

Accountability with large electorates

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Abstract

We show that a large electorate of ignorant voters can succeed in establishing high levels of electoral accountability. In our model, an incumbent politician is confronted with a large number of voters who receive fuzzy private signals about her performance. The accountability problem can be solved well in the sense that the incumbent exerts effort as if she faced a social planner who perfectly observes her performance. Introducing public information has an ambiguous effect: effort decreases when the electorate is ideologically balanced and effort increases when there is a strong ideological (dis)advantage for the incumbent.

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1 Introduction

Popular belief has it that elections can serve to hold incumbent politicians accountable only if “the people” are sufficiently informed about the incumbent’s performance. We can find this notion already in Thomas Jefferson’s fear that

“If once they [the people] become inattentive to the public affairs, you and I, and Congress, and Assemblies, judges and governors shall all become wolves” (Thomas Jefferson to Edward Carrington, 1787. Papers 11:48-49),

in James Madison’s writing where he says that

“A popular Government without popular information or the means of acquiring it, is but a Prologue to a Farce or a Tragedy or perhaps both” (James Madison to W.T. Barry, 1822. Writings 9:103-9),

or in Lyndon B. Johnson’s words regarding the Freedom of Information Act¹

“A democracy works best when the people have all the information that the security of the Nation permits.”,

It is, however, often not clear what “the people” actually means nor which kind of information is thought to be necessary for accountability (see Bartels (1996) or Ashworth and Bueno de Mesquita (2014) for a discussion). Empirical evidence suggests that many voters know little about politics (Delli Carpini and Keeter, 1996) and thus real electorates are far away from an ‘ideal’ electorate where all voters are well-informed about public affairs. From a theoretical point of view, voter ignorance regarding the political sphere is not surprising because an individual vote is not likely to be decisive for the collective decision. Thus, it is simply rational for voters not to waste time and energy on grasping the complex world of politics.

Some scholars doubt that incumbents can be held accountable when voters are poorly informed about politics (Delli Carpini and Keeter, 1996). Other scholars sought

¹Lyndon B. Johnson: Statement by the President Upon Signing the Freedom of Information Act, July 4, 1966.

to develop theories that can help explain why accountability can be ensured although many to most voters know so little about their representatives. One prominent argument says, for example, that incumbents can be held accountable as long as there are informed specialists who can inform the electorate about their politicians. These specialists may, for example, include competing politicians, interest groups, or ‘watch-dog voters’ who enjoy being informed about the details of politics. In summary, these theories claim that having some type of informed elite can be sufficient for establishing electoral accountability (see, for example, Schumpeter (1947), Dahl (1956), Downs (1957), Bartels (1986), Dalager (1996)).

In contrast to this line of reasoning, we show that a large electorate can hold incumbents accountable although there is no informed elite and *all* voters are poorly informed. This is possible because it is not only voter knowledge that determines accountability but also what the incumbent knows about the decisive opinion in the electorate. Being confronted with a large electorate enables the incumbent to form a precise estimate of this decisive opinion and this learning effect on the incumbent’s side can result in a high level of accountability.

We demonstrate this result in a political agency model where an incumbent’s performance influences the level of public goods in a society. The incumbent can try to boost public good provision to impress voters and thus improve the chance of getting re-elected. Each voter has a vague private impression of the incumbent’s performance just by living his life where he perceives and uses public goods: While each voter can observe the utility derived from public goods, he is assumed to be ignorant regarding the political sphere, which makes it difficult for him to attribute the utility from public goods to the responsible politician. Thus, the incumbent’s effort to boost public good provision has but a minor impact on a voter’s opinion as compared to a situation where well-informed voters observe her performance.

The incentives of the incumbent, however, are not only determined by the effect of effort on voter opinions but also by the effect of manipulating opinions on the prospects of re-election. In other words, how does a given change in voter opinions increase the probability of re-election? For the incumbent, the expected magnitude of this effect depends on her knowledge about the decisive opinion in the electorate. While the

incumbent's knowledge of some voter's opinion is quite fuzzy, a large number of voters allows the incumbent to form a much more precise estimate of the decisive median opinion. This learning effect on the incumbent's side counteracts the low impact of performance on voter opinions and increases the payoff of exerting effort. Actually, the incumbent exerts effort as if a voter who can perfectly observe performance would decide the election, although the median voter only has a very vague impression of the incumbent's performance.

Introducing public information about the incumbent's performance to the model blurs the incumbent's estimate of the median opinion which has an ambiguous effect on accountability. As long as the incumbent has no or only a moderate ideological advantage or disadvantage, public information induces a lower level of accountability. The result has two interesting implications: first, information spread via mass media reduces voter welfare due to lower effort by the incumbent. Even critical media coverage about the incumbent's performance leaves voters worse off as compared to a world where voters only receive private information. Second, incumbents who face a neutral to moderately biased electorate have strong incentives to disclose some information about their performance in order to help create public information and reduce their effort level. Interestingly, if incumbents are successful in creating public information that voters cannot avoid, the accountability-enhancing role of critical media coverage is restored. When public information is inevitable, journalists can increase the precision of public information which in turn makes the incumbent work harder.

In case of a strong advantage or disadvantage, however, introducing public information results in a higher level of accountability. Having her knowledge of the median opinion blurred by public information now means that the incumbent is less sure that the median voter will vote either for or against her anyway, which makes it more lucrative to manipulate his opinion by exerting effort. To summarize, the impact of public information depends on the magnitude of the ideological bias in the electorate.

We interpret accountability in our model as the leeway incumbents have regarding the allocation of resources between selfish goals and the benefit of voters. In the model, there is no option for the incumbent to engage in stark abuses of power such as establishing arbitrary government or engaging in criminal activities, for example.

Implicitly we assume a functioning system of checks and balances (Locke [1690] 1976, Montesquieu [1748] 1991, Madison et al. [1788] 1961) that ensures that incumbents who abuse their power are removed from office via court decisions, parliamentary procedures or elections. Our result then implies that the incumbent does not exploit her leeway given by the system of checks and balances for selfish goals even if voters are poorly informed. This result provides a strong case for rational ignorance of voters regarding the daily business of politics.

The learning effect of the incumbent that we describe in this paper results from the law of large numbers. This mechanism relates our analysis to a prominent result regarding a different purpose of elections: the jury theorem. While our analysis deals with the *incentives* of incumbent politicians, the jury theorem applies to *selection problems*.² The key question regarding the selection problem is whether the decisions of individual voters result in a collective decision that selects the better of two alternatives (the more talented candidate, for example). Scholars who study this problem examine whether having a large number of voters can result in a distribution of votes such that the better alternative is selected although each voter is poorly informed (see, for example, Young 1988, Ladha 1992, Austen-Smith and Banks 1996, Feddersen and Pesendorfer 1997, 1998 or Martinelli 2006).

Our model shows that the law of large numbers not only enables scholars but also incumbents to learn something about the distribution of votes in the electorate. Considering the implications for the incumbent shows that high levels of accountability are possible although voters are poorly informed. Further, in our model, the selection problem is also solved well in the sense that only incumbents with talent above average are re-elected. Taken together, our analysis shows that elections can enable ignorant voters to achieve both: *selecting* talented politicians and *holding incumbents accountable*.

In contrast to the implications of the law of large numbers for the selection problem, the implications for accountability have been largely left unexplored. Many papers that study electoral accountability use a representative voter to model the electorate.

²Ashworth et al. (2015) show that the impact of voter knowledge on incentives and selection is not always trivial in the sense that there can be a trade-off between the incentive and selection problems.

Relatively close to our analysis are Ashworth and Bueno de Mesquita (2014) and Ashworth et al. (2015) because they focus on the role of information for accountability. Ashworth and Bueno de Mesquita (2014) show that in contrast to a widely held intuition, an increase in voter knowledge can result in reduced democratic performance. Ashworth et al. (2015) demonstrate that there can be a trade-off between electoral accountability and electoral selection because higher levels of effective accountability can reduce the informativeness of policy performance about an incumbent's characteristics. Ashworth (2005) analyzes the determinants and consequences of the incumbency advantage, Alesina and Tabellini (2007, 2008) discuss the types of policy tasks better suited for a bureaucrat versus for a politician, and Dewatripont et al. (1999) study the organization of government agencies. Kotsogiannis and Schwager (2008) show that fiscal equalization affects the accountability of politicians in the presence of yardstick competition. As all these papers assume a representative voter, the learning effect of the incumbent due to a large number of voters cannot be observed in these papers. One implication of our analysis is that the assumptions regarding voter knowledge should be chosen carefully. An ignorant representative voter, for example, can be an inappropriate description of an electorate where voters are ignorant.

Bruns and Himmler (2016) also use the career concern framework to study the influence of information on electoral accountability. They explain the provision of a public signal for the case of smaller electorates where the impact of a single voter on collective outcomes is not zero. In contrast, our paper studies accountability for given information structures in large electorates.

The paper is structured as follows. We describe the baseline model where voters only have private information in Section 2 and the equilibrium analysis in Section 3. In Section 4, we discuss the impact of introducing public information. Section 5 concludes.

2 The Model

We start the analysis with a baseline model which allows us to study the incentives of incumbent politicians under circumstances as in standard models on information aggregation (common preferences among voters, sincere voting and private signals). Our

model follows the 'career concern' approach of political agency problems as described in Persson and Tabellini (2002).

There are two time periods and there is a continuum of voters with unit mass. In period 1, there is an incumbent politician (I) who provides a public good. At the end of period 1, an election takes place, where the voters can either re-elect the incumbent or elect a challenger (C). The candidate who receives the majority of the votes is the winner and provides the public good in period 2. Ties are broken by tossing a fair coin. Before the election, each voter receives a private signal about the incumbent's performance.

2.1 Incumbent performance

Performance in period $t \in \{1, 2\}$ is

$$g_t^j = e_t^j + \theta^j \quad \text{with } j \in \{I, C\}. \quad (1)$$

The variable $e_t^j \geq 0$ denotes the effort of the politician in office in period t and θ^j her competence. So the level of effort is a period-specific choice whereas competence remains constant over time.

A politician's competence is a realized value of the random variable Θ^j and we assume that politicians and voters share the common prior belief that $\Theta^j \sim N(0, 1/\tau_\theta)$. Thus, as usual in models of the career concern type, an incumbent does not know her own competence, so we do not need to consider signaling issues in the analysis.

Effort can be interpreted as the amount of time an incumbent devotes to activities like attracting grant monies, monitoring bureaucrats or negotiating contracts.³ According to this interpretation, working hard for the constituents reduces the time that is left for enjoying the amenities associated with political office or for pursuing selfish career goals. We introduce the cost function $c(e)$ that measures how much benefit the incumbent forgoes by exerting effort. We assume that $c(e)$ is strictly convex with

³The variable e can also be interpreted as a measure of rent-seeking (see Alesina and Tabellini (2007) or Gehlbach (2007), for example)

$c(0) = 0$, $c'(e) > 0$, $c(e)'' > 0$ and $\lim_{e \rightarrow 0} c'(e) = 0$.

When deciding on her effort level, the incumbent knows that voters evaluate her performance to decide whether to re-elect her. By exerting more effort, the incumbent can increase public good provision to try to impress the voters and thus raise the probability of her re-election $p(e_1)$. The incumbent's objective in period 1 is to maximize

$$p(e_1) \cdot [R - c(e_2)] - c(e_1), \tag{2}$$

where $R > 0$ denotes an exogenous rent from being in office. So the incumbent weighs the cost of effort in period 1 against the expected net rent in period 2.⁴ The level of effort she chooses depends on the mapping of effort into the probability of re-election which depends on the electoral decision.

2.2 Voters

Each voter either votes for the incumbent or for the challenger and we label voter i 's decision $v_i \in \{I, C\}$. There is no abstention. We assume that each voter votes sincerely given his information about the incumbent.

Voters have identical preferences and we assume that each voter's utility increases linearly in the incumbent's performance. Thus, each voter's utility from incumbent performance in period t is

$$u_t = g_t. \tag{3}$$

Although voters know that the incumbent's performance influences their utility as described by equation (3), we assume that no voter can directly observe performance. This can happen, for example, because incumbent performance has long-lasting consequences such as an investment in infrastructure (Besley and Prat, 2006). Further, public good provision results in reality from a complex political process where many

⁴We abstract from discounting throughout the analysis because including it would not generate any interesting insight.

different actors (bureaucrats and other politicians, for example) are involved. Voters may observe the aggregate level of public good provision determined by the political process, but as voters usually are poorly informed about the details of political processes, they will find it difficult to disentangle the contributions of different politicians and thus will make mistakes when estimating the performance of a single politician.

Thus, we assume that each voter i receives an imperfect private signal

$$s_i = g_1 + x_i \tag{4}$$

of the incumbent's performance and the voters can use this information when they decide whom to vote for. We assume that the noise terms x_i are realized values of the random variable $X \sim N(0, 1/\tau_x)$ where the precision τ_x measures the clarity of the signal. The noise terms x_i are independent, so the signals are independent conditional on a realized g_1 . In principle, the precision τ_x can take on any positive value but we assume the precision to be very low in order to model ignorance of voters. This assumption appears appropriate for our case of a large electorate where a single vote is not likely to be decisive, and thus there is no incentive for voters to engage in private gathering of additional information.

2.3 Timing of the game

Period 1:

- Nature selects the competence of the incumbent θ^I which remains unknown to all players.
- The incumbent chooses the effort level e_1 , and $g_1 = e_1 + \theta^I$ is realized but not observed by the voters.
- Each voter receives a private signal $s_i = g_1 + x_i$ about the incumbent's performance.
- The election takes place.

Period 2:

- The winner of the election chooses an effort level, and either $g_2^I = e_2^I + \theta^I$ or $g_2^C = e_2^C + \theta^C$ is realized.

3 Equilibrium

The game ends after period 2 which means that the winner of the election has nothing to gain from exerting effort. Thus, whoever wins the election does not exert any effort ($e_2^I = e_2^C = 0$) and the competence of the winner determines performance in period 2:

$$g_2 = \begin{cases} \theta^I & \text{for } v = I \\ \theta^C & \text{for } v = C, \end{cases}$$

where v denotes the result of the election. It follows that each voter votes for the candidate whom he expects to be more competent.

Voters update their beliefs in a Bayesian way. Given a voter's belief \tilde{e} about the incumbent's effort, the expected competence of the incumbent after having observed a signal s_i is

$$E(\Theta^I | s_i) = \frac{\tau_x}{\tau_x + \tau_\theta} \cdot (s_i - \tilde{e}),$$

which results from a standard signal extraction problem (see, for example, DeGroot (1970) or Pratt et al. (1995)). From now on, we will refer to the posterior expected competence of the incumbent $E(\Theta^I | s_i)$ as the *opinion* of voter i .

The challenger's expected competence is 0 and thus voter i 's decision is

$$v_i = \begin{cases} I & \text{for } E(\Theta^I | s_i) \geq 0 \\ C & \text{for } E(\Theta^I | s_i) < 0. \end{cases}$$

To derive the incumbent's effort in period 1, we have to determine the relation

between effort and p^I . From now on, we drop the subscript and denote the first period's effort simply by e . Since the second period's effort is trivial, there is no risk of confusion.

From the incumbent's perspective, voter i 's opinion of her talent is

$$E(\Theta^I | s_i) = \frac{\tau_x}{\tau_x + \tau_\theta} \cdot (e - \tilde{e} + \theta^I + x_i).$$

When the incumbent has to choose effort, her knowledge about *some* voter's opinion is blurred by the two random variables Θ^I and X_i . From her perspective, a voter's opinion is a normal random variable with mean $\frac{\tau_x}{\tau_x + \tau_\theta} \cdot (e - \tilde{e})$ and variance $\frac{\tau_x}{\tau_\theta(\tau_x + \tau_\theta)}$, and she can manipulate the expected opinion by exerting effort. The incumbent can influence the voters' opinions but she also needs to consider to which extent changing the opinions will increase the probability of re-election. If, for example, a voter receives a signal which makes him have a strong leaning towards either the incumbent or the challenger, a marginal change of this opinion is very unlikely to change the voter's decision. Hence, for the incumbent's decision about effort, it is important whether the decisive opinion in the electorate is likely to be near the threshold of voting for or against her.

While the incumbent's knowledge of some voter's opinion is relatively fuzzy due to the noise in the signal, she has (much) more precise knowledge about the decisive opinion in the electorate. The incumbent knows that she needs at least half of the votes to be re-elected and that she will achieve this number of votes if the voter who receives the median value of signal realizations votes for her. We call this voter the (*posterior*) *median voter*.

Conditional on a given performance g_1 , voter i 's signal is a realization of the random variable $S_i | g_1 \sim N(g_1, \frac{1}{\tau_x})$. The law of large numbers implies that the median voter's signal is equal to the median of the signal distribution which means that $s_m | g_1 = g_1$. Hence, in a large electorate, the decisive opinion of the median voter equals

$$E(\Theta^I | s_m) = \frac{\tau_x}{\tau_x + \tau_\theta} \cdot (e - \tilde{e} + \theta^I).$$

The incumbent can therefore learn the following about the decisive opinion: Without being aware of it, the median voter observes a non-contaminated signal of the incumbent's performance because $x_m = 0$. Further, since the incumbent knows that $x_m = 0$, the only remaining source of uncertainty is the random variable Θ^I . The median voter's opinion then is a normal random variable with mean $\mu = \frac{\tau_x}{\tau_x + \tau_\theta} \cdot (e - \tilde{e})$ and variance $\sigma^2 = \frac{\tau_x^2}{(\tau_x + \tau_\theta)^2 \cdot \tau_\theta}$ from the incumbent's perspective. If we compare the incumbent's beliefs about some voter's opinion and about the median opinion, we can see that both have mean $\frac{\tau_x}{\tau_x + \tau_\theta} \cdot (e - \tilde{e})$ but the variance of the belief about the median opinion is lower. Thus, her knowledge of the median voter's opinion is more precise.

The incumbent knows that she will be re-elected if the median voter considers her talent to be above average:

$$\frac{\tau_x}{\tau_x + \tau_\theta} \cdot (e - \tilde{e} + \theta^I) \geq 0, \quad (5)$$

and thus she chooses effort in order to maximize

$$\left[1 - F(0; \mu, \sigma^2)\right] \cdot R - c(e),$$

where F denotes the distribution function of the median voter's opinion. For given \tilde{e} , optimal effort solves

$$-\left(\frac{\partial F}{\partial \mu} \frac{\partial \mu}{\partial e} + \frac{\partial F}{\partial \sigma^2} \underbrace{\frac{\partial \sigma^2}{\partial e}}_{=0}\right) \cdot R = c'(e).$$

Two effects determine the impact of an additional unit of effort on the probability of re-election: (1) The *direct* effect of effort on the expected median opinion ($\frac{\partial \mu}{\partial e}$) and (2) the *indirect* effect which says how much probability mass an increase of the expected median opinion pushes over the threshold for re-election ($\frac{\partial F}{\partial \mu}$). Applying equilibrium condition $e = \tilde{e}$ yields

Lemma 1. *When each voter receives a private signal about the incumbent's performance, equilibrium effort $e_{s_i}^*$ solves*

$$\phi(0)\sqrt{\tau_\theta}R = c'(e_{s_i}^*), \quad (6)$$

where ϕ denotes the density function of the standard normal distribution.

Proof. See above. □

It follows from Lemma 1 that equilibrium effort does not depend on the precision of the signals (τ_x). This is because the respective effects of τ_x on $\frac{\partial \mu}{\partial e}$ and $\frac{\partial F}{\partial \mu}$ cancel out each other. On the one hand, a lower τ_x implies a lower impact of effort on μ , which reduces the payoff of effort. But on the other hand, a lower τ_x decreases the variance σ^2 , which means that an increase of μ pushes more probability mass over the threshold of re-election at zero. Put into more intuitive terms, a low clarity of the signal implies that effort is less effective in changing the median voter's opinion, but a low clarity also implies that changing the opinion has a stronger impact on the probability of re-election because the median voter's opinion is more likely to be around the decisive threshold of zero.

The effort level described by Lemma 1 is identical to the effort level that the incumbent would choose were she confronted with a social planner who receives a perfect signal $s = g_1$ of her performance in period 1. The decision of the social planner is determined by her estimate of the incumbent's talent which is $s - \tilde{e} = e - \tilde{e} + \theta^I$ and thus she will re-elect the incumbent if $e - \tilde{e} + \theta^I \geq 0$. A comparison with inequality (5) shows that it is the term $e - \tilde{e} + \theta^I$ whose sign determines whether or not the incumbent is re-elected in case of both the collective decision and the social planner with perfect monitoring. Thus, the probability that the median voter estimates the incumbent's competence to be larger than 0 is the same as the probability that a social planner with a perfect signal estimates the incumbent's competence to be larger than 0:

$$Pr \left[\frac{\tau_x}{\tau_x + \tau_\theta} \cdot (e - \tilde{e} + \theta^I) \geq 0 \right] = Pr \left[e - \tilde{e} + \theta^I \geq 0 \right].$$

As a consequence, incentives are the same in both cases. Notice that the above equiv-

alence holds irrespective of the value of τ_x . In other words, even if the precision of individual private signals is arbitrarily small, the incumbent behaves *as if* she is confronted with a social planner who receives a perfect signal $s = g_1$.

Hence, we establish an accountability counterpart to the jury theorem:

Proposition 1. *A large electorate where each voter is poorly informed about the incumbent's performance can establish the same level of accountability as a social planner who is perfectly informed about the incumbent's performance.*

Proof. See above. □

Proposition 1 implies that ignorance of voters has no severe consequences for electoral accountability in a large electorate. Although the opinions of voters about the incumbent are not very sensitive to boosts in public good provision, the incumbent has strong incentives to perform well because she knows that the median opinion is likely to be around the threshold for re-election.

Having an electorate of ‘ideal’ voters who invest much time and effort to become well-informed about the incumbent’s performance then is an inefficient scenario. As improving private knowledge has no impact on the level of accountability, voters are better off when they use their resources for other purposes than becoming informed. Indeed, in a large electorate where the problem of a vote’s low probability to be decisive may be considered most severe for accountability, electoral accountability actually is fine. Even if voters are not selfish but follow a group-oriented moral (Feddersen and Sandroni, 2006), acquiring information would be considered an inefficient activity no voter should engage in. Our baseline model thus provides a strong case for rational ignorance.

We can conclude that ignorant voters can also establish high levels of accountability in addition to selecting talented politicians as postulated by the jury theorem. The well-established result of the jury theorem regarding selection and holds in our analysis: Assume again, that there is a social planner who receives a perfect signal $s = g_1$. The social planner’s estimate of the incumbent’s talent is $E(\theta^I|s) = e - \tilde{e} + \theta^I$ which reduces to θ^I in equilibrium. Thus, in equilibrium, the social planner knows the correct value

of the incumbent's talent. A social planner would retain an incumbent whose talent is equal to or larger than zero, the expected talent of a randomly drawn challenger, and she would replace the incumbent by a challenger if the incumbent's talent is below zero.⁵ Thus, her decision is described by:

$$v^{soc} = \begin{cases} I & \text{for } \theta^I \geq 0 \\ C & \text{for } \theta^I < 0. \end{cases}$$

We are interested in the probability that the collective decision v is correct in the sense that $v = v^{soc}$. Regarding the collective decision, we have $e = \tilde{e}$ in equilibrium and thus, for some given realized value of θ^I , it follows that

$$v = \begin{cases} I & \text{for } \frac{\tau_x}{\tau_x + \tau_\theta} \cdot \theta^I \geq 0 \\ C & \text{for } \frac{\tau_x}{\tau_x + \tau_\theta} \cdot \theta^I < 0 \end{cases} \quad \text{and thus} \quad v = \begin{cases} I & \text{for } \theta^I \geq 0 \\ C & \text{for } \theta^I < 0. \end{cases}$$

Thus, for every possible value of θ^I , the collective decision is identical to the decision of the social planner. We obtain this result because the median voter correctly anticipates the incumbent's manipulation in equilibrium, and because the median signal is not contaminated with noise. Therefore, information aggregation is neither affected by the incumbent's manipulation nor by wrong voting decisions due to a noisy signal and thus the jury theorem holds.

Proposition 2. *A large electorate where each voter is poorly informed about the incumbent's performance can establish the same level of accountability and select the same candidate as a social planner who is perfectly informed about the incumbent's performance.*

Proof. See above. □

Proposition 2 summarizes how a large electorate of ignorant voters can secure high

⁵When the decision is made, the challenger's competence is not known. Hence, naturally, there still is the possibility that for $v = I$ the challenger will be more competent or that for $v = C$ the incumbent will be more competent. The correct decision to be made is to re-elect the incumbent with a higher competence than 0, the *expected* competence of the challenger.

levels of public goods via the voting mechanism: politicians in office are more talented than the average politician and, in addition, they have strong incentives to perform well.

We have derived this result in a model where voters only receive private signals about the incumbent's performance. In the next section, however, we add public information to our model and we find an ambiguous effect of introducing public information on the incumbent's incentives.

4 The ambiguous impact of public information

We add a public signal

$$s_{pub} = g_1 + y \quad \text{with} \quad y \sim N(0, 1/\tau_y)$$

to the baseline model. Now, each voter receives a private signal s_i and the public signal s_{pub} about the incumbent's performance. Think of the public signal as media coverage, for example. We assume that media coverage is at least as precise as a voter's signal ($\tau_y \geq \tau_x$). This means that a journalist is at least as informed as an ignorant voter, or alternatively, the lower bound of the precision of the public signal can be interpreted as a situation where one voter's signal is published.

Voter i then votes for the incumbent if

$$\begin{aligned} E(\Theta^I | s_i, s_{pub}) \geq 0 &\Leftrightarrow \frac{\tau_x(s_i - \tilde{e}) + \tau_y(s_{pub} - \tilde{e})}{\tau_x + \tau_\theta + \tau_y} \geq 0 \\ \Leftrightarrow \frac{\tau_x + \tau_y}{\tau_x + \tau_\theta + \tau_y} \cdot (e - \tilde{e} + \theta^I) + \frac{\tau_y y}{\tau_x + \tau_\theta + \tau_y} + \underbrace{\frac{\tau_x}{\tau_x + \tau_\theta + \tau_y} x_i}_{\text{individual component}} &\geq 0 \end{aligned}$$

where the mean of the individual component equals zero.⁶

⁶The updating of a voter's belief again is a standard signal-extraction problem as in DeGroot (1970).

It follows that the median voter casts his ballot for the incumbent if

$$\frac{\tau_x + \tau_y}{\tau_x + \tau_\theta + \tau_y} \cdot (e - \tilde{e} + \theta^I) + \frac{\tau_y y}{\tau_x + \tau_\theta + \tau_y} \geq 0.$$

Applying the same procedure as above yields equilibrium effort described by

Lemma 2. *When each voter receives both a private signal and the public signal, equilibrium effort $e_{s_i, s_{pub}}^*$ solves*

$$\phi(0) \frac{\tau_x + \tau_y}{\underbrace{\sqrt{(\tau_x + \tau_y)^2 + \tau_y \tau_\theta}}_{<1}} \sqrt{\tau_\theta} R = c'(e_{s_i, s_{pub}}^*). \quad (7)$$

Proof. See above. □

Lemma 2 describes effort in a situation where each voter receives additional information about the incumbent's performance from the public signal. Consequently, all voters know more about the incumbent's competence than in the baseline model with private signals. It can easily be verified that $\partial e_{s_i, s_{pub}}^* / \partial \tau_y > 0$ for $\tau_y > \tau_x$, i.e. the incumbent exerts more effort the more precise the public signal is. Effort is also increasing in the precision of the private signals (τ_x). This implies that – given that voters receive both a private and the public signal – more informative signals always increase effort. However, when we compare equations (6) and (7), we obtain the following result: although all voters are better informed after having added the public signal, effort is lower than in the baseline model where voters receive only private signals. This result is formulated in

Proposition 3. *In a large electorate where voters share identical preferences regarding public good provision, adding public information to voters' private information reduces an incumbent's effort.*

Proof. See above. □

Proposition 3 means that publishing the knowledge of a well-informed journalist reduces accountability and thus voter welfare. This result may be irritating at

first sight because it contradicts the popular idea that critical media coverage helps establish accountability. From a theoretical perspective, however, there is a simple explanation: Adding the public signal to the baseline model reduces effort, because for the incumbent, even a signal created by an expert journalist is a source of additional uncertainty regarding the median opinion. This additional uncertainty blurs the incumbent's knowledge of the median opinion which now is more likely to be farther away from the re-election threshold at zero than in the baseline model. Thus, although the effect of an additional unit of effort on the expected median opinion $\frac{\tau_x + \tau_y}{\tau_x + \tau_\theta + \tau_y} \cdot (e - \tilde{e})$ is larger now than in the baseline model, a change of this opinion results in a smaller push of probability mass over the threshold, and this second effect dominates the first effect on the median opinion.

Voters would be better off in a world without public information where each voter only receives a private signal. The question is, however, whether such a world can be considered realistic or if it is just a hypothetical first best world. Answering this question in depth is beyond the scope of the paper but we can offer the following observations: In reality, people talk to each other and share their knowledge. From the incumbent's perspective, this corresponds to a situation where voters within a group receive a common signal. The model with private signals still is an appropriate description of a world with this type of communication, as long as groups of voters who talk to each other are sufficiently small such that we still have a large number of independent opinions. On the other hand, mass media increases the size of groups observing the same information and therefore reduces the likelihood of a large number of independent opinions.

We can learn from Proposition 3 that the incumbent has a strong interest in sending some vague public information about her performance to the voters because this will allow her to exert less effort than in the case with private signals only. Incumbents can give vague hints about which projects they are involved in whenever they have an audience and mass media can further disseminate these pieces of information. This reasoning may be an explanation for why politicians like to be in the news with reports where they present new roads, public buildings, police cars, fire trucks or other facilities, for example. Although this type of media coverage gives voters an impression about which

politicians may have been involved in the respective project and thus indeed increases voter knowledge a little bit, these reports can hardly be considered what Bowles et al. (2013) refer to as (critical) accountability reporting. If, however, politicians succeed in feeding pieces of information to the public, the accountability-enhancing role of critical journalism is restored. In such a second best world where voters cannot avoid receiving some form of public information anyway, critical journalism can serve to increase the quality of public information which forces the incumbent to work harder. While the level of accountability thus can be improved by critical media reporting, it will still be lower than in a world with private signals except for the unlikely case where journalists are perfectly informed about the incumbent's performance.

So there is an effort-reducing effect of introducing public information in the case of an election where all voters have identical preferences. This finding sheds light on another adverse effect of public information in addition to the effect on the selection problem where public information and thus correlated votes can have adverse effects on electoral outcomes (Ladha, 1992). Our analysis further adds the insight that incumbent politicians have a strong interest in having a bit of public information published in order to reduce electoral accountability.

There are, however, interesting variations of the incumbent's incentives to send public information to the electorate when we add a second dimension to voter preferences. In general, this second dimension of preferences can measure how voters evaluate some characteristic of the candidates not related to public good provision. For ease of exposition, we shall refer to the second dimension of preferences as ideology.

Let $u_{it} = g_t + \beta_i$ be voter i 's utility in period t where β_i denotes ideological closeness of the incumbent to voter i relative to the challenger⁷. For instance, a positive value of β_i implies that voter i prefers the incumbent in the ideological dimension. We assume that for the incumbent $\beta_i \sim N(b, 1/\tau_\beta)$.

⁷We omit the subscript t for this parameter without any confusion, since it matters only for the voting decision at the end of the first period.

Then, voter i votes for the incumbent if

$$\begin{aligned}
E(\Theta^I | s_i, s_{pub}) + \beta_i \geq 0 &\Leftrightarrow \frac{\tau_x(s_i - \tilde{e}) + \tau_y(s_{pub} - \tilde{e})}{\tau_x + \tau_\theta + \tau_y} + \beta_i \geq 0 \\
\Leftrightarrow \frac{\tau_x + \tau_y}{\tau_x + \tau_\theta + \tau_y} \cdot (e - \tilde{e} + \theta^I) + \frac{\tau_y y}{\tau_x + \tau_\theta + \tau_y} + \underbrace{\frac{\tau_x}{\tau_x + \tau_\theta + \tau_y} x_i}_{\text{individual component}} + \beta_i &\geq 0
\end{aligned}$$

where the mean of the individual component is b . It follows that the median voter casts her ballot for the incumbent if

$$\frac{\tau_x + \tau_y}{\tau_x + \tau_\theta + \tau_y} \cdot (e - \tilde{e} + \theta^I) + \frac{\tau_y y}{\tau_x + \tau_\theta + \tau_y} + b \geq 0.$$

Applying the same procedure as above yields equilibrium effort described by

Lemma 3. *When each voter receives both a private signal and the public signal and voters also have ideological preferences, equilibrium effort $e_{s_i, s_{pub}, b}^*$ solves*

$$\phi \left[-b \cdot \frac{\tau_x + \tau_\theta + \tau_y}{\sqrt{(\tau_x + \tau_y)^2 + \tau_y \tau_\theta}} \sqrt{\tau_\theta} \right] \frac{\tau_x + \tau_y}{\sqrt{(\tau_x + \tau_y)^2 + \tau_y \tau_\theta}} \sqrt{\tau_\theta} R = c'(e_{s_i, s_{pub}, b}^*). \quad (8)$$

Proof. See above. □

It can be verified by applying standard techniques that effort is increasing in the respective precision of both the private and the public signals ($\partial e_{s_i, s_{pub}, b}^* / \partial \tau_x > 0$, and $\partial e_{s_i, s_{pub}, b}^* / \partial \tau_y > 0$ for $\tau_y > \tau_x$). Thus, given that voters receive both signals, more information about the incumbent's performance increases effort. We are, however, more interested in comparing effort between the cases where each voter receives only a private signal and where each voter receives both a private and the public signal.

As a benchmark case, consider a situation where voters receive private signals only (that means $\tau_y = 0$). Equilibrium effort $e_{s_i, b}^*$ then solves

$$\phi \left[-b \cdot \frac{\tau_x + \tau_\theta}{\tau_x} \sqrt{\tau_\theta} \right] \sqrt{\tau_\theta} R = c'(e_{s_i, b}^*). \quad (9)$$

For the case that the ideological preferences of voters are balanced in the sense that $b = 0$, we obtain the same level of effort as in the baseline model. Electoral accountability can therefore be high even with an ideologically polarized electorate if the ideological leanings of voters are balanced. For $b \neq 0$, we can recognize the well-known result that a larger ideological advantage or disadvantage of the incumbent results in lower effort because the density ϕ is decreasing in $|b|$.

By comparing equations (8) and (9), we observe that the effect of adding the public signal to the benchmark case with private signals and ideology depends on the ideological bias in the electorate:

Proposition 4. *In a large electorate where voters share identical preferences regarding public good provision but each voter also has ideological preferences, there exists a positive threshold \bar{b} such that adding public information to voters' private information increases an incumbent's effort if and only if the mean ideological position in the electorate satisfies $|b| > \bar{b}$, and reduces an incumbent's effort if and only if $|b| < \bar{b}$.*

Proof. See Appendix. □

According to Proposition 4, adding public information reduces effort in case of moderate ideological leanings of the median voter and it increases effort in case of strong ideological leanings. This ambiguous effect of adding public information arises because the blurring effect of the public signal on the incumbent's knowledge has different implications in both scenarios. When the median opinion is close to the threshold for re-election, blurring the incumbent's knowledge reduces probability mass around the threshold. In case of strong ideological leanings, however, it increases probability mass around the threshold. This means that adding public information can increase or decrease the indirect effect of effort on the probability of re-election ($\frac{\partial F}{\partial \mu}$, see above). In contrast, adding public information always increases the direct effect of effort ($\frac{\partial \mu}{\partial e}$). When the ideological bias is moderate, the negative impact of the indirect effect dominates the positive impact of the direct effect and thus adding public information reduces effort in this scenario.

Regarding the incentives of incumbents to disseminate public information, Proposition 4 implies that incumbents with a moderate advantage or disadvantage in the

ideology dimension (that is $|b| < \bar{b}$) have an incentive to let the electorate receive public information. In contrast, incumbents with a strong advantage or disadvantage in the ideology dimension have no incentive to do so.

5 Concluding remarks

The law of large numbers enables incumbents to form precise estimates of the decisive median opinion in the electorate. As a consequence, even an electorate where voters cast their ballot based on vague private impressions of an incumbent's performance can enjoy high levels of accountability. Since these vague impressions can result from voters just living their lives, this minimal condition for accountability should be satisfied in reality. This result can attenuate concerns that the lack of knowledge among voters hampers a good functioning of democracy.

However, if voters collectively learn more about performance from public sources of information, the level of accountability can be reduced. Politicians thus have an interest to have vague public information about their performance published. Given the ubiquity of public relation activities in the political sphere, politicians seem to have the means to achieve this goal in reality. This suggests that real elections take place in a second best world where voters cannot avoid receiving public information. In such a second best world, critical journalism can play an important role in providing the electorate with additional information to raise accountability levels again. As accountability-enhancing reporting is a public good, however, voters will have incentives to free-ride when it comes to paying for investigations which may be an obstacle for having journalists scrutinize incumbents.

But public information can also induce an increase in accountability when there is a substantial ideological bias in the electorate. The ambiguous relationship between public information and ideology invites further scrutiny from both a theoretical and an empirical perspective. While the implications of having a large electorate for accountability have been largely left unexplored, there is an extensive theoretical literature on the selection problem which also considers the role of ideology. For example, Krishna and Morgan (2011) show that the adverse influence of ideology on information

aggregation need not appear if voting is not mandatory. It will be interesting to study whether modifications of our model along these lines will produce similar results regarding accountability considerations.

Further, it would be interesting to find out whether publicity activities of incumbent politicians show patterns in line with our model. This would mean that incumbents who are confronted with a neutral electorate tend to refer to their performance whereas incumbents who are confronted with a biased electorate should emphasize other areas.

Finally, our analysis suggests that models which use a representative voter to study accountability should be handled and interpreted carefully with respect to the informational assumptions. According to our analysis, a representative voter who receives a noisy signal can fail to be a good description of a situation where the median and all other voters are poorly informed. Conclusions can thus be misleading. With a representative voter, there also is no meaningful distinction between public and private information although the relation between these distinct sources of information can be important for the degree of accountability that can be achieved.

6 Appendix

Proof of Proposition 4. Define

$$\begin{aligned}
f(b) &:= \phi \left[-b \cdot \frac{\tau_x + \tau_\theta + \tau_y}{\sqrt{(\tau_x + \tau_y)^2 + \tau_y \tau_\theta}} \sqrt{\tau_\theta} \right] \frac{\tau_x + \tau_y}{\sqrt{(\tau_x + \tau_y)^2 + \tau_y \tau_\theta}} \sqrt{\tau_\theta} - \phi \left[-b \cdot \frac{\tau_x + \tau_\theta}{\tau_x} \sqrt{\tau_\theta} \right] \sqrt{\tau_\theta} \\
&= \frac{\tau_x + \tau_y}{\sqrt{(\tau_x + \tau_y)^2 + \tau_y \tau_\theta}} \sqrt{\tau_\theta} \cdot \phi \left[-b \cdot \frac{\tau_x + \tau_\theta}{\tau_x} \sqrt{\tau_\theta} \right] \\
&\quad \cdot \left[\frac{\phi \left[-b \cdot \frac{\tau_x + \tau_\theta + \tau_y}{\sqrt{(\tau_x + \tau_y)^2 + \tau_y \tau_\theta}} \sqrt{\tau_\theta} \right]}{\underbrace{\phi \left[-b \cdot \frac{\tau_x + \tau_\theta}{\tau_x} \sqrt{\tau_\theta} \right]}_{=: a(b)}} - \frac{\sqrt{(\tau_x + \tau_y)^2 + \tau_y \tau_\theta}}{\underbrace{\tau_x + \tau_y}_{=: k}} \right]
\end{aligned} \tag{10}$$

Adding public information increases (resp. decreases) an incumbent's effort if and only if $f(b)$ is positive (resp. negative).

Define $\delta_1 := \frac{\tau_x + \tau_\theta + \tau_y}{\sqrt{(\tau_x + \tau_y)^2 + \tau_y \tau_\theta}} \sqrt{\tau_\theta}$ and $\delta_2 := \frac{\tau_x + \tau_\theta}{\tau_x}$.

We have $\frac{\tau_x + \tau_\theta}{\tau_x} > \frac{\tau_x + \tau_\theta + \tau_y}{\sqrt{(\tau_x + \tau_y)^2 + \tau_y \tau_\theta}} \iff 3\tau_x^2 \tau_\theta \tau_y + 4\tau_x \tau_\theta^2 \tau_y + 2\tau_x \tau_\theta \tau_y^2 + \tau_\theta^2 \tau_y^2 + \tau_\theta^3 \tau_y > 0$.
In other words, $\delta_1 < \delta_2$.

We have

$$\begin{aligned} \frac{da(b)}{db} &= \frac{-b\delta_1^2 \phi(-b\delta_1) \phi(-b\delta_2) + b\delta_2^2 \phi(-b\delta_1) \phi(-b\delta_2)}{\phi^2(-b\delta_2)} \\ &= \frac{b\phi(-b\delta_1)(\delta_2^2 - \delta_1^2)}{\phi(-b\delta_2)} \end{aligned}$$

Hence $a(b)$ is an increasing function for $b > 0$, and a decreasing function for $b < 0$. Its minimum is $a(0) = 1$. Moreover, it is convex:

$$\begin{aligned} \frac{d^2a(b)}{db^2} &= \frac{(1 - b^2\delta_1^2)\phi(-b\delta_1)\phi(-b\delta_2) + b^2\delta_2^2\phi(-b\delta_1)\phi(-b\delta_2)}{\phi^2(-b\delta_2)} (\delta_2^2 - \delta_1^2) \\ &= \frac{\phi(-b\delta_1)(1 + b^2(\delta_2^2 - \delta_1^2))}{\phi(-b\delta_2)} (\delta_2^2 - \delta_1^2) > 0 \end{aligned}$$

Since $k > 1$ and $a(b)$ is a symmetric and convex function with minimum $a(0) = 1$, increasing for $b > 0$ and decreasing for $b < 0$, we conclude that there is a positive \bar{b} such that $f(b)$ is positive (resp. negative) if and only if $|b| > \bar{b}$ (resp. $|b| < \bar{b}$).

□

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