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Public versus Secret Voting in Committees

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Keywords: Committees; Voting, Career Concern; Transparency.

JEL Codes: D72; C92; D71.

Public versus Secret Voting in Committees*

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May 2016

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1 Introduction

Committee decision-making is a central feature of many political and economic organizations, including governments, legislative bodies, central banks, law courts, and private companies. A widespread view in the literature is that group decision-making provides an efficient way to aggregate disperse information and contributes mitigating the interference of individual biases in the decision.[1]

The issues confronted by committees are often complex and involve a variety of conflicting interests. Indeed, there are a number of situations in which the goals of committee members are not aligned with the objectives of the community or the organization as a whole. Consider, for example, the case of a company deciding whether to downsize a particular division, legislators voting on a constitutional reform that may be harmful to some of them, or members of a monetary committee with different concerns about inflation versus unemployment.[2] Furthermore, committee members are usually motivated by the desire to advance their own careers and, therefore, care about being perceived as competent decision makers. For example, the reputation for making correct decisions is crucial for the reappointment of the members of a company's board of directors, or for top bureaucrats.[3]

Only recently, and partly following a trend towards increased procedural transparency in central banking, the literature has started focusing on the effects of transparency of voting procedures on decision making in committees.[4] To the best of our knowledge, however, none of the existing papers has investigated how career concerns, individual biases and common interest interact in shaping individuals' voting behavior in a committee, and how this interaction is affected by transparency.

Our main question is whether the individual votes of members should be made public or not, i.e. whether voting should be transparent or secret. We consider a simple yet versatile theoretical environment where agents are heterogenous in two private dimensions, competence and preferences. Decisions over a binary agenda is taken by simple majority and committee members can vote for either alternative or abstain.

[1] See Gerling et al [14] and Li and Suen [22] for reviews of this literature.

[2] Blinder [4] argues that members of monetary committees are potentially heterogeneous along several dimensions: they may have different political preferences, they may believe in different models of the economy or use different forecasts, they may use different heuristics in the decision-making process.

[3] See Wilson [35].

[4] See Gersbach and Hahn [11] and [12], Hansen et al [17], Levy [21], Meade and Stasavage [24], Stasavage [32] and Swank and Visser [33].

Individuals' payoff depends on three components: i) Whether the committee adopts the correct decision; ii) the committee members bias for either alternative; iii) their perceived competence.

Our analysis highlights that the existence of career concerns leads to qualitatively different conclusions depending on the agent's competence level and the magnitude of her bias relative to the common value. We show that, when committee members are relatively biased, career concerns act to "correct" the vote of competent members who otherwise would have simply voted according to their personal interests. On the other hand, when committee members are relatively unbiased, these same concerns induce the incompetent members to vote for their biases, even though they would otherwise have preferred to abstain. While the former effect is fairly straightforward, the latter is somewhat more subtle. Intuitively, when the common value is sufficiently large, it is optimal for the incompetent members to abstain, since by doing so they delegate the decision to the competent agents. This is the well-known swing-voter curse, first studied by Feddersen and Pesendorfer [9]. In our model, however, such behavior affects perceived competence negatively, since in equilibrium abstention signals incompetence.This creates an incentive for the incompetent members to vote and, when they do so, they choose the alternative towards which they are biased. In this sense, our model uncovers that career concerns may actually exacerbate the pre-existing biases of incompetent members.

We show that public voting should be preferred when the magnitude of the bias is large relative to the common value, in which case transparency helps mitigating the influence of private interests on the decisions. Conversely, secret voting should be adopted when the intensity of the bias is relatively small, in which case the non-observability of individual votes reduces the incentives for incompetent members to "gamble" and vote just in order to avoid revealing their lack of competence.

The present analysis yields some interesting implications for the design of committee decision-making rules. Our model emphasizes the idea that voting should be transparent in committees where members are highly subjected to the influence of ideological or self-interested motives. This is often the case of committees composed by politicians such as congressional committees. Other examples are boards of directors of large organizations, where there is usually a diversity of specific interests involved in each decision, or hiring committees in academic departments, where members are sometimes biased towards candidates in their own field. Conversely, voting should be kept secret when the dissent among members due to individual biases is relatively small, as it is perhaps the case of committees of experts charged with highly technical decisions such as top bureaucrats.[5]

Some recent empirical findings by Mian et al [25] suggest an additional possible implication of our results. The authors provide compelling evidence that politicians and voters become more politically polarized in the aftermath of financial crises. In light of these findings, our results suggest that voting in committees should be transparent in relatively "bad times" when ideological biases may tend to be exacerbated. Conversely, secret vote might perform well in relatively "good times" when ideological positions are less polarized.

We test the main theoretical predictions of the model by means of a controlled laboratory experiment. As it will be clear later in the paper, there are regions of the parameters space where our model features multiple equilibria with different properties. From this perspective, a controlled experiment can inform about whether individuals coordinate on certain equilibria and not on others. Perhaps more importantly, a controlled laboratory experiment allows us to collect data on individuals' behavior under the different treatments of interest, i.e. secret versus public voting.[6]

Our experimental setting is simple and naturally originates from the theoretical model. We consider a 2 by 2 design: low versus high bias and secret versus public voting. Consistently with our theoretical predictions, secret vote performs better (worse) than public voting in aggregating information with relatively low (high) bias. While half of the incompetent subjects abstains under secret vote and low bias, this proportion drops dramatically with public vote and it is almost zero in the case of high bias. Furthermore, our results in the secrete low-bias treatment are in line with the results of the literature on swing voter's curse.[7] When there are multiple equilibria, our results suggests that subjects eventually coordinate on the efficient equilibrium.

[5] Alesina and Tabellini [1] and [2] study theoretically the optimal assignment of policy tasks to elected politicians or to non-elected bureaucrats. For an empirical analysis see Iaryczower et al [19].

[6] For an alternative approach, which exploits a natural experiment related to the release of the Federal Open Market Committee (FOMC) transcripts, see Hansen et al [17], Meade and Stasavage [24] and Swank et al [34].

[7] See Battaglini et al [3] and Morton and Tyran [28] and [29]. See also Herrera et al [18] for theory and experiments on strategic abstention in proportional elections.

2 Literature Review

A number of papers in the literature have shown that transparency in decision-making is not always advisable since it creates incentives for agents to distort their behavior in order to convey information about their types. This has been investigated for single decision makers and in the context of decision-making in committees.[8] Gersbach and Hahn [12] and Levy [21] examine models where agents care about acquiring a reputation for competence. They show that secret voting leads to better decisions by reducing distortions arising from signalling. Specifically, Levy [21] shows that transparency induces agents to vote too much against the prior (i.e. the ex-ante more likely alternative) in order to signal that they have accurate information about the state of the world. Gersbach and Hahn [11] and Stasavage [32], on the other hand, analyze a setting where committee members may be misaligned with the interests of society, but also care about being perceived as "unbiased" to the extent that this enhances their reelection prospects. They show that transparency is optimal in this case, since it induces agents to act in accordance with the public interest. In addition to these papers, Gersbach and Hahn [13] show that transparency induces agents to exert more effort in order to improve their chances of reappointment, Dal Bo [6] and Felgenhauer and Gruner [8] argue that public voting makes the committee more vulnerable to the influence of special interest groups, and Swank and Visser [33] point out that career concerns create an incentive for committees to conceal internal disagreements and show a united front in public. Differently from this literature, we study how bias and career concern interact with each other allowing for the possibility of abstention and without imposing that individual biases per se are punished.

As for the experimental literature on committee decision making, the most related paper to ours is Fehrler and Hughes [10]. As in our paper, they focus on the effect of transparency on committee decision making where agents are career concerned. Differently from our approach, their committee members are unbiased, committees are composed of two individuals, and the experimental focus is mostly on deliberation.[9]

[8] For single decision makers see Maskin and Tirole [23], Morris [26] and Prat [31].

[9] See also Morton and Ou [27] for an empirical investigation of whether secret voting leads to less prosocial voting behavior than public voting.

3 The Model

We consider a committee of $n \geq 3$ members, with n odd, that must decide between two alternatives, A and B. There are two states of the world, $\omega \in \{A, B\}$, with $\Pr(\omega = A) = q \in (0, 1)$. While the true state is a priori unknown, committee members may receive an informative signal about it $s_i \in \{A, \emptyset, B\}$. An agent may be either competent, $\mathtt{c}$, in which case he receives a perfectly informative signal, or incompetent, $\mathtt{nc}$, in which case he receives an uninformative signal. We assume that each member knows his own competence type $\tau_i \in \{\mathtt{c},\mathtt{nc}\}$ and the distribution of other members' competences, which is given by $\Pr(\tau_i = \mathtt{c}) = \sigma \in (0, 1)$. After observing their private signals, all members decide simultaneously whether to vote for A or B or to abstain, $v_i \in \{A, \emptyset, B\}$. The final decision, $x \in \{A, B\}$, is determined by simple majority rule and ties are broken randomly.

The committee members care about making correct decisions and receive a common value $\alpha > 0$ whenever the final choice is equal to the state of the world, i.e. $x = \omega$. Additionally, we suppose that every member is biased towards one of the alternatives, i.e. each agent is biased towards either A or B. Every committee member knows his own bias type, $\beta_i \in \{A, B\}$, as well as the distribution of other agents' biases, $\Pr(\beta_i = A) = p \in (0, 1)$, which we assume to be common knowledge. An agent biased towards β_i, receives an extra payoff $\gamma > 0$, irrespective of the state of the world, when alternative $x = \beta_i$ is chosen by the committee.[10]

The members of the committee are also concerned with building a reputation for competence and making correct decisions. Following the literature, we assume the existence of an additional agent, the external evaluator, whose task is simply to update his beliefs about the likelihood that each member is competent and voted correctly, conditional on the state of the world plus any other relevant information that might be available to him. We suppose that the state of the world is always revealed ex-post. Furthermore, under public voting, the evaluator is able to observe the individual votes of all members, while under secret voting, he is able to observe only the aggregate number of votes for each alternative.[11] The posterior probability that an agent i is

[10] This model extends the setting studied by Nakaguma [30] to an asymmetric environment.

[11] Alternatively, we could have assumed that only the final decision of the committee was observed under secrecy. See the discussion in the online Appendix A about changes in voting rule and degree of transparency.

competent and voted correctly is, therefore, given by:

$$r_i^{\omega,\lambda} \equiv \Pr(\tau_i = \mathtt{c}, v_i = \omega | \omega, \mathcal{I}^\lambda), \tag{1}$$

where ω is the state of the world, $\lambda \in \{\mathtt{p}, \mathtt{s}\}$ denotes whether voting is public or secret, and $\mathcal{I}^\lambda$ represents all relevant information available under λ. The condition that a committee member competence is valued only if his vote is correct (with some likelihood) can be interpreted as capturing a situation where the external evaluator cares not only about the competence of the agent per se, but also whether the agent is using his expertise to advance the common interest of the group. This assumption not only simplifies the analysis but proves particularly useful in the experimental study of our theory.[12]

Thus, given the state of the world ω, and the committee's decision x, the utility of a member i biased towards β_i under voting rule λ is given by:

$$u_i^{\beta_i,\lambda}(x,\omega) = \phi r_i^{\omega,\lambda} + \mathbb{I}_{\{x=\omega\}}\alpha + \mathbb{I}_{\{x=\beta_i\}}\gamma, \tag{2}$$

where ϕ is the weight assigned to career concerns and $\mathbb{I}_{\{\cdot\}}$ is an indicator function equal to one if the condition inside brackets is satisfied and zero otherwise.

4 Equilibrium Analysis

We solve the model for symmetric pure-strategy equilibria, where committee members of the same type (i.e., with the same bias and competence level) choose identical strategies. We also assume that agents do not use weakly-dominated strategies. In equilibrium, each committee member chooses a voting strategy that maximizes his expected utility, given the equilibrium strategies of other players and the external evaluator's beliefs. At the same time, the evaluator's beliefs must be consistent with

[12] Under this definition, a committee member receives zero reputation whenever he abstains or votes incorrectly under public voting. Intuitively, this assumes an external evaluator very tough on whoever says "I am not sure what to do" or who expresses blatantly wrong opinions. While it is not always the case that not taking a position is detrimental for expected competence, our assumption seems plausible in a variety of cases. For example, an expert who candidly reveals in public that he does not know what is the right policy to implement would most probably harm his reputation for competency. We show in Section 5 that the main qualitative results of our analysis are robust to using an alternative definition that is based only on the posterior probability that the agent is competent, $r_i^{\omega,\lambda} \equiv \Pr(\tau_i = \mathtt{c} | \omega, \mathcal{I}^\lambda)$.

the agents' strategies and computed by Bayes' rule.

4.1 Basic Properties

We begin our analysis by providing a general characterization of the basic properties of the equilibria. Let μ_i denote the conjecture held by a committee member i about the behavior of other members and the beliefs of the external evaluator. Suppose first that member i observes the state of the world prior to voting, i.e. he receives a perfectly informative signal. Given the conjecture μ_i and the state of the world ω, player i's strategy, $v_i \in \{A, \emptyset, B\}$, induces a probability distribution over final outcomes, which is represented by the mapping $\rho^{\omega}_{\mu_i} : \{A, \emptyset, B\} \to [0,1]$, where $\rho^{\omega}_{\mu_i}(v_i)$ denotes the probability, as perceived by the agent, that the committee's decision is A when the agent chooses v_i, given μ_i and ω. Observe that the probability $\rho^{\omega}_{\mu_i}(v_i)$ already takes into account all the uncertainty related to the realization of types of other committee members. Furthermore, it must be the case that:

$$\rho^{\omega}_{\mu_i}(B) \leq \rho^{\omega}_{\mu_i}(\emptyset) \leq \rho^{\omega}_{\mu_i}(A), \tag{3}$$

since a vote for A can never lead to a lower probability that the committee's decision is A (relative to the case where the individual abstains) and, similarly, a vote for B can never increase the probability that the final outcome is A (relative to the case where he abstains).[13]

Next, let μ_e be the external evaluator's beliefs about the behavior of committee members. Under public voting, all individual votes are observable ex-post, so that career concern reward depend only on each member's own vote according to the following expression:

$$r^{\omega,\mathtt{p}}_{i,\mu_e} = \Pr_{\mu_e}(t = \mathsf{c} | v = \omega)\mathbb{I}_{\{v_i=\omega\}}, \tag{4}$$

where $\Pr_{\mu_e}(t = \mathsf{c}|v = \omega)$, is computed based on the external evaluators' beliefs about the behavior of voters and $\mathbb{I}_{\{v_i=\omega\}}$ is an indicator function that equals one when agent i votes correctly, $v_i = \omega$. Under secret voting, on the other hand, only the aggregate vote is observable ex-post, so that career concern rewards can be made contingent only on the total number of correct votes, $V^c \equiv \sum_i \mathbb{I}_{\{v_i=\omega\}}$, according to the following

[13] The inequalities are weak since there may be situations where the committee member is not expected to be pivotal.

expression:

$$r_{\mu_e}^{\omega,\mathsf{s}} = \Pr_{\mu_e}(t = \mathsf{c}|v = \omega)\frac{V^c}{n} \ , \tag{5}$$

where V^c/n represents the probability that a particular agent voted correctly. Observe that the evaluator expects that each member is equally likely to have cast one of the V^c correct votes, given that all agents are ex-ante identical. Therefore, in this case, the career concern rewards are the same across all members and equal to the average expected competence in the committee.

In equilibrium, each committee member correctly anticipates the beliefs of the external evaluator and, before casting a vote, forms an expectation about the career concern reward that he will receive as a function of his strategy. Suppose, first, that the state of the world is observed by the agent. Under public voting, each agent can perfectly anticipate his career concern reward in equilibrium:

$$\widetilde{r}^{\omega,\mathsf{p}}(v_i) = \Pr(t = \mathsf{c}|v = \omega)\mathbb{I}_{\{v_i=\omega\}}, \tag{6}$$

where we omit the index for the evaluator's beliefs for simplicity. Under secret voting, expected career concern reward depends also on how each agent expects other members to vote:

$$\widetilde{r}^{\omega,\mathsf{s}}(v_i) = \Pr(t = \mathsf{c}|v = \omega)\tfrac{1}{n}(\mathbb{I}_{\{v_i=\omega\}} + \mathbb{E}(\textstyle\sum_{j\neq i}\mathbb{I}_{\{v_j=\omega\}})), \tag{7}$$

where $\mathbb{E}(\sum_{j\neq i}\mathbb{I}_{\{v_j=\omega\}})$ is the number of correct votes expected to be cast by the other committee members. Hence, under secret voting, the impact of an agent's correct vote on his own career concern is diluted in proportion to the size of the committee. When the state of the world is not observed as it is the case, each agent must compute his expected reward by averaging his career concern under each state:

$$\widetilde{r}^{\lambda}(v_i) = q\widetilde{r}^{\omega=A,\lambda}(v_i) + (1-q)\,\widetilde{r}^{\omega=B,\lambda}(v_i)\,. \tag{8}$$

Based on the elements defined above, and assuming that the state of the world is A, the expected utility of a competent member can be expressed as a function of his vote v_i as follows:

$$U^{\beta_i=A,\lambda}(v_i, s_i = A) = \phi\widetilde{r}^{\omega=A,\lambda}(v_i) + \rho^{\omega=A}(v_i)(\alpha+\gamma) \tag{9}$$

and

$$U^{\beta_i=B,\lambda}(v_i, s_i = A) = \phi\widetilde{r}^{\omega=A,\lambda}(v_i) + \rho^{\omega=A}(v_i)\alpha + (1-\rho^{\omega=A}(v_i))\gamma, \tag{10}$$

depending on whether the agent is biased towards A or B, respectively. Similar expressions can be derived for the case where the state of the world is B. The next lemma provides a general characterization of the behavior of competent members.[14]

Lemma 1. *The behavior of competent members is characterized by the following properties:*

a. Both abstaining and voting against the bias are weakly dominated strategies for a competent member whose bias is equal to the signal, $s_i = \beta_i$;

b. Abstaining is a weakly dominated strategy for a competent member whose bias is different than the signal, $s_i \neq \beta_i$.

Intuitively, competent members observe the state of the world and, as a consequence, are not subject to the "swing voter's curse" (Feddersen and Pesendorfer [9]), i.e. the risk of unwillingly shifting the committee's decision away from the correct outcome. Therefore, there is no reason for them to abstain, since by voting for either alternative they can push the decision towards a particular outcome and abstentions are associated with lack of competence. Lemma 1 also implies that a competent member who receives a signal equal to his bias, $s_i = \beta_i$, always prefers (weakly) to vote in accordance with the state of the world, given that both common and private interests are aligned in this case, while a competent member who receives a signal different than his bias, $s_i \neq \beta_i$, may either vote for the state of the world or in accordance with his bias. Note that the above result guarantees that, in any equilibrium, every competent members who is biased towards the state of the world votes correctly. Thus, by Bayes rule, the likelihood that an agent is competent given that he voted correctly is strictly positive, $\Pr(t = \mathsf{c}|v = \omega) > 0$. The next lemma follows as a direct implication of this result.

Lemma 2. *In equilibrium, a member's expected career concern reward is always strictly larger when he votes correctly rather than when he abstains or votes incorrectly:*

$$\widetilde{r}^{\omega,\lambda}(v_i = \omega) > \widetilde{r}^{\omega,\lambda}(v_i \neq \omega)$$

Furthermore, we have that:

$$\widetilde{r}^{\omega,\mathtt{p}}(v_i = \omega) > \widetilde{r}^{\omega,\mathtt{s}}(v_i = \omega)$$

[14] All proofs can be found in Online Appendix C.

and

$$\widetilde{r}^{\omega,\mathbf{p}}(v_i \neq \omega) < \widetilde{r}^{\omega,\mathbf{s}}(v_i \neq \omega)$$

Interestingly, conditional on a correct vote, the expected career concern reward is larger under public than under secret voting, whereas the opposite is the case conditional on an incorrect vote or an abstention. Intuitively, this result follows from the fact that under secrecy career concern rewards are distributed equally across members and depend only on the total number of correct votes. The next lemma characterizes the equilibrium behavior of incompetent members relative to competent ones.

Lemma 3. *There exists no equilibrium in which a competent member who receives a signal different than his bias votes against the state of the world and an incompetent member abstains.*

Intuitively, incompetent agents are relatively more inclined to follow their "biases" by either voting for the ex-ante more likely alternative or for the alternative that matches their bias types. When a competent agent decides to vote against his signal, he knows for sure that he is casting an incorrect vote, while an incompetent agent always attributes positive probability to the event that his vote is correct, in which case he obtains larger career concern rewards. That is, incompetent agents are "naively" optimistic that their vote will coincide with the state of the world, which makes them more willing to vote even without having any information.

Finally, based on the above results, it is possible to show that there are only three types of equilibria in the model.

Proposition 1. *The equilibria of the model can be categorized into one of the following classes:*

i. A fully competent equilibrium, where all competent members vote in accordance with the signal and all incompetent members abstain;

ii. A partially competent equilibrium, where all competent members vote in accordance with the signal and not all incompetent members abstain;

iii. A biased equilibrium, where at least some competent members vote against their signals and all incompetent members vote either to the ex-ante more likely alternative or in accordance with their biases.

Note that this characterization holds under both public and secret voting, any value of the prior and any distribution of types. However, the region of the parameters where each class of equilibrium can be sustained do depend on the transparency of the voting rule, as we shall discuss in detail in the next subsection.

4.2 Main Comparative Statics Results

In this subsection, we provide a characterization of each type of equilibrium under secrete and public voting. Let the subscript $\mu = \{full, part, bias\}$ denote equilibrium beliefs of all agents. The following proposition summarizes the main properties of the fully competent equilibrium.

Proposition 2. *A fully competent equilibrium can be sustained, if and only if*

$$\gamma \leq \overline{\gamma}^{\lambda}_{full}(\alpha, \phi, \sigma, n) < \alpha.$$

Furthermore, if a fully competent equilibrium can be supported under public voting, then it can also be supported under secret voting.

A fully competent equilibrium can be sustained only if the magnitude of the bias is small relatively to the common value, and it is more likely to be supported under secret voting. Intuitively, the interaction between transparency and career concerns creates an incentive for incompetent members to vote, since abstaining perfectly reveals their lack of competence in this case.

The next proposition provides a general characterization of the partially competent equilibrium.

Proposition 3. *A partially competent equilibrium can be sustained, if and only if*

$$\underline{\gamma}^{\lambda}_{part}(\alpha, \phi, \sigma, n) \leq \gamma \leq \overline{\gamma}^{\lambda}_{part}(\alpha, \phi, \sigma, n),$$

where $\underline{\gamma}^{\lambda}_{part}(\alpha, \phi, \sigma, n) < \alpha$ *and* $\overline{\gamma}^{\lambda}_{part}(\alpha, \phi, \sigma, n) > \alpha$. *Furthermore, if a partially competent equilibrium can be supported under secret voting, then it can also be supported under public voting.*

A partially competent equilibrium can be sustained even if the magnitude of the bias is large relatively to the common value, and this equilibrium is more likely to be supported under public voting. Observe that transparency acts to counter-balance the effect of the bias in competent members by creating an incentive for them to vote correctly in order to signal their competence. At the same time, it also provides incentive for the incompetent members to vote rather than to abstain. In general, there is an overlap between the region of parameters where a fully competent and a partially competent equilibria can be supported.

Finally, the next proposition summarizes the main properties of the biased equilibrium.

Proposition 4. *A biased equilibrium can be sustained, if and only if*

$$\alpha < \underline{\gamma}_{bias}^{\lambda}(\alpha, \phi, \sigma, n) \leq \gamma,$$

Furthermore, if a biased equilibrium can be supported under public voting, then it can also be supported under secret voting.

A biased equilibrium is more likely to be sustained under secret voting since secrecy reduces the career concern reward associated with a correct vote, and makes competent members more willing to disregard their information about the state of the world and vote in accordance with their biases.

Overall, our analysis highlights the fact that transparency affects the behavior of competent and incompetent agents in markedly different ways. On the one hand, transparency *attenuates* the preexisting biases of competent members by inducing them to vote correctly, even when the state of the world contradicts their biases. On the other hand, transparency *exacerbates* the preexisting biases of incompetent members by inducing them to vote either for the ex-ante more likely alternative or in accordance with their biases to avoid revealing their lack of competence.

4.3 The Symmetric Case

In this subsection, we provide a precise characterization of the equilibria by assuming that both the prior probability and the distribution of biases are symmetric, i.e. $q = p = 1/2$. The symmetric prior assumption implies that, when an incompetent member decides to vote, he will always vote for the alternative towards which he is biased, while the uniform distribution of biases simplifies the analysis by making the equilibrium behavior of incompetent members symmetric between agents of different bias types.

Under these assumptions, we derive closed forms for the thresholds defined above. The following proposition characterizes the structure of the equilibria under both public and secret voting.

Proposition 5. *Suppose that $q = p = 1/2$, then*

i. A fully competent equilibrium can be supported if and only if

$$\gamma \leq \overline{\gamma}^{\lambda}_{full}(\alpha, \phi, \sigma, n) \equiv \frac{(n-1)\sigma}{2+(n-3)\sigma}\alpha - \frac{\left(1 - \frac{n-1}{n}\mathbb{I}_{\{\lambda=\mathtt{s}\}}\right)\phi}{\left(1+\frac{n-3}{2}\sigma\right)(1-\sigma)^{n-2}}$$

ii. A partially competent equilibrium can be supported if and only if

$$\gamma \leq \overline{\gamma}^{\lambda}_{part}(\alpha, \phi, \sigma, n) \equiv \alpha + \frac{2^{n}\sigma\left(1 - \frac{n-1}{n}\mathbb{I}_{\{\lambda=\mathtt{s}\}}\right)\phi}{\binom{n-1}{(n-1)/2}(1+\sigma)^{\frac{n+1}{2}}(1-\sigma)^{\frac{n-1}{2}}}$$

iii. A biased equilibrium can be supported if and only if

$$\gamma \geq \underline{\gamma}^{\lambda}_{bias}(\alpha, \phi, \sigma, n) \equiv \alpha + \frac{2^{n-1}\sigma\left(1 - \frac{n-1}{n}\mathbb{I}_{\{\lambda=\mathtt{s}\}}\right)\phi}{\binom{n-1}{(n-1)/2}}$$

Furthermore, $\overline{\gamma}^{\lambda}_{full}(\alpha, \phi, \sigma, n) < \underline{\gamma}^{\lambda}_{bias}(\alpha, \phi, \sigma, n) < \overline{\gamma}^{\lambda}_{part}(\alpha, \phi, \sigma, n)$, $\overline{\gamma}^{\mathtt{p}}_{full}(\alpha, \phi, \sigma, n) < \overline{\gamma}^{\mathtt{s}}_{full}(\alpha, \phi, \sigma, n)$, $\overline{\gamma}^{\mathtt{p}}_{part}(\alpha, \phi, \sigma, n) > \overline{\gamma}^{\mathtt{s}}_{part}(\alpha, \phi, \sigma, n)$, and $\underline{\gamma}^{\mathtt{p}}_{bias}(\alpha, \phi, \sigma, n) > \underline{\gamma}^{\mathtt{s}}_{bias}(\alpha, \phi, \sigma, n)$.

The term $\frac{n-1}{n}\mathbb{I}_{\{\lambda=\mathtt{s}\}}$ which appears inside parenthesis in the above expressions captures the effect of the dilution of career concern under secret voting. Hence, a change from public to secret voting is qualitatively equivalent to a reduction in the weight attached to career concerns. Figure 1 shows the values of the parameters α and γ for which each class of equilibria can be sustained, given a level of transparency λ, and for fixed values of ϕ, σ and n.

Observe that since $\overline{\gamma}^{\lambda}_{full} < \overline{\gamma}^{\lambda}_{part}$, the region of parameters where a fully competent equilibrium exists is contained inside the region where a partially competent equilibrium can be supported. Recall that the main reason for an incompetent member to abstain is to avoid adding "noise" to the decision process. However, a coordination issue arises in the region where the two equilibria overlap in that abstaining is only optimal for an incompetent member if he expects other incompetent members to abstain as well. If, on the other hand, he expects other incompetent members to vote for their biases, then it becomes optimal for him to also do so.

Similarly, since $\underline{\gamma}^{\lambda}_{bias} < \overline{\gamma}^{\lambda}_{part}$, there exists a region of parameters where both a partially competent and a biased equilibria can be sustained simultaneously. The multiplicity of equilibria arises in this case due to the existence of a coordination issue among competent members who are biased against the state of the world. In equilibrium, either all of them vote correctly or all of them vote in accordance with their biases.

Figure 2 summarizes the main comparative static results of the model. Observe that in region I, where $\overline{\gamma}^{\mathsf{s}}_{part} < \gamma < \overline{\gamma}^{\mathsf{p}}_{part}$, a partially competent equilibrium can be sustained under public but not under secret voting; while in region II, where $\overline{\gamma}^{\mathsf{p}}_{full} < \gamma < \overline{\gamma}^{\mathsf{s}}_{full}$, a fully competent equilibrium can be sustained under secret but not under public voting. Intuitively, when the magnitude of the bias is relatively large, like in region I, incompetent members always vote in accordance with their biases, but public voting may actually induce competent members to vote correctly rather than to follow their biases since this increases the career concern gain associated with a correct vote. On the other hand, when the magnitude of the bias is relatively small, like in region II, competent members always vote correctly, but secret voting may help incompetent agents to abstain rather than to vote for their biases by reducing the expected career concern gain associated with voting.

For each class of equilibrium, it can be shown that the probability of a correct decision is given by

$$\Pi_{full} = 1 - \tfrac{1}{2}\left(1-\sigma\right)^{n} \tag{11}$$

$$\Pi_{part} = \textstyle\sum_{i=(n+1)/2}^{n} \binom{n}{i} \left(\sigma + \tfrac{1}{2}\left(1-\sigma\right)\right)^{i} \left(\tfrac{1}{2}\left(1-\sigma\right)\right)^{n-i} \tag{12}$$

and

$$\Pi_{bias} = \tfrac{1}{2}, \tag{13}$$

with $\Pi_{full} > \Pi_{part} > \Pi_{bias}$. Observe that the likelihood of a correct decision is lower than one even under a fully competent equilibrium, given that with probability $(1-\sigma)^n$ all committee members are incompetent, in which case the correct alternative would be chosen only half of the time. It is also interesting to note that the expected difference in the quality of decisions between a fully competent and a partially competent equilibrium increases with n, provided that the proportion of competent members is small enough. Intuitively, the theoretical difference between the two classes of equilibria is expected to be particularly pronounced whenever there is a large proportion of incompetent agents in the committee. Given these results, it is possible to rank public and secret voting in terms of the quality of decisions expected under each of them.

Proposition 6. *Suppose that $q = p = 1/2$. In equilibrium, we have that*

i. If $\overline{\gamma}^{\mathsf{s}}_{part}(\alpha, \phi, \sigma, n) < \gamma < \overline{\gamma}^{\mathsf{p}}_{part}(\alpha, \phi, \sigma, n)$, then the probability of a correct decision under public voting is at least as large as under secret voting.

ii. If $\overline{\gamma}^{\mathsf{p}}_{full}(\alpha, \phi, \sigma, n) < \gamma < \overline{\gamma}^{\mathsf{s}}_{full}(\alpha, \phi, \sigma, n)$, then the probability of a correct decision under secret voting is at least as large as under public voting.

Thus, it follows that, when the magnitude of the bias is relatively large, a correct decision is more likely under public voting; while when the magnitude of the bias is relatively small, a correct decision is more likely under secret voting. Note that the possible existence of multiple equilibria in both of the regions considered above prevents us from ordering transparency and secrecy in strict terms, given that it is not possible to guarantee that a change from public to secret voting, or vice-versa, will necessarily lead to a change in the class of equilibrium that ultimately prevails. In light of this, a controlled laboratory experiment is a particularly useful tool that can inform on whether individuals coordinate on certain equilibria.

Finally, in the next proposition, we show that the region of parameters where it is possible to sustain different classes of equilibria under public and secret voting becomes larger as both the relevance of career concerns and the proportion of competent agents increase.

Proposition 7. *Suppose that $q = p = 1/2$. Then the distance $\overline{\gamma}^{\mathsf{p}}_{part}(\alpha, \phi, \sigma, n) - \overline{\gamma}^{\mathsf{s}}_{part}(\alpha, \phi, \sigma, n)$ and the distance $\overline{\gamma}^{\mathsf{s}}_{full}(\alpha, \phi, \sigma, n) - \overline{\gamma}^{\mathsf{p}}_{full}(\alpha, \phi, \sigma, n)$ are increasing in ϕ and σ.*

Therefore, the more career oriented are the members of the committee and the larger the proportion of competent agents, the larger is the region of parameters where the choice between secret and public voting is expected to matter.[15] Finally, it is possible to

[15] Intuitively, as σ increases, the career concern gains associated with a correct vote under a partially competent equilibrium increase, which generates an even stronger incentive for competent members to vote correctly under public voting relatively to secret voting. At the same time, as σ gets larger, the probability that an uninformed agent is pivotal when he decides to cast a vote under a fully competent equilibrium decreases, which diminishes the risk of the "swing voter's curse", thus increasing even more the incentive for incompetent members to vote under public voting relatively to secret voting.

show that these regions become arbitrarily large as the number of committee members goes to infinity, implying that our conclusions become possibly even more relevant for large committees.

5 Career Concern Rewards

Throughout our analysis we have made a number of simplifying assumptions that deserve to be discussed. In this section, we present a detailed analysis of the robustness of our findings to our non-standard modelling of career concerns. We cover other generalizations and extensions of the basic model in the Online Appendix A.[16]

We have assumed in our basic model that the career concern reward of a committee member is proportional to the conditional probability that the agent is competent *and* voted correctly (see equation [1]). However, our main qualitative results would remain the same even if we allow for the career concern reward to be based only on the posterior probability that agent i is competent, $r_i^{\omega,\lambda} \equiv \Pr(\tau_i = \mathsf{c}|\omega, \mathcal{I}^\lambda)$. In particular, both fully competent and partially competent equilibria would still be characterized by Propositions 2 and 3, respectively, and all comparative static results regarding these two types of equilibria would remain unchanged. The intuition is that in both cases the career concern reward associated with a correct vote is strictly larger than that associated with an abstention or an incorrect vote, since all competent members vote correctly in equilibrium.[17] It is in this sense that we can say that our basic conclusion that transparency attenuates the biases of competent members while it exacerbates the biases of incompetent members is robust to how career concern is defined.

The main implication of relaxing the assumption that career concern materializes only in connection with a correct vote is that it is now possible to sustain a larger set equilibria than those described in Proposition 1. In particular, we may also have equilibria involving the following "new" behaviors: (i) competent members with biases that are consistent with the state of the world voting against the state of the world and

[16] In the Online Appendix A we discuss the assumption that the state of the world is observed ex-post and study the case in which competent and incompetent members receive signals of different precision. We elaborate on changes in the voting rule and in the assumption about what is revealed ex-post under secret voting. We show that the model can be easily extended to the existence of unbiased agents and to possible correlations between competence and bias. Finally, we examine the implications of allowing for information sharing prior to the voting stage and we consider the incentives of different types of agents to choose between secret and public voting.

[17] This result follows directly from Bayes' rule since if all competent members vote correctly in equilibrium then it must be that $\Pr(t_i = \mathsf{c}|v_i \neq \omega) = 0$.

(ii) competent members abstaining. The next proposition provides a characterization of some basic aspects of these equilibria.

Proposition 8. *Assume that the career concern rewards depend only on the posterior probability that the agent is competent, $r_i^{\omega,\lambda} \equiv \Pr(\tau_i = c|\omega, \mathcal{I}^\lambda)$, then we have:*

i. An equilibrium in which a competent member with bias equal to the state votes against the state can be sustained only if the career concern reward associated with an incorrect vote is strictly larger than that associated with a correct vote.

ii. An equilibrium in which a competent member with bias equal to the state abstains can be sustained only if the career concern reward associated with an abstention is strictly larger than that associated with a correct vote.

An equilibrium involving a competent member with bias equal to the state either abstaining or voting incorrectly requires a very particular structure of incentives, namely: an agent who abstains or votes incorrectly must be seen as more likely to be competent than a member who votes correctly. There is an aspect of self-fulfilling prophecy involved in such equilibria in that whatever the external evaluator expects competent members to do, regardless of the correctness or incorrectness of the vote, may actually happen provided that career concerns are large enough. We believe that this element is not likely to be dominant in most applications of our model and this is one reason why our initial assumption that career concern is related to the joint probability that an agent is competent and voted correctly may be viewed as a reasonable form of refinement.[18] Still, even if we do not take these issues into account, it is possible to show that the equilibria discussed above can only exist in certain specific regions of the parameter space.

Proposition 9. *An equilibrium in which a competent member with bias equal to the state either abstains or votes against the state can be sustained only if the sum of the common value and the bias term, $\alpha + \gamma$, is small enough.*

[18]Incidentally, in a different model where committee members have incentive to signal both that they are competent and relatively unbiased, it would be reasonable to expect the existence of equilibria where abstentions are associated with relatively large career concern rewards. Note that a situation like that makes less sense in the context of our model, because here career concern depends solely on competence. A formal analysis of this other version of the model is beyond the scope of the present paper and is left for future research.

Intuitively, since in this case the bias and the state of the world are aligned, voting for the state would increase the likelihood that the agent gets a payoff of $\alpha+\gamma$. Therefore, for such agent to have an incentive to either abstain or vote against the state of the world, both the common value and the bias term must be sufficiently small.

Next, we define that beliefs are *monotone* if the evaluator's beliefs are such that $\Pr(t = \mathsf{c}|v = \omega, \omega) \geq \Pr(t = \mathsf{c}|v \neq \omega, \omega)$ for any ω. Note that this condition implies that the career concern reward associated with a correct vote is not strictly smaller than that associated with an abstention or an incorrect vote, *i.e.* $\widetilde{r}_i^{\omega,\lambda}(v_i = \omega) \geq \widetilde{r}_i^{\omega,\lambda}(v_i \neq \omega)$ *for* $\omega \in \{A, B\}$. Proceeding with our analysis, the following proposition provides a characterization of the main properties of the equilibrium where a competent member biased against the state of the world abstains.

Proposition 10. *Assume that* $r_i^{\omega,\lambda} \equiv \Pr(\tau_i = c|\omega, \mathcal{I}^\lambda)$*, then we have:*

i. An equilibrium in which a competent member biased against the state abstains can be sustained only if $\gamma - \alpha$ *is strictly positive and small enough.*

ii. If in equilibrium a competent member biased against the state abstains, then a competent member with bias equal to the state can never vote against the state.

iii. Any equilibrium with monotone beliefs where a competent member biased against the state abstains can be sustained only if:

$$\alpha < \underline{\gamma}^\lambda_{abst}(\alpha, \phi, \sigma, n) \leq \gamma \leq \overline{\gamma}^\lambda_{abst}(\alpha, \phi, \sigma, n)$$

Furthermore, we have that:

$$\underline{\gamma}^{\mathtt{s}}_{abst}(\alpha, \phi, \sigma, n) \leq \underline{\gamma}^{\mathtt{p}}_{abst}(\alpha, \phi, \sigma, n)$$

and

$$\overline{\gamma}^{\mathtt{s}}_{abst}(\alpha, \phi, \sigma, n) \leq \overline{\gamma}^{\mathtt{p}}_{abst}(\alpha, \phi, \sigma, n).$$

There are several interesting facts contained in the above proposition.

First, part (i) emphasizes that equilibria where competent members biased against the state of the world abstain are not pervasive. In particular, they can only exist if agents are somewhat indifferent between voting for the correct alternative and following their biases.

Second, we can provide a sharper characterization of the equilibrium by focusing exclusively on equilibria with monotone beliefs. Indeed, as part (*iii*) of the proposition shows, an equilibrium where a competent member biased against the state abstains can only be sustained if the bias term is larger than the common value. Hence, combining parts (*i*) and (*iii*) of Proposition 10, we have that under the monotone beliefs assumption the bias term must be larger than the common value, but not too large, so that $\gamma - \alpha$ is small enough. Thus, equilibria where competent members biased against the state abstain exist in a "small" subset of the parameters space case in the sense that γ can neither be too small nor too large relatively to α, for otherwise agents would have an incentive to vote correctly or to follow their biases, respectively. The fact that we must have $\gamma > \alpha$ for the equilibrium to be sustained is important, because it guarantees that the region of parameters where an equilibrium involving a competent member abstaining can never overlap with the region where a fully competent equilibrium exists. Therefore, our result that secret voting leads to better decisions when the magnitude of the bias is small relative to the common value is not affected in any way by the possible existence of multiple equilibria in that region.

Third, while equilibria where competent members abstain can be supported in the same region where a partially competent equilibrium exists, part (*iii*) of Proposition 10 also shows that public voting always leads competent members to behave "better". Specifically, they are both more likely to abstain rather than to vote incorrectly, given that $\overline{\gamma}^{\mathrm{s}}_{abst}(\alpha, \phi, \sigma, n) \leq \overline{\gamma}^{\mathrm{p}}_{abst}(\alpha, \phi, \sigma, n)$, and more likely to vote correctly rather than to abstain, since $\underline{\gamma}^{\mathrm{s}}_{abst}(\alpha, \phi, \sigma, n) \leq \underline{\gamma}^{\mathrm{p}}_{abst}(\alpha, \phi, \sigma, n)$. Note, however, that this result refers only to the behavior of competent agents, as it is not possible to guarantee that incompetent agents will behave better as well. Intuitively, there may now exist a region of parameters with $\gamma > \alpha$, where it is possible to support an equilibrium where both competent members biased against the state of the world and some incompetent members abstain. In this case, a move from secrecy to transparency could lead both competent members to vote correctly and incompetent members to vote for their biases. However, there is a sense in which such equilibria are difficult to be supported in that they require a very particular set of conditions to hold. For example, in the symmetric case discussed in Subsection 4.3, under the same parameter values used to construct Figure 1, one can show that there exists no equilibrium with monotone beliefs where a competent member abstains.[19]

[19] Specifically, it is possible to show that an equilibrium where competent members biased against the state abstain and, likewise, all incompetent members abstain can only be supported, in the symmetric

Finally, to complement these results, we can also show that if beliefs are monotone, then a biased equilibrium is still characterized by the same properties stated in Proposition 4, and it is still the case that such equilibrium is less likely to be sustained under public voting.

6 Experimental Design

In this section we explore the main theoretical predictions of our model by means of a controlled laboratory experiment. A controlled experiment allows us to both collect data on individuals' behavior under secret and public voting, and compare the quality of the committees' decisions under these two treatments. Furthermore, since the theoretical model features multiple equilibria with different information aggregation properties, a controlled experiment can inform on equilibrium selection. Finally, as we discuss in the Online Appendix A, the choice of voting rule may be endogenous to the composition of the committee as well as to the types of decisions that are being taken, and this has important implications for the empirical evaluation of the impact of transparency on voting outcomes and individual behavior using non-experimental data.

Given that our main goal is to evaluate whether the degree of transparency affects the behavior of individuals, and in order to highlight the key differences between public and secret voting, we amend the basic model imposing two simplifying assumptions on the structure of career concern rewards. First, we assume that the career concern reward associated with a correct vote is exogenous under both public and secret voting, i.e. before voting, each committee member knows, and is guaranteed to receive, a certain payoff $R^{\lambda} > 0$, $\lambda \in \{\mathtt{p}, \mathtt{s}\}$, whenever his or her vote is correct. Note that this version of the model retains all basic features of the general model, except that now we are not explicitly modelling the updating process of the external evaluator. This assumption helps us to simplify the experiment by avoiding the need for an extra subject whose role would be to guess the competence of each committee member, a complex task that would certainly add a lot of noise to the experimental results. Second, while it is natural to suppose that $R^{\mathtt{p}} > R^{\mathtt{s}}$, we further assume that $R^{\mathtt{s}} = 0$, i.e. the career concern gain associated with a correct vote is zero under secret voting in order to sharpen the contrast between public and secret voting.

case, if the proportion of competent members, σ, is very large.

While the additional assumptions above greatly simplify the model, its basic structure remains unchanged. In particular, the same three classes of equilibria still exist and all previous comparative static results hold. We focus the experimental analysis on committees of three members with uniform prior $q = 1/2$ and symmetric distribution of both biases $p = 1/2$ and competent types $\sigma = 1/2$. Under this parametrization, it is possible to show that the conditions for the existence of a fully competent, partially competent and biased equilibria are, respectively, the following:

$$\gamma \leq \frac{1}{2}\alpha - 2R^{\lambda} \tag{14}$$

$$\gamma \leq \alpha + \frac{8}{3}R^{\lambda} \tag{15}$$

and

$$\gamma \geq \alpha + 2R^{\lambda}, \tag{16}$$

where, as before, α is the common value, γ is the bias term and R^{λ} is the career concern reward associated with a correct vote.[20]

We focus the analysis on parameter regions where a change in the transparency of voting is expected to lead to a change in observed behavior. The choice of parameters as well as the equilibrium predictions associated with each of the four treatments considered in the experiments are summarized in Table 1. The common value is set to $\alpha = 10$ in all treatments, while the magnitude of the bias can be either low, $\gamma = 1$, or high, $\gamma = 14$. Moreover, the career concern rewards are chosen so that the payoff associated with a correct vote is $R^{\mathsf{p}} = 9$ under public voting and $R^{\mathsf{s}} = 0$ under secret voting. Accordingly, the treatments are labelled as: Low/Secret, Low/Public, High/Secret and High/Public.

The experiments were conducted at the Bologna Laboratory for Experiments in Social Science (BLESS) with registered undergraduates from the University of Bologna. We run the experiments in 6 sessions, each consisting of 2 parts with a different treatment being tested in each part. Each treatment was repeated for 32 periods, the first two of which being practice non-paid rounds. In every session, the value of the bias term (low or high) was held fixed and only the parameter corresponding to the career concern reward (public or secret voting) changed from one part to the other. Table 2 summarizes the sequence of treatments and number of participants in each session. In

[20]See Online Appendix D for the derivation of these conditions.

total, 144 distinct subjects took part in the experiments.

The experiment was implemented via computer terminals and programmed in z-Tree. In every session, instructions were read aloud at the beginning of each part, after which a short comprehension quiz was administered in order to check basic understanding of the rules.[21] Subjects were randomly divided into groups of three members and were re-assigned, in every period, to different groups using a random matching procedure. The task of each group was to choose between two colors, blue or yellow. The "group's color" (i.e. the state of the world) was ex-ante unknown and could be either one of the two colors with equal probability.

Before voting, each individual received a message about the group's color that could be either perfectly informative or non-informative with equal probability.[22] Specifically, subjects were told that messages would be randomly assigned so that, among all participants in a given session, half of them would receive a perfectly informative message saying either "*blue*" or "*yellow*" depending on the group's color, and the other half would receive an uninformative message saying "*blue or yellow with equal probability*", in which case no new information would be added to what was previously known.[23] At this point, we were explicit in emphasizing that this procedure did not guarantee that there would always be an informed member in every group and that, in fact, the number of informed individuals in a given committee could be anything between zero and three.

Also before voting, each subject was informed about his or her "role" (i.e. bias), which could be either "*blue*" or "*yellow*" with equal probability. The procedure used to assign individual colors was the same as described above: among all subjects present in a given session, half of them was randomly assigned the blue color and the other half was assigned the yellow color. After observing their messages and roles, each subject

[21] All participants were provided with a copy of the instructions they could consult at any moment during the experiment. See Online Appendix E for a version of the instructions translated into English.

[22] In our discussion of the experiment, we will refer to subjects who receive informative messages (competent) as "informed" and to subjects who receive non-informative messages (incompetent) as "uninformed".

[23] This distribution procedure was adopted in order to make the experiment as transparent as possible. Note, however, that it introduces dependence in the distribution of messages in that if, for instance, a subject receives an informative message, then it is slightly less likely that another subject will receive an informative message as well. Formally, this happens because messages are now being sampled without replacement, so that the distribution of informed members in a group follows a hypergeometric distribution. As a consequence, the conditions for the existence of each class of equilibria are now slightly different than (14)-(16). However, for the number of participants and parameter values used in the experiments, all of our equilibrium predictions remain unchanged.

had to choose whether to vote for blue or yellow or to abstain. The "group's decision" was taken by majority rule and ties were broken randomly. At the end of each period, subjects were provided with information about their group's color, the decision taken and the number of members of the group that voted for Blue, Yellow or abstained.

The final payoff in a given period was such that if the group's decision was equal to the group's color, then each member of the group received 10 points. Moreover, if the group's decision was equal to the individual color of one of its members, then he or she received 1 extra point under low bias treatments and 14 extra points under high bias treatments. Finally, under public voting treatments, subjects were also given an additional payoff of 9 points if his or her vote was equal to the group's color, while no points were given to a correct vote under secret voting treatments. The points obtained during the experiment were converted to Euros at a rate of 1€ per 80 points and participants were paid the sum of their earnings over the 60 paid periods at the end of the experiment. The average earning was around €13.9, including a show-up fee of €2, with each session lasting for approximately 60 minutes.

7 Experimental Results

7.1 Decisions

We begin our analysis of the experimental results by investigating how the degree of transparency affects the quality of the committees' decisions, as measured by the proportion of correct choices made by the committees. Table 3 presents the fraction of correct decisions observed under each treatment, alongside with the fractions predicted by the model. Observe, first, that the quality of the decisions is slightly higher under Low/Secret (85.56%) than Low/Public (84.31%), whereas the fraction of correct decisions under High/Secret (59.58%) is significantly lower than under High/Public (81.53%), as expected.

7.2 Individual Choices

Table 4 summarizes the aggregate choices of uninformed subjects. Note that, when the magnitude of the bias is low, uninformed voters are much more likely to abstain under secret (44.17%) than public voting (18.98%), while being significantly more likely to vote in accordance with their biases under public (64.81%) than secret voting (46.20%).

On the other hand, when the magnitude of the bias is high, the vast majority of uninformed subjects vote in accordance with their biases under both secret (87.96%) and public voting (84.26%). These results are all in line with our theoretical comparative statics. It should be noted that while 18.98% of subjects abstain under Low/Public, this number decreases substantially when we account for sequencing effects (see the Online Appendix B). We also observe between 3% and 16% of uninformed agents voting *against* their biases depending on the treatment. Interestingly, the incentive to vote against the bias seems to be larger under public voting, which may be interpreted as evidence that some individuals do so as part of a gamble to guess the state of the world. This finding is consistent with experimental results previously obtained by Elbittar et al [7], who argue that a large proportion of uninformed subjects vote based on "hunches" (subjective beliefs).[24]

In Table 5 we summarize the behavior of informed voters who received a signal different than their biases. Among informed agents, these individuals are the ones most interesting to our analysis, since they face a trade-off between voting correctly and voting for their biases. Observe that, as predicted by the theory, when the magnitude of the bias is high, these subjects are much more inclined to vote correctly under public (84.60%) than secret voting (21.86%), while when the magnitude of the bias is small, the vast majority of them vote correctly under both secret (95.96%) and public voting (97.71%). The percentage of individuals who vote correctly under High/Secret (21.86%) and the percentage of individuals who vote in accordance with their biases under High/Public (11.94%) are larger than expected. We note, however, that these proportions tend to decrease when we account for learning and sequencing effects.[25] We also observe a fraction of informed voters who abstain under High/Secret (14.70%). This result is puzzling given that, in theory, abstaining is weakly dominated for agents of this type. A possible explanation for this result could be attributed to the fact that both the common value (10 points) and the bias (14 points) are relatively in close magnitude, so that some informed subjects may simply prefer to abstain.

Finally, it is interesting to see how the degree of transparency affects the voting profiles of groups. We start by examining the frequency with which the observed voting profiles are exactly in accordance with one of the three classes of theoretical equilibria. In order to do so, we restrict the sample to include only decisions that involved at least one uninformed agent and one informed agent who received a signal different

[24] Similar findings are also in Guarnaschelli et al [16] and in Bouton et al [5].

[25] See Online Appendix B for a detailed discussion.

than his bias. This restriction is imposed in order to allow us to associate each voting profile to a single class of equilibria. As shown in Table 6, the proportion of voting profiles that are consistent with a fully competent equilibrium decreases, as expected, from 33.23% under Low/Secret to 15.73% under Low/Public. Note that this reduction is accompanied by a proportional increase in the profiles compatible with a partially competent equilibrium from 35.00% under Low/Secret to 51.96% under Low/Public. Moreover, the fraction of voting profiles consistent with a biased equilibrium drops significantly from 48.71% under High/Secret to 8.56% under High/Public. Again, this reduction is accompanied by an increase in the profiles compatible with a partially competent equilibrium from 17.47% under High/Secret to 63.47% under High/Public.[26] We also find evidence (not reported in Table 6) that the percentage of voting profiles consistent with a fully competent equilibrium under Low/Secret, a treatment in which there are multiple equilibria, increases substantially within the treatment. This result provides extra indication that subjects were gradually learning to coordinate on the more efficient equilibrium. In fact, the percentage of voting profiles that are exactly in line with a fully competent equilibrium increases from 27.11% in periods 1-10 to 29.31% in periods 11-20 to, finally, 44.33% in periods 21-30.

7.3 Regression Analysis

We now present a detailed regression analysis of the results of the experiment. The fact that the same subjects were exposed to two different treatments, allows us to perform a rigorous analysis controlling for individual fixed effects.[27] We start by examining the determinants of a correct vote by informed agents. Table 7 presents the results of linear probability models where the dependent variable is a dummy that equals one if the individual voted correctly and zero otherwise. The sample is restricted to subject-period observations where the agent received a signal different than his bias. Furthermore, we focus only on high bias treatments, i.e. High/Secret and High/Public, since these are the cases where we expect a change in the degree of transparency to have an impact on voting behavior. All standard errors were clustered at the individual

[26] Note that in all treatments there is a significant percentage of voting profiles that cannot be strictly categorized in one of the three classes of equilibria. Observe, however, that the fact that a voting profile belongs to this residual category, which we denote by "others", does not necessarily mean that individual behavior is incompatible with rationality. In fact, there are other classes of equilibria that may involve either asymmetric and/or mixed strategies, which we have not characterized in our theoretical analysis, but may be played in practice.

[27] Our results remain unchanged when we control for random effects instead of fixed effects.

level.[28]

We begin by presenting in column [1] the results of a simple OLS regression of correct vote on High/Secret. Consistently with previous findings, a change from public to secret voting leads to a significant 62.7 percentage points (p.p.) decrease in the likelihood that an informed agent votes correctly. Note that, as shown in column [2], this result is very robust to controlling for individual fixed effects, as can be observed by the fact that the estimated coefficient remains almost unchanged.[29] Next, in column [3], we estimate the impact of High/Secret on the likelihood of a correct vote separately in periods 1-10, 11-20 and 21-30.[30] We find that a change from public to secret voting reduces the probability of a correct vote by 56.5 p.p. in periods 1-10, 60.4 p.p. in periods 11-20 and 68.3 p.p. in periods 21-30, which corroborates the existence of a strong learning effect for informed voters.[31]

Finally, we create a dummy variable that captures whether a subject performed poorly in the comprehension quizzes administered before the beginning of each treatment.[32] We interpret a low performance in these tests as evidence that either the individual did not fully understand a particular aspect of the experiment or, perhaps more likely, that he or she did not put enough effort to think through the questions. The results reported in column [4] shows that subjects who performed poorly in the comprehension quiz are less responsive to changes in the degree of transparency; in particular, they are 26.4 p.p. more likely to vote correctly under High/Secret, a treatment in which we would expect all informed subjects to vote in accordance with their biases.

We now proceed to examine the determinants of abstention by uninformed voters. Table 8 presents the results of linear probability models where the dependent variable is a dummy that equals one if the agent abstained and zero otherwise. The sample is

[28] Clustering by session and adjusting the standard errors to account for the small number of clusters using a procedure proposed by Ibragimov and Müller [20] does not change any of our main results.

[29] Note that the individual fixed effects already control for all session specific characteristics, including the order of the treatments and general characteristics of the pool of participants.

[30] Our results are robust to an alternative specification where we include an interaction between High/Secret and a single period variable that assumes values between 1 and 30.

[31] The null hypothesis that these three estimates are identical is rejected at 5% confidence level ($F = 3.21$). See Online Appendix B for additional details.

[32] Before the beginning of each treatment, and immediately after instructions were read aloud, subjects were asked to answer a short comprehension quiz consisting of several multiple choice questions. While these questions were simple in general, most of them required calculation of hypothetical payoffs under various scenarios. An individual is defined to have performed poorly in the comprehension quiz if the number of questions he or she got wrong was above average. Our results are robust to alternative definitions of bad performance.

restricted to subject-period observations where the agent did not receive any information about the state of the world. The analysis focuses only on low bias treatments, i.e. Low/Secret and Low/Public. All standard errors were clustered at the individual level.[33] We, first, present in column [1] the results of a simple OLS regression of abstention on Low/Secret. The estimates confirm our previous findings that uninformed agents are more likely to abstain under secret voting. In particular, a change from public to secret voting leads to a 25.1 p.p increase in the probability that an uninformed agent abstains. Moreover, as shown in column [2], this result is very robust to the inclusion of individual fixed effects in the regression. Next, in column [3], we estimate the impact of the Low/Secret treatment on the likelihood of abstention separately in periods 1-10, 11-20 and 21-30. The results corroborate the previous evidence that there is substantial learning occurring within a treatment, even after controlling for individual fixed effects. Specifically, the impact of a change from public to secret voting on the probability that an uninformed voter abstains is 20.5 p.p. in periods 1-10, 24.7 p.p. in periods 11-20 and 27.6 p.p. in periods 21-30.

Overall, the above results are consistent with our main comparative static predictions about the behavior of uninformed voters. Still, the fraction of subjects who change from voting to abstaining as a result of a change from public to secret voting is significantly below one. Given that there are multiple equilibria under Low/Secret, it would be interesting to better understand why uninformed voters do not coordinate more heavily on the Pareto optimal equilibrium, which involves all of them abstaining in order to let the "experts" decide. Our discussion here is related to previous studies by Elbittar et. al [7], and Grosser and Seebauer [15] who found, in a setting with common values, that a substantial proportion of individuals vote even though they have no information about the state of the world.

One possible explanation for this finding could be attributed to the fact that some subjects may simply have failed to recognize the advantages associated with abstaining. Indeed, some degree of sophistication is required to understand that, under some circumstances, "doing nothing" may be better than trying to influence the voting outcome (Feddersen and Pesendorfer [9]). In order to investigate this hypothesis, we run a fixed effect regression including the interaction between Low/Secret and the dummy for poor performance in the comprehension quiz. The results reported in column [4] show that subjects who perform badly in the quiz tend to be much less responsive to

[33] As before, clustering by session and adjusting the standard errors to account for the small number of clusters does not change any of our main results.

changes in the degree of transparency. In particular, our estimates imply that these individuals are approximately 16.4 p.p. less likely to abstain under Low/Secret.

An alternative explanation for the relatively low levels of abstention is that, while some individuals may have recognized the potential benefits of abstaining, they were discouraged from doing so by the fact that other uninformed agents were not abstaining as well. Indeed, the optimal behavior for an uninformed agent is for him to vote in accordance with his bias if he believes that other uniformed agents are also voting in accordance with their biases. In order to examine whether a negative feedback in one period impacts the subsequent decisions of agents, we define a "bad abstention" as a situation where an uninformed subjects abstains, but the decision of his or her group is incorrect, meaning that at least one other committee member "distorted" the decision by voting for the wrong alternative. We count the number of bad abstentions experienced by each subject during the first ten periods of Low/Secret and add the interaction of this variable with the Low/Secret dummy in a fixed effects regression. In doing so, we restrict the estimation sample to include only observations from the last twenty periods of each treatment (periods 11-30). We also control for the number of times that each subject abstained when uninformed in the first ten rounds of Low/Secret, given that an agent who abstains in the beginning of the treatment is more likely to continue doing so. The results reported in column [5] show that ceteris paribus a bad abstention in the first ten periods reduces the probability of an abstention in subsequent rounds by 13.9 p.p., suggesting that coordination problems among uninformed voters may have, indeed, significantly limited the convergence of voting behavior towards the Pareto optimal equilibrium.

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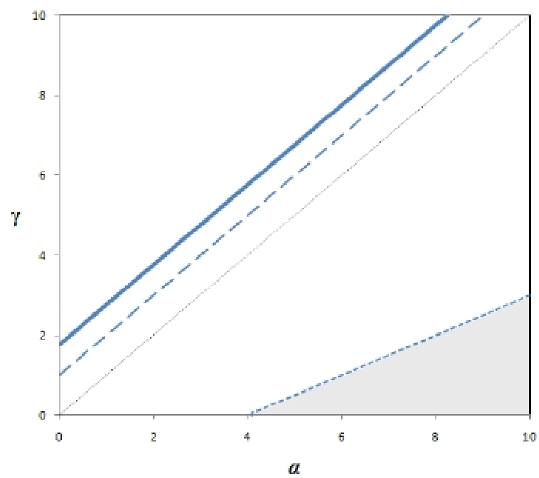
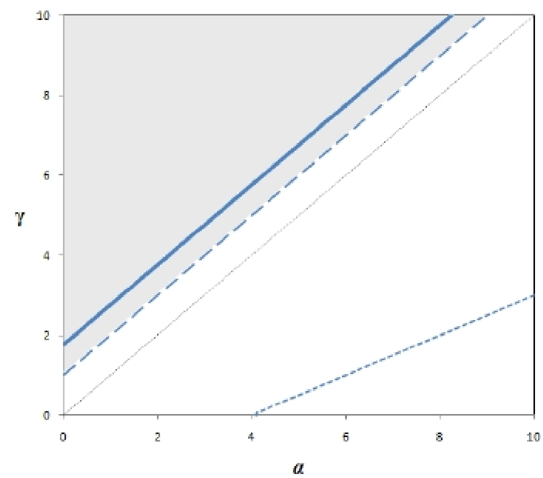
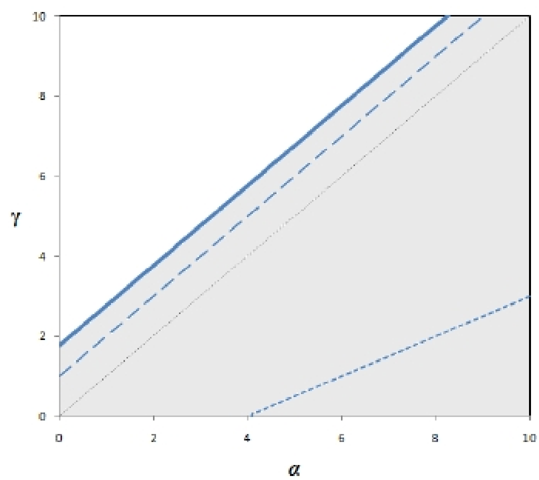


Panel a. Fully Competent Equilibrium



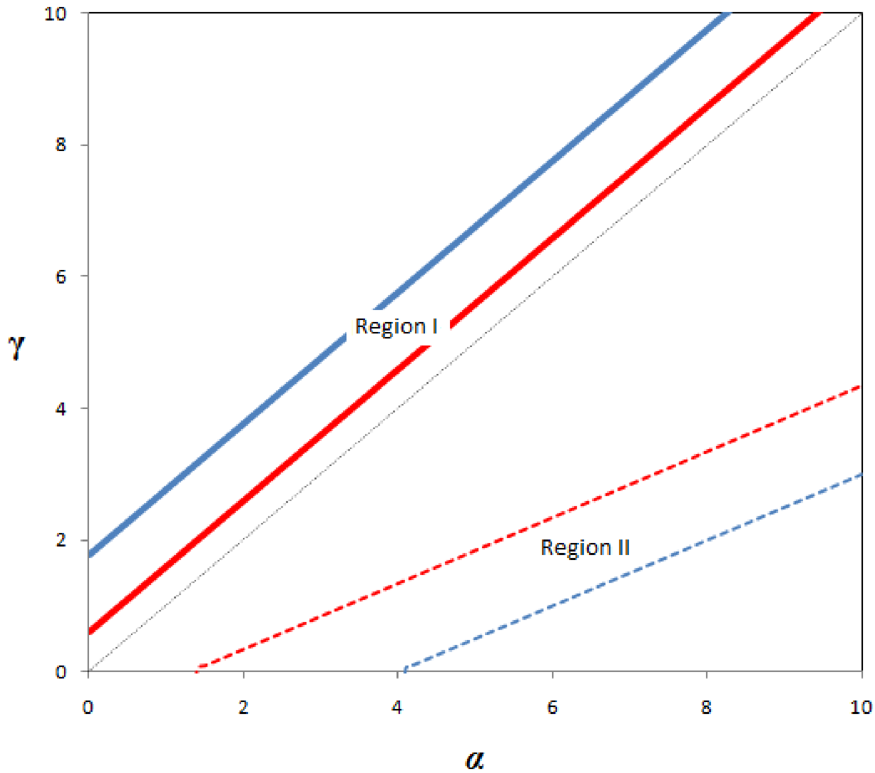
Panel c. Biased Equilibrium



Panel b. Partially Competent Equilibrium

Notes. This figure illustrates the region of the parameters where each class of equilibrium can be sustained under a given voting rule λ, as derived in Proposition 5. The structure of the equilibria looks similar under secret and public voting, although the exact regions where each class of equilibrium can be sustained differ. *Panel a* represents, shaded in grey, the region of the parameters where a fully competent equilibrium can be sustained. P*anel b* represents, shaded in grey, the region of the parameters where a partially competent equilibrium can be sustained. Finally, *panel c* represents, shaded in grey, the region where a biased equilibrium exists. Observe that the shaded areas may overlap in some regions, representing the existence of multiple equilibria. The 45-degree line is depicted as a small dotted line. The parameter values assumed for the construction of this graph were: p=0.5, q=0.5, n=3, ϕ=1 and σ=0.5.

Figure 1. Equilibria: The Symmetric Case



Notes. This figure provides a comparison of the parameter regions where a fully competent and a partially competent equilibrium can be supported under each voting rule. The relevant thresholds for the public and secret voting rules are depicted in blue and red, respectively. Region I represents the set of parameters where a partially competent equilibrium can be sustained under public but not under secret voting, while region II represents the region of parameters where a fully competent equilibrium can be sustained under secret but not under public voting. The 45-degree line is depicted as a small dotted line. The parameter values assumed for the construction of this graph were: p=0.5, q=0.5, n=3, ϕ=1 and σ=0.5.

Figure 2. Comparative Static Result

Treatment	alpha	gamma	Reputation	Predicted Equilibria
Low/Secret	10	1	0	Fully Competent and Partially Competent
Low/Public	10	1	9	Partially Competent
High/Secret	10	14	0	Biased
High/Public	10	14	9	Partially Competent

Table 1. Treatments

Session	Sequence	Subjects
1	Low/Secret – Low/Public	24
2	Low/Secret – Low/Public	30
3	Low/Public – Low/Secret	18
4	High/Secret – High/Public	24
5	High/Secret – High/Public	24
6	High/Public – High/Secret	24

Table 2. Sequence of Treatments

Treatment	Obs	Correct Decisions (%)	Predicted (%)
Low/Secret	720	85.56	93.00 / 84.00
Low/Public	720	84.31	84.00
High/Secret	720	59.58	50.00
High/Public	720	81.53	84.00

Table 3. Decisions

		Uninformed Voters		
Treatment	Obs	Abstention (%)	Bias (%)	Against-Bias (%)
Low/Secret	1080	44.17	46.20	9.63
Low/Public	1080	18.98	64.81	16.20
High/Secret	1080	9.35	87.96	2.69
High/Public	1080	5.83	84.26	9.91

Table 4. Individual Choices: Uninformed Subjects

		Informed Voters with Signal ≠ Bias		
Treatment	Obs	Signal (%)	Bias (%)	Abstention (%)
Low/Secret	520	95.96	1.54	2.50
Low/Public	524	97.71	2.29	0.00
High/Secret	517	21.86	63.44	14.70
High/Public	578	84.60	11.94	3.46

Table 5. Individual Choices: Informed Subjects

Treatment	Obs	Fully Competent (%)	Partially Competent (%)	Biased (%)	Other (%)
Low/Secret	340	33.23	35.00	0.00	31.77
Low/Public	356	15.73	51.96	0.00	32.31
High/Secret	349	0.00	17.47	48.71	33.82
High/Public	397	2.77	63.47	8.56	25.20

Table 6. Voting Profiles

Dependent Variable: Correct Vote				
	[1]	[2]	[3]	[4]
High/Secret	-0.627 ***	-0.618 ***		-0.731 ***
	[0.040]	[0.043]		[0.055]
High/Secret × Periods 1-10			-0.565 ***	
			[0.051]	
High/Secret × Periods 11-20			-0.604 ***	
			[0.053]	
High/Secret × Periods 21-30			-0.683 ***	
			[0.048]	
High/Secret × Low Performance in Comprehension Quiz				0.264 ***
				[0.080]
Individual Fixed-Effects	N	Y	Y	Y
Observations	1095	1095	1095	1095
R^2	0.39	0.55	0.55	0.56

Notes. This table reports OLS regressions in which the dependent variable is a dummy indicating whether the subject abstained. The sample is restricted to include only Low/Secret and Low/Public treatments and subject-period observations where the individual did not receive any information about the state of the world. The regression reported in column [5] further restricts the sample to include only observations from periods 11-30 of Low/Secret and Low/Public treatments. All standard errors are clustered at the individual level. ***, ** and * denote significance at 10%, 5% and 1%, respectively.

Table 7. Regression Analysis: Informed Subjects

Dependent Variable: Abstention					
	[1]	[2]	[3]	[4]	[5]
Low/Secret	0.251 ***	0.243 ***		0.347 ***	0.096 *
	[0.040]	[0.041]		[0.073]	[0.041]
Low/Secret × Periods 1-10			0.205 ***		
			[0.041]		
Low/Secret × Periods 11-20			0.247 ***		
			[0.043]		
Low/Secret × Periods 21-30			0.276 ***		
			[0.046]		
Low/Secret × Low Performance in Comprehension Quiz				-0.164 *	
				[0.087]	
Low/Secret × N° of Abstentions in Periods 1-10					0.106 **
					[0.022]
Low/Secret × N° of Bad Abstentions in Periods 1-10					-0.139 *
					[0.081]
Individual Fixed-Effects	N	Y	Y	Y	Y
Observations	2160	2160	2160	2160	1440
R^2	0.07	0.55	0.55	0.56	0.63

Notes. This table reports OLS regressions in which the dependent variable is a dummy indicating whether the subject abstained. The sample is restricted to include only Low/Secret and Low/Public treatments and subject-period observations where the individual did not receive any information about the state of the world. The regression reported in column [5] further restricts the sample to include only observations from periods 11-30 of Low/Secret and Low/Public treatments. All standard errors are clustered at the individual level. ***, ** and * denote significance at 10%, 5% and 1%, respectively.

Table 8. Regression Analysis: Uninformed Subjects

Public versus Secret Voting in Committees

Online Appendix (NOT FOR PUBLICATION)

This online appendix is organized as follows: section A discusses a number of extensions to our benchmark model, section B presents additional experimental results omitted from the main text, section C collects the proofs of the propositions of the paper, section D presents the derivation of the version of the model tested in the lab and, finally, section E presents the English version of the experiment instructions.

Appendix A. Discussion and Extensions

This section discusses a number of assumptions which we have made throughout our main analysis as well as some possible extensions to our basic model.

A.1 Ex-Post Observability of the State of the World

An important assumption in our model is that the external evaluator always observes the state of the world ex-post. This feature guarantees that, under transparency, voting for the correct alternative is always associated with strictly positive career concern rewards, whereas an incorrect vote is not rewarded in equilibrium. Note that if the evaluator did not observe the state of the world, then the role played by career concerns in providing incentives for agents to vote correctly would be weakened. In particular, as emphasized by Canes-Wrone et al [2], the desire to acquire reputation could create an incentive for committee members to ignore whatever information they might have about the state of the world and simply vote for the alternative which the evaluator believes is more likely to be the correct one.[1] Furthermore, as in Swank and Visser [10], there would be an incentive for the members of the committee to show "internal agreement", since competent agents always receive the same signal. The incentive to pander to the evaluator's opinion makes transparency in committees less appealing in general, a result also emphasized by Stasavage [9]. Finally, note that the assumption that the external evaluator observes the state of the world seems plausible whenever the evaluator himself is either an expert or very well-informed about the environment in which the decision is taking place. Consider, for instance, the case of an institutional investor evaluating the performance of a mutual fund, the "market" evaluating the performance of a monetary committee or a constituency evaluating the performance of a legislature deciding on policies that have direct impact on their daily lives.

[1] See Morris [8] and Maskin and Tirole [7] for studies that also emphasize the importance of pandering incentives in principal-agent models.

A.2 Precision of Signals

Following Feddersen and Pesendorfer [4] and Battaglini et al [1], our analysis assumed that competent members receive perfectly informative signals about the state of the world, while incompetent members received no information at all. Although our main results do rely on the hypothesis that the precision of signals received by competent and incompetent model be sufficiently different, the extreme assumption of perfectly informative and non-informative signals is not crucial for our results. Formally, our main comparative static results regarding the impact of public and secret voting on the behavior of committee members would still hold in an environment where competent agents received signals with precision $\Pr(s = \omega|\omega) = 1 - \varepsilon$, while incompetent agents received signals with precision $\Pr(s = \omega|\omega) = \frac{1}{2} + \delta$, for $\omega \in \{A, B\}$, $\varepsilon > 0$ and $\delta > 0$, provided that ε and δ are relatively small. In particular, the set of possible equilibria would still consist of the same three classes of equilibria characterized in Proposition 1, although the precise conditions for the existence of each class of equilibrium would have to be adjusted in order to take into account the fact that competent agents may now vote for the incorrect alternative even if they follow their signals.

A.3 Voting Rule and Degree of Transparency

Throughout the analysis we have assumed that the main difference between public and secret voting is that, while all votes are observed under public voting, only the vote tally is revealed under secret voting. Note that, in this case, neither the final decision of the committee nor the size of the majority required for an alternative to be chosen has any impact on the evaluator's posterior beliefs, given that the observation of the aggregate voting outcome alone provides strictly more information about the behavior of agents than knowledge of the committee's decision and/or the voting rule. As a consequence, a change in the size of the majority required for an alternative to be approved would have no major impact on our main qualitative results. If we had assumed, as in Levy [6] and Swank and Visser [10], that only the final decision of the committee is observed under secrecy, then the voting rule would have played a more important role in determining how much information is conveyed to the evaluator. Nonetheless, our basic comparative static results would remain unchanged, since the dilution of career concern rewards, the key mechanism behind our results, would still be present under secret voting.

A.4 Unbiased Agents

Although our basic model assumes that all committee members are biased towards one of the alternatives, the main qualitative results of the analysis are robust to allowing for the existence of unbiased agents. In fact, note that unbiased competent members would always have an incentive to follow their signals, since they care only about the common value and the career concern reward associated with a correct vote, while unbiased incompetent members would always be more willing to abstain relatively to biased agents of the same type. Now, given these observations, it would be interesting to consider what would happen if we allowed for the existence of correlation between the voters' level of competence and their biases. Suppose, for instance, that we expected competent members to be ideologically more neutral and consider, in particular, the extreme case where all competent members are unbiased, whereas incompetent members may be either biased or unbiased. Observe that in this case competent agents would always have an incentive to vote for the correct alternative, so that the degree of transparency would have no impact on their behavior. For incompetent agents, on the other hand, public voting would always make them more willing to vote, so that we should expect secret voting to lead to better decisions. Conversely, if competent members were either biased or unbiased and all incompetent members were unbiased, then none of our main comparative static results would change. Observe that unbiased incompetent agents would still have an incentive to vote due to career concerns, though they would not have a preferred alternative in this case. Therefore, the basic trade-off between public and secret voting would remain unchanged, although the region of the parameters where a fully competent equilibrium can be sustained would be larger in this case.

A.5 Information Sharing

Throughout the analysis we have assumed that the signals received by the members of the committee were private and that competent agents were not allowed to share their information with other players. In this subsection, we discuss whether competent agents would actually have an incentive to reveal their information and how this decision could impact our basic comparative static results. In a setting where the members' interests are aligned, Coughlan [3] showed that voters would have strong incentives to share information, since this can only lead to a larger probability that the right decision is taken. However, the direction of incentives in our setting is not so clear-cut given the presence of biases and career concerns. For instance, competent members may prefer not to reveal their private information in order to separate themselves from incompetent agents. Moreover, a competent member may be particularly unwilling to share information if he is biased against the state of the world, since revealing information in this case could lead to the correct decision being taken with higher likelihood.

Let us consider a version of the basic model where we introduce a "mechanism" that collects all private signals and reveals them truthfully to the committee before the voting stage.[2] Note that, in this case, all members become fully informed about the state of the world whenever there is at least one competent agent in the group. Furthermore, it is possible to show that, if all members are informed, then there can be only two symmetric equilibria: one in which all members vote in accordance with the state of the world and another one in which all members vote for their biases. In particular, we can show that the equilibrium where all vote correctly always exists, whereas the equilibrium where all vote for their biases can only be sustained if the size of the bias is large relatively to the common value.[3] Naturally, there is no incentive for anyone to abstain in this case.

[2] For a general model of committee decision making with deliberation, see Gerardi and Yariv [5].

[3] Observe that if an informed agent expects all other members to vote correctly, then he is never pivotal and better off by also voting correctly, since by doing so he guarantees himself larger career concern rewards. Therefore, the equilibrium where all vote in accordance with the state of the world can be sustained for all possible parameter values.

Would competent members actually have incentive to voluntarily participate in the mechanism described above? Note that career concern rewards of competent agents are significantly diluted under the mechanism, since information sharing prevents them distinguishing from the incompetent agents. In particular, the external evaluator now applies an extra discount to the career concern reward assigned to any correct vote in order to account for the fact that incompetent members may also learn the state of the world. It then follows that the willingness of competent members to take part in the mechanism should be especially low if voting is public, since the losses caused by the dilution effect are larger in this case. Similarly, they are less likely to share information when the size of the committee is large and when the importance attached to career concerns is high. On the other hand, competent members are more likely to participate in the mechanism if the common value is high relatively to the bias, given that information sharing is expected to lead to better decisions in this case.

Thus, from a normative point of view, it follows that if all members are expected to vote correctly after information is collected and shared, then secret voting is more likely to lead to better decisions, since it makes competent agents more willing to participate in the mechanism ex-ante. Alternatively, if the members of the committee are expected to vote in accordance with their biases even after information about the state is revealed, then the quality of the decisions cannot be improved by the mechanism. In fact, under certain conditions, public voting could lead to better decisions in this case by creating incentives for competent members to withhold information and then vote correctly in equilibrium (i.e. partially competent equilibrium). Overall, these results reinforce our previous conclusions and highlight another dimension in which the degree of transparency might be relevant for the quality of decisions.

A.6 Institutional Preferences

Which level of transparency would the members of the committee prefer if, prior to voting, they could choose between public and secret voting? Here, we examine the institutional preferences of committee members by competence type. As discussed before, the choice between public and secret voting affects the payoffs of agents both in terms of how the career concern rewards are distributed across agents and the likelihood that the correct decision is taken. Observe that, overall, due to the dilution effect, competent members are more likely to prefer public voting, whereas incompetent members are more likely to prefer secret voting. There are, however, some interesting exceptions to this general observation. First, if the weight associated with career concerns is small and the common value is high relatively to the bias, then competent members may actually prefer a secret voting rule, since secrecy is more likely to lead to better decisions in this case. Furthermore, whenever a biased equilibrium is expected to prevail anyway, then competent agents who are biased against the state of the world would actually prefer a secret voting rule, since in this case they always receive zero career concern rewards under public voting. Overall, our discussion highlights the fact that the choice of voting rule may be endogenous to the composition of the committee as well as to the types of decisions that are being taken, a result that has important implications for the empirical evaluation of the impact of transparency on voting outcomes and individual behavior using non-experimental data.

Appendix B. Additional Experimental Results

B.1 Learning Effects

This subsection investigates whether learning within a treatment affects the behavior of voters. In fact, as individuals become more familiar with the structure of the game, we would expect their choices to converge towards the theoretical predictions of the model. In order to test whether this is the case, we compare the aggregate behavior of voters across periods 1-10, 11-20 and 21-30 and check whether any pattern emerges from the data. Table B.1 reports the aggregate choices of uninformed voters. Note, first, that abstentions under Low/Secret are significantly higher in later periods, increasing from 39.17% in periods 1-10 to 48.33% in period 21-30. Furthermore, we observe an increase in the percentage of uninformed subjects who vote for their biases under High/Secret from 85.83% in periods 1-10 to 90.83% in periods 21-30. Both of these results are consistent with the learning hypothesis in that they show that the observed behavior tends to converge towards the predictions of the model.

Next, Table B.2 reports separately for periods 1-10, 11-20 and 21-30 the aggregate choices of informed voters who received a signal different than their biases. Note, first, that the percentage of informed subjects who vote in accordance with their signals under High/Secret decreases from 25.88% in periods 1-10 to 16.57% in periods 21-30. We also observe a significant reduction in the proportion of subjects who vote for their biases under High/Public from 17.20% in periods 1-10 to 5.00% in periods 21-30. While these result are consistent with the learning hypothesis, the percentage of abstentions under High/Secret increases slightly from 12.94% in periods 1-10 to 18.86% in periods 21-30. As conjectured in section 7.2 of the paper, this result could be due to the fact that both common and private values are relatively close to each other in our setting. Thus, it is possible that some informed agents may have simply decided to abstain as a result of being "practically" indifferent between the two alternatives.

B.2 Sequencing Effects

This subsection investigates whether the main comparative static results presented in section 7.3 are robust to the sequence of treatments. Table B.3 summarizes the behavior of uninformed voters by sequence and treatment. Observe that, consistently with previous results, the percentage of abstentions is significantly higher under Low/Secret than under Low/Public irrespective of the order of treatments; that is, when the magnitude of the bias is low, abstentions are always higher under secret voting. However, the order of treatments does seem to affect the behavior of uninformed voters in one dimension, namely the proportion of abstentions is significantly higher when the session starts with Low/Secret.[4] Thus, it seems that once an individual "learns" to behave in a certain way (e.g. abstaining or voting for his bias), he will tend to repeat the same behavior in later treatments even though it is no longer optimal for him to do so. Nonetheless, it is interesting to observe that the reduction in abstentions associated with a change from Low/Secret to Low/Public is almost identical in both sequences and approximately equal to 25%. Thus, while the order of treatments affects the baseline abstention rate, it has no impact on the size of the treatment effect itself.

Next, Table B.4 reports the behavior of informed voters broken down by sequence and treatment, focusing, as before, on the individuals who received a signal different than their biases. Observe that our main comparative static result is robust to the order of treatments, namely: under both sequences, when the magnitude of the bias is high, the proportion of informed individuals who vote in accordance with their signals is significantly higher under public voting. However, it should be noted that the proportion of subjects who vote correctly under High/Public is larger when the session starts with High/Public (89.62%) than when it starts with High/Secret (82.28%). Furthermore, a change from High/Secret to High/Public leads to an increase of 68.79% (=82.28% − 13.49%) in the percentage of correct votes when the session starts with High/Secret in comparison with an increase of 51.55% (=89.62% − 38.07%) when the session starts with High/Public. Thus, it seems that a change in behavior from voting incorrectly to voting correctly is more likely to occur than the opposite.

Appendix C. Proofs

C.1 Lemma 1

Suppose, without loss of generality, that the state of the world is $\omega = A$. (All arguments are valid for the opposite case, where $\omega = B$.) Consider, first, the behavior of a competent member whose signal, $s_i = A$, is *equal* to his bias, $\beta_i = A$. Given the beliefs of the external evaluator and the strategies of other players, the expected payoffs associated with each of his pure strategies, $v_i \in \{A, \emptyset, B\}$, are the following:

$$U^{\beta_i=A,\lambda}(v_i = A, s_i = A) = \phi\widetilde{r}^{\omega=A,\lambda}(v_i = A) + \rho^{\omega=A}(v_i = A)(\alpha + \gamma)$$

$$U^{\beta_i=A,\lambda}(v_i = \emptyset, s_i = A) = \phi\widetilde{r}^{\omega=A,\lambda}(v_i = \emptyset) + \rho^{\omega=A}(v_i = \emptyset)(\alpha + \gamma)$$

$$U^{\beta_i=A,\lambda}(v_i = B, s_i = A) = \phi\widetilde{r}^{\omega=A,\lambda}(v_i = B) + \rho^{\omega=A}(v_i = B)(\alpha + \gamma),$$

where:

$$\rho^{\omega=A}(v_i = B) \leq \rho^{\omega=A}(v_i = \emptyset) \leq \rho^{\omega=A}(v_i = A) \tag{C.1}$$

[4] Note that the percentage of subjects who abstain under Low/Secret is 47.65% when the session starts with Low/Secret and 33.70% when the session starts with High/Secret. Similarly, the percentage of subjects who abstain under High/Secret is 22.59% when the session starts with Low/Secret but only 8.15% when the session starts with High/Secret.

$$\widetilde{r}^{\omega=A,\lambda}(v_i=\emptyset)=\widetilde{r}^{\omega=A,\lambda}(v_i=B)\leq\widetilde{r}^{\omega=A,\lambda}(v_i=A), \tag{C.2}$$

i.e. voting for A leads to a larger probability that the committee's decision is A and is also associated with a higher career concern rewards. Thus, it follows that:

$$\max\left\{U^{\beta_i=A,\lambda}(v_i=\emptyset,s_i=A),U^{\beta_i=A,\lambda}(v_i=B,s_i=A)\right\}\leq U^{\beta_i=A,\lambda}(v_i=A,s_i=A) \tag{C.3}$$

Therefore, both voting against the signal and abstaining are weakly dominated strategies for a competent member whose signal is equal to his bias.

Next, consider the behavior of a competent member whose signal, $s_i=A$, is *different* than his bias, $\beta_i=B$. Given the beliefs of the external evaluator and the strategies of other players, the expected payoffs associated with each of his pure strategies, $v_i\in\{A,\emptyset,B\}$, are the following:

$$U^{\beta_i=B,\lambda}(v_i=A,s_i=A)=\phi\widetilde{r}^{\omega=A,\lambda}(v_i=A)+\rho^{\omega=A}(v_i=A)\,\alpha+\left(1-\rho^{\omega=A}(v_i=A)\right)\gamma$$

$$U^{\beta_i=B,\lambda}(v_i=\emptyset,s_i=A)=\phi\widetilde{r}^{\omega=A,\lambda}(v_i=\emptyset)+\rho^{\omega=A}(v_i=\emptyset)\,\alpha+\left(1-\rho^{\omega=A}(v_i=\emptyset)\right)\gamma$$

$$U^{\beta_i=B,\lambda}(v_i=B,s_i=A)=\phi\widetilde{r}^{\omega=A,\lambda}(v_i=B)+\rho^{\omega=A}(v_i=B)\,\alpha+\left(1-\rho^{\omega=A}(v_i=B)\right)\gamma$$

Note that the conditions $(C.1)$ and $(C.2)$ still hold in this case, so that if $\alpha\geq\gamma$, then:

$$U^{\beta_i=B,\lambda}(v_i=\emptyset,s_i=A)\leq U^{\beta_i=B,\lambda}(v_i=A,s_i=A), \tag{C.4}$$

whereas if $\alpha<\gamma$, then:

$$U^{\beta_i=B,\lambda}(v_i=\emptyset,s_i=A)\leq U^{\beta_i=B,\lambda}(v_i=B,s_i=A) \tag{C.5}$$

Therefore, abstaining is a weakly dominated strategy for a competent member whose signal is different than his bias. ■

C.2 Lemma 2

In any equilibrium where committee members do not use weakly dominated strategies, it must be the case that every competent member whose signal is equal to his bias votes correctly, $v_i=\omega$ (Lemma 1, part a). Therefore, by the Bayes' rule, the probability that an agent is competent given that he voted correctly is strictly positive:

$$\Pr(t=\mathsf{c}|v=\omega)>0$$

Given the beliefs of the external evaluator, it follows from equations (6) and (7) in the paper that the expected career concern gains associated with a correct vote under public and secret voting are, respectively given, by:

$$\widetilde{r}^{\omega,\mathsf{p}}(v_i=\omega)=\Pr(t=\mathsf{c}|v=\omega) \tag{C.6}$$

and

$$\widetilde{r}^{\omega,\mathtt{s}}(v_i=\omega)=\Pr(t=\mathtt{c}|v=\omega).\tfrac{1}{n}(1+\mathbb{E}(\textstyle\sum_{j\neq i}\mathbb{I}_{\{v_j=\omega\}})), \tag{C.7}$$

while the expected career concern gains associated with an abstention or an incorrect vote under public and secret voting are, respectively, given by:

$$\widetilde{r}^{\omega,\mathtt{p}}\left(v_i\neq\omega\right)=0 \tag{C.8}$$

and

$$\widetilde{r}^{\omega,\mathtt{s}}(v_i\neq\omega)=\Pr(t=\mathtt{c}|v=\omega).\tfrac{1}{n}\mathbb{E}(\textstyle\sum_{j\neq i}\mathbb{I}_{\{v_j=\omega\}})) \tag{C.9}$$

Therefore, since $\Pr(t=\mathtt{c}|v=\omega)>0$, we have that:

$$\widetilde{r}^{\omega,\lambda}(v_i=\omega)>\widetilde{r}^{\omega,\lambda}(v_i\neq\omega),$$

for $\lambda\in\{\mathtt{p},\mathtt{s}\}$.

Furthermore, observe that:

$$\widetilde{r}^{\omega,\mathtt{p}}\left(v_i=\omega\right)>\widetilde{r}^{\omega,\mathtt{s}}(v_i=\omega)$$

and

$$\widetilde{r}^{\omega,\mathtt{p}}\left(v_i\neq\omega\right)<\widetilde{r}^{\omega,\mathtt{s}}(v_i\neq\omega),$$

since $0<\frac{1}{n}\mathbb{E}(\sum_{j\neq i}\mathbb{I}_{\{v_j=\omega\}}))<1$. ■

C.3 Lemma 3

Suppose, for concreteness and without loss of generality, that the state of the world is $\omega=A$ and consider the behavior of a competent member whose bias is B. Suppose, in addition, that in equilibrium all competent members biased towards B vote against the state of the world. In this case, we must have that:

$$U^{\beta_i=B,\lambda}(v_i=B,s_i=A)\geq U^{\beta_i=B,\lambda}(v_i=A,s_i=A), \tag{C.10}$$

so that, by equation (10) in the paper, we have:

$$\phi\widetilde{r}^{\omega=A,\lambda}(B)+\rho^{\omega=A}(B)\alpha+(1-\rho^{\omega=A}(B))\gamma\geq\phi\widetilde{r}^{\omega=A,\lambda}(A)+\rho^{\omega=A}(A)\alpha+(1-\rho^{\omega=A}(A))\gamma$$

Note that since $\widetilde{r}^{\omega=A,\lambda}(B)<\widetilde{r}^{\omega=A,\lambda}(A)$, i.e. the career concern reward associated with a correct vote is strictly larger than that associated with an incorrect vote (by Lemma 2), and $\rho^{\omega=A}(B)\leq\rho^{\omega=A}(A)$, i.e. the probability that the decision is A is larger when the agent votes for A than when he votes for B, the above inequality holds if, and only if:

$$\gamma>\alpha, \tag{C.11}$$

i.e. the bias term must be strictly larger than the common value. Furthermore, from Lemma 1, part b, it follows that, when $\gamma > \alpha$, we must have:

$$U^{\beta_i=B,\lambda}(v_i = B, s_i = A) \geq U^{\beta_i=B,\lambda}(v_i = \emptyset, s_i = A) \tag{C.12}$$

and by the same token:

$$U^{\beta_i=A,\lambda}\left(v_i = A, s_i = B\right) \geq U^{\beta_i=A,\lambda}\left(v_i = \emptyset, s_i = B\right) \tag{C.13}$$

Let us now consider the behavior of an *incompetent* member biased towards B. We want to show that it can never be optimal for agents of this type to abstain. Remember that the expected utility of committee members of this type is given by:

$$U^{\beta_i=B,\lambda}\left(v_i, s_i = \emptyset\right) = qU^{\beta_i=B,\lambda}\left(v_i, s_i = A\right) + (1-q)\, U^{\beta_i=B,\lambda}\left(v_i, s_i = B\right),$$

where $q \in (0,1)$ is the prior probability that the state of the world is A. In this case, we can show that voting for B is preferred than abstaining, since $U^{\beta_i=B,\lambda}\left(v_i = B, s_i = A\right) \geq U^{\beta_i=B,\lambda}\left(v_i = \emptyset, s_i = A\right)$, by (C.12), and $U^{\beta_i=B,\lambda}\left(v_i = B, s_i = B\right) > U^{\beta_i=B,\lambda}\left(v_i = \emptyset, s_i = B\right)$, since the bias and the state of the world are aligned in this case and, by Lemma 2, the career concern reward associated with a correct vote is strictly larger. Thus, for any prior $q \in (0,1)$, we have:

$$U^{\beta_i=B,\lambda}\left(v_i = B, s_i = \emptyset\right) > U^{\beta_i=B,\lambda}\left(v_i = \emptyset, s_i = \emptyset\right)$$

Next, consider the behavior of an incompetent member biased towards A. As before, we want to show that it can never be optimal for members of this type to abstain. The expected utility of these agents can be expressed as:

$$U^{\beta_i=A,\lambda}\left(v_i, s_i = \emptyset\right) = qU^{\beta_i=A,\lambda}\left(v_i, s_i = A\right) + (1-q)\, U^{\beta_i=A,\lambda}\left(v_i, s_i = B\right)$$

Here, it is possible to show that voting for A is preferred than abstaining. In fact, note that $U^{\beta_i=A,\lambda}\left(v_i = A, s_i = B\right) \geq U^{\beta_i=A,\lambda}\left(v_i = \emptyset, s_i = B\right)$ by $(C.13)$, and $U^{\beta_i=A,\lambda}\left(v_i = A, s_i = A\right) > U^{\beta_i=A,\lambda}\left(v_i = \emptyset, s_i = A\right)$, since the bias and the state of the world are aligned in this case and, by Lemma 2, the career concern reward associated with a correct vote is strictly larger. Thus, for any prior $q \in (0,1)$, we have:

$$U^{\beta_i=A,\lambda}\left(v_i = A, s_i = \emptyset\right) > U^{\beta_i=A,\lambda}\left(v_i = \emptyset, s_i = \emptyset\right)$$

Note that none of the above results depend on the value of the prior probability, so that a similar argument applies to the case where B is the state of the world. ∎

C.4 Proposition 1

We focus on symmetric pure-strategy equilibria where agents do not use weakly dominated strategies. From Lemma 1, it follows that competent members never abstain in equilibrium. Therefore, we can divide their possible equilibrium strategies into two categories: either (a) they all vote in accordance with the signal; or (b) some of them vote against the signal. Next, from Lemma 3, it follows that incompetent agents never abstain when a competent member votes against the state of the world, which corresponds to the situation described in case (b) above. Therefore, combining the results in Lemmas 1 and 3, the result follows. ∎

C.5 Proposition 2

The conditions for the existence of a fully competent equilibrium are the following: First, every competent member who receives a signal different than his bias must prefer to vote in accordance with the state of the world:

$$U_{full}^{\beta=A,\lambda}(v_i = B, s_i = B) \geq U_{full}^{\beta=A,\lambda}(v_i = A, s_i = B)$$

and

$$U_{full}^{\beta=B,\lambda}(v_i = A, s_i = A) \geq U_{full}^{\beta=B,\lambda}(v_i = B, s_i = A)$$

Second, all incompetent members must prefer to abstain rather than to vote for either one of the alternatives:

$$U_{full}^{\beta=A,\lambda}\left(v_i = \emptyset, s_i = \emptyset\right) \geq \max\{U_{full}^{\beta=A,\lambda}\left(v_i = A, s_i = \emptyset\right), U_{full}^{\beta=A,\lambda}\left(v_i = B, s_i = \emptyset\right)\}$$

and

$$U_{full}^{\beta=B,\lambda}\left(v_i = \emptyset, s_i = \emptyset\right) \geq \max\{U_{full}^{\beta=B,\lambda}\left(v_i = A, s_i = \emptyset\right), U_{full}^{\beta=B,\lambda}\left(v_i = B, s_i = \emptyset\right)\},$$

where we assume that the beliefs of all agents, including the external evaluator, are consistent with the equilibrium strategies.

After some algebra, it is possible to re-express the conditions on the behavior of competent members more compactly as:

$$\gamma \leq \alpha + \Lambda_{1,full}^{\lambda} \tag{C.14}$$

and

$$\gamma \leq \alpha + \Lambda_{2,full}^{\lambda}, \tag{C.15}$$

whereas the conditions on the behavior of incompetent members can be rewritten as:

$$\gamma \leq \alpha\Gamma_{1,full}^{\lambda} - \Gamma_{2,full}^{\lambda} \tag{C.16}$$

$$\gamma \geq -\alpha\Gamma_{3,full}^{\lambda} + \Gamma_{4,full}^{\lambda} \tag{C.17}$$

and

$$\gamma \leq \alpha\Gamma^{\lambda}_{3,full} - \Gamma^{\lambda}_{4,full} \tag{C.18}$$

$$\gamma \geq -\alpha\Gamma^{\lambda}_{1,full} + \Gamma^{\lambda}_{2,full}, \tag{C.19}$$

where we define:

$$\Lambda^{\lambda}_{1,full} \equiv \frac{\phi(\widetilde{r}^{\omega=B,\lambda}_{full}(B) - \widetilde{r}^{\omega=B,\lambda}_{full}(A))}{\rho^{\omega=B}_{full}(A) - \rho^{\omega=B}_{full}(B)} \geq 0$$

$$\Lambda^{\lambda}_{2,full} \equiv \frac{\phi(\widetilde{r}^{\omega=A,\lambda}_{full}(A) - \widetilde{r}^{\omega=A,\lambda}_{full}(B))}{\rho^{\omega=A}_{full}(A) - \rho^{\omega=A}_{full}(B)} \geq 0$$

$$\Gamma^{\lambda}_{1,full} \equiv \frac{(1-q)\left(\rho^{\omega=B}_{full}(A) - \rho^{\omega=B}_{full}(\emptyset)\right) - q(\rho^{\omega=A}_{full}(A) - \rho^{\omega=A}_{full}(\emptyset))}{q(\rho^{\omega=A}_{full}(A) - \rho^{\omega=A}_{full}(\emptyset)) + (1-q)\left(\rho^{\omega=B}_{full}(A) - \rho^{\omega=B}_{full}(\emptyset)\right)} \gtrless 0$$

$$\Gamma^{\lambda}_{2,full} \equiv \frac{q\phi(\widetilde{r}^{\omega=A,\lambda}_{full}(A) - \widetilde{r}^{\omega=A,\lambda}_{full}(\emptyset))}{q(\rho^{\omega=A}_{full}(A) - \rho^{\omega=A}_{full}(\emptyset)) + (1-q)\left(\rho^{\omega=B}_{full}(A) - \rho^{\omega=B}_{full}(\emptyset)\right)} \geq 0$$

$$\Gamma^{\lambda}_{3,full} \equiv \frac{q(\rho^{\omega=A}_{full}(\emptyset) - \rho^{\omega=A}_{full}(B)) - (1-q)\left(\rho^{\omega=B}_{full}(\emptyset) - \rho^{\omega=B}_{full}(B)\right)}{q(\rho^{\omega=A}_{full}(\emptyset) - \rho^{\omega=A}_{full}(B)) + (1-q)\left(\rho^{\omega=B}_{full}(\emptyset) - \rho^{\omega=B}_{full}(B)\right)} \gtrless 0$$

$$\Gamma^{\lambda}_{4,full} \equiv \frac{(1-q)\,\phi(\widetilde{r}^{\omega=B,\lambda}_{full}(B) - \widetilde{r}^{\omega=B,\lambda}_{full}(\emptyset))}{q(\rho^{\omega=A}_{full}(\emptyset) - \rho^{\omega=A}_{full}(B)) + (1-q)\left(\rho^{\omega=B}_{full}(\emptyset) - \rho^{\omega=B}_{full}(B)\right)} \geq 0$$

Note also that, although we cannot determine the sign of the terms $\Gamma^{\lambda}_{1,full}$ and $\Gamma^{\lambda}_{3,full}$, it must be the case that $-1 \leq \Gamma^{\lambda}_{1,full} \leq 1$ and $-1 \leq \Gamma^{\lambda}_{3,full} \leq 1$.

In equilibrium, all of the above conditions must hold simultaneously. However, observe that if condition $(C.16)$ is satisfied, then it must be that $\alpha\Gamma^{\lambda}_{1,full} - \Gamma^{\lambda}_{2,full} > 0$, since $\gamma > 0$, which, in turn, implies that $\Gamma^{\lambda}_{1,full} > 0$. We must, then, have that $-\alpha\Gamma^{\lambda}_{1,full} + \Gamma^{\lambda}_{2,full} < 0$, which means that condition $(C.19)$ is necessarily satisfied. Furthermore, since $0 < \Gamma^{\lambda}_{1,full} \leq 1$ and $\Gamma^{\lambda}_{2,full} \geq 0$, condition $(C.14)$ also holds, given that $\alpha\Gamma^{\lambda}_{1,full} - \Gamma^{\lambda}_{2,full} < \alpha + \Lambda^{\lambda}_{1,full}$. Therefore, we conclude that whenever $(C.16)$ is satisfied, then $(C.14)$ and $(C.19)$ also hold. Similarly, observe that if condition $(C.18)$ is satisfied, then $\alpha\Gamma^{\lambda}_{3,full} - \Gamma^{\lambda}_{4,full} > 0$, which, in turn, implies that $\Gamma^{\lambda}_{3,full} > 0$. We must then have that $-\alpha\Gamma^{\lambda}_{3,full} + \Gamma^{\lambda}_{4,full} < 0$, which means that condition $(C.17)$ is necessarily satisfied. Moreover, since $0 < \Gamma^{\lambda}_{3,full} \leq 1$ and $\Gamma^{\lambda}_{4,full} \geq 0$, then condition $(C.15)$ must also hold. Hence, we conclude that whenever $(C.18)$ is satisfied, then $(C.15)$ and $(C.17)$ also hold.

Intuitively, what we have shown is that, given the equilibrium beliefs, if incompetent members from both types prefer to abstain rather than to vote in accordance with their biases, then no incompetent member would ever have an incentive to vote against his bias and, likewise, no competent member would ever prefer to vote against his bias rather than to vote in accordance with the state of the world. Therefore, for a fully competent equilibrium to be sustained it is enough that conditions $(C.16)$ and $(C.18)$ both hold. Observe that we can express these conditions more compactly as:

$$\gamma \leq \overline{\gamma}^{\lambda}_{full}\left(\alpha, \phi, \sigma, n\right), \tag{C.20}$$

where:

$$\overline{\gamma}^{\lambda}_{full}\left(\alpha, \phi, \sigma, n\right) \equiv \min\{\alpha\Gamma^{\lambda}_{1,full} - \Gamma^{\lambda}_{2,full}, \alpha\Gamma^{\lambda}_{3,full} - \Gamma^{\lambda}_{4,full}\} \tag{C.21}$$

and note that $\overline{\gamma}^{\lambda}_{full}\left(\alpha, \phi, \sigma, n\right) < \alpha$, since $\Gamma^{\lambda}_{2,full}, \Gamma^{\lambda}_{4,full} \geq 0$ and $-1 < \Gamma^{\lambda}_{1,full} < 1$ and $-1 < \Gamma^{\lambda}_{3,full} < 1$.

Finally, we have:

$$\overline{\gamma}^{\mathsf{p}}_{full}\left(\alpha, \phi, \sigma, n\right) < \overline{\gamma}^{\mathsf{s}}_{full}\left(\alpha, \phi, \sigma, n\right), \tag{C.22}$$

since $\Gamma^{\mathsf{p}}_{1,full} = \Gamma^{\mathsf{s}}_{1,full}$ and $\Gamma^{\mathsf{p}}_{3,full} = \Gamma^{\mathsf{s}}_{3,full}$, given that the expressions $\Gamma^{\lambda}_{1,full}$ and $\Gamma^{\lambda}_{3,full}$ are independent of the degree of transparency, λ. Furthermore, note that $\Gamma^{\mathsf{p}}_{2,full} > \Gamma^{\mathsf{s}}_{2,full}$ and $\Gamma^{\mathsf{p}}_{4,full} > \Gamma^{\mathsf{s}}_{4,full}$, which follow, respectively, from the facts that:

$$\widetilde{r}^{\omega=A,\mathsf{p}}_{full}(A) - \widetilde{r}^{\omega=A,\mathsf{p}}_{full}(\emptyset) > \widetilde{r}^{\omega=A,\mathsf{s}}_{full}(A) - \widetilde{r}^{\omega=A,\mathsf{s}}_{full}(\emptyset)$$

and

$$\widetilde{r}^{\omega=B,\mathsf{p}}_{full}(B) - \widetilde{r}^{\omega=B,\mathsf{p}}_{full}(\emptyset) > \widetilde{r}^{\omega=B,\mathsf{s}}_{full}(B) - \widetilde{r}^{\omega=B,\mathsf{s}}_{full}(\emptyset),$$

by Lemma 2. Intuitively, the career concern reward associated with a correct vote relatively to that associated with an abstention is larger under public voting, so that incompetent members have less incentive to abstain under transparency. ■

C.6 Proposition 3

The conditions for the existence of a partially competent equilibrium are the following: First, every competent member who receives a signal different than his bias must prefer to vote in accordance with the state of the world:

$$U^{\beta=A,\lambda}_{part}(v_i = B, s_i = B) \geq U^{\beta=A,\lambda}_{part}(v_i = A, s_i = B)$$

and

$$U^{\beta=B,\lambda}_{part}(v_i = A, s_i = A) \geq U^{\beta=B,\lambda}_{part}(v_i = B, s_i = A)$$

Second, some incompetent members must prefer to vote for either one of the alternatives rather than to abstain:

$$U^{\beta,\lambda}_{part}\left(v_i = \emptyset, s_i = \emptyset\right) \leq \min\{U^{\beta,\lambda}_{part}\left(v_i = A, s_i = \emptyset\right), U^{\beta,\lambda}_{part}\left(v_i = B, s_i = \emptyset\right)\},$$

for at least one type $\beta \in \{A, B\}$, where we assume that the beliefs of all agents, including the external evaluator, are consistent with the equilibrium strategies.

After some algebra, it is possible to re-express the conditions on the behavior of competent members more compactly as:

$$\gamma \leq \alpha + \Lambda^{\lambda}_{1,part} \tag{C.23}$$

and

$$\gamma \leq \alpha + \Lambda^{\lambda}_{2,part}, \tag{C.24}$$

whereas the conditions on the behavior of incompetent members can be rewritten as:

$$\gamma \geq \alpha \Gamma^{\lambda}_{1,part} - \Gamma^{\lambda}_{2,part} \tag{C.25}$$

and/or

$$\gamma \leq -\alpha \Gamma^{\lambda}_{3,part} + \Gamma^{\lambda}_{4,part} \tag{C.26}$$

and/or

$$\gamma \geq \alpha \Gamma^{\lambda}_{3,part} - \Gamma^{\lambda}_{4,part} \tag{C.27}$$

and/or

$$\gamma \leq -\alpha \Gamma^{\lambda}_{1,part} + \Gamma^{\lambda}_{2,part}, \tag{C.28}$$

where we define:

$$\Lambda^{\lambda}_{1,part} \equiv \frac{\phi(\widetilde{r}^{\,\omega=B,\lambda}_{part}(B) - \widetilde{r}^{\,\omega=B,\lambda}_{part}(A))}{\rho^{\omega=B}_{part}(A) - \rho^{\omega=B}_{part}(B)} \geq 0$$

$$\Lambda^{\lambda}_{2,part} \equiv \frac{\phi(\widetilde{r}^{\,\omega=A,\lambda}_{part}(A) - \widetilde{r}^{\,\omega=A,\lambda}_{part}(B))}{\rho^{\omega=A}_{part}(A) - \rho^{\omega=A}_{part}(B)} \geq 0$$

$$\Gamma^{\lambda}_{1,part} \equiv \frac{(1-q)\,(\rho^{\omega=B}_{part}(A) - \rho^{\omega=B}_{part}(\emptyset)) - q(\rho^{\omega=A}_{part}(A) - \rho^{\omega=A}_{part}(\emptyset))}{q(\rho^{\omega=A}_{part}(A) - \rho^{\omega=A}_{part}(\emptyset)) + (1-q)\,(\rho^{\omega=B}_{part}(A) - \rho^{\omega=B}_{part}(\emptyset))} \gtreqless 0$$

$$\Gamma^{\lambda}_{2,part} \equiv \frac{q\phi(\widetilde{r}^{\,\omega=A,\lambda}_{part}(A) - \widetilde{r}^{\,\omega=A,\lambda}_{part}(\emptyset))}{q(\rho^{\omega=A}_{part}(A) - \rho^{\omega=A}_{part}(\emptyset)) + (1-q)\,(\rho^{\omega=B}_{part}(A) - \rho^{\omega=B}_{part}(\emptyset))} \geq 0$$

$$\Gamma^{\lambda}_{3,part} \equiv \frac{q(\rho^{\omega=A}_{part}(\emptyset) - \rho^{\omega=A}_{part}(B)) - (1-q)\,(\rho^{\omega=B}_{part}(\emptyset) - \rho^{\omega=B}_{part}(B))}{q(\rho^{\omega=A}_{part}(\emptyset) - \rho^{\omega=A}_{part}(B)) + (1-q)\,(\rho^{\omega=B}_{part}(\emptyset) - \rho^{\omega=B}_{part}(B))} \gtreqless 0$$

$$\Gamma^{\lambda}_{4,part} \equiv \frac{(1-q)\,\phi(\widetilde{r}^{\,\omega=B,\lambda}_{part}(B) - \widetilde{r}^{\,\omega=B,\lambda}_{part}(\emptyset))}{q(\rho^{\omega=A}_{part}(\emptyset) - \rho^{\omega=A}_{part}(B)) + (1-q)\,(\rho^{\omega=B}_{part}(\emptyset) - \rho^{\omega=B}_{part}(B))} \geq 0$$

Note also that, although we cannot determine the sign of the terms $\Gamma^{\lambda}_{1,part}$ and $\Gamma^{\lambda}_{3,part}$, it must be the case that $-1 \leq \Gamma^{\lambda}_{1,part} \leq 1$ and $-1 \leq \Gamma^{\lambda}_{3,part} \leq 1$.

In equilibrium, both conditions on competent agents must be satisfied, plus at least one of the conditions on incompetent agents must hold. Thus, the following condition must always be satisfied:

$$\gamma \leq \overline{\gamma}^{\mathsf{c}} \equiv \min\{\alpha + \Lambda^{\lambda}_{1,part}, \alpha + \Lambda^{\lambda}_{2,part}\}$$

Now, let:

$$\overline{\gamma}^{\mathtt{nc}} \equiv \max\{-\alpha\Gamma^{\lambda}_{1,part} + \Gamma^{\lambda}_{2,part}, -\alpha\Gamma^{\lambda}_{3,part} + \Gamma^{\lambda}_{4,part}\}$$

and

$$\underline{\gamma}^{\mathtt{nc}} \equiv \min\{\alpha\Gamma^{\lambda}_{1,part} - \Gamma^{\lambda}_{2,part}, \alpha\Gamma^{\lambda}_{3,part} - \Gamma^{\lambda}_{4,part}\},$$

where $\overline{\gamma}^{\mathtt{nc}} = -\underline{\gamma}^{\mathtt{nc}}$. Observe that if $\underline{\gamma}^{\mathtt{nc}} < 0$, then either $(C.25)$ or $(C.27)$ or both are necessarily satisfied, in which case the condition for the existence of a partially competent equilibrium is simply given by:

$$\gamma \leq \overline{\gamma}^{\mathtt{c}}$$

On the other hand, if $\underline{\gamma}^{\mathtt{nc}} > 0$, then we must necessarily have $\overline{\gamma}^{\mathtt{nc}} < 0$, so that that $(C.26)$ and $(C.28)$ cannot be satisfied, in which case the following condition must hold:

$$\underline{\gamma}^{\mathtt{nc}} \leq \gamma \leq \overline{\gamma}^{\mathtt{c}}$$

Thus, the condition for the existence of a partially competent equilibrium can be written as:

$$\underline{\gamma}^{\lambda}_{part}(\alpha, \phi, \sigma, n) \leq \gamma \leq \overline{\gamma}^{\lambda}_{part}(\alpha, \phi, \sigma, n), \tag{C.29}$$

where:

$$\underline{\gamma}^{\lambda}_{part}(\alpha, \phi, \sigma, n) \equiv \min\{\alpha\Gamma^{\lambda}_{1,part} - \Gamma^{\lambda}_{2,part}, \alpha\Gamma^{\lambda}_{3,part} - \Gamma^{\lambda}_{4,part}\} \tag{C.30}$$

and

$$\overline{\gamma}^{\lambda}_{part}(\alpha, \phi, \sigma, n) \equiv \min\{\alpha + \Lambda^{\lambda}_{1,part}, \alpha + \Lambda^{\lambda}_{2,part}\} \tag{C.31}$$

Note that $\underline{\gamma}^{\lambda}_{part}(\alpha, \phi, \sigma, n) < \alpha$, since $\Gamma^{\lambda}_{2,part}, \Gamma^{\lambda}_{4,part} \geq 0$ and $-1 < \Gamma^{\lambda}_{1,part} < 1$ and $-1 < \Gamma^{\lambda}_{3,part} < 1$. Moreover, $\overline{\gamma}^{\lambda}_{part}(\alpha, \phi, \sigma, n) > \alpha$, since $\Lambda^{\lambda}_{1,part}, \Lambda^{\lambda}_{2,part} > 0$.

Finally, observe that:

$$\overline{\gamma}^{\mathtt{s}}_{part}(\alpha, \phi, \sigma, n) < \overline{\gamma}^{\mathtt{p}}_{part}(\alpha, \phi, \sigma, n), \tag{C.32}$$

since $\Lambda^{\mathtt{p}}_{1,part} > \Lambda^{\mathtt{s}}_{1,part}$ and $\Lambda^{\mathtt{p}}_{2,part} > \Lambda^{\mathtt{s}}_{2,part}$, which follow, respectively, from the facts that:

$$\widetilde{r}^{\,\omega=B,\mathtt{p}}_{part}(B) - \widetilde{r}^{\,\omega=B,\mathtt{p}}_{part}(A) > \widetilde{r}^{\,\omega=B,\mathtt{s}}_{part}(B) - \widetilde{r}^{\,\omega=B,\mathtt{s}}_{part}(A)$$

and

$$\widetilde{r}^{\,\omega=A,\mathtt{p}}_{part}(A) - \widetilde{r}^{\,\omega=A,\mathtt{p}}_{part}(B) > \widetilde{r}^{\,\omega=A,\mathtt{s}}_{part}(A) - \widetilde{r}^{\,\omega=A,\mathtt{s}}_{part}(B),$$

by Lemma 2. Furthermore, we also have that:

$$\underline{\gamma}^{\mathtt{p}}_{part}(\alpha, \phi, \sigma, n) < \underline{\gamma}^{\mathtt{s}}_{part}(\alpha, \phi, \sigma, n), \tag{C.33}$$

since $\Gamma^{\mathtt{p}}_{1,part} = \Gamma^{\mathtt{s}}_{1,part}$, $\Gamma^{\mathtt{p}}_{3,part} = \Gamma^{\mathtt{s}}_{3,part}$, $\Gamma^{\mathtt{p}}_{2,part} > \Gamma^{\mathtt{s}}_{2,part}$ and $\Gamma^{\mathtt{p}}_{4,part} > \Gamma^{\mathtt{s}}_{4,part}$. Note that these last two inequalities follow from the facts that:

$$\widetilde{r}_{part}^{\omega=A,\mathtt{p}}(A) - \widetilde{r}_{part}^{\omega=A,\mathtt{p}}(\emptyset) > \widetilde{r}_{part}^{\omega=A,\mathtt{s}}(A) - \widetilde{r}_{part}^{\omega=A,\mathtt{s}}(\emptyset)$$

and

$$\widetilde{r}_{part}^{\omega=B,\mathtt{p}}(B) - \widetilde{r}_{part}^{\omega=B,\mathtt{p}}(\emptyset) > \widetilde{r}_{part}^{\omega=B,\mathtt{s}}(B) - \widetilde{r}_{part}^{\omega=B,\mathtt{s}}(\emptyset),$$

by Lemma 2. ∎

C.7 Proposition 4

The conditions for the existence of a biased equilibrium are the following: First, some competent members who receive a signal different than their bias must prefer to vote against the state of the world:

$$U_{bias}^{\beta=A,\lambda}(v_i = B, s_i = B) \leq U_{bias}^{\beta=A,\lambda}(v_i = A, s_i = B) \tag{C.34}$$

and/or

$$U_{bias}^{\beta=B,\lambda}(v_i = A, s_i = A) \leq U_{bias}^{\beta=B,\lambda}(v_i = B, s_i = A) \tag{C.35}$$

Second, all incompetent members must prefer to vote rather than to abstain:

$$U_{bias}^{\beta,\lambda}\left(v_i = \emptyset, s_i = \emptyset\right) \leq \min\{U_{bias}^{\beta,\lambda}\left(v_i = A, s_i = \emptyset\right), U_{bias}^{\beta,\lambda}\left(v_i = B, s_i = \emptyset\right)\}, \tag{C.36}$$

where we assume that the beliefs of all agents, including the external evaluator, are consistent with the equilibrium strategies.

From Lemma 3, it follows that if either $(C.34)$ or $(C.35)$ are satisfied, then $(C.36)$ must necessarily hold. Moreover, note that, after some algebra, the conditions on competent members can be re-expressed more compactly as:

$$\gamma \geq \alpha + \Lambda_{1,bias}^{\lambda} \tag{C.37}$$

and/or

$$\gamma \geq \alpha + \Lambda_{2,bias}^{\lambda}, \tag{C.38}$$

where we define:

$$\Lambda_{1,bias}^{\lambda} \equiv \frac{\phi(\widetilde{r}_{bias}^{\omega=B,\lambda}(B) - \widetilde{r}_{bias}^{\omega=B,\lambda}(A))}{\rho_{bias}^{\omega=B}(A) - \rho_{bias}^{\omega=B}(B)} \geq 0$$

$$\Lambda_{2,bias}^{\lambda} \equiv \frac{\phi(\widetilde{r}_{bias}^{\omega=A,\lambda}(A) - \widetilde{r}_{bias}^{\omega=A,\lambda}(B))}{\rho_{bias}^{\omega=A}(A) - \rho_{bias}^{\omega=A}(B)} \geq 0$$

Therefore, the condition for the existence of a biased equilibrium can be written as:

$$\gamma \geq \underline{\gamma}_{bias}^{\lambda}\left(\alpha, \phi, \sigma, n\right), \tag{C.39}$$

where

$$\underline{\gamma}_{bias}^{\lambda}\left(\alpha,\phi,\sigma,n\right)\equiv\min\{\alpha+\Lambda_{1,bias}^{\lambda},\alpha+\Lambda_{2,bias}^{\lambda}\} \tag{C.40}$$

Note that $\underline{\gamma}_{bias}^{\lambda}\left(\alpha,\phi,\sigma,n\right)>\alpha$, since $\Lambda_{1,bias}^{\lambda},\Lambda_{2,bias}^{\lambda}>0$. We also have that:

$$\underline{\gamma}_{bias}^{\mathtt{s}}\left(\alpha,\phi,\sigma,n\right)<\underline{\gamma}_{bias}^{\mathtt{p}}\left(\alpha,\phi,\sigma,n\right),$$

since $\Lambda_{1,bias}^{\mathtt{p}}>\Lambda_{1,bias}^{\mathtt{s}}$ and $\Lambda_{2,biast}^{\mathtt{p}}>\Lambda_{2,bias}^{\mathtt{s}}$, which follow, respectively, from the facts that:

$$\widetilde{r}_{bias}^{\omega=B,\mathtt{p}}(B)-\widetilde{r}_{bias}^{\omega=B,\mathtt{p}}(A)>\widetilde{r}_{bias}^{\omega=B,\mathtt{s}}(B)-\widetilde{r}_{bias}^{\omega=B,\mathtt{s}}(A)$$

and

$$\widetilde{r}_{bias}^{\omega=A,\mathtt{p}}(A)-\widetilde{r}_{bias}^{\omega=A,\mathtt{p}}(B)>\widetilde{r}_{bias}^{\omega=A,\mathtt{s}}(A)-\widetilde{r}_{bias}^{\omega=A,\mathtt{s}}(B),$$

by Lemma 2. ■

C.8 Proposition 5

We start by deriving the conditions for the existence of a fully competent equilibrium under symmetry. Assuming that all competent members vote correctly and all incompetent members abstain, we have:

$$\rho_{full}^{\omega=A}(A)-\rho_{full}^{\omega=A}(\emptyset)=\rho_{full}^{\omega=B}(\emptyset)-\rho_{full}^{\omega=B}(B)=\frac{1}{2}\left(1-\sigma\right)^{n-1}$$

$$\rho_{full}^{\omega=A}(\emptyset)-\rho_{full}^{\omega=A}(B)=\rho_{full}^{\omega=B}(A)-\rho_{full}^{\omega=B}(\emptyset)=\frac{1}{2}\left(1-\sigma\right)^{n-1}+\frac{1}{2}\left(n-1\right)\left(1-\sigma\right)^{n-2}\sigma$$

Moreover, note that in this case:

$$\widetilde{r}_{full}^{\omega=A,\mathtt{p}}(A)=\widetilde{r}_{full}^{\omega=B,\mathtt{p}}(B)=1$$

$$\widetilde{r}_{full}^{\omega=A,\mathtt{p}}(\emptyset)=\widetilde{r}_{full}^{\omega=B,\mathtt{p}}(\emptyset)=0$$

$$\widetilde{r}_{full}^{\omega=A,\mathtt{s}}(A)=\widetilde{r}_{full}^{\omega=B,\mathtt{s}}(B)=\frac{1}{n}\left(1+\mathbb{E}(\ \textstyle\sum_{j\neq i}\ \mathbb{I}_{\{v_j=\omega\}})\right)$$

$$\widetilde{r}_{full}^{\omega=A,\mathtt{s}}(\emptyset)=\widetilde{r}_{full}^{\omega=B,\mathtt{p}}(\emptyset)=\frac{1}{n}\mathbb{E}(\ \textstyle\sum_{j\neq i}\ \mathbb{I}_{\{v_j=\omega\}})$$

Therefore, from $(C.20)$ and $(C.21)$, it follows that:

$$\overline{\gamma}_{full}^{\lambda}\left(\alpha,\phi,\sigma,n\right)\equiv\frac{\left(n-1\right)\sigma}{2+\left(n-3\right)\sigma}\alpha-\frac{1}{\left(1+\frac{n-3}{2}\sigma\right)\left(1-\sigma\right)^{n-2}}\left(1-\frac{n-1}{n}\mathbb{I}_{\{\lambda=\mathtt{s}\}}\right)\phi \tag{C.41}$$

Next, we proceed to derive the conditions for the existence of a partially competent equilibrium under symmetry. Assuming that all competent members vote correctly and all incompetent members vote for their biases, we have:

$$\rho^{\omega}_{part}(A) - \rho^{\omega}_{part}(B) = \binom{n-1}{(n-1)/2} \left(\sigma + \frac{1}{2}(1-\sigma)\right)^{\frac{n-1}{2}} \left(\frac{1}{2}(1-\sigma)\right)^{\frac{n-1}{2}}$$

$$\rho^{\omega}_{part}(A) - \rho^{\omega}_{part}(\emptyset) = \rho^{\omega}_{part}(\emptyset) - \rho^{\omega}_{part}(B) = \frac{1}{2}\binom{n-1}{(n-1)/2} \left(\sigma + \frac{1}{2}(1-\sigma)\right)^{\frac{n-1}{2}} \left(\frac{1}{2}(1-\sigma)\right)^{\frac{n-1}{2}},$$

for $\omega \in \{A, B\}$, where the term $\sigma + \frac{1}{2}(1-\sigma)$ represents the proportion of committee members that are expected to vote for the correct alternative in equilibrium. Note, also, that:

$$\widetilde{r}^{\,\omega=B,\mathrm{p}}_{part}(B) = \widetilde{r}^{\,\omega=A,\mathrm{p}}_{part}(A) = \frac{\sigma}{\sigma + \frac{1}{2}(1-\sigma)}$$

$$\widetilde{r}^{\,\omega=A,\mathrm{p}}_{part}(B) = \widetilde{r}^{\,\omega=B,\mathrm{p}}_{part}(A) = \widetilde{r}^{\,\omega=A,\mathrm{p}}_{part}(\emptyset) = \widetilde{r}^{\,\omega=B,\mathrm{p}}_{part}(\emptyset) = 0$$

$$\widetilde{r}^{\,\omega=B,\mathrm{s}}_{part}(B) = \widetilde{r}^{\,\omega=A,\mathrm{s}}_{part}(A) = \frac{1}{n}\frac{\sigma}{\sigma + \frac{1}{2}(1-\sigma)}\left(1 + \mathbb{E}\left(\textstyle\sum_{j\neq i} \mathbb{I}_{\{v_j=\omega\}}\right)\right)$$

$$\widetilde{r}^{\,\omega=A,\mathrm{s}}_{part}(B) = \widetilde{r}^{\,\omega=B,\mathrm{s}}_{part}(A) = \widetilde{r}^{\,\omega=A,\mathrm{s}}_{part}(\emptyset) = \widetilde{r}^{\,\omega=B,\mathrm{s}}_{part}(\emptyset) = \frac{1}{n}\frac{\sigma}{\sigma + \frac{1}{2}(1-\sigma)}\mathbb{E}\left(\textstyle\sum_{j\neq i} \mathbb{I}_{\{v_j=\omega\}}\right)$$

Therefore, from equations $(C.30)$ and $(C.31)$, it follows that:

$$\underline{\gamma}^{\lambda}_{part}(\alpha, \phi, \sigma, n) < 0 \tag{C.42}$$

and

$$\overline{\gamma}^{\lambda}_{part}(\alpha, \phi, \sigma, n) = \alpha + \frac{2^n \sigma}{\binom{n-1}{(n-1)/2}(1+\sigma)^{\frac{n+1}{2}}(1-\sigma)^{\frac{n-1}{2}}}\left(1 - \frac{n-1}{n}\mathbb{I}_{\{\lambda=\mathrm{s}\}}\right)\phi, \tag{C.43}$$

where the first expression follows from the fact that $\alpha\Gamma^{\lambda}_{1,part} - \Gamma^{\lambda}_{2,part} = \alpha\Gamma^{\lambda}_{3,part} - \Gamma^{\lambda}_{4,part} < 0$, since $\Gamma^{\lambda}_{1,part} = \Gamma^{\lambda}_{3,part} = 0$ and $\Gamma^{\lambda}_{2,part}, \Gamma^{\lambda}_{4,part} > 0$.

Finally, let us derive the conditions for the existence of a biased equilibrium. Assuming that all members vote in accordance with their biases, we have:

$$\rho^{\omega}_{bias}(A) - \rho^{\omega}_{bias}(B) = \binom{n-1}{(n-1)/2}\left(\frac{1}{2}\right)^{\frac{n-1}{2}}\left(\frac{1}{2}\right)^{\frac{n-1}{2}},$$

for $\omega \in \{A, B\}$. Observe that, in this case, the proportion of members expected to vote for each of the alternatives is exactly $\frac{1}{2}$. Note, also, that:

$$\widetilde{r}^{\,\omega=A,\mathrm{p}}_{bias}(A) = \widetilde{r}^{\,\omega=B,\mathrm{p}}_{bias}(B) = \sigma$$

$$\widetilde{r}^{\,\omega=A,\mathrm{p}}_{bias}(B) = \widetilde{r}^{\,\omega=B,\mathrm{p}}_{bias}(A) = 0$$

$$\widetilde{r}^{\,\omega=A,\mathrm{s}}_{bias}(A) = \widetilde{r}^{\,\omega=B,\mathrm{s}}_{bias}(B) = \frac{\sigma}{n}\left(1 + \mathbb{E}\left(\textstyle\sum_{j\neq i} \mathbb{I}_{\{v_j=\omega\}}\right)\right)$$

$$\widetilde{r}^{\omega=A,\mathtt{s}}_{bias}(B)=\widetilde{r}^{\omega=B,\mathtt{s}}_{bias}(A)=\frac{\sigma}{n}\left(\mathbb{E}\left(\ \sum_{j\neq i}\ \mathbb{I}_{\{v_j=\omega\}}\right)\right)$$

Therefore, from equation $(C.40)$, it follows that:

$$\underline{\gamma}^{\lambda}_{bias}\left(\alpha,\phi,\sigma,n\right)=\alpha+\frac{2^{n-1}\sigma}{\binom{n-1}{(n-1)/2}}\left(1-\frac{n-1}{n}\mathbb{I}_{\{\lambda=\mathtt{s}\}}\right)\phi \tag{C.44}$$

Finally, note that:

$$0\leq\frac{(n-1)\,\sigma}{2+(n-3)\,\sigma}\leq 1,$$

since $n\geq 3$ and $\sigma\in(0,1)$; and

$$\frac{2^{n}\sigma}{\binom{n-1}{(n-1)/2}\left(1+\sigma\right)^{\frac{n+1}{2}}\left(1-\sigma\right)^{\frac{n-1}{2}}}>\frac{2^{n-1}\sigma}{\binom{n-1}{(n-1)/2}},$$

since $2>(1+\sigma)^{\frac{n+1}{2}}(1-\sigma)^{\frac{n-1}{2}}$.[5] Therefore, comparing equations $(C.41)$, $(C.43)$ and $(C.44)$, we have:

$$\overline{\gamma}^{\lambda}_{full}\left(\alpha,\phi,\sigma,n\right)<\underline{\gamma}^{\lambda}_{bias}\left(\alpha,\phi,\sigma,n\right)<\overline{\gamma}^{\lambda}_{part}\left(\alpha,\phi,\sigma,n\right)$$

Furthermore, form the inspection of these expressions, it is immediate to see that:

$$\overline{\gamma}^{\mathtt{p}}_{full}\left(\alpha,\phi,\sigma,n\right)<\overline{\gamma}^{\mathtt{s}}_{full}\left(\alpha,\phi,\sigma,n\right)$$

$$\overline{\gamma}^{\mathtt{p}}_{part}\left(\alpha,\phi,\sigma,n\right)>\overline{\gamma}^{\mathtt{s}}_{part}\left(\alpha,\phi,\sigma,n\right)$$

and

$$\underline{\gamma}^{\mathtt{p}}_{bias}\left(\alpha,\phi,\sigma,n\right)>\underline{\gamma}^{\mathtt{s}}_{bias}\left(\alpha,\phi,\sigma,n\right)\ \blacksquare$$

C.9 Proposition 6

Note that if $\overline{\gamma}^{\mathtt{s}}_{part}\left(\alpha,\phi,\sigma,n\right)<\gamma<\overline{\gamma}^{\mathtt{p}}_{part}\left(\alpha,\phi,\sigma,n\right)$, then a partially competent equilibrium can be sustained under public but not under secret voting. Furthermore, for this range of parameters, a biased equilibrium always exists under secret voting, but may or may not exist under public voting. Therefore, the probability of a correct decision under public voting is at least as large as under secret voting, i.e.:

$$\Pi^{\mathtt{p}}=\min\left\{\sum_{i=(n+1)/2}^{n}\binom{n}{i}\left(\sigma+\tfrac{1}{2}\left(1-\sigma\right)\right)^{i}\left(\tfrac{1}{2}\left(1-\sigma\right)\right)^{n-i},\tfrac{1}{2}\right\}\geq\Pi^{\mathtt{s}}=\tfrac{1}{2}$$

Next, observe that if $\overline{\gamma}^{\mathtt{p}}_{full}\left(\alpha,\phi,\sigma,n\right)<\gamma<\overline{\gamma}^{\mathtt{s}}_{full}\left(\alpha,\phi,\sigma,n\right)$, then a fully competent equilibrium can be sustained under secret but not under public voting. Note that for this range of parameters, a partially competent equilibrium always exists under both secret and public voting. Thus, the

[5] Note that $2>(1+\sigma)^{\frac{n+1}{2}}(1-\sigma)^{\frac{n-1}{2}}\leftrightarrow 2>(1+\sigma)(1+\sigma)^{\frac{n-1}{2}}(1-\sigma)^{\frac{n-1}{2}}\leftrightarrow 2^{\frac{2}{n-1}}>(1+\sigma)^{\frac{2}{n-1}}\left(1-\sigma^{2}\right)$. Observe that the last inequality always holds for any $n\geq 3$ and $\sigma\in(0,1)$, since $2^{\frac{2}{n-1}}>(1+\sigma)^{\frac{2}{n-1}}$ and $1-\sigma^{2}<1$.

probability of a correct decision under secret voting is at least as large as under public voting, i.e.:

$$\Pi^{\mathsf{s}} \min\left\{1-\tfrac{1}{2}\left(1-\sigma\right)^{n}, \textstyle\sum_{i=(n+1)/2}^{n}\binom{n}{i}\left(\sigma+\tfrac{1}{2}\left(1-\sigma\right)\right)^{i}\left(\tfrac{1}{2}\left(1-\sigma\right)\right)^{n-i}\right\}$$

$$\geq \Pi^{\mathsf{p}} = \textstyle\sum_{i=(n+1)/2}^{n}\binom{n}{i}\left(\sigma+\tfrac{1}{2}\left(1-\sigma\right)\right)^{i}\left(\tfrac{1}{2}\left(1-\sigma\right)\right)^{n-i} \quad \blacksquare$$

C.10 Proposition 7

Note, first, that:

$$\overline{\gamma}_{part}^{\mathsf{p}} - \overline{\gamma}_{part}^{\mathsf{s}} = \left(\frac{n-1}{n}\right)\frac{2^{n}\sigma}{\binom{n-1}{(n-1)/2}\left(1+\sigma\right)^{\frac{n+1}{2}}\left(1-\sigma\right)^{\frac{n-1}{2}}}\phi$$

Thus, it follows that:

$$\frac{\partial\{\overline{\gamma}_{part}^{\mathsf{p}}-\overline{\gamma}_{part}^{\mathsf{s}}\}}{\partial\phi} = \frac{2^{n}(n-1)\sigma}{n\binom{n-1}{(n-1)/2}(1+\sigma)^{\frac{n+1}{2}}(1-\sigma)^{\frac{n-1}{2}}} > 0$$

Furthermore, we have:

$$\frac{\partial\{\overline{\gamma}_{part}^{\mathsf{p}}-\overline{\gamma}_{part}^{\mathsf{s}}\}}{\partial\sigma} = \frac{2^{n}(n-1)\phi}{n\binom{n-1}{(n-1)/2}}\frac{(1+\sigma)^{\frac{n+1}{2}}(1-\sigma)^{\frac{n-1}{2}}}{\left((1+\sigma)^{\frac{n+1}{2}}(1-\sigma)^{\frac{n-1}{2}}\right)^{2}}\left[1-\sigma\left(\frac{n+1}{2}\frac{1}{1+\sigma}-\frac{n-1}{2}\frac{1}{1-\sigma}\right)\right] > 0 \ ,$$

since $1-\sigma\left(\frac{n+1}{2}\frac{1}{1+\sigma}-\frac{n-1}{2}\frac{1}{1-\sigma}\right) > 0$.[6]

Next, note that:

$$\overline{\gamma}_{full}^{\mathsf{s}} - \overline{\gamma}_{full}^{\mathsf{p}} = \left(\frac{n-1}{n}\right)\frac{1}{\left(1+\frac{n-3}{2}\sigma\right)\left(1-\sigma\right)^{n-2}}\phi$$

Thus, it follows that:

$$\frac{\partial\{\overline{\gamma}_{full}^{\mathsf{s}}-\overline{\gamma}_{full}^{\mathsf{p}}\}}{\partial\phi} = \left(\frac{n-1}{n}\right)\frac{1}{\left(1+\frac{n-3}{2}\sigma\right)(1-\sigma)^{n-2}} > 0$$

Moreover, we have:

$$\frac{\partial\{\overline{\gamma}_{full}^{\mathsf{s}}-\overline{\gamma}_{full}^{\mathsf{p}}\}}{\partial\sigma} = -\frac{n-1}{n\left(\left(1+\frac{n-3}{2}\sigma\right)(1-\sigma)^{n-2}\right)^{2}}\left[\frac{n-3}{2}\left(1-\sigma\right)-\left(1+\frac{n-3}{2}\sigma\right)\left(n-2\right)\right]\left(1-\sigma\right)^{n-3} > 0,$$

since $\frac{n-3}{2}\left(1-\sigma\right)-\left(1+\frac{n-3}{2}\sigma\right)\left(n-2\right) = \frac{-n+1}{2}-\frac{n-3}{2}\sigma-\left(n-2\right)\frac{n-3}{2}\sigma < 0.$ $\blacksquare$

C.11 Proposition 8

Preliminaries. Under the assumption that career concerns are proportional to $r_i^{\omega,\lambda} \equiv \Pr(\tau_i = c|\omega, \mathcal{I}^{\lambda})$, the expected career concern reward of a committee member under public and secret voting

[6] Note that this inequality can be re-written as $(1+\sigma)(1-\sigma) > \sigma(1-\sigma n)$, so that $\sigma^2(n-1)+(1-\sigma) > 0$, which always holds.

are given, respectively, by:

$$\widetilde{r}^{\omega,\mathsf{p}}\left(v_i\right)=\sum\nolimits_{m\in\{A,\emptyset,B\}}\Pr(t=\mathsf{c}|v=m,\omega).\mathbb{I}_{\{v_i=m\}} \tag{C.45}$$

and

$$\widetilde{r}^{\omega,\mathsf{s}}\left(v_i\right)=\tfrac{1}{n}\sum\nolimits_{m\in\{A,\emptyset,B\}}\Pr(t=\mathsf{c}|v=m,\omega).(\mathbb{I}_{\{v_i=m\}}+\mathbb{E}(\sum\nolimits_{j\neq i}\mathbb{I}_{\{v_j=m\}})), \tag{C.46}$$

where, as before, the conditional probabilities $\Pr(t=\mathsf{c}|v=m,\omega)$, for $m\in\{A,\emptyset,B\}$, are computed based on the external evaluator's beliefs.

Moreover, note that for any $k,l\in\{A,\emptyset,B\}$, with $k\neq l$, we have that:

$$\widetilde{r}^{\omega,\mathsf{p}}\left(k\right)-\widetilde{r}^{\omega,\mathsf{p}}\left(l\right)=\Pr(t=\mathsf{c}|v=k,\omega)-\Pr(t=\mathsf{c}|v=l,\omega)$$

and

$$\widetilde{r}^{\omega,\mathsf{s}}\left(k\right)-\widetilde{r}^{\omega,\mathsf{s}}\left(l\right)=\frac{1}{n}\left(\Pr(t=\mathsf{c}|v=k,\omega)-\Pr(t=\mathsf{c}|v=l,\omega)\right)$$

Therefore, conditional on the evaluator's beliefs, the difference $\widetilde{r}^{\omega,\lambda}\left(k\right)-\widetilde{r}^{\omega,\lambda}\left(l\right)$ must always have the same sign under both voting rules, $\lambda\in\{\mathsf{p},\mathsf{s}\}$. Finally, note that the absolute difference between the career concern rewards associated with strategies k and l are always larger under public voting, i.e.:

$$|\widetilde{r}^{\omega,\mathsf{p}}\left(k\right)-\widetilde{r}^{\omega,\mathsf{p}}\left(l\right)|\geq|\widetilde{r}^{\omega,\mathsf{s}}\left(k\right)-\widetilde{r}^{\omega,\mathsf{s}}\left(l\right)| \tag{C.47}$$

This is the sense in which the "dilution effect" is still active in this version of the model.

Proof. Consider the behavior of a competent member whose bias is equal to the state of the world, $\beta_i=\omega$. The expected payoff of such an agent is given by:

$$U^{\beta_i=A,\lambda}(v_i,s_i=A)=\phi\widetilde{r}^{\omega=A,\lambda}(v_i)+\rho^{\omega=A}(v_i)\left(\alpha+\gamma\right) \tag{C.48}$$

and

$$U^{\beta_i=B,\lambda}(v_i,s_i=B)=\phi\widetilde{r}^{\omega=B,\lambda}(v_i)+\left(1-\rho^{\omega=B}(v_i)\right)\left(\alpha+\gamma\right), \tag{C.49}$$

depending on whether he is biased towards A or B, respectively.

Observe that necessary conditions for at least one type of competent member to prefer to vote against the state of the world when his bias is equal to the state are given by:

$$U^{\beta_i=A,\lambda}(v_i=B,s_i=A)\geq U^{\beta_i=A,\lambda}(v_i=A,s_i=A)$$

or

$$U^{\beta_i=B,\lambda}(v_i=A,s_i=B)\geq U^{\beta_i=B,\lambda}(v_i=B,s_i=B)$$

After some manipulations, we can rewrite the above conditions as:

$$\alpha + \gamma \leq \frac{\phi(\widetilde{r}^{\omega=A,\lambda}(B) - \widetilde{r}^{\omega=A,\lambda}(A))}{\rho^{\omega=A}(A) - \rho^{\omega=A}(B)} \tag{C.50}$$

or

$$\alpha + \gamma \leq \frac{\phi(\widetilde{r}^{\omega=B,\lambda}(A) - \widetilde{r}^{\omega=B,\lambda}(B))}{\rho^{\omega=B}(A) - \rho^{\omega=B}(B)} \tag{C.51}$$

Note that since the parameters α and γ are both assumed to be strictly positive, we must have that either $\widetilde{r}^{\omega=A,\lambda}(B) > \widetilde{r}^{\omega=A,\lambda}(A)$ or $\widetilde{r}^{\omega=B,\lambda}(A) > \widetilde{r}^{\omega=B,\lambda}(B)$ for at least one of the above conditions to hold.

Similarly, necessary conditions for at least one type of competent member to prefer to abstain when his bias is equal to the state are:

$$U^{\beta_i=A,\lambda}(v_i = \emptyset, s_i = A) \geq U^{\beta_i=A,\lambda}(v_i = A, s_i = A)$$

or

$$U^{\beta_i=B,\lambda}(v_i = \emptyset, s_i = B) \geq U^{\beta_i=B,\lambda}(v_i = B, s_i = B)$$

We can rewrite the above conditions as:

$$\alpha + \gamma \leq \frac{\phi(\widetilde{r}^{\omega=A,\lambda}(\emptyset) - \widetilde{r}^{\omega=A,\lambda}(A))}{\rho^{\omega=A}(A) - \rho^{\omega=A}(\emptyset)} \tag{C.52}$$

or

$$\alpha + \gamma \leq \frac{\phi\left(\widetilde{r}^{\omega=B,\lambda}(\emptyset) - \widetilde{r}^{\omega=B,\lambda}(B)\right)}{\rho^{\omega=B}(\emptyset) - \rho^{\omega=B}(B)} \tag{C.53}$$

Again, since the parameters α and γ are both strictly positive, we must have that either $\widetilde{r}^{\omega=A,\lambda}(\emptyset) > \widetilde{r}^{\omega=A,\lambda}(A)$ or $\widetilde{r}^{\omega=B,\lambda}(\emptyset) > \widetilde{r}^{\omega=B,\lambda}(B)$ for at least one of the above conditions to hold. ■

C.12 Proposition 9

Note that from equations ($C.50$) and ($C.51$) in the proof of Proposition 8, a necessary condition for a competent member with bias equal to the state of the world to vote against the state of the world is:

$$\alpha + \gamma \leq \max\left\{\frac{\phi(\widetilde{r}^{\omega=A,\lambda}(B) - \widetilde{r}^{\omega=A,\lambda}(A))}{\rho^{\omega=A}(A) - \rho^{\omega=A}(B)}, \frac{\phi(\widetilde{r}^{\omega=B,\lambda}(A) - \widetilde{r}^{\omega=B,\lambda}(B))}{\rho^{\omega=B}(A) - \rho^{\omega=B}(B)}\right\}, \tag{C.54}$$

whereas from equations ($C.52$) and ($C.53$), a necessary condition for agents of this type to abstain is given by:

$$\alpha + \gamma \leq \max\left\{\frac{\phi(\widetilde{r}^{\omega=A,\lambda}(\emptyset) - \widetilde{r}^{\omega=A,\lambda}(A))}{\rho^{\omega=A}(A) - \rho^{\omega=A}(\emptyset)}, \frac{\phi\left(\widetilde{r}^{\omega=B,\lambda}(\emptyset) - \widetilde{r}^{\omega=B,\lambda}(B)\right)}{\rho^{\omega=B}(\emptyset) - \rho^{\omega=B}(B)}\right\} \blacksquare \tag{C.55}$$

C.13 Proposition 10

An equilibrium where a competent member biased against the state of the world abstains can be sustained only if:

$$U^{\beta_i=A,\lambda}(v_i=\emptyset,s_i=B)\geq \max\{U^{\beta_i=A,\lambda}(v_i=B,s_i=B),U^{\beta_i=A,\lambda}(v_i=A,s_i=B)\}$$

or

$$U^{\beta_i=B,\lambda}(v_i=\emptyset,s_i=A)\geq \max\{U^{\beta_i=B,\lambda}(v_i=A,s_i=A),U^{\beta_i=B,\lambda}(v_i=B,s_i=A)\}$$

After some algebra, we can rewrite the above conditions as:

$$-\frac{\phi\left(\widetilde{r}^{\omega=B,\lambda}(\emptyset)-\widetilde{r}^{\omega=B,\lambda}(B)\right)}{\rho^{\omega=B}(\emptyset)-\rho^{\omega=B}(B)}\leq\gamma-\alpha\leq\frac{\phi(\widetilde{r}^{\omega=B,\lambda}(\emptyset)-\widetilde{r}^{\omega=B,\lambda}(A))}{\rho^{\omega=B}(A)-\rho^{\omega=B}(\emptyset)} \tag{C.56}$$

or

$$-\frac{\phi\left(\widetilde{r}^{\omega=A,\lambda}(\emptyset)-\widetilde{r}^{\omega=A,\lambda}(A)\right)}{\rho^{\omega=A}(A)-\rho^{\omega=A}(\emptyset)}\leq\gamma-\alpha\leq\frac{\phi\left(\widetilde{r}^{\omega=A,\lambda}(\emptyset)-\widetilde{r}^{\omega=A,\lambda}(B)\right)}{\rho^{\omega=A}(\emptyset)-\rho^{\omega=A}(B)} \tag{A.57}$$

Thus, the difference in absolute terms between the parameters α and γ cannot be too large. In fact, note that if α is much larger than γ, then the agent would have an incentive to vote for the correct alternative, whereas if γ is much larger than α, then the agent would have an incentive to vote in accordance with his bias. This proves part (i) of the proposition.

Next, suppose, for concreteness, that the state of the world is A and assume that a competent member biased towards B abstains in equilibrium, so that we must have:

$$U^{\beta_i=B,\lambda}(v_i=\emptyset,s_i=A)\geq U^{\beta_i=B,\lambda}(v_i=B,s_i=A) \tag{C.58}$$

Note that the above expression can be written as:

$$\phi\widetilde{r}^{\omega=A,\lambda}(\emptyset)+\rho^{\omega=A}(\emptyset)\alpha+\left(1-\rho^{\omega=A}(\emptyset)\right)\gamma\geq\phi\widetilde{r}^{\omega=A,\lambda}(B)+\rho^{\omega=A}(B)\alpha+\left(1-\rho^{\omega=A}(B)\right)\gamma$$

and re-arranging we get:

$$\phi(\widetilde{r}^{\omega=A,\lambda}(\emptyset)-\widetilde{r}^{\omega=A,\lambda}(B))+\left(\rho^{\omega=A}(\emptyset)-\rho^{\omega=A}(B)\right)\alpha\geq\left(\rho^{\omega=A}(\emptyset)-\rho^{\omega=A}(B)\right)\gamma$$

Observe that since the righ-hand side is positive, it must be the case that:

$$\phi(\widetilde{r}^{\omega=A,\lambda}(\emptyset)-\widetilde{r}^{\omega=A,\lambda}(B))+\left(\rho^{\omega=A}(\emptyset)-\rho^{\omega=A}(B)\right)\alpha\geq-\left(\rho^{\omega=A}(\emptyset)-\rho^{\omega=A}(B)\right)\gamma$$

Finally, the above inequality can be re-expressed as:

$$\phi\widetilde{r}^{\omega=A,\lambda}(\emptyset)+\rho^{\omega=A}(\emptyset)\left(\alpha+\gamma\right)\geq\phi\widetilde{r}^{\omega=A,\lambda}(B)+\rho^{\omega=A}(B)\left(\alpha+\gamma\right),$$

so that:

$$U^{\beta_i=A,\lambda}(v_i=\emptyset, s_i=A) > U^{\beta_i=A,\lambda}(v_i=B, s_i=A) \tag{C.59}$$

Therefore, a competent member biased towards A would never have the incentive to vote against the state of the world in this case. A similar argument applies to when the state of the world is B. This proves part (ii) of the proposition.

Next, suppose that beliefs are monotone, i.e. $\widetilde{r}^{\omega,\lambda}(v_i=\omega) \geq \widetilde{r}^{\omega,\lambda}(v_i \neq \omega)$ for $\omega \in \{A,B\}$. Note that, in this case, conditions $(C.56)$ and $(A.57)$ can rewritten as:

$$\alpha + \underbrace{\frac{\phi\left(\widetilde{r}^{\omega=B,\lambda}(B) - \widetilde{r}^{\omega=B,\lambda}(\emptyset)\right)}{\rho^{\omega=B}(\emptyset) - \rho^{\omega=B}(B)}}_{\geq 0} \leq \gamma \leq \alpha + \frac{\phi(\widetilde{r}^{\omega=B,\lambda}(\emptyset) - \widetilde{r}^{\omega=B,\lambda}(A))}{\rho^{\omega=B}(A) - \rho^{\omega=B}(\emptyset)} \tag{C.60}$$

or

$$\alpha + \underbrace{\frac{\phi\left(\widetilde{r}^{\omega=A,\lambda}(A) - \widetilde{r}^{\omega=A,\lambda}(\emptyset)\right)}{\rho^{\omega=A}(A) - \rho^{\omega=A}(\emptyset)}}_{\geq 0} \leq \gamma \leq \alpha + \frac{\phi\left(\widetilde{r}^{\omega=A,\lambda}(\emptyset) - \widetilde{r}^{\omega=A,\lambda}(B)\right)}{\rho^{\omega=A}(\emptyset) - \rho^{\omega=A}(B)}, \tag{C.61}$$

Therefore, the equilibrium can only exist if either $\frac{\phi(\widetilde{r}^{\omega=B,\lambda}(\emptyset) - \widetilde{r}^{\omega=B,\lambda}(A))}{\rho^{\omega=B}(A) - \rho^{\omega=B}(\emptyset)} \geq 0$ or $\frac{\phi\left(\widetilde{r}^{\omega=A,\lambda}(\emptyset) - \widetilde{r}^{\omega=A,\lambda}(B)\right)}{\rho^{\omega=A}(\emptyset) - \rho^{\omega=A}(B)} \geq 0$, that is a necessary (but not sufficient) condition for the equilibrium to exist is:

$$\widetilde{r}^{\omega=B,\lambda}(\emptyset) \geq \widetilde{r}^{\omega=B,\lambda}(A)$$

or

$$\widetilde{r}^{\omega=A,\lambda}(\emptyset) \geq \widetilde{r}^{\omega=A,\lambda}(B)$$

Assuming that the equilibrium exists, it must be the case (necessary condition) that:

$$\underline{\gamma}^{\lambda}_{abst}(\alpha, \phi, \sigma, n) \leq \gamma \leq \overline{\gamma}^{\lambda}_{abst}(\alpha, \phi, \sigma, n), \tag{C.62}$$

where the thresholds $\underline{\gamma}^{\lambda}_{abst}$ and $\overline{\gamma}^{\lambda}_{abst}$ can be defined as:

$$\underline{\gamma}^{\lambda}_{abst}(\alpha, \phi, \sigma, n) \equiv \min\left\{\alpha + \frac{\phi\left(\widetilde{r}^{\omega=B,\lambda}(B) - \widetilde{r}^{\omega=B,\lambda}(\emptyset)\right)}{\rho^{\omega=B}(\emptyset) - \rho^{\omega=B}(B)}, \alpha + \frac{\phi\left(\widetilde{r}^{\omega=A,\lambda}(A) - \widetilde{r}^{\omega=A,\lambda}(\emptyset)\right)}{\rho^{\omega=A}(A) - \rho^{\omega=A}(\emptyset)}\right\}$$

and

$$\overline{\gamma}^{\lambda}_{abst}(\alpha, \phi, \sigma, n) \equiv \max\left\{\alpha + \frac{\phi(\widetilde{r}^{\omega=B,\lambda}(\emptyset) - \widetilde{r}^{\omega=B,\lambda}(A))}{\rho^{\omega=B}(A) - \rho^{\omega=B}(\emptyset)}, \alpha + \frac{\phi\left(\widetilde{r}^{\omega=A,\lambda}(\emptyset) - \widetilde{r}^{\omega=A,\lambda}(B)\right)}{\rho^{\omega=A}(\emptyset) - \rho^{\omega=A}(B)}\right\},$$

where $\underline{\gamma}^{\lambda}_{abst}(\alpha, \phi, \sigma, n)$ and $\overline{\gamma}^{\lambda}_{abst}(\alpha, \phi, \sigma, n)$ are both larger than α. Furthermore, if the equilibrium exists, there must be at least one state of the world $\omega \in \{A, B\}$ such that:

$$\widetilde{r}^{\omega,\lambda}_{abst}(v_i=\emptyset) \geq \widetilde{r}^{\omega,\lambda}_{abst}(v_i=\sim\omega),$$

where $\sim\omega$ denotes a vote against the state of the world, for otherwise conditions $(C.60)$ and $(C.61)$ would certainly not hold. Thus, from the "dilution effect" (see inequality $(C.47)$ in Proposition 8), it follows that:

$$\widetilde{r}^{\omega,\mathtt{p}}_{abst}(v_i=\omega)-\widetilde{r}^{\omega,\mathtt{p}}_{abst}(v_i=\emptyset)\geq\widetilde{r}^{\omega,\mathtt{s}}_{abst}(v_i=\omega)-\widetilde{r}^{\omega,\mathtt{s}}_{abst}(v_i=\emptyset)$$

and

$$\widetilde{r}^{\omega,\mathtt{p}}_{abst}(v_i=\emptyset)-\widetilde{r}^{\omega,\mathtt{p}}_{abst}(v_i=\sim\omega)\geq\widetilde{r}^{\omega,\mathtt{s}}_{abst}(v_i=\emptyset)-\widetilde{r}^{\omega,\mathtt{s}}_{abst}(v_i=\sim\omega)$$

Therefore, we have:

$$\underline{\gamma}^{\mathtt{s}}_{abst}(\alpha,\phi,\sigma,n)\leq\underline{\gamma}^{\mathtt{p}}_{abst}(\alpha,\phi,\sigma,n)$$

and

$$\overline{\gamma}^{\mathtt{s}}_{abst}(\alpha,\phi,\sigma,n)\leq\overline{\gamma}^{\mathtt{p}}_{abst}(\alpha,\phi,\sigma,n),$$

which proves part (iii) of the proposition. ∎

Appendix D. Model for Lab Experiment

Consider a committee of three members, $n=3$, with uniform prior, $q=\frac{1}{2}$, and symmetric distribution of both bias, $p=\frac{1}{2}$, and competence types, $\sigma=\frac{1}{2}$. Assume that the career concern reward associated with a correct vote is exogenous and given by R^{λ} for $\lambda\in\{\mathtt{p},\mathtt{s}\}$.

D.1 Fully Competent Equilibrium

Suppose that all committee members act in accordance with a fully competent equilibrium and consider the behavior of a competent member biased against the state of the world. Note that for agents of this type the expected utility of voting in accordance with the state of the world is:

$$U^{\beta,\lambda}_{full}\left(v_i=s_i,s_i\neq\beta\right)=\alpha+R^{\lambda},$$

while the expected utility of voting in accordance with his or her bias is:

$$U^{\beta,\lambda}_{full}\left(v_i=\beta,s_i\neq\beta\right)=\frac{1}{2}\alpha+\frac{1}{2}\gamma$$

Therefore, the condition for a competent member to always prefer to vote correctly in equilibrium is:

$$\alpha+R^{\lambda}\geq\frac{1}{2}\alpha+\frac{1}{2}\gamma\;\Rightarrow\;\gamma\leq\alpha+2R^{\lambda}\tag{D.1}$$

Now, consider the behavior of an incompetent member. Observe that for agents of this type the expected utility of abstaining is:

$$U^{\beta,\lambda}_{full}\left(v_i=\emptyset,s_i=\emptyset\right)=\frac{7}{8}\alpha+\frac{1}{2}\gamma,$$

while the expected utility of voting in accordance with his or her bias is:

$$U^{\beta,\lambda}_{full}\left(v_i=\beta, s_i=\emptyset\right)=\frac{3}{4}\alpha+\frac{3}{4}\gamma+\frac{1}{2}R^{\lambda}$$

Thus, the condition for an incompetent member to always prefer to abstain in equilibrium is:

$$\frac{7}{8}\alpha+\frac{1}{2}\gamma\geq\frac{3}{4}\alpha+\frac{3}{4}\gamma+\frac{1}{2}R^{\lambda}\;\Rightarrow\;\gamma\leq\frac{1}{2}\alpha-2R^{\lambda} \tag{D.2}$$

Finally, note that the condition on incompetent members $(D.2)$ is always harder to satisfy than condition on competent members $(D.1)$, so that a fully competent equilibrium can be sustained if, and only if:

$$\gamma\leq\frac{1}{2}\alpha-2R^{\lambda} \tag{D.3}$$

D.2 Partially Competent Equilibrium

Next, suppose that all committee members act in accordance with a partially competent equilibrium and consider the behavior of a competent member biased against the state of the world. Note that for agents of this type the expected utility of voting in accordance with the state of the world is:

$$U^{\beta,\lambda}_{part}\left(v_i=s_i, s_i\neq\beta\right)=\frac{15}{16}\alpha+\frac{1}{16}\gamma+R^{\lambda},$$

while the expected utility of voting in accordance with his or her bias is:

$$U^{\beta,\lambda}_{part}\left(v_i=\beta, s_i\neq\beta\right)=\frac{9}{16}\alpha+\frac{7}{16}\gamma$$

Therefore, the condition for a competent member to always prefer to vote correctly in equilibrium is:

$$\frac{15}{16}\alpha+\frac{1}{16}\gamma+R^{\lambda}\geq\frac{9}{16}\alpha+\frac{7}{16}\gamma\;\Rightarrow\;\gamma\leq\alpha+\frac{8}{3}R^{\lambda} \tag{D.4}$$

Now, consider the behavior of an incompetent member. Observe that for agents of this type the expected utility of abstaining is:

$$U^{\beta,\lambda}_{part}\left(v_i=\emptyset, s_i=\emptyset\right)=\frac{3}{4}\alpha+\frac{1}{2}\gamma,$$

while the expected utility of voting in accordance with his or her bias is:

$$U^{\beta,\lambda}_{part}\left(v_i=\beta, s_i=\emptyset\right)=\frac{3}{4}\alpha+\frac{11}{16}\gamma+\frac{1}{2}R^{\lambda}$$

Thus, the condition for an incompetent member to prefer to vote in accordance with his bias rather than to abstain is given by:

$$\frac{3}{4}\alpha+\frac{11}{16}\gamma+\frac{1}{2}R^{\lambda}\geq\frac{3}{4}\alpha+\frac{1}{2}\gamma\;\Rightarrow\;\frac{3}{16}\gamma+\frac{1}{2}R^{\lambda}\geq 0 \tag{D.5}$$

Note that this condition is always satisfied, so that we can guarantee that incompetent members do not have any incentive to deviate from the equilibrium.

Therefore, it follows that a partially competent equilibrium can be sustained if, and only if:

$$\gamma \leq \alpha + \frac{8}{3}R^{\lambda} \tag{D.6}$$

D.3 Biased Equilibrium

Finally, suppose that all committee members act in accordance with a biased equilibrium and consider the behavior of a competent member biased against the state of the world. Note that for agents of this type the expected utility of voting in accordance with the state of the world is:

$$U_{bias}^{\beta,\lambda}\left(v_i = s_i, s_i \neq \beta\right) = \frac{3}{4}\alpha + \frac{1}{4}\gamma + R^{\lambda},$$

while the expected utility of voting in accordance with his or her bias is:

$$U_{bias}^{\beta,\lambda}\left(v_i = \beta, s_i \neq \beta\right) = \frac{1}{4}\alpha + \frac{3}{4}\gamma$$

Therefore, the condition for a competent member to always prefer to vote for his or her bias in equilibrium is:

$$\frac{3}{4}\alpha + \frac{1}{4}\gamma + R^{\lambda} \leq \frac{1}{4}\alpha + \frac{3}{4}\gamma \ \Rightarrow \ \gamma \geq \alpha + 2R^{\lambda} \tag{D.7}$$

Next, consider the behavior of an incompetent member. Observe that for agents of this type the expected utility of abstaining is:

$$U_{bias}^{\beta,\lambda}\left(v_i = \emptyset, s_i = \emptyset\right) = \frac{1}{2}\alpha + \frac{1}{2}\gamma,$$

while the expected utility of voting in accordance with his bias is:

$$U_{bias}^{\beta,\lambda}\left(v_i = \beta, s_i = \emptyset\right) = \frac{1}{2}\alpha + \frac{3}{4}\gamma + \frac{1}{2}R^{\lambda}$$

Thus, the condition for an incompetent member to prefer to vote in accordance with his bias rather than to abstain is given by:

$$\frac{1}{2}\alpha + \frac{3}{4}\gamma + \frac{1}{2}R^{\lambda} \geq \frac{1}{2}\alpha + \frac{1}{2}\gamma \ \Rightarrow \ \frac{1}{4}\gamma + \frac{1}{2}R^{\lambda} \geq 0 \tag{D.8}$$

Note that this condition is always satisfied, so that, consistently with Lemma 3, incompetent members do not have any incentive to deviate from the equilibrium in this case.

Therefore, it follows that a biased equilibrium can be sustained if, and only if:

$$\gamma \geq \alpha + 2R^{\lambda} \ \blacksquare \tag{D.9}$$

Appendix E. Experiment Instructions

This section presents the English version of the experiment instructions for treatments Low/Secret and Low/Public.[7] See Figures E.1 and E.2 for a depiction of the two main screens of the experiment.

Instructions

Thank you for your participation! The goal of this study is to investigates how people make decisions in group. You will be paid 2 euros for your presence. Your total earnings will depend partly on your decisions, partly on the decisions of other participants, and partly on chance. Your gains will be calculated in points and will be converted in euros at the rate of 1 euro per 80 points. You will be paid in cash at the end of the experiment.

During the experiment, you are not allowed to communicate with anyone. Please turn off your cell phone. If you have any question, please raise your hand.

This study is divided in 2 parts. We will begin by reading the instructions for the first part. Please, pay careful attention. After the instructions are read, there will be a short comprehension quiz.

First Part

This part consists of 32 rounds. The first two rounds are practice rounds and will not be paid. All other rounds are paid.

Groups. We begin every round by randomly dividing you into groups of three people. Every group receives one color: Blue or Yellow. In each round, your group's color may be Blue or Yellow with equal probability. The color of your group may be different from the colors of other groups and may change from one round to another. The computer will randomly choose your group's color in every round. Some people observe their group's color, while others do not.

Votes. In each round, your group will choose one color by voting. Each member of the group may vote for Blue, vote for Yellow or abstain. Whichever color receives more votes is the group's choice. Ties are broken randomly by the computer. Examples:

i. If the number of votes for Blue is 2, the number of votes for Yellow is 1 and the number of abstentions is 0, then Blue is the group's choice;

ii. If the number of votes for Blue is 0, the number of votes for Yellow is 2 and the number of abstentions is 1, then Yellow is the group's choice;

[7] The full set of instructions in Italian is available upon request.

iii. If the number of votes for Blue is 1, the number of votes for Yellow is 1 and the number of abstentions is 1, then we have a tie and the group's choice will be Blue or Yellow with equal probability;

iv. If all members of the group abstain, then we have a tie and the group's choice will be Blue or Yellow with equal probability.

Messages. Before voting, each of you will receive a message that may reveal the color of your group. There are three types of message.

1. The message says: "*The color of your group is Blue.*" In this case, you know for sure that your group's color is Blue.

2. The message says: "*The color of your group is Yellow.*" In this case, you know for sure that your group's color is Yellow.

3. The message says: "*The color of your group is Blue or Yellow with equal probability.*" In this case, the message does not provide any additional information with respect to what was already known.

Messages 1 and 2 are informative messages, while the third one is an uninformative message. In every round, half of the people in this room will receive an uninformative message, while the other half will receive an informative message and, therefore, will know exactly what is the color of their groups. For every group, there are four possible cases.

1. All members of the group know the group's color;

2. Two members of the group know the group's color while one member does not know;

3. One member of the group knows the group's color while two members do not know;

4. No member of the group knows the group's color.

Why does your vote matter? Your payoff in a given round depends on the choice made by your group, which is the color that receives the largest number of votes. If your group chooses the alternative that matches your group's color, then all members of the group receive 10 points; otherwise, everyone receives zero points.

Roles. Your payoff also involves an additional component that depends on your "role". In every round, the computer will randomly assign a role to each of you, which can be either Blue or Yellow. In every round, half of the people in this room will receive the Blue role and the other half will receive the Yellow role. Your role in a given round does not depend on the role of other members of your group nor on your role in previous rounds. For a given group, the number of members with the Blue role can be 3, 2, 1 or none. Your role is not known by anyone except you. If your group's choice is equal to your role, then you receive 1 extra point; otherwise, you receive no extra point.

Examples. Suppose that your role is Blue. The following table summarizes all possible payoffs in this case:

	Group's Color	Group's Choice	Group's Choice = Group's Color		Group's Choice = Role	Total Payoff
i	Blue	Blue	10	+	1	11
ii	Yellow	Yellow	10	+	0	10
iii	Yellow	Blue	0	+	1	1
iv	Blue	Yellow	0	+	0	0

The first line corresponds to the case where your group's color is Blue and your group's choice is Blue. In this case, your total payoff is 11 points: 10 points because your group's choice is equal to your group's color plus 1 extra point because your group's choice is equal to your role. In the second line, we have, instead, the case where your group's color is Yellow and your group's choice is Yellow. In this case, your total payoff is 10 points because your group's choice is equal to your group's color but not equal to your role. Next, in the third line, your group's color is Yellow and your group's choice is Blue. In this case, your total payoff is 1 point because your group's choice is equal to your role, but not equal to your group's color. Finally, in the fourth line, your payoff is zero, because your group's choice is neither equal to your group's color nor to your role.

Similarly, suppose that your role is Yellow. The following table summarizes all possible payoffs in this case:

	Group's Color	Group's Choice	Group's Choice = Group's Color		Group's Choice = Role	Total Payoff
i	Yellow	Yellow	10	+	1	11
ii	Blue	Blue	10	+	0	10
iii	Blue	Yellow	0	+	1	1
iv	Yellow	Blue	0	+	0	0

The first line corresponds to the case where your group's color is Yellow and your group's choice is Yellow. In this case, your total payoff is 11 points: 10 points because your group's choice is equal to your group's color plus 1 extra point because your group's choice is equal to your role. In the second line, we have, instead, the case where your group's color is Blue and your group's choice is Blue. In this case, your total payoff is 10 points because your group's choice is equal to your group's color but not equal to your role. Next, in the third line, your group's color is Blue and your group's choice is Yellow. In this case, your total payoff is 1 point because your group's choice is equal to your role, but not equal to your group's color. Finally, in the fourth line, your payoff is zero, because your group's choice is neither equal to your group's color nor to your role.

Summary. To conclude, please remember the following information.

- At the beginning of each round, you will see a screen with information about your message and your role.
- In every round, the number of members of your group who know the group's color can be 3, 2, 1 or none.
- In every round, the number of members of your group with the Blue role can be 3, 2, 1 or none.
- You can vote for Blue, vote for Yellow or abstain. Remember that the group's choice is taken by majority and that ties are broken randomly by the computer.
- After every round, you will be able to see what were your group's color and choice in that round. You will also receive information about your payoff and how many members of your group voted for Blue, voted Yellow and abstained.
- Your payoff in every round is determined by the sum of two components:

If your group's choice is equal to your group's color, then all members of the group earn 10 points. Otherwise, everyone gets zero points.

  +

If your group's choice is equal to your role, then you earn 1 extra point. Otherwise, you get zero extra points.

- Remember that the decision of each group is independent of the decisions of other groups and that new groups are formed randomly in every round.

Second Part

The second part of the experiment is almost exactly the same as the first part, with a single difference. In the first part, your payoff depended on your group's choice, your group's color and your role. In this part of the experiment, your payoff will depend on your group's choice, your group's color, your role and on *how you vote*. In particular, if you vote for your group's color, you will now earn 9 extra points. Otherwise, if you vote for a color that is different than your group's color or if you abstain, you will earn zero extra points. For example, if you vote for Yellow and your group's color is Yellow, then you receive 9 extra points independently of what your group chooses. Remember that you still earn 10 points if your group's choice is equal to your group's color and 1 extra point if your group's choice is equal to your role.

Examples. Suppose that your role is Blue and that you voted for Blue. The following table summarizes all possible payoffs in this case:

	Group's Color	Group's Choice	Group's Choice = Group's Color		Group's Choice = Role		Vote = Group's Color	Total Payoff
i	Blue	Blue	10	+	1	+	9	20
ii	Yellow	Yellow	10	+	0	+	0	10
iii	Yellow	Blue	0	+	1	+	0	1
iv	Blue	Yellow	0	+	0	+	9	9

The first line corresponds to the case where your group's color is Blue and your group's choice is Blue. In this case, your total payoff is 20 points. You earn 10 points because your group's choice is equal to your group's color plus 1 extra point because your group's choice is equal to your role. These two components of your payoff are exactly the same as in the first part of the experiment, but now you also earn 9 extra points because you voted for your group's color. In the second line, we have, instead, the case where your group's color is Yellow and your group's choice is Yellow. In this case, your total payoff is 10 points because your group's choice is equal to your group's color, but not equal to your role, and you did not vote for your group's color. Next, in the third line, your group's color is Yellow and your group's choice is Blue. In this case, your total payoff is 1 point because your group's choice is equal to your role, but not equal to your group's color, and you did not vote for your group's color. Finally, in the fourth line, your payoff is 9, because you voted for your group's color, but your group's choice is neither equal to your group's color nor to your role.

Similarly, suppose that your role is Blue and that you voted for Yellow. The following table summarizes all possible payoffs in this case:

	Group's Color	Group's Choice	Group's Choice = Group's Color		Group's Choice = Role		Vote = Group's Color	Total Payoff
i	Blue	Blue	10	+	1	+	0	11
ii	Yellow	Yellow	10	+	0	+	9	19
iii	Yellow	Blue	0	+	1	+	9	10
iv	Blue	Yellow	0	+	0	+	0	0

The first line corresponds to the case where your group's color is Blue and your group's choice is Blue. In this case, your total payoff is 11 points, because your group's choice is equal to your group's color and to your role, but you did not vote for your group's color. In the second line, we have, instead, the case where your group's color is Yellow and your group's choice is Yellow. In this case, your total payoff is 19 points; $10 + 0$ points because your group's choice is equal to your group's color, but not equal to your role, plus 9 extra points because you voted for your group's color. Next, in the third line, your group's color is Yellow and your group's choice is Blue. In this case, your total payoff is 10 point because your group's choice is equal to your role, but not equal to your group's color, and you voted for your group's color. Finally, in the fourth line, your payoff is zero, because you did not vote for your group's color and your group's choice is neither equal to your group's color nor to your role.

Finally, suppose that your role is Blue and that you abstained. The following table summarizes all possible payoffs in this case:

	Group's Color	Group's Choice	Group's Choice = Group's Color		Group's Choice = Role		Vote = Group's Color	Total Payoff
i	Blue	Blue	10	+	1	+	0	11
ii	Yellow	Yellow	10	+	0	+	0	10
iii	Yellow	Blue	0	+	1	+	0	1
iv	Blue	Yellow	0	+	0	+	0	0

The first line corresponds to the case where your group's color is Blue and your group's choice is Blue. In this case, your total payoff is 11 points, because your group's choice is equal to your group's color and to your role, but you did not vote for your group's color. In the second line, we have, instead, the case where your group's color is Yellow and your group's choice is Yellow. In this case, your total payoff is 10 points, because your group's choice is equal to your group's color, but not equal to your role, and you did not vote for your group's color. Next, in the third line, your group's color is Yellow and your group's choice is Blue. In this case, your total payoff is 1 point because your group's choice is equal to your role, but not equal to your group's color, and you did not vote for your group's color. Finally, in the fourth line, your payoff is zero, because you did not vote for your group's color and your group's choice is neither equal to your group's color nor to your role.

In a similar way, you can calculate your payoffs in case your role is Yellow.

Summary. To conclude, please remember the following information.

- At the beginning of each round, you will see a screen with information about your message and your role.
- In every round, the number of members of your group who know the group's color can be 3,

2, 1 or none.

- In every round, the number of members of your group with the Blue role can be 3, 2, 1 or none.
- You can vote for Blue, vote for Yellow or abstain. Remember that the group's choice is taken by majority and that ties are broken randomly by the computer.
- After every round, you will be able to see what were your group's color and choice in that round. You will also receive information about your payoff and how many members of your group voted for Blue, voted Yellow and abstained.
- Your payoff in every round is determined by the sum of three components:

If your group's choice is equal to your group's color, then all members of the group earn 10 points. Otherwise, everyone gets zero points.

+

If your group's choice is equal to your role, then you earn 1 extra point. Otherwise, you get zero extra points.

+

If your vote is equal to your group's color, then you earn 9 extra points. Otherwise, you get zero extra points.

- Remember that the decision of each group is independent of the decisions of other groups and that new groups are formed randomly in every round.

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Online Appendix: Tables

Treatment	Periods	Obs	Uninformed Voters		
			Abstention (%)	Bias (%)	Against-Bias (%)
Low/Secret	1 – 10	360	39.17	50.56	10.28
	11 – 20	360	45.00	44.72	10.28
	21 – 30	360	48.33	43.33	8.33
Low/Public	1 – 10	360	19.44	65.28	15.28
	11 – 20	360	16.67	66.94	16.39
	21 – 30	360	20.83	62.22	16.94
High/Secret	1 – 10	360	11.11	85.83	3.06
	11 – 20	360	10.00	87.22	2.78
	21 – 30	360	6.94	90.83	2.22
High/Public	1 – 10	360	6.39	86.39	7.22
	11 – 20	360	6.11	82.50	11.39
	21 – 30	360	5.00	83.89	11.11

Table B.1. Learning Effects: Uninformed Subjects

Treatment	Periods	Obs	Informed Voters with Signal ≠ Bias		
			Signal (%)	Bias (%)	Abstention (%)
Low/Secret	1 – 10	180	94.44	1.67	3.89
	11 – 20	171	96.49	0.58	2.92
	21 – 30	169	97.04	2.37	0.59
Low/Public	1 – 10	178	96.07	3.93	0.00
	11 – 20	168	97.62	2.38	0.00
	21 – 30	178	99.44	0.56	0.00
High/Secret	1 – 10	170	25.88	61.18	12.94
	11 – 20	172	23.26	64.53	12.21
	21 – 30	175	16.57	64.57	18.86
High/Public	1 – 10	186	80.11	17.20	2.69
	11 – 20	192	81.25	14.06	4.69
	21 – 30	200	92.00	5.00	3.00

Table B.2. Learning Effects: Informed Subjects

Sequence	Treatment	Obs	Uninformed Voters		
			Abstention (%)	Bias (%)	Against-Bias (%)
Low/Secret – Low/Public	Low/Secret	810	47.65	43.46	8.89
	Low/Public	810	22.59	61.85	15.56
Low/Public – Low/Secret	Low/Secret	270	33.70	54.44	11.85
	Low/Public	270	8.15	73.70	18.15
High/Secret – High/Public	High/Secret	720	11.39	85.69	2.92
	High/Public	720	5.28	83.33	11.39
High/Public – High/Secret	High/Secret	360	5.28	92.50	2.22
	High/Public	360	6.94	86.11	6.94

Table B.3. Sequencing Effects: Uninformed Subjects

Sequence	Treatment	Obs	Informed Voters with Signal ≠ Bias		
			Signal (%)	Bias (%)	Abstention (%)
Low/Secret – Low/Public	Low/Secret	394	95.69	1.27	3.05
	Low/Public	390	97.69	2.31	0.00
Low/Public – Low/Secret	Low/Secret	126	96.83	2.38	0.79
	Low/Public	134	97.76	2.24	0.00
High/Secret – High/Public	High/Secret	341	13.49	70.38	16.13
	High/Public	395	82.28	14.43	3.29
High/Public – High/Secret	High/Secret	176	38.07	50.00	11.93
	High/Public	183	89.62	6.56	3.83

Table B.4. Sequencing Effects: Informed Subjects

Online Appendix: Figures

Figure E.1. Voting Screen

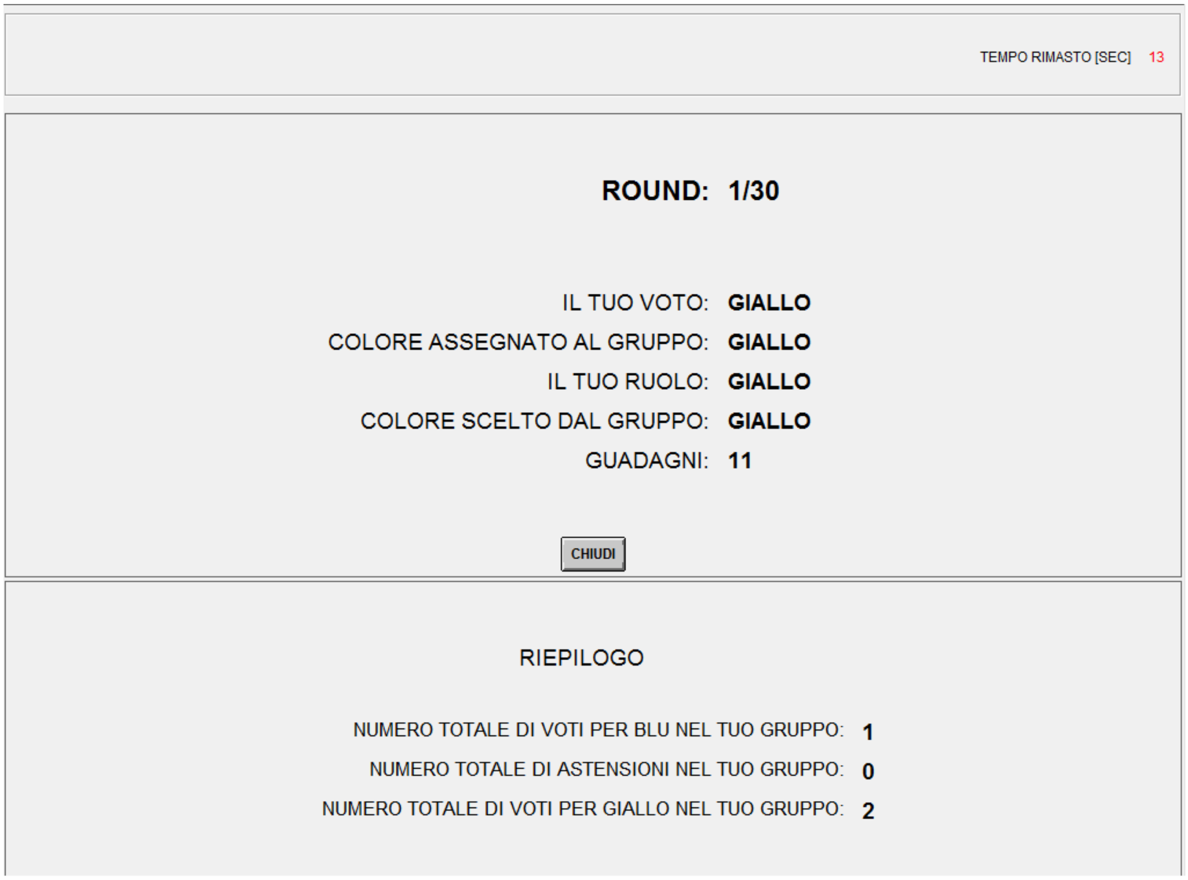

Figure E.2. Feedback Screen