate the possibility of media bias into the model, in which mass media, motivated by their own political preferences, may distort and misrepresent information to voters. We verify that in the presence of media bias, how mass media affect the probability of dishonest action depends on the political environment that an incumbent faces. More specifically, we obtain the following results. In the presence of media bias, the probability of dishonest action by the incumbent is higher than or equal to that in the case of no media bias. In particular, when the incumbent is less likely to be opportunistic than the
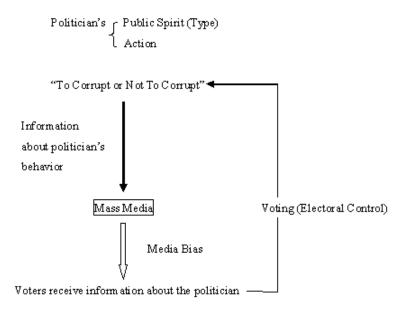
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Figure 1: How Mass Media Affect the Politician's Behavior

challenger, the probability of dishonest action is strictly higher than that in the case of no media bias *if and only if* the media are *negatively* biased against the incumbent such that the media distort information. On the other hand, when the incumbent is more likely to be opportunistic than the challenger, the opposite result is obtained; that is, the probability of dishonest action is strictly higher than that in the case of no media bias *if and only if* the media are *positively* biased in favor of the incumbent. In this sense, not only the degree of media bias but also its direction matters for determining the effects of media bias on an incumbent's behaviors. Interestingly, even when the media are biased against the incumbent, his or her reelection probability is *never* lower than that in the case of no media bias. Moreover, anti-incumbent mass media *never* decrease the probability of dishonest action. This is because media bias makes it more difficult for voters to identify an opportunistic incumbent.

Assume that an opportunistic politician, who wins the election, engages in dishonest behavior, while an ethical politician never performs a dishonest action. By defining voter welfare as a decreasing function of the sum of the expected disutility from political dishonesty in two terms, we observe a fundamental trade-off. That is, a higher probability of dishonest action by the incumbent increases the disutility to the voters in the first

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term (i.e., the *discipline* effect) but it makes it easier for the voters to judge whether the incumbent is ethical or opportunistic; this evaluation can decrease the disutility to the voters in the second term (i.e., the *selection* effect).[6] We show that media bias never improves voter welfare. In particular, if the rent from a dishonest action is sufficiently large, then no discipline is effective in reducing the probability that the incumbent acts dishonestly irrespective of the presence of media bias, while media bias increases the probability of an opportunistic politician being elected for the next term. If the rent is not sufficiently large, then the extent of the selection effect remains the same irrespective of the degree of media bias (because of the nature of mixed strategy (mentioned later)), while media bias increases the probability of the incumbent's acting dishonestly. While it can be thought that anti-incumbent bias may help counter pro-incumbent bias, our results suggest that society should make an effort to eliminate media bias *per se* rather than promote antagonistic media.

This paper is concerned with the problem of so-called *electoral* or *political accountability*. The literature on this issue started with Barro (1973), followed by, among others, Ferejohn (1986), and Persson, Roland and Tabellini (1997).[7] By considering politicians as agents and voters as principals, this literature studies the role of elections as a disciplining device.[8] Each incumbent is disciplined by the possibility that voters, who observe some signals gathered from his or her behavior, may vote him or her out in the next election. Voters are concerned about selecting a better politician in an election. The central issue is how effective the possibility of ousting a politician is in preventing him or her from engaging in rent extraction. This is the essence of the idea of *retrospective voting*.

The rest of the paper is organized as follows. After reviewing the related literature in

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[6]This type of trade-off is also studied in a signaling model by Besley and Smart (2007), although they do not consider the direction of media bias. They consider how some forms of fiscal restraint affect voter welfare. A change in fiscal restraint may cause a change in realized equilibrium from a pooling to a separating one, which worsens the policy choice by an opportunistic incumbent but reveals the type of the incumbent. Whether voter welfare increases or decreases depends on whether the selection effect outweighs the discipline effect.

[7]Banks and Sundaram (1998) consider the problem of both moral hazard and adverse selection. Meirowitz (2007) considers repeated elections with the same two parties where each incumbent selects a two dimensional policy, rather than effort level. Smart and Sturm (2011) analyze the effects of term limits in a political accountability model. See, e.g., Besley (2006, Chapter 3) for an excellent survey of political accountability models.

[8]Another important role of elections is to aggregate dispersed information among voters (about their preferences or social policies). In the present paper, we assume away this role of election.

the next section, we present our model in Section 3. Section 4 then derives the equilibria in the case of no media bias as a benchmark and then those in the presence of media bias. A comparison of these two cases reveals the potential effects of media bias on dishonest behaviors by the incumbent. We then consider voter welfare in Section 5. In Section 6, we discuss two issues: we first argue that our main results are valid with an alternative modeling of information and then discuss how mass media are biased to achieve their own objectives. The last section concludes the paper.

2 Related Literature

The notion that the media play an important role in determining public policies in the short or sometimes long term is not unique. Understanding how voters obtain information from mass media, which may pursue their own interest, has therefore been of fundamental importance in the study of political economy in the last decade (see Prat and Strömberg (2010) for a comprehensive survey of the economic studies of mass media). Political economy literature on mass media has been growing steadily. Our model builds on the idea of retrospective voting, and to the best of our knowledge, this is the first paper that studies *the effects of media bias on politician's actions and voting behavior* in the framework of *retrospective voting*. In this section, we review some representative papers on the relationship between *media bias* and *policy formation*.[9,10]

Strömberg (2004a), in one of the early formal studies, constructs an "industrial organization" model in which media bias toward large groups that share common interest is created through competition between media firms (whose revenue comes from advertising). This bias arises because of the scale effect on the supply side. Media bias, thus,

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[9]Empirical studies on mass media and policies include Besley and Burgess (2002), Strömberg (2004b), Gentzkow and Shapiro (2010), Larcinese, Puglisi and Snyder (2010), Puglisi and Snyder (2010), Snyder and Strömberg (2010), Durante and Knight (2011), and Puglisi (2011). As Prat and Strömberg (2010) state, these papers do *not* study the effects of media bias on politicians' behavior (i.e., political accountability) through election, which is our focus in this paper.

[10]Another important issue that is assumed away in this paper is *media competition*. Chan and Suen (2008, 2009), among others, model both mass media competition and electoral competition. Chan and Suen (2009) assume media bias while their companion paper (2008) assume that media bias is caused by media's profit motive. In a similar model, Chan and Stone (2012) study the desirability of media proliferation. Stone (2011) proposes a model to show that media competition may make voters less informed about political situations because competing media firms differentiate from each other by employing extreme news reporters.

distorts public policies toward large groups. Mullainathan and Shleifer (2005) propose an "information processing" model to consider whether media competition or diversity of readers' opinions is important for the accuracy of media information. Mullainathan and Shleifer (2005) predict that competition *per se* plays a limited role, i.e., the more diverse the readers' opinions, the more fierce the media competition. In these two studies, media bias is endogenously obtained, while our aim in the present paper is to focus more on the effects of media bias on politicians' behavior and electoral outcomes in the context of voting.[11]

Baron (2006) ascribes media bias to career concerns of journalists in the media industry. In Baron's (2006) model, individuals demand news that can improve their personal decisions. As in our paper, information is incomplete, which creates media bias via individual incentives of agents on both demand and supply sides. Gentkow and Shapiro (2006) construct a game between monopolistic media and consumers. In their model, media bias results from low-quality media's motivation to mimic high-quality media (in order to attract consumers). Whereas these studies focus on how media bias is endogenously created, the present paper focuses on another issue, namely, how the *direction* in media bias (whether the media is against or for the incumbent) affects a politician's actions and the voting behavior of the public, while assuming that media bias is exogenously given. In addition, note that these papers do *not* directly focus on the relationships between media bias and political accountability.

Besley and Prat (2006), Corneo (2006), Bernhardt, Krasa, and Polborn (2008), Warren (2012), and Chiang and Knight (2011), among others, study *voting behavior in the presence of media bias*. Besley and Prat (2006) construct a retrospective voting model of corrupt behavior by media firms (*"media capture"*). In this model, an incumbent and media firms may collude, i.e., a media firm can suppress information about the incumbent's type by taking a bribe from him or her. Besley and Prat's (2006) main conclusion is that the greater the number of media firms, the less likely is the media capture occurs. This is because it becomes more costly for a politician to bribe all media firms and "buy" their silence when the number of media firms is greater. However, in contrast to Besley and Prat (2006), we assume that *no direct interaction occurs between politicians and media*

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[11]In a recent paper, Duggan and Martinelli (2011) propose a model of media slant based on spatial theory.

firms.

Corneo (2006) relates media bias to wealth concentration and media firm ownership, and conducts a welfare analysis of media bias. He showed that welfare decreases in many cases. In Corneo's (2006) formulation, a game of information transmission (with the "sender" being mass media and the "receiver" being voters) is explicitly modeled, in which two types of journalists, opportunistic and idealistic, are introduced. A similar setting is assumed in the present paper. In contrast to the present paper, politicians' behavior plays *no* role in Corneo's (2006) model.

Bernhardt, Krasa, and Polborn (2008) propose a model in which each voter determines how much time he or she spends listening to biased media (listening entails a cost), and the profit of a media firm is the aggregate sum of the listening time of all voters in a constituency. This structure creates electoral outcomes that differ from the ideal ones, although the voters are aware that media are biased. In contrast to the present paper, Bernhardt, Krasa, and Polborn (2008) do *not* model politicians' behavior. In addition, most papers in the literature considers only one direction in media bias, either conservative (e.g., DellaVigna and Kaplan (2007)) or liberal (e.g., Groseclose and Milyo (2005)). On the other hand, our study acknowledges media bias in *both directions*, i.e., antagonistic bias against and protagonistic bias for the incumbent coexist.

Warran (2012) proposes a similar model of political accountability. With strong market incentives, moderate pro-incumbent bias can make auditors work harder, while too much bias can lead to suppression of bad news. The differences between Warren (2012) and the present study are the following. First, our model has a unique equilibrium. Second, we allow the quality of a challenger to differ that of an incumbent, and show that the difference is crucial in the way the direction of media bias affects voter behavior.[12]

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[12]Recently, Ashworth and Shotts (2010) use a similar voting model to study how informative media changes politicians' incentives to pander to voters, though they do not consider media bias in their analysis. Their main result is that informative media can encourage pandering incentives: even if media are not biased, pandering incentives may not be fully eliminated. In Ashworth and Shotts' (2010) model, there is uncertainty with regard to the state of the world, and the incumbent is inclined to pander to voters' prior belief of the state to avoid too much the burden of proof for his or her policy choice. Ashworth and Shotts (2010) show that this occurs if a challenger's competence is close to his or her own, and if voters are not sufficiently capable of understanding the realization of the state of the world. In contrast to Ashworth and Shotts (2010), our model below assumes that voters are uncertain about the incumbent's policy preferences, rather than about his or her ability in understanding the state of the world.

Lastly, Chiang and Knight (2011) conduct an emprical analysis of media bias on voter behavior in the context of newspaper endorsement. Voters are uncertain over candidate quality. Using data from the 2000 and 2004 US presidential elections, Chiang and Knight (2011) find that media bias affects voters in an interesting way: moderate voters are most influenced by newspaper endorsements, and left-learning media's endorsements are less influential. Chiang and Knight's (2011) findings validate our theoretical analysis in the sense that they suggest that the relationship between media bias and voter behavior is not a merely theoretical hypothesis.

3 The Model

We construct a two-period retrospective voting model of political accountability. Our model is not framed in a specific context such as public goods provision and public spending, but can be applied to a variety of contexts. This is a dynamic game of incomplete information played between an incumbent politician and voters. There is no time discounting. In the first period, an incumbent holds office (for exogenous reasons).[13] There are two possible types of politicians, *ethical* (E) and *opportunistic* (O). To simplify our analysis, we assume that the ex-ante probability of the incumbent being ethical is one half (i.e., $\Pr(E) = \Pr(O) = 1/2$).[14] The actual type of the incumbent is determined randomly at the beginning of the game. It is the incumbent's private information: this information is known only to the incumbent, whereas from the viewpoint of voters, the two types are equally likely at the beginning of the game (hereafter, we use "he" as a pronoun for a politician and "she" for a voter, following the tradition of the principal-agent theory).

The incumbent performs two possible actions: *dishonest behavior* (D) and *honest behavior* (H). These actions, such as taking a bribe, backroom diplomacy, and fiscal decision making, cannot be directly observed by the voters; hence they are interpreted as secret behaviors. Here, we assume that an ethical incumbent always selects H because of factors such as extremely high ethical cost of performing a dishonest action. On the other hand, an opportunistic incumbent can select either D or H. Let $\sigma \in [0,1]$ denote the probability that an opportunistic incumbent selects D. If he selects D, he obtains a

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[13]For a study on the selection of politicians from the outset, see Mattozzi and Merlo (2008, 2009).

[14]It can be observed that generalizing this probability is not useful for our results and complicates the calculations.

private rent $R > 0$ in the first period, whereas he does not gain anything if he selects H.[15] There are various interpretations of private rent R, such as personal use of government budget, or using the budget for his daily political activities and future elections (see, e.g., Chapter 1 of Persson and Tabellini (2000) for further discussions of this type of rent).

Voters in our model are assumed to have homogeneous preferences so that we can treat them as a representative voter. They do not exactly know whether the incumbent's type is E or O (i.e., the odds are equal by the assumption above). In addition, they cannot observe which action the incumbent has performed but can obtain information regarding the incumbent's behavior *through mass media* in the following manner.

If action H is selected, the mass media observe signal h with a probability of $\pi \in$ (1/2,1) and signal d with a probability of $1 - \pi$. Similarly, if action D is selected, they observe signal d with a probability of π and observe signal h with a probability of $1 - \pi$. A signal can be interpreted as one that gives information about a politician's behavior, for example, whom the politician meets everyday and what he talks about in a town meeting. The signal should not be considered as "hard" evidence, rather it is "soft" information that needs clarification (Subsection 6.1 verifies that our main results are valid even if an alternative model with hard information is considered). Voters cannot observe the signal; it can be observed only by social entities that specialize in information processing, i.e., mass media. To simplify the following analysis, we assume the symmetry of the information structure (i.e., $\Pr(h|H) = \Pr(d|D) = \pi$). However, incorporating asymmetry should not invalidate the main results of the analysis.[16] Here, π represents the media organizations' ability to process and analyze information.[17]

In reality, media outlets may be heterogenous in terms of attitude toward incumbent politicians and parties. While some media firms may harshly attack incumbents, others may enthusiastically support them. There may be others who take the middle path. To model media bias in a simple manner, we assume that voters face the media *as a whole*,

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[15] Another method of formulating different types of politicians is to assume that each politician is either opportunistic or *fraudulent* in the sense that he always performs a dishonest action. This formulation is discussed in Appendix A. One of the main differences is that multiple equilibria arise in that formulation, whereas there is a unique equilibrium in the formulation below.

[16] Another possible formulation is to allow a continuous choice for R (with the honest politician always selecting $R = 0$) and the dependence of π on R such as $\Pr(h|R) \equiv \pi(R)$ (and thus $\Pr(d|R) = 1 - \pi(R)$). However, this would complicate the analysis.

[17] In the case of $\pi = 1$, if the media observes signal "d", then they know with certainty that the incumbent is opportunistic. This makes our equilibrium analysis less interesting (see below).
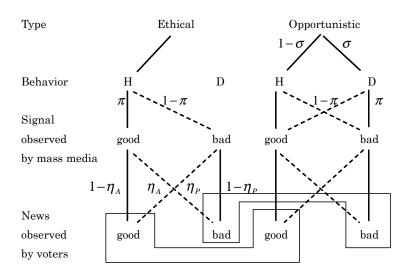
Figure 2: Information Structure when Mass Media are Biased

and that they obtain information from the media as if they are a single agent.

After the mass media observe a signal, they "interpret" the signal and report news to the voters. However, in "interpreting" the signal, the mass media can be biased and misreport news with a positive probability, possibly because of their inherent favorable perception of the incumbent politician. We assume that the mass media are nonstrategic to avoid difficulties in modeling a signaling game, and we keep our model sufficiently simple to capture the fact that news can be reported in different ways. Figure 2 depicts the information structure from the incumbent politician to the voters through mass media. Throughout this paper, we assume that information flows without any cost. If the mass media observe h, they misreport it as news "b" (bad) with a probability of $\eta_A \in [0,1]$, and report it as news "g" (good) with a probability of $1 - \eta_A$. If mass media observe d, they misreport it as news "g" with a probability of $\eta_P \in [0,1]$, and report it as news "b" with a probability of $1 - \eta_P$.[18]

We assume that media bias is exogenously given, and hence, η_A and η_P are exogenous

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[18]More simply, by assuming that a large number of media firms exist and that each firm is partisan in the sense that it is either pro- or anti-incumbent biased (and the degree of bias in each group is common), we can interpret $\eta_A/(\eta_A + \eta_P)$ as the ratio of media firms that distort signal h into bad news, and $\eta_P/(\eta_A + \eta_P)$ as the ratio of media firms that distort signal d into good news. This aggregation idea would be less relevant if one assumes that media outlets are strategic (strategic mass media are considered in Subsection 6.2).

variables. Media bias in our model may be caused by sources such as media capture (Besley and Prat (2006)) and journalists' left-leaning tendencies (Baron (2006)). As already mentioned, we consider two types of media bias: the media are said to have "*anti-incumbent*" bias if $\eta_A > 0$ and "*pro-incumbent*" bias if $\eta_P > 0$.[19] Note that the mass media can have *both* anti- and pro-incumbent bias (i.e., both $\eta_A > 0$ and $\eta_P > 0$). However, they can be more or less biased in favor of or against the incumbent (i.e., $\eta_A < \eta_P$ or $\eta_A > \eta_P$). Their political stance is characterized in Figure 3. The sum of η_A and η_P is termed as the *degree* of media bias and the ratio η_P/η_A is termed as the *direction* of media bias. Without loss of generality, we impose a natural assumption that $\eta_A + \eta_P < 1$, i.e., the mass media cannot be extremely much biased in both directions.[20] In Subsection 6.2, we discuss how mass media are biased if they behave strategically to achieve some objectives. In reality, there may be some media firms that have only anti-incumbent bias ($\eta_A \in (0, 1]$ and $\eta_P = 0$), and there may be other media firms that have only pro-incumbent bias ($\eta_A = 0$ and $\eta_P \in (0, 1]$). However, the media as a whole must have some intermediate values between the two bias directions.

Our specification allows media firms to "fabricate" real news, while studies on mass media and voting such as Besley and Prat (2006) and Bernhardt, Krasa and Polborn (2008) allow media firms only to reveal or hide *negative* news about politicians. Our specification is the simplest way to consider the effects of the *directions* of media bias on *both* politicians' behaviors and electoral outcomes.[21] There are many methods of "fabricating" and "interpreting" real news from literally creating to overemphasizing, distorting, or hiding information. In this sense, the mass media in our model are no more than "frictions," although they are necessary for relaying information about politicians' behaviors to voters.[22]

After receiving news through mass media, a representative voter decides whether to

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[19]Note that we do not use the terms "conservative" and "liberal" because the incumbent himself may be conservative or liberal.

[20]If both $\eta_A > 1/2$ and $\eta_P > 1/2$ are valid, receiving news g (resp. b) implies to voters that mass media are more likely to have observed signal d (h) than signal h (d). Then, voters only have to interpret news g (b) as a bad (good) signal. As only the notations of news change, the analysis does not change.

[21]We assume that voters know that media can be biased. This assumption seems plausible given the numbers in Table 1 (A).

[22]Prat and Strömberg (2010) categorize media bias into three types: (1) issue bias, (2) facts bias, and (3) framing bias. As in many papers on political economics, our focus is on facts bias (relative to the truth). Notice also that in our model, media bias is driven by the supply-side.
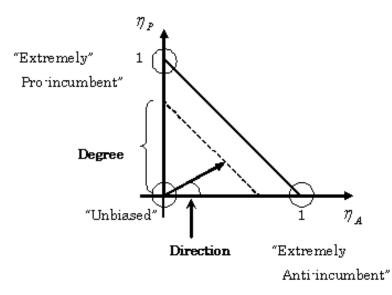
Figure 3: Degree of and Direction in Media Bias

reelect the incumbent or to elect a challenger.[23] That is, her pure strategy is described by a function from the news she receives to the candidate she elects: $\{g, b\} \rightarrow \{incumbent, challenger\}$. Mixed strategies are also allowed. Let $\gamma_y \in [0, 1]$ denote the probability of reelecting the incumbent when voters receive news $y \in \{g, b\}$. The challenger's type is his private information, and he is ethical with probability $\alpha \in (0, 1)$ or opportunistic with probability $1 - \alpha$ in the view of voters. As seen in the next section, the value of α is key in deriving our main results.[24]

We do not explicitly consider the actions of the politicians in the second period. Because the game ends after the second period, the incentive for not selecting D is not available to opportunistic politicians by means of voting. We assume that the politicians can obtain salary $s > 0$ if they are in office in the second period.

Finally, we assume that a representative voter is concerned with electing an ethical

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[23]Another voting model can be considered where some partisan voters always listen to only pro-incumbent media firms or only anti-incumbent media firms. We assume that the proportion of independent voters who indiscriminately listen to media as a whole is sufficiently large to be considered as pivotal voters (as in Feddersen and Pesendorfer (1996)).

[24]Only the relative relationship between α and $1/2$ is important in our results. Hence, the basic logic does not change even if we reconstruct the model in such a way that voters cannot guess the challenger's type (i.e., two types are equally likely for the challenger), whereas they know whether the incumbent is more likely to be ethical or opportunistic. The formulation in the main text simplifies calculations.

politician for the second period. This is because an ethical politician never selects a dishonest action while an opportunistic politician selects a dishonest action with certainty in the second period after the election. In deriving the representative voter's optimal decision, we assume, without loss of generality, that she obtains a payoff of 1 if she elects an ethical politician successfully, and 0 if she elects an opportunistic politician.[25],[26] Thus, her utility is not accrued from politicians' actions. The next section provides an equilibrium analysis under the behavioral assumption described above. In Section 5 where we evaluate voter welfare, we consider the case where dishonest behavior hurts the welfare of the voters.

4   Equilibrium Analysis

In this section, we derive the perfect Bayesian equilibria of the model. As a benchmark, we first study the case where the mass media are unbiased. Then, we consider the case of biased mass media. The case without media bias, which is an extreme case of our general model with respect to parameter values, helps us understand in a simple setup the importance of information value of each news report for the incumbent and the voters.

4.1   Equilibria without Media Bias

Assume that the mass media are unbiased (i.e., $\eta_A = \eta_P = 0$). Note that all nodes (namely, events h and d) can be reached with positive probabilities for any $\sigma \in [0,1]$ (because $\pi < 1$). As described later, whether the challenger is more likely to be ethical than the incumbent (i.e., whether α is less than $1/2$) is important for the characterization of equilibria.

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[25]The results do not change if we replace the representative voter's payoff from electing an ethical politician with any other positive value, instead of 1. Appendix B also verifies that the optimal voting strategy remains the same even if we assume that the voters consider disutility from dishonest behavior in each period. In addition, even if voters' payoff from electing the ethical incumbent is different from that of electing an ethical challenger, our results qualitatively remains the same.

[26]One may think that if a representative voter were able to commit herself to electing a particular candidate (i.e., either the incumbent or the challenger) at the beginning of the first period irrespective of news formation, then her ex-ante payoff would be maximized, i.e., irrespective of news provided by the media would reelect the incumbent if $\alpha \leq 1/2$ or the challenger if $\alpha > 1/2$. However, Appendix C shows that if R is not large, the voters' expected payoffs with and without such commitment are *exactly the same*. It is also shown that if R is sufficiently large, voters benefit by watching the news.

The case of $\alpha < 1/2$ is interpreted as the situation where voters ex-ante prefer the incumbent to the challenger, and vice versa for the case of $\alpha > 1/2$.[27] The former case would be more likely in a more fully dynamic situation: Ashworth and Bueno de Mesquita (2008) argue that selection effects make the quality of an incumbent higher (on average) than that of a challenger in repeated elections. Thus, we focus the case of $\alpha < 1/2$ in the analysis below. The case of $\alpha > 1/2$ can be analyzed analogously.

4.1.1 Case of $\alpha < 1/2$

Assume that the challenger is less likely to be ethical than the incumbent (i.e., $\alpha < 1/2$). In this case, voters will reelect the incumbent as long as he is not highly likely to be opportunistic. We obtain the following result.

Proposition 1. *Assume that the mass media are unbiased (i.e., $\eta_A = \eta_P = 0$), the challenger is less likely to be ethical (i.e., $\alpha < 1/2$), and the information structure is sufficiently accurate that $\pi > 1 - \alpha$. If the private rent from dishonest behavior is so large that $R > (2\pi - 1)s$, then the game has a unique perfect Bayesian equilibrium, $(\sigma^* = 1, \gamma_g^* = 1, \gamma_b^* = 0)$, where voters reelect the incumbent only when they receive good news, and the opportunistic incumbent performs a dishonest action with certainty. If $R \in (0, (2\pi - 1)s)$, then the game has a unique perfect Bayesian equilibrium*

$$\left(\sigma^* = \frac{(1 - 2\alpha)(1 - \pi)}{(2\pi - 1)\alpha}, \ \gamma_g^* = 1, \ \gamma_b^* = 1 - \frac{R}{(2\pi - 1)s} \right),$$

where voters do not necessarily elect the challenger even when they receive bad news, and the opportunistic incumbent performs a dishonest action with a positive probability.[28]

Proof. See Appendix D. $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\square$

Figure 4 describes the unique perfect Bayesian equilibrium for $R \in (0, (2\pi - 1)s)$. The bold solid line depicts the value of $\gamma_g - \gamma_b$. Note that $\gamma_g - \gamma_b$ can take any real number with the minimum being zero and the maximum being one, and it *increases* as the probability of dishonesty σ increases, which might appear *counterintuitive*. However,

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[27]It is easily verified that if $\alpha = 1/2$, then voters reelect the incumbent if news g is received, and elect the challenger if news b is realized. In this case, the opportunistic incumbent never takes a dishonest action unless R is extremely large.

[28]It can be observed that if $R = (2\pi - 1)s$, there is a continuum of the equilibria with $\sigma \in [(2\alpha - 1)\pi/(2\pi - 1)\alpha, 1]$, $\gamma_g = 1$ and $\gamma_b = 0$.
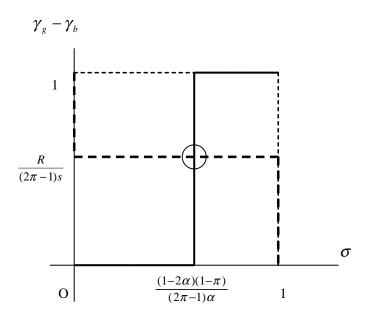
Figure 4: The Unique Perfect Bayesian Equilibrium without Media Bias for $R \in (0, (2\pi - 1)s)$

the logic is simple and is explained in the following manner. When the ex-ante probability of the challenger being ethical is lower than that of the incumbent (i.e., $\alpha < 1/2$), voters elect the incumbent with certainty if they receive good news (i.e., $\gamma_g(\sigma) = 1$ for any $\sigma \in [0,1]$). When voters receive bad news, however, they consider whether to reelect the incumbent. The decision to reelect the incumbent thus depends on the *information value of bad news* regarding the type of the incumbent. If the opportunistic incumbent performs a dishonest behavior with a higher probability (i.e., higher σ), then bad news implies that the incumbent is *more likely to be opportunistic*. It can be verified that $\Pr(E|b)$ *decreases* with respect to σ. Therefore, voters reelect the incumbent (i.e., $\gamma_b(\sigma) = 1$) if σ is sufficiently small, but not (i.e., $\gamma_b(\sigma) = 0$) if σ is sufficiently large.

The bold dashed line corresponds to the optimal dishonesty strategy for the opportunistic incumbent when the private rent is not very large (i.e., $R \in (0, (2\pi - 1)s)$). If dishonest behaviors are highly likely to result in being defeated in the election in comparison with honest behaviors (i.e., $\gamma_g - \gamma_b$ is large), then the opportunistic incumbent will not perform a dishonest action (i.e., $\sigma = 0$), and vice versa. Therefore, the probability of dishonesty negatively affects or decreases his reelection probability, and there exists a value of $\gamma_g - \gamma_b$ at which the opportunistic incumbent is indifferent toward selecting between dishonest and honest behaviors.

The mixed-strategy equilibrium is determined at the intersection of the two reaction correspondences. In the equilibrium, the election plays a disciplinary role but its effect is limited in the sense that the opportunistic incumbent performs a dishonest action with a probability that is strictly between zero and one.

To understand why there exists *no* pure-strategy equilibrium, assume that the opportunistic incumbent never performs a dishonest action (i.e., $\sigma = 0$). Then, he is *behaviorally equivalent* to the ethical politician. In this case, the news media provide voters with no more information than what they originally have, i.e., the incumbent is ethical with a probability of one half. Then, the opportunistic incumbent, knowing that he will be reelected with certainty (because $\alpha < 1/2$), will perform a dishonest action with certainty, leading to a contradiction. Next, assume that the opportunistic incumbent performs a dishonest action with certainty (i.e., $\sigma = 1$). Then, since the voters regard the bad news as a sufficiently reliable proof that the incumbent is opportunistic, they elect the challenger with certainty if they receive bad news. On the other hand, good news is a proof

of the incumbent being ethical: hence the voters reelect the incumbent if they receive good news. These voting behaviors give the opportunistic incumbent reasons to refrain from being dishonest, which leads to a contradiction. Hence, the equilibrium probability of dishonesty must be strictly between zero and one.

It is clear that if the private rent from a dishonest behavior is sufficiently attractive for the incumbent (i.e., $R > (2\pi - 1)s$), then the bold dashed line in Figure 4 will be modified into a vertical line at $\sigma = 1$. In this case, voters cannot prevent the opportunistic incumbent from performing a dishonest action.

4.1.2 Case of $\alpha > 1/2$

Next, we consider the case where the challenger is more likely to be ethical than the incumbent (i.e., $\alpha > 1/2$). In this case, the above analysis for $\alpha < 1/2$ changes as follows. The voters are willing to replace the incumbent with the challenger if the incumbent seems opportunistic. Therefore, when the voters receive bad news, they elect the challenger with certainty. We can verify that $\Pr(E|b) < 1/2$ for any $(\sigma, \pi) \in [0,1] \times (1/2,1)$, so that $\gamma_b^*(\sigma) = 0$ for all $\sigma \in [0,1]$. On the other hand, when voters receive good news, the decision to reelect the incumbent will depend on the *information value of good news*. If the information structure is sufficiently accurate such that $\pi > \alpha$, then we obtain the voters' optimal probability of reelecting the incumbent conditional on good news being received as

$$\gamma_g^*(\sigma) = \begin{cases} 1 & \text{if } \sigma > \dfrac{(2\alpha - 1)\pi}{(2\pi - 1)\alpha} \\[2ex] [0,1] & \text{if } \sigma = \dfrac{(2\alpha - 1)\pi}{(2\pi - 1)\alpha} \\[2ex] 0 & \text{if } \sigma < \dfrac{(2\alpha - 1)\pi}{(2\pi - 1)\alpha}. \end{cases}$$

That is, if the opportunistic incumbent performs a dishonest action with a higher probability, then good news implies that the incumbent is more likely to be ethical. Hence, voters reelect the incumbent (i.e., $\gamma_g^*(\sigma) = 1$) for sufficiently large σ. Note that $\gamma_g - \gamma_b$ increases as σ increases as in the case of $\alpha < 1/2$. On the other hand, the reaction correspondence of the opportunistic incumbent is the same as that for $\alpha < 1/2$. Therefore, if $R \in (0, (2\pi - 1)s)$, we can draw a graph similar to Figure 4. The game has a unique

perfect Bayesian equilibrium, which is described in the following proposition.

Proposition 2. *Assume that the mass media are unbiased (i.e., $\eta_A = \eta_P = 0$), the challenger is more likely to be ethical (i.e., $\alpha > 1/2$), and the information structure is sufficiently accurate that $\pi > \alpha$. If the private rent from dishonest behavior is sufficiently large that $R > (2\pi - 1)s$, then the game has a unique perfect Bayesian equilibrium, ($\sigma^* = 1$, $\gamma_g^* = 1$, $\gamma_b^* = 0$). In this equilibrium, voters reelect the incumbent only when they receive good news, and the opportunistic incumbent performs a dishonest action with certainty. If $R \in (0, (2\pi - 1)s)$, then the game has a unique perfect Bayesian equilibrium*

$$\left(\sigma^* = \frac{(2\alpha - 1)\pi}{(2\pi - 1)\alpha}, \; \gamma_g^* = \frac{R}{(2\pi - 1)s}, \; \gamma_b^* = 0 \right),$$

where voters do not necessarily reelect the incumbent even when they receive good news, and the opportunistic incumbent performs a dishonest action with a positive probability.

The equilibrium for the case of $\alpha > 1/2$ favors the challenger than the equilibrium for the case of $\alpha < 1/2$, i.e., when voters receive bad news, they never reelect the incumbent in the case of $\alpha > 1/2$, whereas the same does not always happen in the case of $\alpha < 1/2$. In either case, however, the opportunistic politician performs a dishonest action with a positive probability.

As seen in Propositions 1 and 2, if the challenger is less (resp. more) likely to be ethical than the incumbent, then the information value of bad (resp. good) news matters in voter decisions. This property is important in the analysis of media bias in subsection 4.2.

4.1.3 Equilibrium Probability of an Ethical Politician Being Elected for the Second Period

Before introducing media bias into the model, we examine the equilibrium probability of an ethical politician (either the incumbent or the challenger) being elected for the second period.

			Challenger	
			α	$1 - \alpha$
			(E)	(O)
Incumbent	1/2	(E)	1	$\mu(E)$
	1/2	(O)	$1 - \mu(O)$	0

The ex-ante reelection probability of the incumbent with type $t \in \{E, O\}$ is given by

$$\mu(t) = \Pr(g|t)\gamma_g + \Pr(b|t)\gamma_b. \tag{1}$$

Table 2 depicts the probability of an ethical politician being elected for the second period for each pair of the possible types. From this table, the probability of an ethical politician being elected for the second period is given by

$$\frac{1}{2}\alpha \times 1 + \frac{1}{2}(1-\alpha)\mu(E) + \frac{1}{2}\alpha[1 - \mu(O)]$$
$$= \alpha + \frac{1}{2}(1-\alpha)\mu(E) - \frac{1}{2}\alpha\mu(O).$$

Note that, without media bias, we obtain

$$\Pr(g|E) = \pi,$$
$$\Pr(b|E) = 1 - \pi,$$
$$\Pr(g|O) = (1-\sigma)\pi + \sigma(1-\pi) = \pi - (2\pi - 1)\sigma$$

and

$$\Pr(b|O) = (1-\sigma)(1-\pi) + \sigma\pi = 1 - \pi + (2\pi - 1)\sigma.$$

Consider the case of $\alpha < 1/2$ (analogous arguments apply to the case of $\alpha > 1/2$). Using the mixed-strategy equilibrium in Proposition 1, we can calculate:

$$\mu(E) = 1 - \frac{(1-\pi)R}{(2\pi - 1)s}$$

and

$$\mu(O) = 1 - \frac{(1-\alpha)}{\alpha}\frac{(1-\pi)R}{(2\pi - 1)s},$$

which leads to

$$\alpha + \frac{1}{2}(1-\alpha)\mu(E) - \frac{1}{2}\alpha\mu(O) = \frac{1}{2}.$$

This is exactly the probability of electing an ethical politician voters can achieve when they do not make use of the news and reelect the incumbent who is ethical with

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probability $1/2$. The logic behind this result is as follows. If $R > (2\pi - 1)s$, the unique equilibrium is $(\sigma^* = 1, \gamma_g^* = 1, \gamma_b^* = 0)$. In this equilibrium, the probability of electing an ethical politician is

$$\alpha + \frac{1}{2}(1 - \alpha)\mu(E) - \frac{1}{2}\alpha\mu(O) = \frac{1}{2}(\pi + \alpha) > \frac{1}{2}.$$

Thus, this probability is higher than in the case when news is ignored.

In summary, if $R < (2\pi - 1)s$, voters expect a lower probability of dishonest action by using the news for their voting decisions while the probability of electing an ethical politician remains the same. On the other hand, if $R > (2\pi - 1)s$, voters achieve a higher probability of electing an ethical politician, while they cannot prevent the opportunistic politician from performing a dishonest action, regardless of the use of the news. In either case, using the news is beneficial in their voting decisions.[29]

4.2 Equilibria with Media Bias

In this subsection, we introduce media bias by assuming η_A, $\eta_P > 0$. The following proposition describes the equilibrium with media bias for the case where the incumbent is (ex-ante) less likely to be opportunistic (i.e., $\alpha < 1/2$).

Proposition 3. *Suppose that there exists media bias (i.e., η_A, $\eta_P > 0$), the challenger is less likely to be ethical (i.e., $\alpha < 1/2$), and the information structure is sufficiently accurate that $\pi > 1 - \alpha$ and $(\pi - \alpha)\eta_A/(\pi + \alpha - 1) + \eta_P < 1$. If the private rent from dishonest behavior is so large that $R > [1 - (\eta_A + \eta_P)](2\pi - 1)s$, then the game has a unique perfect Bayesian equilibrium, $(\sigma^* = 1, \gamma_g^* = 1, \gamma_b^* = 0)$, where voters reelect the incumbent only when they receive good news, and the opportunistic incumbent performs a dishonest action with certainty. If $R \in (0, [1 - (\eta_A + \eta_P)](2\pi - 1)s)$, then the game has a unique perfect Bayesian equilibrium*

$$\left(\sigma^* = \frac{(1 - 2\alpha)[(1 - \eta_P)(1 - \pi) + \eta_A\pi]}{[1 - (\eta_A + \eta_P)](2\pi - 1)\alpha}, \gamma_g^* = 1, \gamma_b^* = 1 - \frac{R}{[1 - (\eta_A + \eta_P)](2\pi - 1)s}\right),$$

where voters do not necessarily elect the challenger even when they receive bad news, and the opportunistic incumbent performs a dishonest action with a positive probability.

Proof. See Appendix E. □

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[29]More detailed argument including the case of $\alpha > 1/2$ is provided in Appendix C.

Similarly, we can also derive the unique equilibrium for the case of $\alpha > 1/2$.

Proposition 4. *Suppose that there exists media bias (i.e., $\eta_A, \eta_P > 0$), the challenger is more likely to be ethical (i.e., $\alpha > 1/2$), and the information structure is sufficiently accurate that $\pi > \alpha$ and $\eta_A + (\pi + \alpha - 1)\eta_P/(\pi - \alpha) < 1$. If the private rent from dishonest behavior is so large that $R > [1 - (\eta_A + \eta_P)](2\pi - 1)s$, then the game has a unique perfect Bayesian equilibrium, ($\sigma^* = 1$, $\gamma_g^* = 1$, $\gamma_b^* = 0$), where voters reelect the incumbent only when they receive good news, and the opportunistic incumbent performs a dishonest action with certainty. If $R \in (0, [1 - (\eta_A + \eta_P)](2\pi - 1)s)$, then it has a unique perfect Bayesian equilibrium*

$$\left(\sigma^* = \frac{(2\alpha - 1)[(1 - \eta_A)\pi + \eta_P(1 - \pi)]}{[1 - (\eta_A + \eta_P)](2\pi - 1)\alpha}, \ \gamma_g^* = \frac{R}{[1 - (\eta_A + \eta_P)](2\pi - 1)s}, \ \gamma_b^* = 0 \right),$$

where voters do not necessarily reelect the incumbent even when they receive good news, and the opportunistic incumbent performs a dishonest action with a positive probability.[30]

Note that the condition for the equilibrium ($\sigma^* = 1$, $\gamma_g^* = 1$, $\gamma_b^* = 0$) in Propositions 3 and 4, $R > [1 - (\eta_A + \eta_P)](2\pi - 1)s$, is rewritten as $\eta_A + \eta_P > 1 - R/[(2\pi - 1)s]$. This implies that if the total amount of media bias is sufficiently large, then the incumbent's dishonest behavior cannot be prevented.

4.3   The Effect of Media Bias on Dishonest Behavior

We now examine the effect of media bias on dishonest behavior. By comparing Propositions 1 and 3, we have the following corollary.

Corollary 1. *Suppose that the challenger is less likely to be ethical (i.e., $\alpha < 1/2$), the information structure is sufficiently accurate that $\pi > 1 - \alpha$ and $(\pi - \alpha)\eta_A/(\pi + \alpha - 1) + \eta_P < 1$, and the private rent from dishonest behavior is sufficiently small that $R < [1 - (\eta_A + \eta_P)](2\pi - 1)s$. Then, the probability of dishonesty is strictly greater when media bias exists (i.e., $max\{\eta_A, \eta_P\} > 0$) than when such bias does not exist (i.e., $\eta_A = \eta_P = 0$) if and only if mass media have "anti-incumbent" bias (i.e., $\eta_A > 0$).*

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[30]It is easy to see that if $R = [1 - (\eta_g + \eta_b)](2\pi - 1)s$, then there is a continuum of equilibria with $\sigma^* \in \left[\frac{(2\alpha - 1)[(1 - \eta_g)\pi + \eta_b(1 - \pi)]}{[1 - (\eta_g + \eta_b)](2\pi - 1)\alpha}, 1 \right]$, $\gamma_g^* = 1$ and $\gamma_b^* = 0$.

This corollary is obtained by calculating the difference in equilibrium dishonesty probabilities between cases with and without media bias as follows:

$$\sigma^*|_{\eta_A,\eta_P>0,\alpha<1/2} - \sigma^*|_{\eta_A=\eta_P=0,\alpha<1/2} = \frac{(1-2\alpha)\eta_A}{[1-(\eta_A+\eta_P)](2\pi-1)\alpha},$$

which derives

$$\frac{\partial(\sigma^*|_{\eta_A,\eta_P>0,\alpha<1/2} - \sigma^*|_{\eta_A=\eta_P=0,\alpha<1/2})}{\partial\eta_A} = \frac{(2\alpha-1)(2\pi-1)\alpha(1-\eta_P)}{\{[1-(\eta_A+\eta_P)](2\pi-1)\alpha\}^2} > 0$$

and

$$\frac{\partial(\sigma^*|_{\eta_A,\eta_P>0,\alpha<1/2} - \sigma^*|_{\eta_A=\eta_P=0,\alpha<1/2})}{\partial\eta_P} = \frac{(1-2\alpha)\eta_A}{[1-(\eta_A+\eta_P)]^2(2\pi-1)\alpha} > 0.$$

Voters reelect the incumbent if the incumbent's probability of being ethical conditional upon the received news is greater than that of the challenger (i.e., $\Pr(E|\cdot) > \alpha$). Therefore, we now examine the effect of media bias on $\Pr(E|\cdot)$ in order to understand Corollary 1.

Corollary 1 assumes that the challenger is more likely to be opportunistic than the incumbent (i.e., $\alpha < 1/2$). Then, as mentioned in the previous subsection, inequality $\Pr(E|g) > \alpha$ holds for any $\sigma \in [0,1]$, and voters reelect the incumbent with certainty when they receive good news about the incumbent. However, when they receive bad news, whether inequality $\Pr(E|b) > \alpha$ holds or not depends on the probability of dishonesty, σ. Therefore, we should focus on the effect of media bias on $\Pr(E|b)$. Bad news reaches the voters through the following two routes (see also Figure 2):

(A) unfavorable information (signal d) is produced by the incumbent's behavior, and mass media report bad news about the incumbent to the voters;

(B) favorable information (signal h) is produced by the incumbent's behavior, but the biased media misreport this behavior as bad news to the voters.

In the case of no media bias (i.e., $\eta_A = \eta_P = 0$), only route (A) exists. Now, suppose that media bias exists, but that mass media have no anti-incumbent bias, never distorting favorable information into bad news (i.e., $\eta_A = 0$ and $\eta_P > 0$). Then, route (B) does not

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exist. The effect of such media reporting on $\Pr(E|b)$ through route (A) is clarified by comparing the probability of receiving news "b", conditional on the incumbent's type, through unbiased media (see Appendix D),

$$\begin{cases} \Pr(b|E) = 1 - \pi \\ \Pr(b|O) = (1-\sigma)(1-\pi) + \sigma\pi \end{cases}$$

and those through biased media (see Appendix E),

$$\begin{cases} \Pr(b|E) = \pi\eta_A + (1-\pi)(1-\eta_P) \\ \Pr(b|O) = (1-\sigma)[(1-\pi)(1-\eta_P) + \pi\eta_A] + \sigma[\pi(1-\eta_P) + (1-\pi)\eta_A]. \end{cases}$$

If $\eta_A = 0$, then we can obtain the latter equations by multiplying the former equations by $(1-\eta_P)$, respectively. This implies that when unfavorable information is produced by the incumbent's behavior, it does not reach the voters but is misreported as good news with probability η_P if mass media are biased. Since both $\Pr(b|E)$ and $\Pr(b|O)$ decrease by the same proportion, the ex-post probability $\Pr(E|b)$ remains the same between the two cases, $\eta_P = 0$ and $\eta_P > 0$. Therefore, if $\eta_A = 0$, then media bias does *not* alter the voters' decisions, and therefore the incumbent does not change his dishonest behavior.

Suppose that mass media have anti-incumbent bias, distorting favorable information into bad news with a positive probability, $\eta_A > 0$. Then, route (B) exists. In the case of an ethical incumbent, who always chooses H, bad news reaches the voters through route (B) if favorable information (signal h) is produced from behavior H and if the media distort the favorable information into bad news (with probability $\pi\eta_A$). In contrast, in the case of an opportunistic incumbent, who chooses D with probability σ and H with probability $1-\sigma$, bad news reaches the voters through route (B) in the following two ways. First, the incumbent chooses H, signal h is produced, and the media garble this favorable information to bad news (this occurs with probability $(1-\sigma)\pi\eta_A$). Second, the incumbent chooses D, signal h is produced, and the media distort this favorable information into bad news (this occurs with probability $\sigma(1-\pi)\eta_A$). As $\pi\eta_A > (1-\sigma)\pi\eta_A + \sigma(1-\pi)\eta_A$ holds (which is equivalent to $\pi > 1/2$), the probability of bad news reaching the voters through route (B) is greater in the case of an ethical incumbent than in the case of an opportunistic incumbent. Therefore, if $\eta_A > 0$, then $\Pr(E|b)$ increases compared to the case of no media bias, and voters become more likely to reelect the incumbent when they receive bad news (i.e., the threshold level of σ, where voters are indifferent between reelecting the incumbent and electing the challenger when they receive bad news, increases). The opportunistic

incumbent responds to this voting behavior and performs a dishonest action with a higher probability.

Similarly, the comparison between Propositions 2 and 4 yields the following result.

Corollary 2. *Suppose that the challenger is more likely to be ethical (i.e., $\alpha > 1/2$), the information structure is sufficiently accurate that $\pi > \alpha$ and $\eta_A + (\pi + \alpha - 1)\eta_P/(\pi - \alpha) < 1$, and the private rent from dishonest action is sufficiently small that $R < [1 - (\eta_A + \eta_P)](2\pi - 1)s$. Then, the probability of dishonesty is strictly greater when media bias exists (i.e., $max\{\eta_A, \eta_P\} > 0$) than when such bias does not exist (i.e., $\eta_A = \eta_P = 0$) if and only if mass media have "pro-incumbent" bias (i.e., $\eta_P > 0$).*

When the incumbent is more likely to be opportunistic than the incumbent (i.e., $\alpha > 1/2$), the information value of *good* news matters in voters' decisions. Therefore, the value of η_P, whether zero or strictly positive, determines the presence of the effect of media bias on both the incumbent's reelection probability and his probability of dishonesty.

Our arguments above provide the following interesting implications. As Ashworth and Bueno de Mesquita (2008) imply, if repeated elections make the average quality of an incumbent higher (on average) than that of a challenger ($\alpha < 1/2$), then anti-authority media firms, which distort favorable information into bad news, increase the probability of dishonest action by the incumbent. In this case, only when anti-authority media firms exist, pro-authority media firms, which garble bad information to good news, also affect the probability of dishonesty. In contrast, if selection plays a limited role, then democracies may expect a higher quality of challengers ($\alpha > 1/2$). In this case, pro-authority media firms increase the probability of dishonest action by the incumbent. However, only when pro-authority media firms exist, anti-authority media firms also affect the probability of dishonest behavior.

Thus, which type of mass media, anti-authority or pro-authority, has a decisive influence on the probability of dishonest behavior by the incumbent depends on whether the average quality of challengers is lower or higher than that of the incumbent.

4.4 Comparative Statics in the Presence of Media Bias

We now provide comparative statics in mixed-strategy equilibria. Set $\overline{\eta} = \eta_A + \eta_P$ (the absolute degree of media bias) and $\widetilde{\eta} = \eta_P/\eta_A$ ($= \overline{\eta}/\eta_A - 1$) (the relative degree of pro-incumbent bias).[31] Table 3 summarizes the results from comparative statics (see Appendix F for the details).

	$\alpha < 1/2$	$\alpha > 1/2$
$\partial \sigma^*/\partial \overline{\eta}$	$+$	$+$
$\partial \sigma^*/\partial \widetilde{\eta}$	$-$	$+$
$\partial \sigma^*/\partial \eta_A$	$-$	$+$
$\partial \sigma^*/\partial \alpha$	$-$	$+$
$\partial \sigma^*/\partial \pi$	$-$	$-$

Table 3: Signs of Comparative Statics

Note that an increase in the absolute degree of media bias increases the equilibrium probability of dishonesty in the cases of both $\alpha < 1/2$ and $\alpha > 1/2$. However, the effects of the relative degree of pro-incumbent bias on the equilibrium probability of dishonesty are reversed in the cases of both $\alpha < 1/2$ and $\alpha > 1/2$: if the incumbent is less (resp. more) likely to be opportunistic, the larger $\widetilde{\eta}$ decreases (increases) the equilibrium probability of dishonesty. These results indicate that the direction of media bias, rather than aggregate media bias, has opposite effects on dishonest behavior, depending on the political environment confronting the incumbent.

The third row shows that the effects of an increase in η_A are also opposite, *given* the absolute level of aggregate media bias. The fourth row shows that if the challenger is more (resp. less) likely to be ethical ex-ante, then a marginal increase in the ex-ante probability of the challenger being ethical increases (decreases) the incumbent's probability of dishonest behavior. Finally, an improvement in the information value of news always decreases the probability of dishonesty.

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[31]Note that the results of comparative statics with respect to $\widetilde{\eta}$ have exactly the same signs when comparative statics are conducted for $\eta_P/(\eta_A + \eta_P)$.

5 Voter Welfare

What is the effect of a higher probability of dishonesty σ on voter welfare? One may think that, paradoxically, dishonesty may improve voter welfare because a higher σ makes it easier for the voters to judge whether the incumbent is ethical or opportunistic conditional on the received news, which decreases their expected disutility in the second term (i.e., the *selection* effect). If this effect outweighs the increase in their disutility from dishonest behavior in the first term (i.e., the *discipline* effect), then the presence of media bias can increase voter welfare. To study these issues, this section examines the effect of media bias on ex-ante voter welfare.

Suppose that voters perceive a disutility $x > 0$ if a dishonest action occurs in each period.[32] It is possible that $x = R$ if the rent is a monetary transfer from the voters to the politician. Because $\Pr(E) = \Pr(O) = 1/2$, the ex-ante voter welfare is given by

$$
\begin{aligned}
W &\equiv \Pr(E) \left[\underbrace{0}_{\text{first-period}} + \underbrace{\mu(E) \times 0 + (1 - \mu(E))\left\{\alpha \times 0 + (1 - \alpha)(-x)\right\}}_{\text{second-period}} \right] \\
&\quad + \Pr(O) \left[\underbrace{(1 - \sigma) \times 0 + \sigma(-x)}_{\text{first-period}} + \underbrace{\mu(O)(-x) + (1 - \mu(O))\left\{\alpha \times 0 + (1 - \alpha)(-x)\right\}}_{\text{second-period}} \right] \\
&= \frac{1}{2}(1 - \mu(E))(1 - \alpha)(-x) + \frac{1}{2}\left[\sigma(-x) + \mu(O)(-x) + (1 - \mu(O))(1 - \alpha)(-x)\right] \\
&= -\frac{x}{2}\left[2(1 - \alpha) + \sigma + \alpha\mu(O) - (1 - \alpha)\mu(E)\right], \quad\quad\quad (2)
\end{aligned}
$$

where $\mu(t)$ is defined by equation (1), and

$$
\begin{aligned}
\Pr(g|E) &= \pi(1 - \eta_A) + (1 - \pi)\eta_P, \\
\Pr(g|O) &= [(1 - \sigma)\pi + \sigma(1 - \pi)](1 - \eta_A) + [\sigma\pi + (1 - \sigma)(1 - \pi)]\eta_P,
\end{aligned}
$$

and

$$
\Pr(b|t) = 1 - \Pr(g|t) \text{ for } t = E, O.
$$

First, we solve for the first best behaviors $(\sigma^{FB}, \gamma_g^{FB}, \gamma_b^{FB})$, assuming that voters can force the incumbent to choose a particular probability of dishonest behavior, σ. Since we

---

[32] As mentioned in Footnote 25 (and shown in Appendix B), the optimal voting strategy characterized in Sections 3 and 4 remains the same with this formulation. Thus, there is no discrepancy between the equilibrium analysis above and the welfare analysis.

have

$$
\begin{aligned}
\alpha\mu(O) - (1-\alpha)\mu(E) \;=\;\; & \alpha\{\eta_P + \pi(1-\eta_A-\eta_P) - (2\pi-1)\sigma(1-\eta_A-\eta_P)\}(\gamma_g - \gamma_b) \\
& +\alpha\gamma_b \\
& -(1-\alpha)[\pi(1-\eta_A-\eta_P)+\eta_P](\gamma_g - \gamma_b) \\
& -(1-\alpha)\gamma_b,
\end{aligned}
$$

maximizing W with respect to σ is equivalent to minimizing

$$
\sigma - \alpha(2\pi-1)(1-\eta_A-\eta_P)(\gamma_g - \gamma_b)\sigma
$$

with respect to σ. Therefore, given γ_g^{FB} and γ_b^{FB}, we have

$$
\sigma^{FB} = \left\{
\begin{array}{ll}
0 & \text{if } 1 > \alpha(2\pi-1)(1-\eta_A-\eta_P)(\gamma_g^{FB} - \gamma_b^{FB}) \\
[0,1] & \text{if } 1 = \alpha(2\pi-1)(1-\eta_A-\eta_P)(\gamma_g^{FB} - \gamma_b^{FB}) \\
1 & \text{if } 1 < \alpha(2\pi-1)(1-\eta_A-\eta_P)(\gamma_g^{FB} - \gamma_b^{FB}) \, .
\end{array}
\right.
$$

Because $\gamma_g^{FB} - \gamma_b^{FB} \le 1$, we have

$$
\begin{aligned}
1 \;>\;\; & \alpha(2\pi-1) \\
\;>\;\; & \alpha(2\pi-1)(1-\eta_A-\eta_P) \\
\;\ge\;\; & \alpha(2\pi-1)(1-\eta_A-\eta_P)(\gamma_g^{FB} - \gamma_b^{FB}),
\end{aligned}
$$

which verifies that $\sigma^{FB} = 0$. Similarly, maximizing W with respect to γ_g and γ_b is equivalent to minimizing

$$
\begin{aligned}
& \alpha[\pi(1-\eta_A-\eta_P)+\eta_P](\gamma_g - \gamma_b) \\
& -(1-\alpha)[\pi(1-\eta_A-\eta_P)+\eta_P](\gamma_g - \gamma_b) + (2\alpha-1)\gamma_b \\
=\;\; & (2\alpha-1)[\pi(1-\eta_A-\eta_P)+\eta_P]\gamma_g \\
& +(2\alpha-1)[1-\pi(1-\eta_A-\eta_P)-\eta_P]\gamma_b
\end{aligned}
$$

with respect to γ_g and γ_b, where we use $\sigma^{FB} = 0$. Note that

$$
\begin{aligned}
1 \;>\;\; & \Pr(g|E) \\
=\;\; & \pi(1-\eta_A) + (1-\pi)\eta_P \\
=\;\; & \pi(1-\eta_A-\eta_P) + \eta_P.
\end{aligned}
$$

Thus, we have

$$(\sigma^{FB}, \gamma_g^{FB}, \gamma_b^{FB}) = \begin{cases} (0,1,1) & \text{if } \alpha < 1/2 \\ (0,0,0) & \text{if } \alpha > 1/2 \end{cases}$$

as the first-best strategy profile.[33] This rule has a natural interpretation: if the incumbent is less likely to be opportunistic than the challenger (i.e., $\alpha < 1/2$), then voters should always choose the incumbent (i.e., $\gamma_g = \gamma_b = 1$) even in the presence of media bias. If this is the case, the selection effect of a higher probability of dishonest behavior does not matter to voters. Thus, dishonest behaviors must be prevented ($\sigma = 0$). This argument also holds if the incumbent is more likely to be opportunistic ($\alpha > 1/2$). The first-best level of voter welfare is easily computed as

$$W^{FB} = \begin{cases} (-x)/2 & \text{if } \alpha < 1/2 \\ (1-\alpha)(-x) & \text{if } \alpha > 1/2. \end{cases}$$

Note that if the voters cannot force the incumbent to choose a particular probability of dishonest behavior, σ, but still commit to the above voting rule, then the incumbent always chooses the dishonest behavior ($\sigma = 1$) because he will be either elected or ousted with certainty. This decreases voter welfare.

In the mixed-strategy equilibrium for $\alpha < 1/2$ in Proposition 3, equation (2) is rewritten as

$$W_{\alpha<1/2}^* = \frac{1}{2}\sigma_{\alpha<1/2}^*(-x) + \frac{1}{2}(-x).$$

The first term on the right-hand side represents the *discipline* effect; that is, if the incumbent is opportunistic (with probability $1/2$) and if he performs a dishonest action (with probability $\sigma_{\alpha<1/2}^*$), then voters incur disutility $-x$. The second term represents the *selection* effect; that is, an opportunistic politician is elected for the second period with probability $1/2$ in the mixed-strategy equilibrium for $\alpha < 1/2$. Since $\sigma_{\alpha<1/2}^*$ is increasing in η_P and η_A, $W_{\alpha<1/2}^*$ is *decreasing* in η_P and η_A. This implies that media bias decreases voter welfare. In addition, Corollary 1 implies that if $\eta_A = 0$, then the value of η_P does not affect voter welfare.

Similarly, in the mixed-strategy equilibrium for $\alpha > 1/2$ in Proposition 4, equation (2) is rewritten as

$$W_{\alpha>1/2}^* = \frac{1}{2}\sigma_{\alpha>1/2}^*(-x) + (1-\alpha)(-x).$$

---

[33]If $\alpha = 1/2$, the first-best voting strategy is indeterminate: any $\gamma_g^{FB} \in [0,1]$ and any $\gamma_b^{FB} \in [0,1]$ attain the first-best voter welfare.

Since $\sigma^*_{\alpha>1/2}$ is increasing in η_P and η_A, $W^*_{\alpha>1/2}$ is *decreasing* in η_P and η_A. In addition, Corollary 2 implies that if $\eta_P = 0$, then the value of η_A does not affect voter welfare.

In the mixed-strategy equilibria, media bias (i.e., the increase in η_P and η_A) does not affect the probability of an ethical politician being elected for the second period, which remains $1/2$ if $\alpha < 1/2$ or α if $\alpha > 1/2$, whereas it increases the probability of dishonesty in the first period. Therefore, media bias decreases voter welfare.

When the rent R is sufficiently large, the equilibrium is $(\sigma = 1, \gamma_g = 1, \gamma_b = 0)$. In that case, media bias does not affect the probability of dishonesty in the first period, which remains $\sigma = 1$, whereas it increases the probability of an opportunistic politician being elected for the second period. Therefore, media bias again decreases voter welfare.

As we see above, the amount of rent determines whether media bias influences the discipline effect or the selection effect, but, in either case, we have the following proposition.

Proposition 5. *Media bias never improves the ex-ante voter welfare for any $x > 0$.*

This proposition implies that a government ("social planner") should encourage the emergence of media watch groups or even strengthen the law's punishment for media if their reporting is revealed to be inaccurate in response to a politician's request for an investigation.

6   Discussion

6.1   An Alternative Model with Hard Information

Throughout the analysis above, we have assumed that information that mass media report is "soft" in the sense that they can process ("spin") it to make it good or bad news. In the following, we show that our main results hold even if we consider an alternative model with hard information, which mass media can either hide from or reveal to the voters.[34]

Suppose that mass media observe independent and identical signals twice from one action of the incumbent. That is, if the incumbent performs an honest (resp. dishonest)

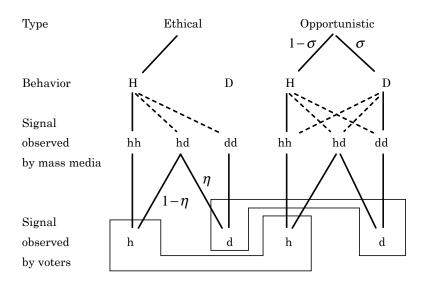[34]The following informational setup is close to Puglisi (2004).

Figure 5: Information Structure with Hard Information

action, signal h (d) occurs with probability $\pi > 1/2$, and signal d (h) occurs with probability $1 - \pi$. Thus, we have $\Pr(hh|H) = \Pr(dd|D) = \pi^2$, $\Pr(dd|H) = \Pr(hh|D) = (1-\pi)^2$ and $\Pr(hd|H) = \Pr(hd|D) = 2\pi(1-\pi)$.

Due to the space limitation in their publications, mass media can report only one of the two signals that they have observed. We assume here that the signal is hard information, and so when mass media observe h (resp. d) twice, which we write hh (dd), they can reasonably report h (d) only. When they observe h and d, which we write hd, they can report either h or d to the voters. We assume that when mass media observe hd, they report d with probability $\eta \in [0, 1]$ to the voters. The higher value of η implies that mass media have a stronger *anti*-incumbent bias. Figure 5 depicts the information flow in this two-signal model.[35]

First, suppose that the incumbent is less likely to be opportunistic than the challenger (i.e., $\alpha < 1/2$). The expected payoff for an opportunistic incumbent is

$$
\begin{aligned}
Ev(\sigma; \gamma_h, \gamma_d) &= \sigma \left\{ R + \left[\left(\pi^2 + 2\pi(1-\pi)\eta \right) \gamma_d + \left((1-\pi)^2 + 2\pi(1-\pi)(1-\eta) \right) \gamma_h \right] s \right\} \\
&\quad + (1 - \sigma) \left\{ \left[\pi^2 + 2\pi(1-\pi)(1-\eta) \right] \gamma_h + \left[(1-\pi)^2 + 2\pi(1-\pi)\eta \right] \gamma_d \right\} s
\end{aligned}
$$

[35] In this formulation, $\eta = 0$ corresponds to no media bias in the model with soft information if $\alpha < 1/2$. On the contrary, if $\alpha > 1/2$, $\eta = 1$ corresponds to no media bias.

$$= \left\{ \left[\pi^2 + 2\pi(1-\pi)(1-\eta) \right] \gamma_h + \left[(1-\pi)^2 + 2\pi(1-\pi)\eta \right] \gamma_d \right\} s$$
$$+ \sigma \left[R - (2\pi - 1)(\gamma_h - \gamma_d)s \right].$$

Thus, if $R \in (0, (2\pi - 1)s)$, then the opportunistic incumbent's optimal strategy is given by

$$\sigma^*(\gamma_h, \gamma_d) = \begin{cases} 1 & \text{if } \gamma_h - \gamma_d < \dfrac{R}{(2\pi - 1)s} \\[2ex] [0,1] & \text{if } \gamma_h - \gamma_d = \dfrac{R}{(2\pi - 1)s} \\[2ex] 0 & \text{if } \gamma_h - \gamma_d > \dfrac{R}{(2\pi - 1)s}. \end{cases}$$

If $R > (2\pi - 1)s$, then we have $\sigma^*(\gamma_h, \gamma_d) = 1$ for any (γ_h, γ_d).

Next, we examine the voters' decisions. By the Bayes rule, we have

$$\begin{aligned} \Pr(E|d) &= \frac{\Pr(d|E)\Pr(E)}{\Pr(d|E)\Pr(E) + \Pr(d|O)\Pr(O)} \\[2ex] &= \frac{(1-\pi)^2 + 2\pi(1-\pi)\eta}{2\left[(1-\pi)^2 + 2\pi(1-\pi)\eta\right] + (2\pi - 1)\sigma}, \end{aligned}$$

where we use

$$\Pr(d|E) = (1-\pi)^2 + 2\pi(1-\pi)\eta$$

and

$$\begin{aligned} \Pr(d|O) &= (1-\sigma)\left[(1-\pi)^2 + 2\pi(1-\pi)\eta\right] + \sigma\left[\pi^2 + 2\pi(1-\pi)\eta\right] \\[1ex] &= (1-\pi)^2 + 2\pi(1-\pi)\eta + (2\pi - 1)\sigma. \end{aligned}$$

If this probability is greater than α, then the voters should reelect the incumbent. Thus, given σ, the optimal voting strategy when the voters receive news d, $\gamma_d^*(\sigma)$, is described as follows:

$$\gamma_d^*(\sigma) = \begin{cases} 0 & \text{if } \sigma > \dfrac{(1-2\alpha)\left[(1-\pi)^2 + 2\pi(1-\pi)\eta\right]}{\alpha(2\pi - 1)} \\[2ex] [0,1] & \text{if } \sigma = \dfrac{(1-2\alpha)\left[(1-\pi)^2 + 2\pi(1-\pi)\eta\right]}{\alpha(2\pi - 1)} \\[2ex] 1 & \text{if } \sigma < \dfrac{(1-2\alpha)\left[(1-\pi)^2 + 2\pi(1-\pi)\eta\right]}{\alpha(2\pi - 1)}. \end{cases}$$

On the other hand, since $\Pr(E|h) > 1/2$ $(> \alpha)$ for any $\sigma \in [0, 1]$, we obtain $\gamma_h^*(\sigma) = 1$ for any $\sigma \in [0,1]$ as the optimal voting strategy when the voters receive news h.

Solving for the fixed point, we obtain the mixed-strategy equilibrium as follows:

$$\left(\sigma^* = \frac{(1 - 2\alpha)\left[(1 - \pi)^2 + 2\pi(1 - \pi)\eta\right]}{\alpha(2\pi - 1)}, \gamma_h^* = 1, \gamma_d^* = 1 - \frac{R}{(2\pi - 1)s} \right).$$

If the anti-incumbent bias, η, increases, then the equilibrium probability of dishonest behavior, σ^*, *increases*. Although the interpretation of media bias is different from our main model, the intuition remains the same. For $\alpha < 1/2$, voters reelect the incumbent as soon as they receive news h. Therefore, the information value of news d is important in their voting decisions. If $\eta = 0$, then voters receive news d only when mass media observe dd. If $\eta = 1$, then voters receive news d when mass media observe either dd or hd. In the former case, voters are more willing to elect the challenger after receiving news d (i.e., voters choose a lower value of γ_d). This voting behavior motivates the opportunistic incumbent to avoid producing dd by decreasing the probability of dishonesty.

Analogous logic applies to the case of $\alpha > 1/2$. In this case, the mixed-strategy equilibrium consists of

$$\left(\sigma^* = \frac{(2\alpha - 1)\left[\pi^2 + 2\pi(1 - \pi)(1 - \eta)\right]}{\alpha(2\pi - 1)}, \gamma_h^* = \frac{R}{(2\pi - 1)s}, \gamma_d^* = 0 \right),$$

where if the anti-incumbent bias, η, increases, then the equilibrium probability of dishonest behavior, σ^*, *decreases*. Here, the information value of news h, rather than d, is important in their voting decisions.

In this way, whether the anti-incumbent bias works for or against the voters depends on whether the incumbent is less or more likely to be ethical compared to the challenger.

6.2   Strategic Mass Media

We have analyzed the effect of media bias on the incumbent's dishonest behavior and voter welfare under the assumption that media bias is exogenously given. This assumption is appropriate if mass media are not strategic and therefore behave according to their inherent (or at least currently fixed) preferences regarding the incumbent. However, if mass media behave strategically to achieve their objective, how do they inform voters of signals they observe?

There are several reasonable objectives for mass media. If mass media have a sense of justice, they may want to minimize the possibility of politicians' dishonest behaviors, or, equivalently, they may want to maximize voter welfare. Then, mass media provide news that does not include anti-incumbent bias (i.e., $\eta_A = 0$) if the challenger is less likely to be ethical than the incumbent (i.e., $\alpha < 1/2$), while they exclude pro-incumbent bias (i.e., $\eta_P = 0$) otherwise (i.e., $\alpha > 1/2$).

If mass media maximize their own profit by attracting voters to their news, then they should maximize the information value of their news so that voters use the news to elect an ethical politician. Therefore, mass media behave as if they had a sense of justice. In contrast, if mass media are influenced by an opportunistic incumbent, then they try to maximize the expected payoff for the opportunistic incumbent with respect to media bias. In this case, mass media set η_A as large as possible if $\alpha < 1/2$, whereas they set η_P as large as possible otherwise.

One can also consider how media bias is determined in the presence of multiple media firms. However, if voters can choose the type of media firm they want to buy news from, they can avoid increasing the probability of dishonest behavior. For example, suppose that there exist two media firms, and that one is anti-incumbent whereas the other is pro-incumbent. Then, the voters will buy news from the anti-incumbent (resp. pro-incumbent) media firm when they believe ex-ante that the incumbent is more (less) likely to be opportunistic than the challenger. Therefore, the situation where these two biased media firms commit to price competition might be preferable for the voters to the situation where one unbiased media firm sells news at a monopoly price. Formal research to analyze this characteristic of the media industry's market structure remains to be conducted in the future.

7 Concluding Remarks

In this study, we have analyzed the effect of mass media on the relationship between a politician and voters in terms of the degree of political accountability. In this model, we assume that mass media may be biased and may not improve the quality of information about the incumbent's dishonest behavior. Therefore, in the presence of media bias, it becomes more difficult for voters to determine whether the incumbent has performed a

dishonest action, which motivates the incumbent to be more dishonest.

We have shown how mass media's effect on the probability of dishonesty depends upon the average quality of challengers' ethics in the presence of media bias: if challengers are more (resp. less) likely to be ethical ex-ante than incumbents, then the probability of dishonest behavior is higher than that in the case of no media bias only if mass media distort unfavorable (favorable) information into favorable (unfavorable) information. In this sense, not only the degree of media bias but also its direction and the quality of challengers are important factors in determining the effects of media bias on dishonest behavior.

Our results depend on the implicit assumption that mass media distort information and do not "create" new perspectives for voters in considering political issues. Although it seems difficult to deal with this issue, a more thorough analysis of mass media and politics in general would yield greater insight.

Appendix

A. *Discussion on the Robustness of the Model*

In the main text, we consider the model where only the opportunistic politician decides on what kind of action he performs, and thus the ethical politician is clean in the sense that he *always* chooses H. Another possible formulation would allow a stubborn politician, who does not change his behavior, to be dishonest, always choosing D (called a *fraudulent* (F), rather than an ethical politician). As in the main text, we assume that the representative voter obtains 1 if she elects an opportunistic politician, and 0 if she elects a fraudulent politician. Here we set the probability of a challenger being opportunistic to be $\beta \in (1/2,1)$.

In contrast to Propositions 1 and 2 (i.e., the case without media bias), we (generically) have *multiple* perfect Bayesian equilibria if the private rent is sufficiently small that $R < (2\pi - 1)s$. To understand this better, first, by the Bayes rule, we have

$$
\begin{aligned}
\Pr(O|g) &= \frac{\Pr(g|O)\Pr(O)}{\Pr(g|O)\Pr(O) + \Pr(g|F)\Pr(F)} \\
&= \frac{(1-\sigma)\pi + \sigma(1-\pi)}{(1-\sigma)\pi + \sigma(1-\pi) + (1-\pi)}
\end{aligned}
$$

as the voters' payoff when they reelect the incumbent, while they obtain β when they vote for the challenger. Thus, given σ, the optimal voting strategy when they receive news g, $\gamma_g^*(\sigma)$, is described as follows:

$$
\gamma_g^*(\sigma) = \begin{cases} 1 & \text{if } \sigma < \dfrac{\pi - \beta}{(2\pi - 1)(1 - \beta)} \\[2ex] [0,1] & \text{if } \sigma = \dfrac{\pi - \beta}{(2\pi - 1)(1 - \beta)} \\[2ex] 0 & \text{if } \sigma > \dfrac{\pi - \beta}{(2\pi - 1)(1 - \beta)}. \end{cases}
$$

The optimal voting strategy when they receive news b is given by $\gamma_b^*(\sigma) = 0$ for any $\sigma \in [0,1]$ because $\Pr(O|b) < \beta$ for any $(\sigma, \pi) \in [0,1] \times (1/2,1)$. On the other hand, the optimal strategy for the opportunistic incumbent is the same as that in the proof of Proposition 1. Solving for a fixed point as in the proof of Proposition 1, we have the following proposition.

Proposition A1. *Suppose that politicians are either opportunistic or fraudulent, mass media are unbiased (i.e., $\eta_A = \eta_P = 0$), the challenger is more likely to be opportunistic (i.e., $\beta > 1/2$), and the information structure is sufficiently accurate that $\pi > \beta$. If the private rent from dishonesty is sufficiently large that $R > (2\pi - 1)s$, then the game has a unique perfect Bayesian equilibrium, $(\sigma^* = 1, \gamma_g^* = 0, \gamma_b^* = 0)$, where voters never reelect the incumbent regardless of the received news, and the opportunistic politician performs a dishonest action with certainty (the "anarchic equilibrium"). If $R < (2\pi - 1)s$, then the game has three perfect Bayesian equilibria,*

$$(\sigma^* = 1, \ \gamma_g^* = 0, \ \gamma_b^* = 0),$$

which is the same as that in the case of $R > (2\pi - 1)s$,

$$\left(\sigma^* = \frac{\pi - \beta}{(2\pi - 1)(1 - \beta)}, \ \gamma_g^* = \frac{R}{(2\pi - 1)s}, \ \gamma_b^* = 0\right),$$

where voters never reelect the incumbent when they receive bad news, and the opportunistic politician performs a dishonest action with some probability (the "distrust equilibrium"), and

$$(\sigma^* = 0, \ \gamma_g^* = 1, \ \gamma_b^* = 0),$$

where voters reelect the incumbent with certainty when they receive good news, and the opportunistic politician never performs a dishonest action (the "reliance equilibrium").[36]

Figure A1 depicts all three perfect Bayesian equilibria for $R < (2\pi - 1)s$. In this situation, when voters trust the incumbent so that they always reelect the incumbent when they receive good news, the incumbent responds to such reliance by never performing a dishonest action. Such a disciplinary action itself makes the voters' behavior rational. However, when they distrust the incumbent and do not always reelect the incumbent even when they receive the good news, the incumbent performs a dishonest action with some probability, and the voters' and the incumbent's behaviors are mutually reinforcing.
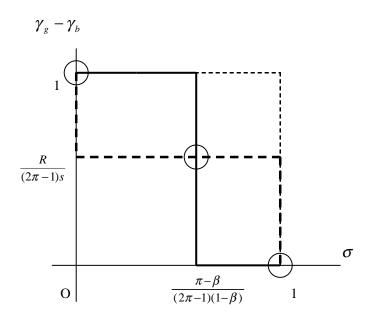

Figure A1: Perfect Bayesian Equilibria when $R < (2\pi - 1)s$

The difference from Propositions 1 and 2 comes from the fact that the reelection probability is *decreasing* (not increasing as in Propositions 1 and 2) in the probability of a dishonest action. This occurs because, in contrast to the model structure of Propositions 1 and 2, if the opportunistic politician never performs a dishonest action (i.e., $\sigma = 0$), he

---

[36]It can be easily observed that if $R = (2\pi - 1)s$, there is a continuum of the equilibria with $\sigma^* \in [0, (\pi - \alpha)/(2\pi - 1)(1 - \alpha)]$, $\gamma_g^* = 1$ and $\gamma_b^* = 0$.

can separate himself from the fraudulent politician and therefore increase his reelection probability. Now, it is easily verified that $\Pr(O|g)$ is *decreasing* in σ. Thus, voters know that, given the received news g, the politician is less likely to be *fraudulent* if the opportunistic type is less dishonest. In contrast, as in Propositions 1 and 2, the opportunistic incumbent is inclined to perform a dishonest action when the voters are less likely to distinguish between the good news and the bad news. These complementary incentives are the source of multiple equilibria.

B. *When Voters Consider Disutility in the First Period*

Throughout the analysis, we assume that voters make their voting decisions to maximize the probability of electing an ethical politician for the second period (whether it is the incumbent or the challenger). The following argument shows that the optimal voting strategy remains the same if we assume that the voters consider disutility from dishonest behavior in each period. Suppose that voters perceive a disutility $x > 0$ if a dishonest action happens in each period.[37] Then, the voters' expected utility when they receive news g is given by

$$
\Pr(E|g)(1-\gamma_g)(1-\alpha)(-x) + \Pr(O|g)[\sigma(-x) + \gamma_g(-x) + (1-\gamma_g)(1-\alpha)(-x)]
$$
$$
= (-x)\left\{\Pr(E|g)(1-\gamma_g)(1-\alpha) + \Pr(O|g)[\sigma + \gamma_g + (1-\gamma_g)(1-\alpha)]\right\}
$$
$$
= (-x)\left\{1 - \alpha + \Pr(O|g)\sigma + [\alpha - \Pr(E|g)]\gamma_g\right\}.
$$

Thus, the optimal γ_g depends on the sign of $\Pr(E|g) - \alpha$. This is equivalent to the situation where voters compare the probability of the incumbent being ethical given news g to the probability of the challenger being ethical. The same argument holds for the case of news b.

---

[37]However, voters do not know the outcome of the disutility. Otherwise, they would use the information about the payoff (whether 0 or $-x$) for their voting strategy. In our context, the assumption that the voters know their payoff outcomes at the end of the game is not unnatural because politicians' dishonest behavior arguably affects them in the long run (tax burden, low economic growth rate, and so on). In contrast, this situation where voters cannot immediately know the consequences of politicians' dishonest behavior enables media firms to function as a medium between politicians and voters.

C. *Ex-Ante Commitment*

If voters were able to commit to their voting choices before they receive news (so that they ignore the news), then they might simply reelect the incumbent if $\alpha < 1/2$ and elect the challenger if $\alpha > 1/2$. In this appendix, we examine whether such a commitment helps voters increase their payoffs in the case without media bias (the same logic applies to the case with media bias).

In the case of $\alpha < 1/2$, if voters do not use the news, they should commit to voting for the *incumbent* to achieve probability $1/2$ to select an ethical politician. However, if the voters do use the news, the probability of selecting an ethical politician is described as:

$$\Pr(g)[\gamma_g \Pr(E|g) + (1 - \gamma_g)\alpha] + \Pr(b)[\gamma_b \Pr(E|b) + (1 - \gamma_b)\alpha]. \tag{A1}$$

Since $\gamma_g = 1$ in equilibrium for $\alpha < 1/2$ (see Proposition 1), equation (A1) is rewritten as

$$\Pr(g) \Pr(E|g) + \Pr(b)[\gamma_b \Pr(E|b) + (1 - \gamma_b)\alpha].$$

By using $\Pr(E|g) = \Pr(g|E) \Pr(E)/\Pr(g)$, we can further rewrite this equation as

$$\Pr(g|E) \Pr(E) + \Pr(b)[\gamma_b \Pr(E|b) + (1 - \gamma_b)\alpha]. \tag{A2}$$

First, let us consider the mixed-strategy equilibrium, which occurs for sufficiently small R. In the mixed-strategy equilibrium, voters are indifferent between the incumbent and the challenger when they receive bad news (i.e., $\Pr(E|b) = \alpha$). Therefore, equation (A2) is rewritten as

$$\Pr(g|E) \Pr(E) + \Pr(b)\alpha. \tag{A3}$$

Because $\Pr(g|E) = \pi$, $\Pr(E) = 1/2$, and

$$\Pr(b) = \frac{1}{2}(1 - \pi) + \frac{1}{2}[\sigma^*\pi + (1 - \sigma^*)(1 - \pi)] = 1 - \pi + \frac{1}{2}(2\pi - 1)\sigma^*,$$

we can verify that equation (A3) is equal to $1/2$. That is, the probability of selecting an ethical politician is the *same* whether voters make use of the news (i.e., mixed-strategy equilibrium) or not (i.e., ex-ante commitment).

Next, let us consider the case of sufficiently large R. In this case, by $\gamma_g^* = 1$, $\gamma_b^* = 0$, and $\sigma^* = 1$, equation (A2) is rewritten as

$$\Pr(g|E) \Pr(E) + \Pr(b)\alpha = \pi\frac{1}{2} + \left[1 - \pi + \frac{1}{2}(2\pi - 1)\right]\alpha$$

$$= \frac{1}{2}(\pi + \alpha) > \frac{1}{2},$$

where we use the assumption $\pi > 1 - \alpha$ in Proposition 1. Therefore, for sufficiently large R, utilizing the news is better for voters than not doing so in selecting an ethical politician.

In the case of $\alpha > 1/2$, if voters do not utilize the news that they receive through mass media, they should commit to voting for the challenger to achieve probability α to select an ethical politician. If the voters utilize the news, however, we have $\gamma_b^* = 0$, and thus equation (A1) is rewritten as

$$\Pr(g)[\gamma_g \Pr(E|g) + (1 - \gamma_g)\alpha] + \Pr(b)\alpha.$$

In the mixed-strategy equilibrium, voters are indifferent between the incumbent and the challenger when they receive good news (i.e., $\Pr(E|g) = \alpha$). Therefore, this equation is rewritten as

$$\Pr(g)[\gamma_g \alpha + (1 - \gamma_g)\alpha] + \Pr(b)\alpha = \Pr(g)\alpha + \Pr(b)\alpha = \alpha.$$

Hence, the probability of selecting an ethical politician is the same whether voters make use of the news (i.e., mixed-strategy equilibrium) or not (i.e., ex-ante commitment).

Lastly, let us consider the case of sufficiently large R. As in the case of $\alpha < 1/2$, we have

$$\Pr(g|E)\Pr(E) + \Pr(b)\alpha = \frac{1}{2}(\pi + \alpha) > \alpha,$$

where we use the assumption $\pi > \alpha$ in Proposition 2. Hence, for sufficiently large R, making use of the news is better for voters than not doing so in selecting an ethical politician.

D. *Proof of Proposition 1*

Let $Ev(\sigma; \gamma_g, \gamma_b)$ denote the opportunistic incumbent's expected payoff when he performs a dishonest action with probability of σ, given (γ_g, γ_b). Then, we obtain

$$
\begin{aligned}
Ev(\sigma; \gamma_g, \gamma_b) &= \sigma\left[R + \{(1 - \pi)\gamma_g + \pi\gamma_b\}s\right] + (1 - \sigma)\left[\pi\gamma_g + (1 - \pi)\gamma_b\right]s \\
&= [\pi\gamma_g + (1 - \pi)\gamma_b]s + [R - (2\pi - 1)(\gamma_g - \gamma_b)s]\sigma.
\end{aligned}
$$

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Thus, if $R \in (0, (2\pi - 1)s)$, then the opportunistic incumbent's optimal strategy is given by

$$\sigma^*(\gamma_g, \gamma_b) = \begin{cases} 1 & \text{if } \gamma_g - \gamma_b < \dfrac{R}{(2\pi - 1)s} \\[3mm] [0,1] & \text{if } \gamma_g - \gamma_b = \dfrac{R}{(2\pi - 1)s} \\[3mm] 0 & \text{if } \gamma_g - \gamma_b > \dfrac{R}{(2\pi - 1)s}. \end{cases}$$

If $R > (2\pi - 1)s$, then we have $\sigma^*(\gamma_g, \gamma_b) = 1$ for any (γ_g, γ_b).

Next, we examine the voters' decisions. By the Bayes rule, we have

$$\begin{aligned} \Pr(E|b) &= \frac{\Pr(b|E)\Pr(E)}{\Pr(b|E)\Pr(E) + \Pr(b|O)\Pr(O)} \\[2mm] &= \frac{1 - \pi}{1 - \pi + (1 - \sigma)(1 - \pi) + \sigma\pi}, \end{aligned} \qquad (A4)$$

where we use

$$\Pr(b|E) = 1 - \pi$$

and

$$\Pr(b|O) = (1 - \sigma)(1 - \pi) + \sigma\pi.$$

Because of the normalization of payoffs, equation (A4) coincides with the voters' expected payoff when they reelect the incumbent, whereas they obtain α if they vote for the challenger.[38] Thus, given σ, the optimal voting strategy when they receive signal b, $\gamma_b(\sigma)$, is described as follows:

$$\gamma_b^*(\sigma) = \begin{cases} 1 & \text{if } \sigma < \dfrac{(1 - 2\alpha)(1 - \pi)}{(2\pi - 1)\alpha} \\[3mm] [0,1] & \text{if } \sigma = \dfrac{(1 - 2\alpha)(1 - \pi)}{(2\pi - 1)\alpha} \\[3mm] 0 & \text{if } \sigma > \dfrac{(1 - 2\alpha)(1 - \pi)}{(2\pi - 1)\alpha}. \end{cases}$$

---

[38] If payoff for the case of the ethical challenger being elected is lower than that for the case of the ethical incumbent being reelected, say $u < 1$, then the voters obtain $\alpha \cdot u$ if they vote for the challenger, and the main results below do not change.

By calculating $\Pr(E|g)$, we obtain $\gamma_g^*(\sigma) = 1$ for all $\sigma \in [0,1]$ as the optimal voting strategy when voters receive news g. By solving for the fixed point, we obtain the desired result. *Q.E.D.*

E. *Proof of Proposition 3*

Given (γ_g, γ_b), the opportunistic incumbent's expected payoff when he performs a dishonest action with a probability of σ is written as

$$
\begin{aligned}
Ev(\sigma; \gamma_g, \gamma_b) &= \sigma \left(R + \left[(1-\pi) \left\{ (1 - \eta_A)\gamma_g + \eta_A \gamma_b \right\} + \pi \left\{ \eta_P \gamma_g + (1 - \eta_P)\gamma_b \right\} \right] s \right) \\
&\quad + (1 - \sigma) \left(\pi \left\{ (1 - \eta_A)\gamma_g + \eta_A \gamma_b \right\} + (1-\pi)\{ \eta_P \gamma_g + (1 - \eta_P)\gamma_b \} \right) s \\
&= \pi \left\{ (1 - \eta_A)\gamma_g + \eta_A \gamma_b \right\} + (1-\pi)\{ \eta_P \gamma_g + (1 - \eta_P)\gamma_b \} s \\
&\quad + \{ R - (2\pi - 1)[1 - (\eta_A + \eta_P)](\gamma_g - \gamma_b)s \} \sigma.
\end{aligned}
$$

Thus, if $R \in (0, [1 - (\eta_A + \eta_P)](2\pi - 1)s)$, then the opportunistic incumbent's optimal strategy is given by

$$
\sigma^*(\gamma_g, \gamma_b) = \begin{cases}
1 & \text{if } \gamma_g - \gamma_b < \dfrac{R}{[1 - (\eta_A + \eta_P)](2\pi - 1)s} \\[3mm]
[0,1] & \text{if } \gamma_g - \gamma_b = \dfrac{R}{[1 - (\eta_A + \eta_P)](2\pi - 1)s} \\[3mm]
0 & \text{if } \gamma_g - \gamma_b > \dfrac{R}{[1 - (\eta_A + \eta_P)](2\pi - 1)s}.
\end{cases}
$$

If $R > [1 - (\eta_A + \eta_P)](2\pi - 1)s$, then we have $\sigma^*(\gamma_g, \gamma_b) = 1$ for any (γ_g, γ_b).

We next examine the voters' decisions. By the Bayes rule, we have

$$
\Pr(E|b) = \frac{\Pr(b|E)\Pr(E)}{\Pr(b|E)\Pr(E) + \Pr(b|O)\Pr(O)},
$$

where

$$
\Pr(b|E) = \pi \eta_A + (1 - \pi)(1 - \eta_P)
$$

and

$$
\Pr(b|O) = (1 - \sigma)[(1 - \pi)(1 - \eta_P) + \pi \eta_A] + \sigma[\pi(1 - \eta_P) + (1 - \pi)\eta_A].
$$

Thus, given σ, the optimal voting strategy when they receive news g, $\gamma_b^*(\sigma)$, is described

as follows:

$$\gamma_b^*(\sigma) = \begin{cases} 1 & \text{if } \sigma < \dfrac{(1-2\alpha)[(1-\eta_P)(1-\pi)+\eta_A\pi]}{[1-(\eta_A+\eta_P)](2\pi-1)\alpha} \\[3ex] [0,1] & \text{if } \sigma = \dfrac{(1-2\alpha)[(1-\eta_P)(1-\pi)+\eta_A\pi]}{[1-(\eta_A+\eta_P)](2\pi-1)\alpha} \\[3ex] 0 & \text{if } \sigma > \dfrac{(1-2\alpha)[(1-\eta_P)(1-\pi)+\eta_A\pi]}{[1-(\eta_A+\eta_P)](2\pi-1)\alpha}. \end{cases}$$

In contrast, we can verify that $\gamma_g^*(\sigma) = 1$ for any $\sigma \in [0,1]$ because $\Pr(E|g) > 1/2$ ($> \alpha$) for any $(\sigma, \pi) \in [0,1] \times (1/2,1)$. Solving for the fixed point, we have the desired result. *Q.E.D.*

F. *Comparative Statics*

For the case of $\alpha < 1/2$, the equilibrium dishonesty probability is now written as

$$\sigma^* = \frac{(1-2\alpha)[(1-\widetilde{\eta}\eta_A)(1-\pi)+\dfrac{\overline{\eta}}{1+\widetilde{\eta}}\pi]}{(1-\overline{\eta})(2\pi-1)\alpha}.$$

The derivatives are given by

$$\frac{\partial\sigma^*|_{\alpha<1/2}(\overline{\eta},\widetilde{\eta},\eta_A,\alpha,\pi)}{\partial\overline{\eta}} = \frac{(1-2\alpha)[1+(1-\pi)\widetilde{\eta}(1-\overline{\eta})]}{(1-\overline{\eta})^2(2\pi-1)\alpha(1+\widetilde{\eta})} > 0,$$

$$\frac{\partial\sigma^*|_{\alpha<1/2}(\overline{\eta},\widetilde{\eta},\eta_A,\alpha,\pi)}{\partial\widetilde{\eta}} = -\frac{(1-2\alpha)\left[\dfrac{\pi\overline{\eta}}{(1+\widetilde{\eta})^2}+(1-\pi)\eta_A\right]}{(1-\overline{\eta})(2\pi-1)\alpha} < 0,$$

$$\frac{\partial\sigma^*|_{\alpha<1/2}(\overline{\eta},\widetilde{\eta},\eta_A,\alpha,\pi)}{\partial\eta_A} = -\frac{(1-2\alpha)(1-\pi)\widetilde{\eta}}{(1-\overline{\eta})(2\pi-1)\alpha} < 0,$$

$$\frac{\partial\sigma^*|_{\alpha<1/2}(\overline{\eta},\widetilde{\eta},\eta_A,\alpha,\pi)}{\partial\alpha} = -\frac{\pi\overline{\eta}+(1+\widetilde{\eta})(1-\pi)(1-\widetilde{\eta}\eta_A)}{(1-\overline{\eta})(2\pi-1)\alpha^2(1+\widetilde{\eta})} < 0,$$

and

$$\frac{\partial\sigma^*|_{\alpha<1/2}(\overline{\eta},\widetilde{\eta},\eta_A,\alpha,\pi)}{\partial\pi} = -\frac{(1-2\alpha)[\overline{\eta}+(1+\widetilde{\eta})(1-\widetilde{\eta}\eta_A)]}{(1-\overline{\eta})(2\pi-1)^2\alpha(1+\widetilde{\eta})} < 0.$$

For the case of $\alpha > 1/2$, the equilibrium probability of dishonesty is now written as:

$$\sigma^* = \frac{(2\alpha-1)[(1-\dfrac{\overline{\eta}}{1+\widetilde{\eta}})\pi+\widetilde{\eta}\eta_A(1-\pi)]}{(1-\overline{\eta})(2\pi-1)\alpha}.$$

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The derivatives are given by

$$\frac{\partial \sigma^*|_{\alpha>1/2}(\overline{\eta}, \widetilde{\eta}, \eta_A, \alpha, \pi)}{\partial \overline{\eta}} = \frac{(2\alpha-1)\widetilde{\eta}[\pi + (1-\pi)(1+\widetilde{\eta})\eta_A]}{(1-\overline{\eta})^2(2\pi-1)\alpha(1+\widetilde{\eta})} > 0,$$

$$\frac{\partial \sigma^*|_{\alpha>1/2}(\overline{\eta}, \widetilde{\eta}, \eta_A, \alpha, \pi)}{\partial \widetilde{\eta}} = \frac{(2\alpha-1)\left[\dfrac{\pi\overline{\eta}}{(1+\widetilde{\eta})^2} + (1-\pi)\eta_A\right]}{(1-\overline{\eta})(2\pi-1)\alpha} > 0,$$

$$\frac{\partial \sigma^*|_{\alpha>1/2}(\overline{\eta}, \widetilde{\eta}, \eta_A, \alpha, \pi)}{\partial \eta_A} = \frac{(2\alpha-1)(1-\pi)\widetilde{\eta}}{(1-\overline{\eta})(2\pi-1)\alpha} > 0,$$

$$\frac{\partial \sigma^*|_{\alpha>1/2}(\overline{\eta}, \widetilde{\eta}, \eta_A, \alpha, \pi)}{\partial \alpha} = \frac{\pi[(1-\overline{\eta})+\overline{\eta}] + \widetilde{\eta}\eta_A[(1-\pi)+(1+\pi)\widetilde{\eta}]}{(1-\overline{\eta})(2\pi-1)\alpha^2(1+\widetilde{\eta})} > 0,$$

and

$$\frac{\partial \sigma^*|_{\alpha>1/2}(\overline{\eta}, \widetilde{\eta}, \eta_A, \alpha, \pi)}{\partial \pi} = -\frac{(2\alpha-1)[(1+\widetilde{\eta})(1+\widetilde{\eta}\eta_A)-\overline{\eta}]}{(1-\overline{\eta})(2\pi-1)^2\alpha(1+\widetilde{\eta})} < 0.$$

In the above exercise, the sum of η_A and η_P is fixed. If we relax this constraint, we have the following derivatives for the case of $\alpha < 1/2$:

$$\frac{\partial \sigma^*|_{\alpha<1/2}(\eta_A, \eta_P, \alpha, \pi)}{\partial \eta_A} = \frac{(1-2\alpha)(1-\eta_P)}{[1-(\eta_A+\eta_P)]^2(2\pi-1)\alpha} > 0,$$

$$\frac{\partial \sigma^*|_{\alpha<1/2}(\eta_A, \eta_P, \alpha, \pi)}{\partial \eta_P} = \frac{(1-2\alpha)\eta_A}{[1-(\eta_A+\eta_P)]^2(2\pi-1)\alpha} > 0,$$

$$\frac{\partial \sigma^*|_{\alpha<1/2}(\eta_A, \eta_P, \alpha, \pi)}{\partial \alpha} = -\frac{\pi\eta_A + (1-\pi)(1-\eta_P)}{[1-(\eta_A+\eta_P)](2\pi-1)\alpha^2} < 0,$$

and

$$\frac{\partial \sigma^*|_{\alpha<1/2}(\eta_A, \eta_P, \alpha, \pi)}{\partial \pi} = -\frac{(1-2\alpha)(1+\eta_A-\eta_P)}{[1-(\eta_A+\eta_P)](2\pi-1)^2\alpha} < 0,$$

and for the case of $\alpha > 1/2$:

$$\frac{\partial \sigma^*|_{\alpha>1/2}(\eta_A, \eta_P, \alpha, \pi)}{\partial \eta_A} = \frac{(2\alpha-1)\eta_P}{[1-(\eta_A+\eta_P)]^2(2\pi-1)\alpha} > 0,$$

$$\frac{\partial \sigma^*|_{\alpha>1/2}(\eta_A, \eta_P, \alpha, \pi)}{\partial \eta_P} = \frac{(2\alpha-1)(1-\eta_A)}{[1-(\eta_A+\eta_P)]^2(2\pi-1)\alpha} > 0,$$

$$\frac{\partial \sigma^*|_{\alpha>1/2}(\eta_A, \eta_P, \alpha, \pi)}{\partial \alpha} = \frac{[1-(\eta_A+\eta_P)]\pi + \eta_P}{[1-(\eta_A+\eta_P)](2\pi-1)\alpha^2} > 0,$$

and

$$\frac{\partial \sigma^*|_{\alpha>1/2}(\eta_A, \eta_P, \alpha, \pi)}{\partial \pi} = -\frac{(2\alpha-1)(1-\eta_A+\eta_P)}{[1-(\eta_A+\eta_P)](2\pi-1)^2\alpha} < 0.$$

Tabke D1 summarizes these results.

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	$\alpha < 1/2$	$\alpha > 1/2$
$\partial\sigma^*/\partial\eta_A$	+	+
$\partial\sigma^*/\partial\eta_P$	+	+
$\partial\sigma^*/\partial\alpha$	−	+
$\partial\sigma^*/\partial\pi$	−	−

Table D1: Signs of Comparative Statics without the Sum of η_A and η_P Fixed

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