Information Revelation and Pandering in Elections*

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Abstract

Do elections efficiently aggregate politicians' policy-relevant private information? This paper argues that politicians' office motivation is an obstacle. In a two-candidate Hotelling-Downs model in which each candidate has socially-valuable policy information, we establish that equilibrium welfare is at best what can be obtained by disregarding one politician's information. We also find that for canonical information structures, politicians have an incentive to "anti-pander", i.e., to overreact to their information. Some degree of pandering—underreacting to information—would be socially beneficial.

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1. Introduction

For representative democracy to be effective, voters must select representatives whose policies will enhance their welfare. A challenge is that citizens may be poorly informed on policy issues, as posited by Downs (1957) in his "rational ignorance" hypothesis and since supported by numerous studies starting with Campbell, Converse, Miller and Stokes (1960). Political candidates, on the other hand, devote substantial resources and have broad access to policy experts and think tanks. Politicians can convey their information to the electorate through their electoral campaigns, and in particular, their policy positions. Indeed, there is evidence that voters learn and/or refine their views during elections.[1] But when office-seeking politicians choose their positions strategically, how well do elections aggregate their information?

One prevalent view is that elections function well because even office-seeking politicians are impelled to choose policies that promote voters' interests. Indeed, Wittman (1989, p. 1400) influentially argued that political competition benefits the electorate because "there are returns to an informed political entrepreneur from providing the information to the voters, winning office, and gaining the [...] rewards of holding office. Concurrently, however, there are also charges—both in popular circles and in academic work that we discuss subsequently—that competitive pressures drive politicians to pander to voters' opinions rather than provide valuable information. After all, the argument goes, it is hard to win an election by campaigning on policies with recondite merits; a politician is better off just promising to do whatever voters believe is best from the outset. Pandering is viewed as inefficient because it would lead to policies that are excessively distorted toward the voters' less-informed opinions.

Our paper (re-)assesses the efficiency of elections when office-seeking politicians possess policy-relevant private information. Section 2 lays out an extension of the canonical Downsian model of elections (Downs, 1957; Hotelling, 1929). Our framework is quite general—e.g., the policy space can be multidimensional—but we maintain the Downsian assumption of two candidates making policy commitments to maximize their probability of winning the election. The key twist is that each politician has (imperfect) private information about

[1] This includes experiments on deliberative polling (Fishkin, 1997), studies on the effects of information on voters' opinions (Zaller, 1992; Althaus, 1998; Gilens, 2001), work on framing in polls (Schuman and Presser, 1981), and experiments on priming (Iyengar and Kinder, 1987).

policy consequences. In other words, they each have information about which policy would be best for a representative or median voter—hereafter, "the voter".

Our main result is a sharp bound on how much of the politicians' private information can be aggregated in a Downsian election. Theorem 1 establishes that the voter's welfare—ex-ante expected utility—in any electoral equilibrium is equal to the welfare from implementing policy based on just one politician's information, while not necessarily using even this information efficiently. Consequently, equilibrium voter welfare is no higher than what can be obtained by disregarding the presence of one politician entirely. This inefficiency is fairly general—across informational structures and voter preferences—and we explain how it can be traced to two implications of office motivation: (i) as far as they are concerned, the politicians are engaged in a constant-sum game; and (ii) their information, while socially valuable, does not affect their own payoffs directly.

We gain further insight by specializing in Section 3 to a canonical one-dimensional normal-quadratic specification. More precisely, we assume that the best policy for the voter—hereafter, the "state" of the world—is drawn from a normal distribution; each candidate's private signal is the true state plus noise that is also normally distributed; and the voter's payoff is a quadratic loss function of the distance between the chosen policy and the state.

For this specification, we explain why it is not an equilibrium for each politician to propose a policy that is best for the voter based on his own information, i.e., to use an "unbiased strategy" (in which case the election would aggregate more than one politician's information). We show that, perhaps contrary to intuition, politicians would have an incentive to deviate by "anti-pandering"—*overreacting* to their private information—as the rational voter would elect the more extreme politician under unbiased strategies. The voter would do so because each politician's estimate of the state based on his own signal puts more weight on the prior than the voter's estimate after learning both politicians' signals.[2]

Building on the above logic, we identify in Proposition 2 a symmetric equilibrium that features anti-pandering by both politicians. In this equilibrium, politicians choose different

[2] Glaeser and Sunstein (2009) and Roux and Sobel (2015) also identify this implication of Bayesian updating in a non-strategic group decision-making context. The underlying statistical property holds whenever the posterior distribution of the state given a politician's signal is in an exponential family and the prior is conjugate with the posterior; this class includes a variety of familiar information structures as elaborated in Section 4.

platforms with probability one, but no matter their platforms are elected with equal probability. Although there are other equilibria,[3] the anti-pandering equilibrium provides a new perspective on the classic issue of policy divergence. Unlike some other prevalent explanations (e.g., ideologically-motivated candidates with uncertainty about voter preferences, as in Wittman (1983) and Calvert (1985)), anti-pandering features office-motivated politicians diverging in order to increase their support from a risk-averse voter whose ideology is known.[4]

Besides observing that pandering—underreacting to information—need not arise in equilibrium, we also find that some (disequilibrium) pandering would actually benefit the voter, contrary to perceptions that pandering is harmful. Specifically, an implication of Proposition 3 is that compared to the unbiased strategy profile, and hence also to all equilibria, voter welfare would be improved if each candidate were to choose a platform that suitably underreacts to his information. Reminiscent of a winner's curse, the intuition is that under unbiased strategies a candidate wins when his signal is more extreme than his opponent's. The voter would benefit if candidates were to incorporate such (contingent) information into their platforms.

Related Literature. There is a small prior literature on electoral competition when candidates have policy-relevant private information.[5] Heidhues and Lagerlof (2003) illustrate why candidates may have an incentive to pander to the electorate's prior belief; their setting is one with binary policies, binary states, and binary signals. We find that in our richer setting, the opposite may be true for a broad class of information structures. Plainly, with binary policies, one cannot see the logic of why and how candidates may wish to overreact to private information. Loertscher (2012) maintains the binary signal and state structure, but introduces a continuum policy space. His results are more nuanced, but at least when signals are sufficiently precise, the conclusions are similar to those of Heidhues and Lagerlof (2003).[6]

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[3] In particular, there is a trivial equilibrium with full pandering: both candidates ignore their information and simply choose the prior-optimal platform.

[4] Other explanations for divergence include those based on increasing turnout (Glaeser, Ponzetto and Shapiro, 2005), campaign contributions (Alesina and Holden, 2008; Campante, 2011), valence asymmetries (Groseclose, 2001; Aragones and Palfrey, 2002), signaling character, competence, or related mechanisms (Callander and Wilkie, 2007; Kartik and McAfee, 2007; Honryo, 2018), or more than two candidates (Palfrey, 1984).

[5] There are also models in which candidates have private information that is not policy relevant for voters, e.g., about the location of the median voter (Chan, 2001; Ottaviani and Sorensen, 2006; Bernhardt, Duggan and Squintani, 2007, 2009).

[6] In the Supplementary Appendix, we show how overreaction or anti-pandering arises in a binary-signal model specification when the policies and the state lie in the unit interval. This model specification is a special

Laslier and Van de Straeten (2004) show that if voters in the Heidhues and Lagerlof (2003) model are endowed with sufficiently precise private information about the policy-relevant state, then there are equilibria in which candidates fully reveal their private information; see also Klumpp (2014) and Gratton (2014). By contrast, we are interested in settings in which there is little information voters have that candidates do not. While we make the extreme assumption that voters have no private information, our main points are robust to variations on this dimension.

Building on earlier versions of the current paper, Millner, Ollivier and Simon (2020) introduce confirmation bias for voters in a continuum-policy ternary-state model. They find that confirmation bias can reduce equilibrium anti-pandering.

Schultz (1996) studies a model in which two candidates are perfectly informed about the policy-relevant state but are policy motivated. He finds that when the candidates' ideological preferences are sufficiently extreme, platforms cannot reveal the true state; however, because of the perfect information assumption, full revelation can be sustained when ideological preferences are not too extreme. Martinelli (2001) and Martinelli and Matsui (2002) derive further results with ideologically motivated candidates who are perfectly informed about a policy-relevant variable.

Subsequent to earlier versions of the current paper, Ambrus, Baranovskyi and Kolb (2021) study a model related to our normal-quadratic specification, but with candidates who are policy motivated.[7] We explain in Section 4 that our welfare result continues to hold, approximately, when the extent of policy motivation is small. Ambrus et al. (2021) show that when policy motivation looms large and candidates' ideologies are sufficiently similar to the voter's, equilibria can aggregate more information. Our papers are complementary.

There are various other settings in economics and political science in which distortions arise because agents wish to influence their principals' beliefs. In particular, there are electoral models in which a single politician seeks to build reputation for either competence (e.g., Canes-Wrone, Herron and Shotts, 2001) or aligned preference (e.g., Maskin and Tirole, 2004). While most such papers highlight the possibility of pandering—or even "over-pandering" in

case of the statistical family mentioned in fn. 2; it permits a closer comparison with Heidhues and Lagerlof (2003) and Loertscher (2012).

[7] They assume the state is drawn from an improper prior, which can be viewed as the limit of our normal prior as the precision goes to 0.

Acemoglu, Egorov and Sonin (2013) and Kartik and Van Weelden (2019)—anti-pandering arises in Prendergast and Stole (1996) and Levy (2004).

2. The Limit to Aggregating Candidates' Information

This section formulates our general model of a Downsian election with informed candidates and presents our main result.

The Model. An electorate is represented in reduced-form by a single (median or representative) voter, whose preferences depend upon the implemented policy $x \in X$, and an unknown state of the world $\theta \in \Theta$, where both X and Θ are standard Borel spaces (e.g., subsets of $\mathbb{R}^n$). The state is drawn from a probability measure F_θ. The voter's preferences are represented by a bounded von-Neumann utility function $u(x, \theta) : X \times \Theta \to \mathbb{R}$. A leading example that we will return to is the (one-dimensional) quadratic loss function: $X, \Theta \subset \mathbb{R}$ and $u(x, \theta) = -(x - \theta)^2$.

There are two electoral candidates, A and B. Given the state θ, each candidate $i \in \{A, B\}$ observes a signal $s_i \in S_i$. The signal space S_i is a closed subset of $\mathbb{R}^n$, with $n \geq 1$. To avoid trivialities, we assume that either S_A or S_B contains more than one element. We denote the conditional cumulative distribution of s_i in state θ by $F_{s_i|\theta}$. The measure F_θ and distributions $F_{s_i|\theta}$ ($i = A, B$) induce a joint cumulative distribution F_{s_A,s_B} of signal profiles, with marginals F_{s_A} and F_{s_B}. We assume each marginal distribution F_{s_i} has support S_i.

It bears noting that we do not impose restrictions on the interdependence of the signals s_A and s_B conditional on the state θ. The signals can be conditionally independent, or conditionally positively (or even negatively) correlated. We also allow for $F_{s_A|\theta}$ to differ from $F_{s_B|\theta}$; for instance, candidates may have access to information of different quality. A leading specification, however, is the familiar (one-dimensional) symmetric *normal-normal* structure: the state $\theta \in \mathbb{R}$ is drawn from a normal distribution with mean 0 and precision $\alpha \in \mathbb{R}_{++}$ (or variance $1/\alpha$); and candidate $i = A, B$ observes signal $s_i = \theta + \varepsilon_i$, where each ε_i is drawn independently of any other random variable from a normal distribution with mean 0 and precision $\beta \in \mathbb{R}_{++}$.

After privately observing their signals, the candidates simultaneously choose their platforms x_A and x_B from the policy space X, with the objective of maximizing their respective probabilities of winning the election.[8] Upon observing the platforms (x_A, x_B), the voter updates her belief about the state θ and then elects the candidate who provides the highest expected utility. The elected candidate $i \in \{A, B\}$ implements his platform x_i. Platforms are thus policy commitments in the Downsian tradition. All aspects of the model except the candidates' private signals are common knowledge.

Strategies, Equilibria, and Welfare. A pure strategy for a candidate i is a measurable function $y_i : S_i \to X$, with $y_i(s_i)$ the platform chosen by i when his signal is s_i. A strategy for the voter is a measurable function $w_A : X^2 \to [0, 1]$, where $w_A(x_A, x_B)$ represents the probability with which candidate A is elected when the platforms are x_A and x_B. Candidate B is elected with the complementary probability $w_B(x_B, x_A) := 1 - w_A(x_A, x_B)$.

We study (weak) perfect Bayesian equilibria (y_A, y_B, w_A) of the electoral game in which candidates play pure strategies—hereafter, simply *equilibria*.[9] The voter elects candidate i if x_i is strictly preferred to x_{-i} (the subscript $-i$ refers to candidate i's opponent). We allow the voter to randomize arbitrarily when indifferent. For the median voter interpretation, one may want to insist on uniform randomization when indifferent; our results would be unaffected by this requirement, modulo one caveat noted in fn. 16.

Our notion of (equilibrium) welfare is the voter's ex-ante expected utility:

$$v(y_A, y_B, w_A) := \mathbb{E}_{s_A, s_B}\left[\max\left\{\mathbb{E}_\theta[u(y_A(s_A), \theta) \mid y_A(s_A), y_B(s_B)], \mathbb{E}_\theta[u(y_B(s_B), \theta) \mid y_A(s_A), y_B(s_B)]\right\}\right].$$

Main Result. Our main result, Theorem 1 below, is a bound on voter welfare across all equilibria. It requires the following statistical condition.

Condition 1. *For any $i \in \{A, B\}$, any dense $\hat{S}_i \subseteq S_i$,[10] and any bounded and measurable*

[8] We assume that both candidates can choose from the same set of platforms for notational simplicity. Our analysis in this section would hold equally well if each candidate i can only choose platforms from some subset $X_i \subset X$. One could use $X_A \neq X_B$ to capture asymmetries between the candidates, e.g., if there is an incumbent and a challenger, and the incumbent's history precludes him from choosing certain policies.

[9] Our leading specifications—such as the normal-normal structure—have continuous signals with atomless distributions, in which case it is salient to focus on equilibria with pure candidate strategies. Proposition 1 assures that such equilibria exist regardless of the model specification. Notwithstanding, we discuss equilibria in which candidates may mix in Section 4.

[10] Dense in the relative topology of S_i.

function $g : S_{-i} \to \mathbb{R}$,

$$\mathbb{E}_{s_{-i}}[g(s_{-i}) \mid s_i] = 0 \text{ for all } s_i \in \hat{S}_i \implies \Pr(\{s_{-i} : g(s_{-i}) = 0\} \mid s_i) = 1 \text{ for all } s_i \in \hat{S}_i. \quad (1)$$

In words, (1) says that if $g(s_{-i})$ has mean zero conditional on every $s_i \in \hat{S}_i$, then conditional on any such s_i, it holds that $g(s_{-i}) = 0$ a.s. Condition 1 is thus equivalent to saying that any dense subset of S_i induces a *boundedly complete* family of conditional distributions over S_{-i}. Bounded completeness is a recognized concept in statistics (e.g., Lehmann, 1986, p. 144), which in our context captures a notion of richness in how variation in s_i affects candidates i's beliefs about his opponent's signal s_{-i}. For finite signal spaces S_A and S_B, Condition 1 is equivalent to the matrix of joint probabilities of signals s_A and s_B (unconditional on the state θ) having full rank. Plainly, Condition 1 is violated if the signals are independent, e.g., if either signal is uninformative about the state. But so long as both signals s_A and s_B are informative about the state—which is the case of interest—we view Condition 1 as a reasonable requirement.

In particular, it follows from a well-known fact about complete families that, so long as each signal space S_i has a nonempty interior, Condition 1 holds when the distribution of $s_{-i}|s_i$ for each $i \in \{A, B\}$ is in the exponential family of distributions; see Remark 2 in Appendix B for details. This canonical class includes a variety of widely-used discrete and continuous distributions with bounded and unbounded supports, such as normal, exponential, gamma, beta, chi-squared, binomial, Dirichlet, and Poisson. Condition 1 is thus satisfied by common statistical models of a state $\theta \in \mathbb{R}^n$ and signals s_A and s_B, including our leading normal-normal specification.

Theorem 1. *Assume Condition 1. In any equilibrium, there is a candidate $i \in \{A, B\}$ such that the voter's welfare is the same as if candidate i were elected no matter which policies are proposed in that equilibrium.*

To elaborate, consider any equilibrium (y_A, y_B, w_A). Denote by $v_i(y_A, y_B)$ the voter's welfare from electing candidate i no matter which policies are proposed. Theorem 1 implies that, under Condition 1, the voter's equilibrium welfare $v(y_A, y_B, w_A)$ is given by

$$v(y_A, y_B, w_A) = \max\{v_A(y_A, y_B), v_B(y_A, y_B)\}.$$

Put another way, insofar as welfare is concerned, the voter may as well be ignoring one of the candidates and always electing the other. Crucially, this is an "as if": both candidates may in fact win with positive ex-ante probability, with the voter strictly preferring candidate A after some platforms and strictly preferring B after other platforms.

Theorem 1 implies a sharp upper bound on the voter's welfare across all equilibria. To make that precise, let v_i^* denote the voter's welfare if candidate i were always elected with his platform chosen—based on his information alone—to maximize voter welfare. Theorem 1 implies that in any equilibrium, welfare is at most

$$\max\{v_A^*, v_B^*\}. \tag{2}$$

In other words, even when both candidates having socially valuable information, the voter's equilibrium welfare is, at best, determined by the efficient use of only one candidate's signal.

We now sketch the logic behind Theorem 1. The key insight is Lemma 1 below, which states that under Condition 1, every equilibrium of our model must be also an *ex-post* equilibrium. Specifically, we show that in any equilibrium, the voter's strategy $w_A(x_A, x_B)$ must be constant across almost all on-path platforms. Consequently, neither candidate can affect his probability of winning by changing his platform, no matter which (on-path) platform is played by his opponent.

Lemma 1. *Assume Condition 1. In any equilibrium* (y_A, y_B, w_A)*, there is a constant* $c \in [0, 1]$ *such that* $\Pr(\{(x_A, x_B) : w_A(x_A, x_B) \neq c\}) = 0$.[11]

To see the logic behind the lemma, observe that given an arbitrary voter strategy, the candidates are engaged in a constant-sum Bayesian game in which their payoffs depend only on their platforms x_A and x_B, not directly on their signals s_A and s_B. Lemma 2 in Appendix A provides a general result about any two-player constant-sum Bayesian game with payoffs that depend only on the players' actions and not on their types. In any Bayes-Nash equilibrium, any action chosen by some type of a player would also be a best response for any other type of that player,[12] even though the two types will generally hold different beliefs about the opponent's distribution of actions when types are correlated. Applied to our electoral game,

[11] Here, $\Pr(\cdot)$ refers to the probability distribution over platforms induced by the joint distribution of candidates' signals F_{s_A,s_B} and the strategy profile (y_A, y_B).

[12] To be precise, this is up to a probability-zero caveat; we frequently omit such caveats hereafter.

Lemma 2 implies that in any equilibrium (y_A, y_B, w_A), each candidate i's ex-ante probability of winning, call it ω_i, is also i's interim probability of winning, $\mathbb{E}_{x_{-i}}[w_i(x_i, x_{-i}) \mid s_i]$, no matter his signal s_i or which on-path platform x_i (possibly chosen in equilibrium only by some other type s_i') he chooses. Equivalently, $\omega_i = \mathbb{E}_{s_{-i}}[w_i(x_i, y_{-i}(s_{-i})) \mid s_i]$ for all s_i and on-path x_i. But then, Condition 1 implies that for any on-path x_i, we have $\omega_i = w_i(x_i, y_{-i}(s_{-i}))$ for all s_{-i}. It follows that $w_i(\cdot)$ is constant on path, which is the ex-postness property of Lemma 1.[13]

Lemma 1 implies that in any equilibrium, there are only two possibilities on the equilibrium path. Either (i) one candidate wins with probability one, or (ii) both candidates win with a constant interior probability, regardless of their platforms. In the latter case, the voter is always indifferent between the candidates. It follows that in either case, the voter's ex-ante expected utility can be evaluated as if she always elects the same candidate, which is what Theorem 1 states.

As already noted, Theorem 1 implies the upper bound (2) on equilibrium voter welfare. Our next result is that this upper bound can be achieved. Say that candidate i is *better* (than his opponent) if $v_i^* \geq v_{-i}^*$. That is, if each candidate would choose the voter-optimal policy based on their information alone, $y_i^*(s_i) := \arg\max_{x \in X} \mathbb{E}_\theta[u(x, \theta) \mid s_i]$,[14] then the voter would prefer to ex-ante delegate policymaking to i rather than the opponent.

Proposition 1. *If Condition 1 holds, then a voter-welfare maximizing equilibrium has welfare* $\max\{v_A^*, v_B^*\}$. *There is one such equilibrium in which the better candidate $i \in \{A, B\}$ is elected with probability one and plays y_i^*.*

While there may be multiple equilibria that achieve the proposition's welfare bound, a simple equilibrium construction is as follows. The better candidate i plays y_i^*, and the opponent uninformatively chooses the prior-optimal policy, i.e., he plays $y_{-i}(s_{-i}) = \arg\max_{x \in X} \mathbb{E}_\theta[u(x, \theta)]$. It is then optimal for the voter to always elect i on path. We can stipulate that the voter also elects i if $-i$ chooses any other platform (and i chooses any of his on-path platforms)

[13] To see how ex-postness can fail absent Condition 1, consider $\Theta = X = S_1 = S_2 = \{1, 2\}$, $u(x, \theta) = 1$ if $x = \theta$ and 0 if $x \neq \theta$, a uniform prior on Θ, and each candidate gets an uninformative signal with each $s_i \in \{1, 2\}$ equally likely in both states. Condition 1 fails because s_1 and s_2 are independent. There is an equilibrium in which both candidates play $y_i(s_i) = s_i$ and the voter (being indifferent between both policies) plays $w_A(x_A, x_B) = 1$ if $x_A = x_B$ and 0 if $x_A \neq x_B$. This is not an ex-post equilibrium, but regardless of their signals candidates are indifferent between both platforms because they face a "matching pennies" problem.

[14] If there are multiple maximizers at any s_i, we can choose an arbitrary one.

because she believes that the deviation by $-i$ is uninformative about s_{-i}.[15,16] Note that this construction does not require Condition 1; rather, the condition guarantees, by Theorem 1, that this equilibrium is welfare maximizing.

3. Pandering and Anti-Pandering

We now turn to assessing pandering both from an equilibrium and (disequilibrium) welfare perspective. We specialize in this section to a one-dimensional normal-quadratic specification: $X, \Theta \subset \mathbb{R}$, the voter's utility is $u(x,\theta) = -(x-\theta)^2$, the state is $\theta \sim \mathcal{N}(0, 1/\alpha)$, and each candidate $i \in \{A, B\}$ receives a conditionally independent signal $s_i = \theta + \varepsilon_i$, with $\varepsilon_i \sim \mathcal{N}(0, 1/\beta)$, with parameters $\alpha, \beta \in \mathbb{R}_{++}$. Section 4 discusses how the themes of this section can be generalized.

Quadratic-loss utility implies that that voter's preferred policy given information $\mathcal{I}$ is $\mathbb{E}[\theta|\mathcal{I}]$. Hence, by standard properties of normal information (e.g., Degroot, 1970),

$$y_i^*(s_i) = \mathbb{E}\left[\theta|s_i\right] = \frac{\beta}{\alpha+\beta} s_i, \tag{3}$$

and we refer to y_i^* as the *unbiased* strategy because it is the best estimate of state given s_i. We say that a strategy y_i displays *pandering* (or underreaction) if $s_i > 0 \implies y_i(s_i) \in [0, \mathbb{E}[\theta|s_i])$, $s_i < 0 \implies y_i(s_i) \in (\mathbb{E}[\theta|s_i], 0]$, and $y_i(0) = 0$. In other words, a candidate panders if for $s_i \neq 0$ his platform is distorted from his unbiased estimate toward the voter's prior expectation $\mathbb{E}[\theta] = 0$ of the best policy. Analogously, we say that y_i displays *anti-pandering* (or overreaction) if $s_i > 0 \implies y_i(s_i) > \mathbb{E}[\theta|s_i]$ and $s_i < 0 \implies y_i(s_i) < \mathbb{E}[\theta|s_i]$. We also say that a platform x is *more extreme* than platform x' if the former is further from the prior mean of 0, i.e., if $|x| > |x'|$. A strategy y_i is *informative* if it is not constant, and it is *fully revealing* if it is bijective. An equilibrium is *symmetric* if both candidates use the same strategy and both win with positive probability.

[15] Any sequentially rational behavior by the voter after an observable deviation by i supports the equilibrium, as i has no incentive to deviate.

[16] Let x_i be an on-path platform of candidate i. Our construction entails the voter electing candidate i even if both candidates choose x_i. If one insists that the voter must randomize uniformly between the candidates when indifferent, then Proposition 1 is still valid with essentially the same construction so long as every on-path platform of candidate i has zero ex-ante probability. This is the case with a continuous policy space when there is a unique and distinct optimal policy after each signal of the better candidate i and the marginal distribution F_{s_i} is atomless. An example is the normal-normal information structure with quadratic-loss voter preferences.

Equilibrium Anti-Pandering. There are trivial equilibria in which candidates disregard their information and fully pander to the voter's prior belief, i.e., play $y_i(\cdot) = \mathbb{E}[\theta] = 0$.[17] We are interested, instead, in the nature of informative equilibria.

A natural starting point is to consider the profile of unbiased strategies. From Equation 3, we see that the voter would then infer from a platform x_i that $s_i = \frac{\alpha+\beta}{\beta} x_i$. As the expected value of θ conditional on both signals is

$$\mathbb{E}[\theta|s_A, s_B] = \frac{2\beta}{\alpha + 2\beta} \left(\frac{s_A + s_B}{2} \right), \tag{4}$$

the voter's posterior expectation of the state given the platforms x_A and x_B is

$$\frac{2(\alpha + \beta)}{\alpha + 2\beta} \left(\frac{x_A + x_B}{2} \right).$$

So the voter's preferred policy, which is the posterior expectation, has the same sign as the average of the two platforms but is more extreme (so long as the average is non-zero). Since the voter elects the candidate whose platform is closer to her posterior expectation, she elects the more extreme candidate. Each candidate would thus benefit by deviating to a more extreme platform, i.e., by overreacting to his information; on the other hand, underreacting would not be profitable. Proposition 4 in the appendix provides a formal argument.

Building on the above intuition, the next result identifies an anti-pandering equilibrium.

Proposition 2. *There is a symmetric and fully-revealing equilibrium with anti-pandering: both candidates play*

$$y_i(s_i) = \mathbb{E}[\theta|s_i, s_{-i} = s_i] = \frac{2\beta}{\alpha + 2\beta} s_i, \tag{5}$$

and each candidate is elected with probability $1/2$ *regardless of their platforms. Moreover, any symmetric equilibrium in which both candidates use fully-revealing and continuous strategies has both candidates playing* (5).

In the equilibrium of Proposition 2, candidates can be viewed as acting as if their signals are twice as accurate as they actually are. Alternatively, candidate i's platform is the Bayesian estimate of the state assuming his opponent has received the same signal s_i. Note that i knows that in expectation, his opponent's signal is in fact more moderate than his own, as

[17] Indeed, for any uninformative pure strategy, there is an equilibrium in which both candidates use that strategy due to the latitude in specifying off-path beliefs.

i's expectation of his opponent's signal is simply his unbiased estimate of the state, $\frac{\beta}{\alpha+\beta}s_i$. When the voter conjectures that both candidates play the strategy (5), she is indifferent between the candidates no matter their platforms. For, whenever a candidate i increases his platform by $\delta > 0$, formula (4) implies that the voter's posterior expectation increases by $\frac{2\beta}{\alpha+2\beta}\left(\frac{\alpha+2\beta}{2\beta}\frac{\delta}{2}\right) = \delta/2$.

Not only does Proposition 2 establish the existence of an anti-pandering equilibrium, but it shows that this is the unique symmetric fully-revealing equilibrium subject to continuity.[18] It implies, for example, that if both candidates play the same linear strategy $y(s_i) = ks_i$ with coefficient $k \neq 0$, then only $k = 2\beta/(\alpha + 2\beta)$ constitutes a symmetric equilibrium; in particular, there is no non-trivial symmetric linear equilibrium with pandering, i.e., with $k \in (0, \beta/(\alpha + \beta))$.

The degree of overreaction in the equilibrium of Proposition 2, as measured by $\frac{2\beta}{\alpha+2\beta} - \frac{\beta}{\alpha+\beta}$, is non-monotonic in the parameters: it is increasing in β and decreasing in α when $\beta\sqrt{2} < \alpha$, and decreasing in β and increasing in α when $\beta\sqrt{2} > \alpha$. The degree of overreaction vanishes as either α or β tend to 0 or ∞. Thus, Proposition 2 predicts that overreaction is maximized when candidates are somewhat better informed than the voters but not too much so.

The Benefits of Pandering. A common view is that politicians' pandering to an electorate's prior harms welfare (e.g., Heidhues and Lagerlof, 2003). We will show that in the normal-quadratic setting, an appropriate degree of (disequilibrium) pandering would actually benefit the voter. To get some intuition for why, consider again the benchmark where both politicians play the unbiased strategy $y_i^*(\theta) = \mathbb{E}[\theta|s_i]$. As explained above, the voter would then select the politician with the most extreme platform. This implies a "winner's curse": the electoral winner, say i, would have received the most extreme signal, and so voter welfare would be improved if i were elected with a slightly more moderate platform. Such moderation can be achieved by underreacting to private information, i.e., by pandering.

Building on this intuition, the following result shows that, subject to a qualifier, voter

[18] The proof of Proposition 2 actually establishes that among fully-revealing equilibria with continuous strategies in which both candidates win with positive probability, there can be only a very limited degree of asymmetry. In any such equilibrium, there is a constant $c \in \mathbb{R}$ and a candidate $i \in \{A, B\}$ such that

$$y_i(s_i) = \frac{2\beta}{\alpha + 2\beta}s_i + c \quad \text{and} \quad y_{-i}(s_{-i}) = \frac{2\beta}{\alpha + 2\beta}s_{-i} - c.$$

welfare would be maximized by a suitable degree of pandering.

Proposition 3. *The symmetric strategy profile in which each candidate i panders by playing*

$$y_i(s_i) = \mathbb{E}\left[\theta \mid s_i, |s_{-i}| \leq |s_i|\right], \tag{6}$$

maximizes voter welfare among all strategy profiles in which the voter's optimal response would lead to candidate i winning whenever $|s_i| > |s_{-i}|$.

The intuition for Proposition 3 is as follows. The welfare-maximizing platform given any information $\mathcal{I}$ is $\mathbb{E}[\theta|\mathcal{I}]$. When the voter is selecting the candidate with the most extreme signal, the relevant information that candidate i has when he conditions on winning is his own signal, s_i, and that $|s_i| > |s_{-i}|$. Strategy (6) features pandering because conditioning on the opponent having a more moderate signal makes a candidate underreact to his own signal. Since the voter would optimally elect the candidate with the most extreme signal if both candidates used unbiased strategies, an implication of Proposition 3 is that both candidates playing the pandering strategy (6) provides higher voter welfare than both candidates playing unbiased strategies. Hence, by Theorem 1, such pandering also dominates any equilibrium.

We remark that although we do not have a proof, we conjecture that Proposition 3 holds without the qualification that a candidate must win when he has the more extreme signal.[19]

4. Discussion

This section discusses the robustness of Theorem 1 to mixing by candidates and to candidates who are not entirely office motivated; we also generalize the anti-pandering equilibrium beyond the normal-normal information structure.

Candidates' Mixed Strategies. We have studied equilibria with pure candidate strategies. We now explain how Theorem 1 extends to candidates mixing, at least subject to a qualifier.

[19] For a suggestive heuristic, consider any symmetric strategy profile in which both candidates play the same strategy y that is symmetric around 0. For the unbiased strategy, we have the derivative $y'(\cdot) = \frac{\beta}{\beta+\alpha}$; for the overreaction strategy identified in Proposition 2, we have $y'(\cdot) = \frac{2\beta}{\alpha+2\beta}$. Presuming differentiability, one can verify that whenever $y'(\cdot) \in [0, \frac{2\beta}{\alpha+2\beta}]$, it would be optimal for the voter to elect the candidate with the most extreme platform and hence the most extreme signal. Thus, roughly speaking, the requirement that a candidate wins when he has the most extreme signal is satisfied as long as neither candidate overreacts by more than he would when conditioning on the opponent having received the same signal as he did. It appears unlikely that such a degree of overreaction could improve voter welfare.

A mixed strategy for candidate i is a measurable function $\sigma_i : S_i \to \Delta(X)$, where $\Delta(X)$ is the set of probability measures over the policy space X. We say that a strategy σ_i is *identifiable* if for any dense $\hat{S}_i \subseteq S_i$ and any bounded and measurable $g : X \to \mathbb{R}$,

$$\mathbb{E}_{x_i}\left[g\left(x_i\right) \mid s_i\right] = 0 \text{ for all } s_i \in \hat{S}_i \implies \Pr\left(\left\{x_i : g\left(x_i\right) = 0\right\} \mid s_i\right) = 1 \text{ for all } s_i \in \hat{S}_i,$$

where both the left-hand-side expectation and the right-hand-side probability are computed using σ_i. Analogous to Condition 1, identifiability is a completeness property, but now on the distributions of $x_i|s_i$ induced by σ_i. Any pure strategy y_i is identifiable because in that case $\mathbb{E}[g(x_i) \mid s_i] = g(y_i(s_i))$. An example of a non-identifiable strategy is $\sigma_i(s_i)$ any non-degenerate probability measure on X that does not vary with s_i.

Theorem 1 holds for any equilibrium in which candidates mix, so long as at least one candidate plays an identifiable strategy. This is because the ex-postness conclusion of Lemma 1 applies to such equilibria, formally as a consequence of Theorem 2 in Appendix A. We do not know whether equilibria in which both candidates play non-identifiable strategies—if they exist in a given specification—can overturn the conclusion of Theorem 1.[20] In particular, even non-ex-post equilibria can still satisfy the theorem's conclusion. To illustrate, consider a variant of the example described in fn. 13: $\Theta = X = \{1, 2\}$, $u(x, \theta) = 1$ if $x = \theta$ and 0 if $x \neq \theta$, a uniform prior on Θ, and any signal structure that satisfies Condition 1. There is an equilibrium in which, regardless of their signals, both candidates mix uniformly over both policies, and the voter (being indifferent between both policies) plays $w_A(x_A, x_B) = 1$ if $x_A = x_B$ and 0 if $x_A \neq x_B$. Neither candidate's strategy is identifiable and Lemma 1 fails; yet, the equilibrium trivially still satisfies the conclusion of Theorem 1.

Ideological and Other Motivations. We now argue that our main welfare conclusion, Proposition 1, is robust to small departures from the assumption that candidates are entirely office-motivated. Consider a variant of our model in which the payoff of each candidate $i \in \{A, B\}$ is given by $u_i(x_A, x_B, \theta, W; \gamma_i)$, where the new notation $W \in \{A, B\}$ denotes the election's winner and γ_i is a commonly-known payoff parameter. Pure office-motivation corresponds to the utility $\mathbb{1}_{\{W=i\}}$, but in general $u_i(\cdot)$ allows for a variety of *mixed motivations*,

[20] In some specifications, we can deduce that they do not. For example, consider a binary-policy binary-signal setting (e.g., Heidhues and Lagerlof, 2003). Here the only non-identifiable strategies are uninformative and so an equilibrium in which neither candidate uses an identifiable strategy is clearly no better for voter welfare than efficiently aggregating one candidate's signal.

including policy motivation (a candidate cares about the winner's policy, in relation to the state), platform motivation (he cares about his own platform, in relation to the state), etc.

An election with mixed motivations is not generally a constant-sum game for the candidates; consequently, for arbitrary mixed motivations, voter welfare may be significantly different from the bound in Proposition 1. However, consider a family of mixed-motivations games in which each candidate i's payoff is parameterized by $\gamma_i \in \mathbb{R}^m$ such that $u_i(x_A, x_B, \theta, W; \vec{0}) = \mathbb{1}_{\{W=i\}}$. That is, when $\gamma_i = \vec{0} \equiv (0, \ldots, 0)$, candidate i is purely office motivated. Under appropriate technical conditions, the Theorem of the Maximum assures that the equilibrium correspondence is upper hemicontinuous in the parameter (γ_A, γ_B), and hence the upper bound on voter welfare when $(\gamma_A, \gamma_B) \approx (\vec{0}, \vec{0})$, i.e., when candidates are almost office-motivated, is approximately that of Proposition 1.[21] Simple sufficient technical conditions are that all the spaces S_A, S_B, Θ, and X are finite and that each $u_i(\cdot)$ is continuous in $(x_A, x_B, \theta, \gamma_i)$.

We note that our leading normal-quadratic specification does not satisfy the aforementioned technical conditions; in particular, the policy space $X = \mathbb{R}$ is not compact. The Supplementary Appendix analyzes an extension of the normal-quadratic model with mixed motivations of the form

$$u_i(x, \theta, W; b_i, \rho_i) = -\rho_i(x_W - \theta - b_i)^2 + (1 - \rho_i)\mathbb{1}_{\{W=i\}}. \tag{7}$$

So each candidate i has quadratic-loss policy utility with an ideological bias $b_i \in \mathbb{R}$ and places weight $\rho_i \in [0, 1]$ on policy utility. The Supplementary Appendix establishes that even though the equilibrium correspondence is not upper hemicontinuous, the upper bound on voter welfare when each $b_i \approx 0$ and $\rho_i \approx 0$ is still close to that of efficiently using only one candidate's signal. Moreover, there is an equilibrium that approximately achieves that welfare. So, the welfare conclusions of Proposition 1 still approximately hold.[22]

[21] More precisely, we would be assured upper hemicontinuity of the set of Bayes-Nash equilibria. Although our solution concept is weak Perfect Bayesian equilibrium (in which candidates use pure strategies), Theorem 1 holds for Bayes-Nash equilibria too because its backbone, Lemma 1, guarantees the ex-postness property for an arbitrary voter strategy. Note also that we implicitly restrict attention to equilibria of the perturbed games in which candidates use pure strategies, to ensure that this property is preserved in any limit.

[22] Ambrus et al. (2021) study specification (7) assuming an improper prior, i.e., when our normal prior's precision $\alpha \to 0$. As noted in the comparative-statics paragraph after Proposition 2, at this limit the overreaction in our anti-pandering equilibrium vanishes, i.e., unbiased strategies constitute an equilibrium when candidates are office motivated ($\rho_A = \rho_B = 0$). Because of the improper prior, voter welfare in this equilibrium is the same as if only aggregating one candidate's signal, consistent with Theorem 1. Ambrus et al. (2021) construct equilibria with higher welfare when candidates are substantially policy motivated (each ρ_i is sufficiently large)

Robustness of the Anti-Pandering Equilibrium. In any specification of our model, there are both a trivial equilibrium with "full pandering" in which candidates uninformatively choose a prior-optimal policy, and an informative equilibrium that efficiently aggregates one candidate's signal.

The existence of an anti-pandering equilibrium like the one characterized in Proposition 2 requires more structure, but holds beyond our normal-quadratic specification. The simplest extension is to an asymmetric normal-quadratic specification in which the candidate's signals $s_i = \theta + \varepsilon_i$ have ε_i's drawn from normal distributions with different precisions β_i. So, one candidate is more 'competent' than the other. In this case, the anti-pandering equilibrium strategy takes the form $y_i(s_i) = \frac{2\beta_i}{\alpha+\beta_A+\beta_B} s_i$.

More generally, maintaining quadratic loss voter preferences, a fully-revealing anti-pandering equilibrium exists when the distributions of the state θ and signals s_i are conjugate and belong to an exponential family. The Supplementary Appendix explicitly derives such an equilibrium in a Beta prior-Bernoulli signals specification and shows that it has characteristics analogous to that of Section 3. The key general property of an exponential family is that the posterior expectation $\mathbb{E}[\theta|s_0, s_1, \ldots, s_n]$ of the state θ given a prior mean parameter, say s_0, and any number of signal realizations, $s_1, \ldots, s_n$, is linear in $s_0, s_1, \ldots$ and s_n, (Jewel, 1974). In our Downsian framework, suppose the two candidates' signals s_A and s_B are identically distributed conditional on the state θ. (Identical distributions are not necessary, but make the points below more transparent.) Then, there are constants w_0 and w_1 such that

$$\mathbb{E}[\theta|s_i] = \frac{w_0 s_0 + w_1 s_i}{w_0 + w_1} \quad \text{and} \quad \mathbb{E}[\theta|s_A, s_B] = \frac{w_0 s_0 + 2w_1\left((s_A + s_B)/2\right)}{w_0 + 2w_1}.$$

Hence, the difference between the posterior mean and the prior mean s_0 is

$$\mathbb{E}[\theta|s_A, s_B] - s_0 = \frac{2w_1\left((s_A + s_B)/2 - s_0\right)}{w_0 + 2w_1}. \tag{8}$$

Instead, the difference between the midpoint of the candidates' unbiased strategy platforms and the prior mean is

$$\frac{y_A^*(s_A) + y_B^*(s_B)}{2} - s_0 = \frac{\mathbb{E}[\theta|s_A] + \mathbb{E}[\theta|s_B]}{2} - s_0 = \frac{w_1\left((s_A + s_B)/2 - s_0\right)}{(w_0 + w_1)}. \tag{9}$$

with limited ideological biases (the magnitude of each b_i is sufficiently small). Note that the best equilibrium with benevolent candidates ($\rho_i = b_i = 0$) would maximize voter welfare; cf. Proposition 3 for proper priors.

We see from (8) and (9) that for any pair of signal realizations, the posterior expectation given the average signal and the average of candidates' individual posterior expectations both shift in the same direction relative to the prior mean, but the former does so by a larger magnitude. It is this property that underlies the incentive to overreact in an unbiased strategy profile; the logic of anti-pandering thus applies here.[23] The following generalization of the existence result of Proposition 2 can be verified: there is an equilibrium with overreaction in which each candidate i plays

$$y_i(s_i) = \frac{2w_1}{w_0 + 2w_1} s_i + \frac{w_0}{w_0 + 2w_1} s_0,$$

and the voter randomizes uniformly after any pair of on-path platforms.[24]

5. Conclusion

Motivated by the debate on whether political competition promotes information aggregation and leads electorates to make informed choices when exercising voting rights, this paper has studied Downsian electoral competition between two office-motivated candidates who have private information about policy consequences.

Our main result is a sharp bound on the (median or representative) voter's welfare that holds under a statistical condition on the candidate's signals. We find that welfare in any equilibrium is effectively determined by just one candidate's platform strategy. Consequently, Downsian elections cannot efficiently aggregate more than one candidate's information, despite the availability of two informational sources. Moreover, the upper bound of efficiently aggregating the "better" candidate's information can be achieved in an equilibrium.

We have also studied positive and normative aspects of pandering in a normal-quadratic specification of our model. Although a trivial equilibrium exists in which candidates fully disregard their private information (i.e., they fully pander to the electorate's prior belief), we

[23] As the prior density need no longer be symmetric around the mean (unlike with a normal prior) and signals may be bounded (unlike with normally distributed signals), the definitions of anti-pandering or overreaction have to be broadened from earlier. We now say that a strategy y_i has overreaction if for all s_i, $|y_i(s_i) - \mathbb{E}[\theta]| \geq |\mathbb{E}[\theta|s_i] - \mathbb{E}[\theta]|$ with strict inequality for some s_i. The focus on posterior expectations of the state is justified when the voter has a quadratic loss function. See the discussion in Roux and Sobel (2015) to get a sense of how asymmetric loss functions would affect the conclusions.

[24] While there may now be off-path platforms (unlike with normal distributions), as in the Beta-Bernoulli example in the Supplementary Appendix, the equilibrium can be supported with reasonable off-path beliefs.

show that a fully-revealing equilibrium with anti-pandering exists in which politicians overreact to their information. Furthermore, we find that an appropriate degree of (disequilibrium) pandering by candidates would actually benefit voters.

In the Downsian tradition, our analysis assumes that candidates make commitments to the policies they would implement if elected.[25] From a positive point of view, it seems reasonable to suppose that some degree of electoral commitment is available and valuable to candidates; in their meta-study of earlier research, Pétry and Collette (2009) conclude that around 67% of campaign promises have historically been kept. The theoretical literature has proposed multiple rationales for commitment, most prominently that of re-election concerns (Alesina, 1988). Another rationale, particularly relevant in our context, is that if there is uncertainty about a candidate's quality of information and candidates have reputation concerns (perhaps because of re-election motives), then "flip flopping" or "vacillating" may be associated with poor quality information, resulting in stickiness akin to commitment; see, for example, Prendergast and Stole (1996) or Majumdar and Mukand (2004).

As in most formal models of spatial electoral competition, we have restricted attention to two candidates and assumed that their information is exogenously given. Relaxing both these assumptions are interesting topics for future research. We note here that since a voter-optimal equilibrium of our model involves always electing the "better"—roughly, more informed—candidate, there can be strong incentives for candidates to observably acquire information.

Finally, while we have focused exclusively here on electoral competition, we believe the logic underlying anti-pandering and the welfare bounds ought to be relevant more broadly. For example, consider two consultants (or other experts) proposing changes that an organization should undertake; the optimal course of action is uncertain and only one of their proposals can be accepted. One may also consider product choice or standards submissions by firms who are vying for a consumer's purchase or a standards-setting body's approval. Depending on the application, it may of interest to extend our model to incorporate additional features such as prices.

[25] See Osborne and Slivinski (1996), Besley and Coate (1997) and subsequent work for non-Downsian "citizen-candidate" models.

Appendices

A. Constant-Sum Bayesian Games with Type-Independent Payoffs

In this appendix, we prove a more general version of Lemma 1 that may have independent interest.

Setting. There are two players, A and B. Each player $i \in \{A, B\}$ has type $s_i \in S_i$, where S_i is a standard Borel space. Type profiles (s_A, s_B) are drawn from a probability measure F on $S_A \times S_B$ with marginals F_A and F_B whose supports are S_A and S_B. The players simultaneously choose actions $x_i \in X_i$, where each X_i is a standard Borel space. No matter the type profile, player i's payoff is $u_i(x_i, x_{-i})$, with $u_A(\cdot) + u_B(\cdot) = 0$. So the game is constant sum, and types do not directly affect payoffs. Assume payoffs are uniformly bounded: $|u_i(\cdot)| \leq 1$, where the constant 1 is a normalization. We denote elements of $\Delta(X_i)$, i.e., mixed actions, by ξ_i. Payoffs are extended to mixed action profiles by linearity as usual, and we also write $u_i(\xi_i, \xi_{-i})$. A mixed strategy for player i is $\sigma_i : S_i \to \Delta(X_i)$. We study Bayes-Nash equilibria.

Say that a mixed action $\xi_i \in \Delta(X_i)$ *secures* player i (no matter his type) the payoff $U_i \in \mathbb{R}$ if for all $\xi_{-i} \in \Delta(X_{-i})$, it holds that $u_i(\xi_i, \xi_{-i}) \geq U_i$.

Results. Loosely, the following result says that in any equilibrium, any on-path action of a player is a best response for every type of that player.

Lemma 2. *Take any equilibrium $\sigma^* \equiv (\sigma^*_A, \sigma^*_B)$ with equilibrium payoffs (U^*_A, U^*_B). It holds for each $i \in \{A, B\}$, (σ^*_i, F_i)-a.e. x_i, and F_i-a.e. s_i that*

$$U^*_i = \mathbb{E}_{x_{-i}}[u_i(x_i, x_{-i}) \mid s_i],$$

where the expectation is with respect to the measure induced by σ^*_i and F.

Proof. Since the game is zero sum and σ^* is an equilibrium, each player i can secure U^*_i. This implies that for each i, conditional on F_i-a.e. types s_i, player i's equilibrium payoff must in fact be U^*_i. Moreover, for F_i-a.e. types s_i, the conditional distribution of the opponent's actions induced by σ^*_{-i} and F must secure the opponent U^*_{-i}; for if not, there would be some action that yields s_i a payoff strictly larger than U_i^*. Finally, (σ_i^*, F_i)-a.e. actions x_i must be a best response to any mixed action ξ_{-i} that secures U_{-i}^*; for if not, player $-i$ can obtain a payoff strictly larger than U_{-i}^* by playing the constant strategy $s_{-i} \mapsto \xi_{-i}$. The lemma's conclusion follows. $\square$

Remark 1. Consider a *complete-information* two-player game G with action spaces X_A and X_B and payoff functions u_A and u_B as above. Any (objective) *correlated* equilibrium of this game is a Bayes-Nash equilibrium of a suitably-defined Bayesian game as above. It thus follows from Lemma 2 that if $\rho \in \Delta(X_1 \times X_2)$ is a correlated equilibrium of G with payoffs (π_1, π_2), then for any $i \in \{A, B\}$ and ρ-a.e. x_i and ρ-a.e. x_i', it holds that $\mathbb{E}_{x_{-i}}[u_i(x_i', x_{-i}) \mid x_i] = \pi_i$, and hence x_i' is a best response to $\rho(\cdot|x_i)$. For finite games, this result has been noted by Viossat (2006, Proposition 3.8). $\square$.

We build on Lemma 2 for a generalization of Lemma 1. In the current setting, say that an equilibrium σ^* with payoffs (U_A^*, U_B^*) is an *ex-post equilibrium* if for (σ^*, F)-a.e. (x_A, x_B), it holds that $u_i(x_i, x_{-i}) = U_i^*$ for $i \in \{A, B\}$. Note that the notions of bounded completeness (Condition 1) and strategy identifiability (Section 4) port over without change to the current setting.[26] Recall that any pure strategy is identifiable.

Theorem 2. *If Condition 1 holds, then any equilibrium in which either player's strategy is identifiable (in particular, if either player uses a pure strategy) is an ex-post equilibrium.*

Proof. Let player $-i$'s strategy be identifiable and σ^* be an equilibrium with i's payoff U_i^*. Below, all expectations are with respect to the measure induced by (σ^*, F). For (σ_i^*, F_i)-a.e. x_i and F_i-a.e. s_i, it holds that

$$\begin{aligned}
U_i^* &= \mathbb{E}_{x_{-i}}[u_i(x_i, x_{-i}) \mid s_i] \quad \text{by Lemma 2} \\
&= \mathbb{E}_{s_{-i}}[\mathbb{E}_{x_{-i}}[u_i(x_i, x_{-i}) \mid s_i, s_{-i}] \mid s_i] \quad \text{by the law of iterated expectation} \\
&= \mathbb{E}_{s_{-i}}[\mathbb{E}_{x_{-i}}[u_i(x_i, x_{-i}) \mid s_{-i}] \mid s_i] \quad \text{because } x_{-i} \text{ is independent of } s_i, \text{ conditional on } s_{-i}.
\end{aligned}$$

Since any subset of S_i that has F_i-probability one is dense in S_i (because F_i has support

[26] The topology on S_i for denseness in Condition 1 is now given by the metric that makes S_i standard Borel.

S_i), it follows from Condition 1 that for (σ_i^*, F_i)-a.e. x_i and F_{-i}-a.e. s_{-i}, we have

$$\mathbb{E}_{x_{-i}}[u_i(x_i, x_{-i}) \mid s_{-i}] = U_i^*.$$

It then follows from the identifiability of σ_{-i}^* that for (σ^*, F)-a.e. (x_i, x_{-i}), we have $u_i(x_i, x_{-i}) = U_i^*$. □

B. Proofs and Supporting Material for Section 2

The following two remarks concern exponential families and Condition 1.

Remark 2. It is well known (e.g., Lehmann, 1986, Theorem 1, p. 142) that the entire set S_i is boundedly complete if it has a nonempty interior and the distribution of $s_{-i}|s_i$ is in the exponential family of distributions, i.e., the conditional density is given by

$$f(s_{-i}|s_i) = e^{s_i \cdot T(s_{-i}) - \psi(s_i)} h(s_{-i}), \tag{10}$$

where $s_i \cdot T(s_{-i})$ is the dot product (with $s_i \in \mathbb{R}^n$ viewed as a row vector and $T(s_{-i}) \in \mathbb{R}^n$ as a column vector), $\psi : S_i \to \mathbb{R}$, and $h : S_{-i} \to \mathbb{R}$.

In addition, if ψ is continuous— as is the case for familiar exponential-family distributions— then Condition 1 is satisfied. To see that, note that if $s_i^k \to s_i$, then the density $f(s_{-i}|s_i^k) \to f(s_{-i}|s_i)$ pointwise, hence in total variation (by Scheffe's Theorem), and hence for any bounded and measurable $g : S_{-i} \to \mathbb{R}$, it holds that $s_i^k \to s_i \implies \int_{S_{-i}} g \mathrm{d}F_{s_i^k} \to \int_{S_{-i}} g \mathrm{d}F_{s_i}$. Thus, if the antecedent in (1) holds for a dense subset $\hat{S}_i$, then it also holds when replacing $\hat{S}_i$ with its closure S_i, and S_i being boundedly complete implies Condition 1. □

Remark 3. As an example, we detail how the exponential family includes our leading normal-normal specification in which the state $\theta \sim \mathcal{N}(0, 1/\alpha)$, and each candidate i receives a conditionally independent signal $s_i = \theta + \varepsilon_i$, with $\varepsilon_i \sim \mathcal{N}(0, 1/\beta)$. In this case, the random variable $s_{-i}|s_i = (\theta + \varepsilon_{-i})\,|s_i$ is normally distributed with mean $\mu|s_i = \mathbb{E}\left[\theta + \varepsilon_{-i}|s_i\right] = \mathbb{E}\left[\theta|s_i\right] + \mathbb{E}\left[\varepsilon_{-i}|s_i\right] = \frac{\beta}{\alpha+\beta} s_i$ and variance $\sigma^2 = \mathrm{Var}\left[\theta + \varepsilon_{-i}|s_i\right] = \mathrm{Var}\left[\theta|s_i\right] + \mathrm{Var}\left[\varepsilon_{-i}|s_i\right] = \frac{1}{\alpha+\beta} + \frac{1}{\beta}$, because ε_{-i} is independent of s_i. Hence, Equation 10 holds with $T(s_{-i}) = \frac{1}{\sigma^2}\frac{\beta}{\alpha+\beta} s_{-i}$, $\psi(s_i) = \frac{1}{2\sigma^2}\left(\frac{\beta}{\alpha+\beta} s_i\right)^2$, and $h(s_{-i}) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2\sigma^2} s_{-i}^2}$. □

Proof of Lemma 1. Given any voter strategy w_A, the two candidates are playing a zero-sum Bayesian game with type-independent payoffs—e.g., A's payoff is $w_A(x_A, x_B)$—that fits into the setting of Appendix A. The lemma follows from Theorem 2. $\square$

Proof of Theorem 1. Fix any equilibrium (y_A, y_B, w_A). The result trivially holds if there is one candidate who is elected with probability one after almost all platform pairs on the equilibrium path. So, suppose that is not the case. Then Lemma 1 implies that the voter is indifferent between the two candidates after almost all on-path platform pairs. Hence, voter welfare $v(y_A, y_B, w_A)$ would not change if, holding fixed the candidates' strategies (y_A, y_B), either candidate i were elected with probability one after almost every platform pair. $\square$

Proof of Proposition 1. Omitted, as it was explained in the main text. $\square$

C. Proofs and Supporting Material for Section 3

We first show that there is no equilibrium with unbiased strategies.

Proposition 4. *The profile of unbiased strategies cannot be supported in an equilibrium. In particular, candidates would deviate by overreacting to their information, whereas underreacting would be worse than playing the unbiased strategy.*

Proof. Assume both candidates use the unbiased strategy $y_i(s_i) = \frac{\beta}{\alpha+\beta} s_i$. Since this strategy is fully revealing, the voter correctly infers s_A, s_B for all signal realizations. The voter's expected utility from a platform x follows a standard mean-variance decomposition:

$$\begin{aligned}
\mathbb{E}[u(x,\theta)|s_A, s_B] &= -\mathbb{E}\left[(x-\theta)^2 \,|s_A, s_B\right] \\
&= -\left[x^2 + \mathbb{E}(\theta^2|s_A, s_B) - 2x\mathbb{E}(\theta|s_A, s_B)\right] \\
&= -\left[x^2 + \mathbb{E}(\theta|s_A, s_B)^2 - 2x\mathbb{E}(\theta|s_A, s_B)\right] - \mathbb{E}(\theta^2|s_A, s_B) + \mathbb{E}(\theta|s_A, s_B)^2 \\
&= -\left[x - \mathbb{E}(\theta|s_A, s_B)\right]^2 - \mathrm{Var}\left(\theta|s_A, s_B\right). \qquad (11)
\end{aligned}$$

So the voter elects candidate i with probability one whenever x_i is closer to $\mathbb{E}[\theta|s_A, s_B]$ than is x_{-i}.

We now show that for any $i = A, B$ and s_i, candidate i can profitably deviate. By (11), if i plays as if he has received signal $\hat{s}_i$ (no matter his true signal), then i wins against any realization s_{-i} such that

$$\left(y_{-i}\left(s_{-i}\right)-\mathbb{E}\left[\theta|s_{-i},s_i\right]\right)^2>\left(y_i(\hat{s}_i)-\mathbb{E}\left[\theta|s_{-i},s_i\right]\right)^2.$$

Substituting from (3) and (4), this is equivalent to

$$\left(\frac{\beta}{\alpha+\beta}s_{-i}-\frac{\beta}{\alpha+2\beta}(\hat{s}_i+s_{-i})\right)^2>\left(\frac{\beta}{\alpha+\beta}s_i-\frac{\beta}{\alpha+2\beta}(\hat{s}_i+s_{-i})\right)^2,$$

or after algebraic simplification, $(\hat{s}_i)^2>(s_{-i})^2$. Hence, i wins when he mimics a more extreme (i.e., larger in magnitude) signal than $-i$'s true signal. Since for any true signal s_i the conditional distribution of $-i$'s signal is normal with mean $\mathbb{E}[\theta|s_i]=\frac{\beta}{\alpha+\beta}s_i$, it follows that no matter his true signal, candidate i strictly increases his win probability by overreacting and strictly decreases it by underreacting. □

Proof of Proposition 2. For the proposition's first statement, it suffices to verify that the voter is indifferent between the two candidates for any pair of platforms, assuming that both candidates play the strategy (5). Since the candidates' strategies are fully revealing, the voter correctly infers the candidates' signals from the platform pair. Furthermore, since the candidates' strategies each have range $\mathbb{R}$, there are no off-path platform pairs. Therefore, it suffices to show that for any s_i and s_{-i}, $-\mathbb{E}[(y_i(s_i)-\theta)^2|s_i,s_{-i}]=-\mathbb{E}[(y_{-i}(s_{-i})-\theta)^2|s_i,s_{-i}]$, or equivalently that $\left(y_i(s_i)-\mathbb{E}\left[\theta|s_i,s_{-i}\right]\right)^2=\left(y_{-i}\left(s_{-i}\right)-\mathbb{E}\left[\theta|s_i,s_{-i}\right]\right)^2$.[27] Using (4) and (5), this latter equality can be rewritten as

$$\left(\frac{2\beta}{\alpha+2\beta}s_i-\frac{2\beta}{\alpha+2\beta}\left(\frac{s_i+s_{-i}}{2}\right)\right)^2=\left(\frac{2\beta}{\alpha+2\beta}s_{-i}-\frac{2\beta}{\alpha+2\beta}\left(\frac{s_i+s_{-i}}{2}\right)\right)^2,$$

which holds for any s_i, s_{-i}.

Next, we turn to the proposition's second statement. We actually prove something stronger: in any equilibrium in which both candidates win with positive probability and use continuous fully-revealing strategies, there is $c\in\mathbb{R}$ and $i\in\{A,B\}$ such that

$$y_i(s_i)=\frac{2\beta}{\alpha+2\beta}s_i+c \quad\text{and}\quad y_{-i}(s_{-i})=\frac{2\beta}{\alpha+2\beta}s_{-i}-c.$$ [28]

[27] That this latter equality is equivalent to the former follows from a standard mean-variance decomposition under quadratic loss utility as in the proof of Proposition 4.

[28] Using a very similar analysis to that in the previous paragraph, it is readily verified that these strategies

To prove that, fix any equilibrium in which each candidate i uses a continuous and fully revealing and continuous strategy $\bar{y}_i$ and both win with positive probability. Denote the interior of the range of $\bar{y}_i$ by $\bar{X}_i$, noting that $\bar{X}_i$ is an open interval. Also denote $\bar{s}_i(x_i) := (\bar{y}_i)^{-1}(x_i)$. Lemma 1 and voter optimality imply that the voter is indifferent between both candidates after almost all on-path platform pairs. This implies that for almost all $x'_A \in \bar{X}_A$ and $x'_B \in \bar{X}_B$—hereafter we drop the "almost all" qualifier for brevity, understanding that some subsequent statements are up to measure zero sets, returning to the issue at the very end of the proof—we must have $\mathbb{E}[\theta|x'_A, x'_B] = \frac{x'_A+x'_B}{2}$, which implies $\frac{\beta}{\alpha+2\beta}(\bar{s}_A(x'_A) + \bar{s}_B(x'_B)) = \frac{x'_A+x'_B}{2}$, or equivalently

$$\bar{s}_B(x'_B) = \frac{\alpha + 2\beta}{2\beta}(x'_A + x'_B) - \bar{s}_A(x'_A). \tag{12}$$

For small $\varepsilon > 0$ and $x_A \in \bar{X}_A$ and $x_B \in \bar{X}_B$, the same logic also holds for platforms $x_A + \varepsilon$ and $x_B - \varepsilon$, yielding

$$\bar{s}_B(x_B - \varepsilon) = \frac{\alpha + 2\beta}{2\beta}(x_A + x_B) - \bar{s}_A(x_A + \varepsilon). \tag{13}$$

Substituting into (13) from (12) with $x'_B = x_B - \varepsilon$ and $x'_A = x_A$ yields

$$\frac{\alpha + 2\beta}{2\beta}(x_A + x_B - \varepsilon) - \bar{s}_A(x_A) = \frac{\alpha + 2\beta}{2\beta}(x_A + x_B) - \bar{s}_A(x_A + \varepsilon),$$

or equivalently,

$$\bar{s}_A(x_A + \varepsilon) = \frac{\alpha + 2\beta}{2\beta}\varepsilon + \bar{s}_A(x_A). \tag{14}$$

The equality in (14) can only hold for all $x_A \in \bar{X}_A$ and small $\varepsilon > 0$ if there is a constant $c_A \in \mathbb{R}$ such that $\bar{s}_A(x_A) = \frac{\alpha+2\beta}{2\beta}x_A + c_A$ for all $x_A \in \bar{X}$, from which it follows that $\bar{y}_A(s_A) = \frac{2\beta}{\alpha+2\beta}s_A + c_A$ for all s_A. A symmetric argument establishes that $\bar{y}_B(s_B) = \frac{2\beta}{\alpha+2\beta}s_B + c_B$ for all s_B. But then (12) implies $c_B = -c_A$. Finally, note that continuity pins down the strategies even at measure zero sets of signals. $\square$

Proof of Proposition 3. By the law of iterated expectations, the voter's ex-ante utility can be expressed as

$$v(y_A, y_B, w_A) = -\mathbb{E}[(x-\theta)^2] = -\mathbb{E}[\mathbb{E}[(x-\theta)^2 \,|s_A, s_B]] = -\mathbb{E}\left[\left(x - \frac{\beta\,(s_A + s_B)}{\alpha + 2\beta}\right)^2\right] - \frac{1}{\alpha + 2\beta}$$

constitute an equilibrium, with the voter indifferent after any pair of platforms.

$$= -\Pr(A \text{ wins})\,\mathbb{E}\left[\left(x_A - \frac{\beta(s_A+s_B)}{\alpha+2\beta}\right)^2 \,\middle|\, A \text{ wins}\right]$$

$$- \Pr(B \text{ wins})\,\mathbb{E}\left[\left(x_B - \frac{\beta(s_A+s_B)}{\alpha+2\beta}\right)^2 \,\middle|\, B \text{ wins}\right] - \frac{1}{\alpha+2\beta}. \tag{15}$$

It is convenient to define $h_i(s_i) := \mathbb{E}[s_{-i}|s_i, i \text{ wins}]$. Using iterated expectations again and a mean-variance decomposition as in the proof of Proposition 4, it also holds that for any i,

$$\begin{aligned}
&\mathbb{E}\left[\left(x_i - \frac{\beta(s_A+s_B)}{\alpha+2\beta}\right)^2 \,\middle|\, i \text{ wins}\right] \\
&= \mathbb{E}\left[\mathbb{E}\left[\left(x_i - \frac{\beta(s_A+s_B)}{\alpha+2\beta}\right)^2 \,\middle|\, s_i, i \text{ wins}\right] \,\middle|\, i \text{ wins}\right] \\
&= \mathbb{E}\left[\left(x_i - \frac{\beta(s_i+\mathbb{E}[s_{-i}|s_i, i \text{ wins}])}{\alpha+2\beta}\right)^2 + \left(\frac{\beta}{\alpha+2\beta}\right)^2 \mathrm{Var}[s_{-i}|s_i, i \text{ wins}] \,\middle|\, i \text{ wins}\right] \\
&= \mathbb{E}\left[\left(x_i - \frac{\beta(s_i+h(s_i))}{\alpha+2\beta}\right)^2 \,\middle|\, i \text{ wins}\right] + \left(\frac{\beta}{\alpha+2\beta}\right)^2 \mathbb{E}\left[\mathrm{Var}[s_{-i}|s_i, i \text{ wins}] \,\middle|\, i \text{ wins}\right].
\end{aligned} \tag{16}$$

Equations (15) and (16) imply

$$v(y_A, y_B, w_A) = -\left(\frac{\beta}{\alpha+2\beta}\right)^2 L_V - L_E - \frac{1}{\alpha+2\beta}, \tag{17}$$

where

$$L_V := \sum_{i=A,B} \Pr(i \text{ wins})\,\mathbb{E}\left[\mathrm{Var}[s_{-i}|s_i, i \text{ wins}] \,\middle|\, i \text{ wins}\right], \tag{18}$$

$$L_E := \sum_{i=A,B} \Pr(i \text{ wins})\,\mathbb{E}\left[\left(x_i(s_i) - \frac{\beta(s_i+h(s_i))}{\alpha+2\beta}\right)^2 \,\middle|\, i \text{ wins}\right]. \tag{19}$$

Our problem is to maximize (17) subject to i winning when $|s_i| > |s_{-i}|$. Since (18) does not depend on platforms while (19) is bounded below by 0, a solution must satisfy for each i:

$$y_i(s_i) = \frac{\beta(s_i+h(s_i))}{\alpha+2\beta} = \mathbb{E}[\theta \mid s_i, i \text{ wins}].$$

Since the constraint is that i wins when $|s_i| > |s_{-i}|$, it follows immediately that the solution is for each candidate to use the strategy (6).

Using the closed-form expression for truncated normal distributions, Equation 6 can be expressed as

$$y\left(s_i\right) = \frac{\beta}{\alpha+\beta} s_i - \sigma \frac{\beta}{\alpha+2\beta} \frac{\phi\left(\frac{1}{\sigma}\frac{\alpha}{\alpha+\beta} s_i\right) - \phi\left(-\frac{1}{\sigma}\frac{\alpha+2\beta}{\alpha+\beta} s_i\right)}{\Phi\left(\frac{1}{\sigma}\frac{\alpha}{\alpha+\beta} s_i\right) - \Phi\left(-\frac{1}{\sigma}\frac{\alpha+2\beta}{\alpha+\beta} s_i\right)},$$

where $\sigma := \sqrt{\frac{\alpha+2\beta}{(\alpha+\beta)\beta}}$, and ϕ and Φ are respectively the density and cumulative distributions of the standard normal distribution. To see that this strategy has pandering, consider any $s_i > 0$ (with a symmetric argument for $s_i < 0$). Then $0 < y\left(s_i\right) < \frac{\beta}{\alpha+\beta} s_i$ because $\phi\left(\frac{1}{\sigma}\frac{\alpha}{\alpha+\beta} s_i\right) > \phi\left(\frac{1}{\sigma}\frac{\alpha+2\beta}{\alpha+\beta} s_i\right) > 0$ and $\Phi\left(\frac{1}{\sigma}\frac{\alpha}{\alpha+\beta} s_i\right) > \Phi\left(-\frac{1}{\sigma}\frac{\alpha+2\beta}{\alpha+\beta} s_i\right) > 0$. □

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Supplementary Appendix

D. Mixed Motives

This section substantiates the discussion in Section 4 of the paper by formally generalizing our main welfare conclusions to a normal-quadratic setting in which candidates are largely but not entirely office motivated. We will establish that when the parameters b_i and ρ_i defined in Equation 7 are sufficiently close to zero for each $i = A, B$, (i) there is an equilibrium that achieves welfare arbitrarily close to the level obtained by efficiently aggregating the signal of only one candidate (Proposition 5 below), and (ii) that welfare is an approximate bound on voter welfare in any equilibrium (Proposition 6 below).

In the context of a normal-quadratic mixed-motivation game, with candidates' payoffs as defined in Equation 7, we say that candidate's i strategy is *unbiased* if

$$y_i(s_i) = \frac{\beta}{\alpha+\beta} s_i + b_i. \tag{20}$$

Note that this refers to candidate i choosing a policy that maximizes *his* preference over policy given his signal, as opposed to the voter's.

Proposition 5. *In the normal-quadratic mixed-motivations game, there is a fully revealing equilibrium in which one candidate i plays the unbiased strategy (20), the other candidate $-i$ plays*

$$y_{-i}(s_{-i}) = s_{-i} - \frac{\alpha+\beta}{\beta} b_i, \tag{21}$$

and the voter elects candidate i no matter the pair of platforms.

Proof. Given the strategies (20) and (21), it follows that

$$\mathbb{E}[\theta|x_i, x_{-i}] = \frac{\beta(x_i - b_i)\frac{\alpha+\beta}{\beta} + \beta\left(x_{-i} + \frac{\alpha+\beta}{\beta} b_i\right)}{\alpha+2\beta} = \frac{\alpha x_i + \beta(x_i + x_{-i})}{\alpha+2\beta}.$$

Straightforward algebra then verifies that for any x_i and x_{-i},

$$(x_i - \mathbb{E}[\theta|x_i, x_{-i}])^2 < (x_{-i} - \mathbb{E}[\theta|x_i, x_{-i}])^2 \iff \beta < \alpha + \beta.$$

Hence it is optimal for the voter to always elect candidate i; clearly the candidates are playing optimally given this strategy for the voter. □

As the equilibrium constructed in Proposition 5 is invariant to ρ_A and ρ_B, it has a number of interesting implications. First, the equilibrium exists when candidates are purely policy-motivated. Second, for $\rho_A = \rho_B = b_A = b_B = 0$, this equilibrium reduces to one that verifies the first statement of Proposition 1. Moreover, by taking $b_A = b_B = 0$ and $\rho_A = \rho_B = 1$, we see that there is also an equilibrium in which one candidate plays the unbiased strategy and always wins when both candidates are benevolent. Hence, the equilibrium of Proposition 5 continuously spans all three polar cases of candidate motivation.

Consider a normal-quadratic game with mixed-motivated candidates parameterized by $(\boldsymbol{\rho}, \boldsymbol{b})$, where $\boldsymbol{\rho} \equiv (\rho_A, \rho_B)$ and $\boldsymbol{b} \equiv (b_A, b_B)$. Let $\mathcal{E}(\boldsymbol{\rho}, \boldsymbol{b})$ denote the set of equilibria in which candidates play pure strategies, for consistency with our baseline model. Given any equilibrium $\sigma \equiv (y_A, y_B, w_A)$, let $v(\sigma)$ be the voter's welfare in this equilibrium. Note that the voter's welfare depends only on the strategies used and not directly on the candidates' motivations. Let $v^*(\boldsymbol{\rho}, \boldsymbol{b}) := \sup\{v(\sigma) : \sigma \in \mathcal{E}(\boldsymbol{\rho}, \boldsymbol{b})\}$ be the supremum of equilibrium voter welfare given candidate motivations. Plainly, $v^*(\mathbf{0}, \mathbf{0})$ is the welfare bound identified by Proposition 1.

Proposition 6. *In the normal-quadratic mixed-motivations game, as $(\boldsymbol{\rho}, \boldsymbol{b}) \to (\mathbf{0}, \mathbf{0})$, it holds that $v^*(\boldsymbol{\rho}, \boldsymbol{b}) \to v^*(\mathbf{0}, \mathbf{0})$.*

This result holds despite the equilibrium correspondence not being upper hemicontinuous. Indeed, observe that given any candidates' motivations with $b_A > 0$, there is an equilibrium in which both candidates use the constant strategy $y_i(s_i) = 1/b_A$; this is supported by suitable off-path beliefs such that any candidate whose platform differs from b_A loses for sure. The limit of these candidates' strategies, $\lim_{b_A \to 0} 1/b_A$, is not a valid strategy.

We require two lemmas to prove Proposition 6. Let

$$\mathcal{E}^*(\boldsymbol{\rho}, \boldsymbol{b}) := \{\sigma \in \mathcal{E}(\boldsymbol{\rho}, \boldsymbol{b}) : v(\sigma) = v^*(\boldsymbol{\rho}, \boldsymbol{b})\}$$

be the set of welfare-maximizing equilibria.[29] Given a strategy profile $\sigma \equiv (y_A, y_B, w_A)$ and an $\varepsilon > 0$, let $W^\sigma_\varepsilon(s_A, s_B)$ denote the set of candidates who win with probability at least ε when

[29] In what follows, we will proceed as if $\mathcal{E}^*(\boldsymbol{\rho}, \boldsymbol{b})$ is non-empty for all $(\boldsymbol{\rho}, \boldsymbol{b})$. If this is not the case, one can proceed almost identically, just by defining for any $\varepsilon > 0$, $\mathcal{E}^*_\varepsilon(\boldsymbol{\rho}, \boldsymbol{b}) := \{\sigma \in \mathcal{E}^*(\boldsymbol{\rho}, \boldsymbol{b}) : v(\sigma) \geq v^*(\boldsymbol{\rho}, \boldsymbol{b}) - \varepsilon\}$, and then applying the subsequent arguments for a sequence of $\varepsilon \to 0$.

the signal realizations are s_A, s_B.

Lemma 3. *For any bounded set of signals $\hat{S}_A \times \hat{S}_B$ of positive measure and any $\varepsilon > 0$, there exists $k > 0$ such that for any $(\boldsymbol{\rho}, \boldsymbol{b})$, if $\sigma \equiv (y_A, y_B, w_A) \in \mathcal{E}^*(\boldsymbol{\rho}, \boldsymbol{b})$ and $i \in W^{\sigma}_{\varepsilon}(s_A, s_B)$ for almost all $(s_A, s_B) \in \hat{S}_A \times \hat{S}_B$, then $|y_i(s_i)| < k$ for almost all $s_i \in \hat{S}_i$.*

Proof. Take any $\sigma \in \mathcal{E}^*(\boldsymbol{\rho}, \boldsymbol{b})$. We have $v(\sigma) \geq -\operatorname{Var}(\theta) = -1/\alpha$, because $-\operatorname{Var}(\theta)$ is the welfare in a trivial equilibrium in which both candidates uninformatively choose policy 0. Now consider any (s_A, s_B), any $\varepsilon > 0$. The voter's (expected) utility from any policy x given s_A, s_B does not depend on $(\boldsymbol{\rho}, \boldsymbol{b})$ and gets arbitrarily low as $|x| \to \infty$. Since the voter's utility conditional on any other signal profile is bounded above by zero, if the lemma's conclusion were false then σ would have arbitrarily low welfare, a contradiction. □

Lemma 4. *In any sequence of welfare-maximizing equilibria $\sigma^{\boldsymbol{\rho},\boldsymbol{b}} \equiv (y_A^{\boldsymbol{\rho},\boldsymbol{b}}, y_B^{\boldsymbol{\rho},\boldsymbol{b}}, w_A^{\boldsymbol{\rho},\boldsymbol{b}}) \in \mathcal{E}^*(\boldsymbol{\rho}, \boldsymbol{b})$, as $(\boldsymbol{\rho}, \boldsymbol{b}) \to (\mathbf{0}, \mathbf{0})$ either:*

(1) for some i, $\Pr(i \text{ wins in } \sigma^{\boldsymbol{\rho},\boldsymbol{b}}) \to 0$ as $(\boldsymbol{\rho}, \boldsymbol{b}) \to 0$; or

(2) for any i and almost all s_i, $y_i^{\boldsymbol{\rho},\boldsymbol{b}}(s_i)$ is bounded.

Proof. Suppose the lemma is false. Then, without loss, there is a positive measure of signals $\overline{s}_A$, a number $\delta > 0$, and a (sub)sequence of $(\boldsymbol{\rho}, \boldsymbol{b}) \to (\mathbf{0}, \mathbf{0})$ with equilibria $\sigma^{\boldsymbol{\rho},\boldsymbol{b}} \in \mathcal{E}^*(\boldsymbol{\rho}, \boldsymbol{b})$ such that: (i) for all $(\boldsymbol{\rho}, \boldsymbol{b})$ and $i \in \{A, B\}$, it holds that $\Pr(i \text{ wins in } \sigma^{\boldsymbol{\rho},\boldsymbol{b}}) > \delta$; and (ii) either $y_A^{\boldsymbol{\rho},\boldsymbol{b}}(\overline{s}_A) \to +\infty$ or $y_A^{\boldsymbol{\rho},\boldsymbol{b}}(\overline{s}_A) \to -\infty$. Lemma 3 implies for any $k > 0$ and $\varepsilon > 0$, there exists $(\hat{\boldsymbol{\rho}}, \hat{\boldsymbol{b}}) > (\mathbf{0}, \mathbf{0})$ such for any $(\boldsymbol{\rho}, \boldsymbol{b}) < \hat{(}\hat{\boldsymbol{\rho}}, \hat{\boldsymbol{b}})$, if $|s_B| < k$, then almost surely $A \notin W_{\varepsilon}^{\sigma^{\boldsymbol{\rho},\boldsymbol{b}}}(\overline{s}_A, s_B)$. (Intuitively, as $(\boldsymbol{\rho}, \boldsymbol{b}) \to (\mathbf{0}, \mathbf{0})$, since $y_A^{\boldsymbol{\rho},\boldsymbol{b}}(\overline{s}_A)$ explodes, it must be that A with signal $\overline{s}_A$ wins with non-vanishing probability only against at most a set of signals s_B that have vanishing prior probability.) Since the distribution of $s_B|\overline{s}_A$ does not change with $(\boldsymbol{\rho}, \boldsymbol{b})$, it follows that

$$\text{for any } \varepsilon > 0, \text{ if } (\boldsymbol{\rho}, \boldsymbol{b}) \text{ is small enough then } U_A(\overline{s}_A; \sigma^{\rho}, \boldsymbol{\rho}, \boldsymbol{b}) < \varepsilon, \tag{22}$$

where $U_A(s_A; \sigma, \boldsymbol{\rho}, \boldsymbol{b})$ is the expected utility for candidate A when his signal is s_A in an equilibrium σ given candidate motivations $(\boldsymbol{\rho}, \boldsymbol{b})$. However, notice that by point (i) above, it must be that there is a bounded set, say $\hat{S}_A \subset \mathbb{R}$, such that for any $(\boldsymbol{\rho}, \boldsymbol{b})$, $\Pr(i \text{ wins in } \sigma^{\boldsymbol{\rho},\boldsymbol{b}} | s_A \in \hat{S}_A)$ is bounded below by some positive number.[30] But then, candidate A with signal $\overline{s}_A$ can mimic

[30] The reason $\hat{S}_A$ must be a bounded set is because types in the tails have vanishing prior probability.

how he plays when his signal is in $\hat{S}_A$ (e.g., mix uniformly over the associated strategies) to get a probability of winning for all $(\boldsymbol{\rho}, \boldsymbol{b})$ that is bounded away from zero, which given (22) would be a profitable deviation for small enough $(\boldsymbol{\rho}, \boldsymbol{b})$. $\square$

Proof of Proposition 6. Let $\sigma_{\text{UB}}^{\boldsymbol{\rho},\boldsymbol{b}}$ be the equilibrium identified in Proposition 5 where, without loss, we take A to be the candidate who wins with probability one. Let $\sigma^{\boldsymbol{\rho},\boldsymbol{b}} \equiv (y_A^{\boldsymbol{\rho},\boldsymbol{b}}, y_B^{\boldsymbol{\rho},\boldsymbol{b}}, w_A^{\boldsymbol{\rho},\boldsymbol{b}}) \in \mathcal{E}^*(\boldsymbol{\rho}, \boldsymbol{b})$ be a sequence of welfare-maximizing equilibria as $(\boldsymbol{\rho}, \boldsymbol{b}) \to (\mathbf{0}, \mathbf{0})$. Applying Lemma 4 to this sequence, there are two cases:

(a) If Case 1 of Lemma 4 holds, then it is straightforward to verify that $v(\sigma^{\boldsymbol{\rho},\boldsymbol{b}}) \to v^*(\mathbf{0}, \mathbf{0})$. Intuitively, for $(\boldsymbol{\rho}, \boldsymbol{b}) \approx (\mathbf{0}, \mathbf{0})$, if i is winning with ex-ante probability approximately zero, then the voter's welfare cannot be much higher than if $-i$ wins with ex-ante probability one using the unbiased strategy, and Proposition 5 ensures that in a welfare-maximizing equilibrium it is not much lower either.

(b) If Case 2 of Lemma 4 holds, pick any subsequence of $\sigma^{\boldsymbol{\rho},\boldsymbol{b}}$ that converges pointwise almost everywhere and denote the limit by $\sigma^{\mathbf{0},\mathbf{0}}$.[31] Since payoffs are continuous, it can be verified using standard arguments that $\sigma^{\mathbf{0},\mathbf{0}}$ is an equilibrium of the limit pure-office-motivation game (intuitively, if the voter or a candidate with any signal has a profitable deviation, there would also have been a profitable deviation from $\sigma^{\boldsymbol{\rho},\boldsymbol{b}}$ for small enough $(\boldsymbol{\rho}, \boldsymbol{b}) > (\mathbf{0}, \mathbf{0})$). This implies that

$$\lim_{(\boldsymbol{\rho},\boldsymbol{b})\to(\mathbf{0},\mathbf{0})} v(\sigma^{\boldsymbol{\rho},\boldsymbol{b}}) = v(\sigma^{\mathbf{0},\mathbf{0}}) \leq v^*(\mathbf{0}, \mathbf{0}).$$

Finally, the inequality above holds with equality because for all $(\boldsymbol{\rho}, \boldsymbol{b})$, we have $v(\sigma^{\boldsymbol{\rho},\boldsymbol{b}}) \geq v(\sigma_{\text{UB}}^{\boldsymbol{\rho},\boldsymbol{b}})$ as $\sigma^{\boldsymbol{\rho},\boldsymbol{b}}$ is welfare maximizing, and $v(\sigma_{\text{UB}}^{\boldsymbol{\rho},\boldsymbol{b}}) \to v^*(\mathbf{0}, \mathbf{0})$. $\square$

E. A Beta-Bernoulli Specification

Here we repeat the analysis of Section 3 for the case in which the state follows a Beta distribution and each candidate gets a binary signal drawn from a Bernoulli distribution; the feasible set of policies is $[0, 1]$ (or any superset thereof). This statistical structure is a member

[31] More precisely, letting $\sigma^{\mathbf{0},\mathbf{0}} \equiv (y_A, y_B, w_A)$, we require that (i) $y_i^{\boldsymbol{\rho},\boldsymbol{b}}(s_i) \to y_i(s_i)$ for each i and almost all s_i and (ii) $w_A^{\boldsymbol{\rho},\boldsymbol{b}}(x_A, x_B) \to w_A(x_A, x_B)$ for each $(x_A, x_B) \in \mathbb{R}^2$. Case 2 of Lemma 4 assures that at least one subsequence converges in this sense. How each y_i is defined on zero-measure sets of signals is irrelevant. Note also that because the ex-ante probability of $\{s_i : s_i \notin [-k, k]\}$ can be made arbitrarily small by choosing $k > 0$ arbitrarily large, it follows that $v(\sigma^{\boldsymbol{\rho},\boldsymbol{b}}) \to v(\sigma^{\mathbf{0},\mathbf{0}})$.

of the exponential family with conjugate priors discussed in Section 4 of the main text. Aside from illustrating how the incentives to overreact exist even when the state distribution may not be unimodal and may be skewed, signals are discrete, etc., it also provides a closer comparison with the setting of Heidhues and Lagerlof (2003) and Loertscher (2012) than does our leading normal-normal specification.

Assume the prior distribution of θ is Beta(α,β), which is the Beta distribution with parameters $\alpha,\beta>0$ whose density is given by $f(\theta)=\frac{\theta^{\alpha-1}(1-\theta)^{\beta-1}}{B(\alpha,\beta)}$, where $B(\cdot,\cdot)$ is the Beta function.[32] Thus θ has support $[0,1]$ and $\mathbb{E}[\theta]=\frac{\alpha}{\alpha+\beta}$. For reasons explained at the end of the section, we assume $\alpha\neq\beta$. (This rules out a uniform prior, which corresponds to $\alpha=\beta=1$.) Each candidate $i\in\{A,B\}$ observes a private signal $s_i\in\{0,1\}$; conditional on θ, signals are drawn independently from the same Bernoulli distribution with $\Pr(s_i=1|\theta)=\theta$. The policy space is any subset of $\mathbb{R}$ containing $[0,1]$.

It is well-known that the posterior distribution of the state given signal 1 is now Beta$(\alpha+1,\beta)$ (i.e. has density $f(\theta|s_i=1)=\frac{\theta^{\alpha}(1-\theta)^{\beta-1}}{B(\alpha+1,\beta)}$); similarly the posterior given signal 0 is Beta$(\alpha,\beta+1)$. It is also straightforward to check that the posterior distribution of the state given two signals is as follows: if both $s_i=s_{-i}=1$, it is Beta$(\alpha+2,\beta)$; if $s_i=0$ and $s_{-i}=1$, it is Beta$(\alpha+1,\beta+1)$; and if $s_i=s_{-i}=0$, it is Beta$(\alpha,\beta+2)$.

It follows that

$$\mathbb{E}[\theta|s_i]=\frac{\alpha+s_i}{\alpha+\beta+1}\text{ and }\mathbb{E}[\theta|s_i,s_{-i}]=\frac{\alpha+s_i+s_{-i}}{\alpha+\beta+2}.$$

The above formulae imply that for any realization (s_A,s_B),

$$\begin{aligned}\text{sign}\left(\mathbb{E}[\theta|s_A,s_B]-\mathbb{E}[\theta]\right)&=\text{sign}\left(\frac{\mathbb{E}[\theta|s_A]+\mathbb{E}[\theta|s_B]}{2}-\mathbb{E}[\theta]\right),\\ \left|\mathbb{E}[\theta|s_A,s_B]-\mathbb{E}[\theta]\right|&>\left|\frac{\mathbb{E}[\theta|s_A]+\mathbb{E}[\theta|s_B]}{2}-\mathbb{E}[\theta]\right|.\end{aligned}\tag{23}$$

In other words, both the posterior mean given two signals and the average of the individual posterior means shift in the same direction from the prior mean, but the former does so by a larger amount.

[32] If α and β are positive integers then $B(\alpha,\beta)=\frac{(\alpha-1)!(\beta-1)!}{(\alpha+\beta-1)!}$.

Consequently, if candidates were to play unbiased strategies and the voter best responds, then whenever $s_A \neq s_B$ there is one candidate who wins with probability one: the candidate i with $s_i = 1$ (resp., $s_i = 0$) when $\beta > \alpha$ (resp., $\beta < \alpha$). Of course, when $s_A = s_B$, both candidates would choose the same platform and win with equal probability. It is worth highlighting that when $s_A \neq s_B$, it is the candidate with the ex-ante *less* likely signal who wins, because ex-ante $\Pr(s_i = 1) = \mathbb{E}[\theta] = \alpha/(\alpha+\beta)$. This implies that unbiased strategies cannot form an equilibrium, but not because candidates would deviate when drawing the ex-ante less likely signal; rather, they would deviate when drawing the ex-ante *more* likely signal to the platform corresponding to the ex-ante less likely signal.[33] Notice that this profitable deviation given signal s_i is to an (on-path) platform x_i such that $|x_i - \mathbb{E}[\theta]| > |\mathbb{E}[\theta|s_i] - \mathbb{E}[\theta]|$; hence, it is a profitable deviation through overreaction rather than pandering.

Finally, we observe there is symmetric fully revealing equilibrium with overreaction in which both candidates play

$$y(1) = \frac{\alpha+2}{\alpha+\beta+2} \text{ and } y(0) = \frac{\alpha}{\alpha+\beta+2}.$$

This strategy displays overreaction because

$$y(0) < \mathbb{E}[\theta|s_i = 0] < \mathbb{E}[\theta] < \mathbb{E}[\theta|s_i = 1] < y(1).$$

It is readily verified that when both candidates use this strategy, $\mathbb{E}[\theta|s_A, s_B] = \frac{y(s_A)+y(s_B)}{2}$ for all (s_A, s_B), and hence each candidate would win with probability $1/2$ for all on-path platform pairs; a variety of off-path beliefs can be used to support the equilibrium.

Note that this overreaction equilibrium would exist even when $\alpha = \beta$. However, were $\alpha = \beta$, unbiased strategies would also constitute an equilibrium: the reason is that in this case, both sides of (23) would be equal to each other (in fact, equal to zero) when $s_A \neq s_B$, and hence the voter would elect both candidates with equal probability no matters their platforms under unbiased strategies.

[33] See Che, Dessein and Kartik (2013) for an analog where options that are "unconditionally better-looking" need not be "conditionally better-looking".