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PIER Working Paper 18-022

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September 20, 2018

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Abstract

A Principal appoints a committee of partially informed experts to choose a policy. The experts' preferences are aligned with each other but conflict with hers. We study whether she gains from banning committee members from communicating or "deliberating" before voting. Our main result is that if the committee plays its preferred equilibrium and the Principal must use a threshold voting rule, then she does not gain from banning deliberation. We show using examples how she can gain if she can choose the equilibrium played by the committee, or use a non-anonymous or non-monotone social choice rule.

KEYWORDS: Information Aggregation, Committees, Deliberation, Collusion.
JEL: D7, D8

*We thank Mehmet Ekmekci, Ben Golub, Emir Kamenica, Navin Kartik, Max Mihm, Lucas Siga, and various seminar participants for helpful comments, and Garima Singhal for expert research assistance. Ali gratefully acknowledges financial support from the NSF (SES-1530639).

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1 Introduction

A Dean is considering whether to offer a recruiting slot to the economics department. She would like to hire good professors, not hire bad ones, and incurs a particular configuration of costs from making type 1 and type 2 errors. She delegates her choice to a committee of experts who assess the costs of those errors differently. For example, the committee may not find it so costly to hire a bad economist, or conversely, the committee may be less willing to expand the department. The Dean then faces two non-trivial choices:

- *Whom should she appoint to the committee and what social choice rule should she select?*
- *Should she ban the committee from drawing straw polls and communicating before their vote, or should she tolerate such deliberations?*

We pose these questions in a standard information aggregation framework. There is an unknown state of the world, and agents appointed to a committee obtain signals of that state. Each committee member makes a binary recommendation that is aggregated by a social choice rule that selects a binary action, i.e. whether to hire or not hire the job candidate. The Principal and the committee members have completely aligned preferences when the state is known, but *ex interim* there is imperfect information and signal profiles exist at which the Principal and committee members prefer different actions. All committee members are likeminded.

The Principal can choose the committee's composition, the social choice rule, and whether to permit committee members to *deliberate* (e.g., take a straw poll or secretly communicate) before their vote. Because the Principal's and agents' preferences differ, the Principal may wish to ban straw polls or any form of secret communication within the committee before the committee votes. After all, such communication permits committee members to perfectly coordinate their recommendations based on the joint signal profile and implement their (ex interim) preferred outcome. In contrast, banning deliberation prevents the committee from perfectly colluding in this manner against the Principal's preferred outcome. Nevertheless, committee members may still *tacitly collude* by coordinating on their favorite equilibrium in the voting game without communication.

Our main result speaks to whether the Principal gains from banning deliberation. We show that when restricted to monotone and anonymous social choice rules (i.e. threshold rules), which are frequently used in practice, she does not.

> **Theorem.** *If a committee adopts its most preferred equilibrium and the Principal uses a threshold rule, the highest payoff that the Principal achieves from banning deliberation is no more than her payoff from permitting deliberation.*

Our result argues that once a Principal has to contend with a committee that can tacitly collude, she may as well allow committee members to communicate with each other. She gains from banning deliberation only if she can select the equilibrium that is played by the committee in the voting game without communication or she uses non-standard social choice rules.

We view this result as one rationale for the prevalence of deliberative practices, where committee members often are given the chance to communicate prior to voting. In certain instances (e.g., a jury), one may view the Principal as sharing committee members' preferences, and so the use of deliberative practices appears natural. But in other cases where there is a clear conflict of interest, such as that of hiring and budgetary decisions, it may be puzzling as to why a Principal does not prohibit committee members from secretly communicating with each other. One response is that perhaps it is technologically costly to prohibit communication; another is that perhaps the binary voting environment coarsely filters the potentially rich information of experts, and so communication is needed. To isolate a new tension – namely, that the Principal cannot choose the equilibrium that is played – we preclude both of these rationales. We assume that it is technologically feasible to prohibit deliberation and that voters obtain identically distributed binary signals, so that there is no need for a finer communication language. Our result suggests that this new tension provides an additional reason for allowing communication: if committee members can tacitly collude, the Principal does not gain from banning deliberation.

Related Literature: The tension that we study—namely, that even if a designer is involved in designing the rules of the game, she may be unable to force agents to play her preferred equilibrium of that game—has been posed in mechanism design (Laffont and Martimort, 2000). In a mechanism, agents may collude both in reports made to a Principal and in participation decisions. In our context, "overt collusion" corresponds to deliberation, where committee members share all information with each other before reporting types to the Principal. By contrast, "tacit collusion" corresponds to committee members being unable to share information with each other, but being able to coordinate in equilibrium selection. We identify an equivalence from the Principal's perspective: after designing the committee optimally, she is affected identically by both forms of collusion.

We build on studies of committee decision-making with common interests, particularly McLennan (1998). Our focus is on the best equilibrium (from the committee's standpoint) with and without communication, and with such behavior in mind, how the Principal forms a committee and selects a social choice rule. Our message complements that of Coughlan (2000) and Gerardi and Yariv (2007) who establish equivalence results across threshold rules when committee members can communicate with each other before voting. Austen-Smith and Feddersen (2006) study when truthful communication among committee members is incentive-compatible, given the potential for disagreements within the committee. In such cases, deliberation may not be so costly to the Principal. By contrast, we show that even if committee members share perfectly aligned preferences, the Principal does not gain from banning deliberation.

Our paper also connects to work on communication with multiple senders. The study of cheap talk with multiple senders (Gilligan and Krehbiel, 1987; Krishna and Morgan, 2001; Battaglini,

2002) focuses on how the conflict of preferences within a committee of experts can be useful to elicit information. By contrast, we study the conflict between a Principal and a committee of like-minded experts. A series of papers study a setting similar to ours but focus on behavior when the Principal cannot commit to a social choice rule, and hence, messages are payoff-irrelevant.[1] Truthful communication is impeded by each agent anticipating that her report matters only on the margin for the Principal, and given the conflict of interest, agents are unwilling to report truthfully on the margin. We complement this literature by focusing on settings where the Principal can commit to a rule, and highlight the implications of tacit collusion by the committee members.

2 Model

2.1 Environment

Payoffs. A Principal faces a binary choice with uncertain payoffs, and delegates that choice to a committee of experts. The quality of that alternative is either low, $\omega = L$, or high, $\omega = H$. All players share a common prior that attributes probability $\pi \in (0,1)$ to high quality.

The Principal and committee share the same ordinal ranking over decision-quality pairs, but differ in the intensity of their preferences. All players receive a payoff of zero from accepting a high quality alternative or rejecting a low quality alternative. The Principal's payoff from accepting a low quality alternative is $-q_P$ and her payoff from rejecting a high quality alternative is $-(1-q_P)$. The analogous payoffs for a committee member are $-q_C$ and $-(1-q_C)$, respectively. We assume that $1 > q_P > q_C > 0$: because the Principal is worse off from accepting the low quality alternative, for every interior belief about the quality of the alternative, the committee is more willing to accept than the Principal.

	Low	High
Accept	$-q_P, -q_C$	$0, 0$
Reject	$0, 0$	$-(1-q_P), -(1-q_C)$

Figure 1: The Principal's and Committee Members' Payoffs.

Committee Design. If chosen to be on the committee, expert i obtains private information $s_i \in \{l, h\}$ about the quality of the alternative, where $\gamma^l = \Pr(s^i = l|L)$ and $\gamma^h = \Pr(s^i = h|H)$ denote the precision of his signal in each state. Without loss of generality, we assume that $\gamma^l \geq 1/2$ and $\gamma^h \geq 1/2$. No signal is perfectly informative ($\gamma^l < 1$ and $\gamma^h < 1$) and conditional on ω, signals are independent across experts. Let N be the number of available experts, which we assume to be finite. The Principal chooses a committee size $C \leq N$. Let $\mathcal{C}$ denote the set of committee members and $s \equiv (s_i)_{i \in \mathcal{C}}$ denote the committee signal profile.

[1] See Wolinsky (2002), Morgan and Stocken (2008), Battaglini (2016), and Gradwohl and Feddersen (2018).

Each committee member i simultaneously votes to accept or reject, $v_i \in \{A, R\}$. Denote the committee voting profile by $v \equiv (v_i)_{i \in \mathcal{C}}$. The Principal commits to a social choice rule $f : \{A, R\}^C \to \{0, 1\}$ to aggregate votes, where an alternative is accepted if $f(\cdot) = 1$ and otherwise is rejected. A social choice rule f is *monotone* if $f(R, v_{-i}) = 1$, then $f(A, v_{-i}) = 1$; *anonymous* if $f(v) = f(v')$ for all v' a permutation of v; and *non-constant* if $\exists v, v' \in \{A, R\}^C$ such that $f(v) \neq f(v')$. We refer to monotone and anonymous social choice rules as *threshold rules*, given that one can be implemented by accepting the alternative if the number of accept votes is above some threshold $k \in \{0, ..., C + 1\}$. Let $\mathcal{F}_C$ be the set of feasible social choice rules for a committee of size C, and let $\mathcal{F} \equiv \{F_C\}_{C \leq N}$ denote this set for each feasible committee size. We assume $\mathcal{F}_C$ is a subset of the set of non-constant social choice rules, and may also contain additional restrictions – for example, a restriction to threshold rules. We refer to (f, C) as the *committee design.*

No Deliberation. Suppose that the committee cannot share private information in any way before voting. In other words, there is *no deliberation.* A strategy for committee member i is a mapping $\sigma_i : \{l, h\} \to \Delta\{A, R\}$ from his private signal to (a distribution over) his vote. To simplify notation, let $\sigma_i(s_i)$ denote the probability with which he votes to accept following signal s_i. We say that committee member i votes *fully informatively* if $\sigma_i(h) = 1$ and $\sigma_i(l) = 0$.

Fixing a committee $\mathcal{C}$ of size C, let $\sigma \equiv (\sigma_i)_{i \in \mathcal{C}}$ denote a strategy profile and Σ_C denote the set of strategy profiles. Since committee members share common interests, they each earn an identical *ex ante* expected payoff $W(\sigma; f, C)$ from strategy profile σ when the Principal uses design (f, C). Let $\Sigma^*(f, C)$ denote the set of equilibrium strategy profiles for design (f, C) in the game without deliberation.

Definition 1. A committee **tacitly colludes** if it plays an equilibrium in the game without deliberation that maximizes the committee's payoff, $\sigma^* \in \arg\max_{\sigma \in \Sigma^*(f,C)} W(\sigma; f, C)$.

Tacit collusion corresponds to the committee behaving in a way that is committee-optimal (among equilibria). If the committee has multiple optimal equilibria, we assume that it resolves indifference in favor of an equilibrium that is optimal for the Principal. Let $\Sigma^*_T(f, C)$ denote the set of tacit collusive equilibria.

The Principal earns *ex ante* expected payoff $V(\sigma; f, C)$ from strategy profile σ when she chooses design (f, C). Therefore, when the committee engages in tacit collusion, the Principal's expected payoff is $V_T(f, C) = V(\sigma^*_T; f, C)$ for any $\sigma^*_T \in \Sigma^*_T(f, C)$. Given a set of feasible social choice rules $\mathcal{F}$, the best payoff that the Principal can achieve in any committee design under tacit collusion is

$$V^*_T(\mathcal{F}) = \max_{C \leq N} \max_{f \in \mathcal{F}_C} V_T(f, C). \tag{1}$$

Deliberation. Suppose the committee can freely communicate their private information with each other before voting, in other words, *deliberate.* One may envision a range of communication protocols, but given the simplicity of the environment that we consider, it suffices to study the following simple protocol. Suppose that, as in a *straw poll*, each committee member simultaneously sends the message h or l. Messages are publicly observed by all members of the committee, but not the Principal. Based on these messages, committee members vote on an alternative. In this game, we define overt collusion as follows.

Definition 2. A committee engages in **overt collusion** if it selects its most preferred equilibrium in the game with deliberation.

Let $V_O(f, C)$ be the Principal's expected payoff from using design (f, C) when the committee engages in overt collusion. The best payoff that the Principal can achieve in any committee design is

$$V_O^*(\mathcal{F}) = \max_{C \leq N} \max_{f \in \mathcal{F}_C} V_O(f, C). \tag{2}$$

2.2 Discussion of Model

Our model is a stylized model of deliberation and voting – we make a number of assumptions to simplify and sharpen the analysis. Importantly, committee members share pure common values, and information is binary. We view the pure common values environment as being appropriate to elucidate whether a Principal may wish to allow deliberation, even if all committee members truthfully reveal information to each other.[2]

We also restrict attention to identically distributed binary signals to isolate the effect of tacit collusion. An important complementary motive for permitting deliberation is that the binary action of voting may be too coarse to appropriately reflect the richness of voters' information. In a model with a richer or heterogeneous information structure, the power of tacit collusion would then be confounded with the gains from allowing a more expressive language through deliberation. To isolate the particular force that we study and obviate this orthogonal motive for deliberation, we assume that the action space of voting is as rich as the information space.

3 Banning Deliberation: An Irrelevance Result

The Principal's design problem involves choosing whether to delegate to a committee, a design (f, C), and whether to allow the committee to deliberate. We study how the Principal makes these choices when she anticipates that if deliberation is banned, then the committee will tacitly collude and play its preferred equilibrium.

Theorem 1. *If the Principal must use an anonymous and monotone social choice rule, then she does not gain from banning deliberation:* $V_T^*(\mathcal{F}) = V_O^*(\mathcal{F})$.

[2] If committee members had misaligned interests, they would not truthfully reveal information to each other (Austen-Smith and Feddersen, 2006; Gerardi and Yariv, 2007).

Our result offers a strategic rationale for the ubiquity of deliberation. Whenever the Principal uses an anonymous and monotone social choice rule—i.e., a threshold rule—then she may as well permit committee members to take a straw poll.

In Section 4, we show that the conditions for our results are tight. Namely, once the Principal can use a social choice rule that is non-monotone or non-anonymous, she can gain from banning deliberation. This result indicates a new and different rationale for non-standard social choice rules: namely, if a committee tacitly colludes, a non-monotone or non-anonymous rule may allow the Principal to sway the committee, despite its conflict of interest. Alternatively, if she can recommend the equilibrium that is played by the committee in the game without deliberation, then she can also sway the committee. In this case, she once again gains from banning deliberation.

In proving Theorem 1, we show that, regardless of the feasible set of social choice rules, the Principal can restrict attention to committees in which all members vote fully informatively in the committee's preferred equilibrium. When the Principal must use a threshold rule, for any committee size, there is (generically) a unique rule that induces fully informative voting and this rule implements the same outcome that arises under overt collusion. Therefore, the design problem reduces to deciding whether to delegate to a committee, and if so, what size committee to select (larger committees are not necessarily preferred). Banning or allowing deliberation is irrelevant, and the Principal selects the threshold rule that induces fully informative voting.

3.1 Proof of Theorem 1

We characterize equilibrium behavior for each type of collusion. Let us turn first to the case of overt collusion. The committee faces a common interest game and so the committee-optimal strategy is to truthfully reveal private information and then vote unanimously for the committee-preferred action given this information. In other words, for any committee design (f, C), the committee plays a voting profile v such that $f(v) = 1$ if and only if, given signal profile s, $P(\omega = H|s) \geq q_C$. The outcome, and therefore, the Principal's value from overt collusion, is the same for all (non-constant) social choice rules.

Lemma 0 (Overt Collusion)**.** *For every committee size C, $V_O(f, C) = V_O(f', C)$ for all $f, f' \in \mathcal{F}_C$.*

We omit a formal proof of Lemma 0, as its clear logic is exposited in the preceding discussion.

Our novel results are in the characterization of tacit collusion. Lemma 1 establishes that there exists a committee-optimal pure strategy equilibrium for any committee design. Moreover, for generic parameters, such an equilibrium is unique within the class of all strategy profiles (up to a re-ordering of player labels). Lemma 2 shows that once the committee is selecting its preferred equilibrium, it is without loss for the Principal to restrict attention to committee designs in which fully informative voting is the committee-optimal equilibrium.[3] Finally, Lemma 3 shows

[3] Persico (2003) establishes an analogue for Lemma 2 in the context of threshold rules (i.e. monotone and

that in any committee design with a threshold rule in which the committee-optimal equilibrium is fully informative voting in the game with tacit collusion, the Principal earns the same payoff as she would in the game with overt collusion.

Lemma 1. *For any committee design (f, C), there exists a committee-optimal equilibrium that is in pure strategies. Generically, in every committee-optimal equilibrium, all members who are pivotal with positive probability play a pure strategy.*

Proof. Given a committee (f, C), we say that a strategy profile σ is a committee-optimal strategy profile if $W(\sigma) \geq W(\sigma')$ for all $\sigma' \in \Sigma_C$. Such a strategy profile exists because W is continuous in $(\sigma_i(l), \sigma_i(h))$ for each i. McLennan (1998) establishes that every committee-optimal strategy profile is a Nash equilibrium.

First we show that there exists a committee-optimal strategy profile in pure strategies. The logic stems from the observation that a common interest game has a pure strategy profile maximizer, as all agents earn an identical payoff in any pure strategy profile and therefore, it can be mapped into a finite single-agent problem. To illustrate this explicitly, we begin with a committee-optimal strategy profile σ in which member i follows a strictly mixed strategy and construct a pure strategy profile with the same payoff. Let us denote the four different pure strategies for member i: $\tilde{\sigma}_{AA}$ is the strategy that involves voting to accept regardless of signal; $\tilde{\sigma}_{AR}$ is the strategy that involves informative voting; $\tilde{\sigma}_{RA}$ is the strategy that involves inverted voting, $\sigma_i(h) = 0$ and $\sigma_i(l) = 1$; and $\tilde{\sigma}_{RR}$ is the strategy that involves voting to reject regardless of signal. If member i is playing a mixed strategy, then he is randomizing between at least two of these pure strategies, $\tilde{\sigma}$ and $\tilde{\sigma}'$. For member i to be willing to randomize, it must be that $W(\tilde{\sigma}, \sigma_{-i}) = W(\tilde{\sigma}', \sigma_{-i})$. But then the strategy $(\tilde{\sigma}, \sigma_{-i})$ is also committee-optimal. Iterating through each committee member who randomizes results in a pure strategy profile $\tilde{\sigma}$ that is payoff-equivalent to σ, and therefore also a committee-optimal strategy profile. But then $\tilde{\sigma}$ is also an equilibrium strategy profile, and therefore there also exists a committee-optimal strategy profile in which all members follow a pure strategy.

We establish the second statement of Lemma 1 in Online Appendix A. □

Lemma 2. *Generically, for any committee design (f, C), there exists a committee design (f', C'), with $C' \leq C$, in which the committee-optimal equilibrium is for all committee members to vote informatively, such that $V_T(f, C) = V_T(f', C')$.*

Proof. For any subset of committee members $\mathcal{X} \subset \mathcal{C}$ and strategy σ, let $\sigma_{\mathcal{X}} \equiv (\sigma_i)_{i \in \mathcal{X}}$ be the strategy profile and $v_{\mathcal{X}} \equiv (v_i)_{i \in \mathcal{X}}$ be the voting profile for members in $\mathcal{X}$. Let σ^* be a committee-optimal pure strategy equilibrium for committee design $(f, \mathcal{C})$, with ex ante expected payoff $W(\sigma^*)$. In a pure strategy equilibrium, committee members either (i) always vote to accept; (ii) always vote to reject or (iii) reveal their private information either by voting informatively

anonymous social choice rules), restricting attention to "monotone" pure-strategy equilibria. We show that a more general conclusion holds across social choice rules and equilibria.

or inverted. Let $\mathcal{I} \subset \mathcal{C}$ be the subset of committee members who vote informatively or inverted and $\mathcal{U} = \mathcal{C} \setminus \mathcal{I}$ be the set of uninformative voters who either always accept or always reject when the committee plays σ^*.

First, we show that for any design in which some committee members vote uninformatively in the committee-optimal equilibrium, there is a design of equivalent value to the Principal in which no member votes uninformatively. Define a social choice rule $f' : \{A, R\}^{|\mathcal{I}|} \to \{0, 1\}$ such that f' implements the same outcome as social choice rule f when informative and inverted voters play profile $v_{\mathcal{I}}$ and uninformative voters play profile $v_{\mathcal{U}}$ corresponding to their constant strategy $\sigma^*_{\mathcal{U}}$. In other words, $f'(v_{\mathcal{I}}) = f(v_{\mathcal{I}}, v_{\mathcal{U}})$. Then $W'(\sigma^*_{\mathcal{I}}) = W(\sigma^*)$, where W' is the ex ante expected payoff for a committee member in design $(f', \mathcal{I})$. There cannot exist a $\sigma_{\mathcal{I}}$ such that $W'(\sigma_{\mathcal{I}}) > W'(\sigma^*_{\mathcal{I}})$; otherwise, it would also be possible to construct a strategy profile $\sigma = (\sigma_{\mathcal{I}}, \sigma^*_{\mathcal{U}})$ such that $W(\sigma) > W(\sigma^*)$, a contradiction. Therefore, $\sigma^*_{\mathcal{I}}$, which corresponds to all committee members voting informatively or inverted, is the committee-optimal equilibrium in design $(f', \mathcal{I})$. Both designs $(f, \mathcal{C})$ and $(f', \mathcal{I})$ result in the same outcome for any realized profile of private signals. Therefore, when the committee plays a committee-optimal equilibrium, the Principal's value of committee design $(f, \mathcal{C})$ is equal to the value of design $(f', \mathcal{I})$.

Next, we show that for any design in which some committee members vote inverted in the committee-optimal equilibrium, there is a design of equivalent value to the Principal in which all members vote informatively. Given design $(f', \mathcal{I})$, let $\mathcal{J} \subset \mathcal{I}$ be the set of members who play the inverted voting strategy and let $\alpha_i = \{v_{-i} | f(A, v_{-i}) \neq f(R, v_{-i})\}$ be the set of voting profiles at which member i is pivotal. Member i is willing to play the inverted voting strategy if he prefers to reject when he observes a high signal,

$$\sum_{a_{-i} \in \alpha_i} P(v_{-i}|h)(2f'(A, v_{-i}) - 1)(\mu(h, v_{-i}) - q_C) \leq 0$$

and he prefers to accept when she observes a low signal,

$$\sum_{a_{-i} \in \alpha_i} P(v_{-i}|l)(2f'(A, v_{-i}) - 1)(\mu(l, v_{-i}) - q_C) \geq 0$$

where $\mu(s, v_{-i})$ the posterior belief that the state is H at action profile v_{-i} when other players play strategy $\sigma^*_{\mathcal{I}}$ and member i observes signal s, and $P(v_{-i}|s)$ is the probability that member i believes that other players play v_{-i} when he observes signal s. Define a social choice rule $f'' : \{A, R\}^{|\mathcal{I}|} \to \{0, 1\}$ such that for $i \in \mathcal{J}$ and $v_{-i} \in \alpha_i$, $f''(A, v_{-i}) = f'(R, v_{-i})$ and $f''(R, v_{-i}) = f'(A, v_{-i})$. In other words, at the action profiles at which inverted voters are pivotal, invert the social choice rule. Then under f'', member i is willing to play an informative voting strategy, as this reverses the inequalities in the above incentive constraints. For any signal profile s, the same decision is taken under f' and f''. Therefore, changing f' does not interfere with the incentives of other members and the Principal's value of committee design $(f', \mathcal{I})$ is equal to the value of design $(f'', \mathcal{I})$. Note that in design $(f'', \mathcal{I})$, all committee members vote informatively in the committee-optimal equilibrium. $\square$

Lemma 3. *For any committee design (f, C) in which f is a threshold rule and a committee-optimal equilibrium under tacit collusion is fully informative voting for all committee members, $V_T(f, C) = V_O(f, C)$.*

Proof. Let (f, C) be a committee design in which f is a threshold rule and there exists a committee-optimal equilibrium in which all committee members vote fully informatively. Lemma 2 of Austen-Smith and Banks (1996) establishes that informative voting is an equilibrium if and only if the threshold rule is statistically optimal for the committee. Therefore, the decisions reached in a committee design (f, C) are identical under tacit and overt collusions, which establishes the conclusion. $\square$

These Lemmas establish Theorem 1: by Lemmas 1 and 2, there exists a committee-design (f^*, C^*) that is optimal under tacit collusion and induces informative voting. By Lemma 3, when f^* is a threshold rule, the payoffs achieved by the Principal must be identical to that of overt collusion.

4 When There are Gains from Banning Deliberation

In this section, we describe scenarios where banning deliberation benefits the Principal. We show that either if the Principal selects the equilibrium when she must use a threshold rule, or if the set of feasible social choice rules is not restricted to threshold rules, there are gains from banning deliberation.

In both cases, we consider a setting with three available committee members. Suppose that the prior is uniform, $\pi = 1/2$, and that the signal precision is symmetric across states, $\gamma^l = \gamma^h = \gamma$. Moreover, suppose that the payoff parameters are such that the committee strictly prefers to accept any alternative with at least two out of three favorable signals and strictly prefers to reject any alternative with one or fewer favorable signals. In contrast, the Principal strictly prefers to accept only those alternatives with three favorable signals and strictly prefers to reject alternatives with two or fewer favorable signals.[4]

No Collusion. We first illustrate how the Principal gains from banning deliberation when she can select the equilibrium played by the committee. In this example, she chooses a mixed strategy equilibrium for the committee, which gives each committee member a strictly lower payoff than the committee-optimal pure strategy equilibrium.

Consider the threshold rule in which the Principal accepts an alternative if it receives three accept votes, and otherwise rejects. We know that informative voting is not an equilibrium under this rule, since accepting an alternative if it receives at least two accept votes is the

[4] These parametric restrictions correspond to $q_C \in (1 - \gamma, \gamma)$ and $q_P \in (\gamma, \gamma^3/(\gamma^3 + (1 - \gamma)^3)$.

unique threshold rule that induces fully informative voting. We show that a symmetric mixed strategy equilibrium in which committee members vote to accept following a favorable signal and randomize between accept and reject following an unfavorable signal yields a higher payoff for the Principal that she attains under overt collusion.

Before delving into the calculations, we describe why the Principal benefits from banning deliberation when she can recommend an equilibrium for the committee. She sways the committee towards rejecting the alternative with positive probability when only two players receive favorable signals, as the player who receives an unfavorable signal mixes and rejects with positive probability. With deliberation, the committee would accept such an alternative. The Principal also sways the committee towards accepting the alternative with positive probability when the committee receives zero or one favorable signals, as any player who receives an unfavorable signal accepts with positive probability. Both the Principal and the committee prefer to reject such alternatives. We show that under parametric restrictions, the Principal's gain from the higher probability of rejecting an alternative with two favorable signals is greater than her loss from the higher probability of accepting an alternative with zero or one favorable signals, and therefore, the mixed strategy equilibrium yields a higher payoff than overt collusion. We graph the Principal's expected payoff below in Figure 2, and illustrate how she gains from a no-collusion mixed strategy equilibrium (in the game without deliberation) relative to overt collusion in two- or three-person committees.

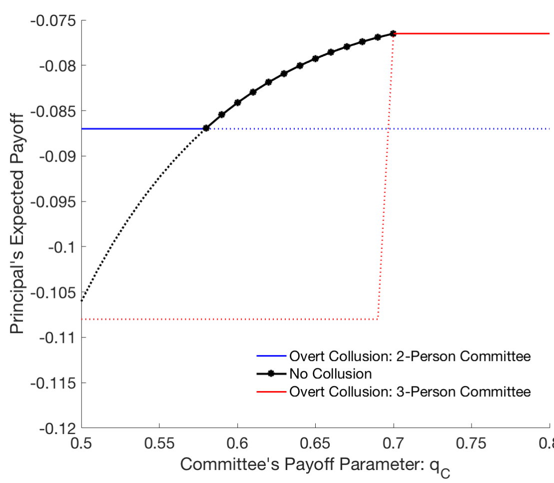

Figure 2: Banning collusion. The above figure sets $\gamma = 0.7$ and $q_P = 0.8$. In the intermediate region, the Principal's optimal design bans deliberation and selects a mixed strategy equilibrium in a 3−person committee.

In the game without deliberation, consider the mixed strategy profile in which each committee member votes to accept following $s_i = h$ and votes to accept with probability p following $s_i = l$. Committee member i is pivotal when the other two committee members vote to accept. He is indifferent between accepting and rejecting, conditioning on being pivotal and observing

$s_i = l$, if

$$\left(\frac{1-\gamma}{\gamma}\right)\left(\frac{\gamma + p(1-\gamma)}{1-\gamma+p\gamma}\right)^2 = \frac{q_C}{1-q_C}. \tag{3}$$

The solution to (3) characterizes the unique symmetric mixed strategy equilibrium of the form described above.[5] Moreover, for an open set of parameters, it is also the Principal's preferred equilibrium.[6] Therefore, if there are at most three committee members and the Principal can select the equilibrium, she benefits from banning deliberation.

Non-Anonymous Monotone Rule. Next, we illustrate how the Principal gains from banning deliberation if the social choice rule can be non-anonymous (but still must be monotone); an analogous example can be used to illustrate the same effect if the social choice rule can be non-monotone (even if it must be anonymous). Return to the three-member committee introduced above. Additionally, suppose that the committee members' payoff parameter is such that the committee prefers to accept the alternative based solely on the prior (i.e. $q_C < 1/2$). Consider the monotone and non-anonymous social choice rule described in Figure 3. This social choice rule involves player 1 having the ability to veto acceptance: if she votes to reject, then the alternative is rejected. If she votes to accept, then at least one of players 2 and 3 have to vote in favor for the alternative to be accepted. Thus, $1 = f(A, A, R) = f(A, R, A) \neq f(R, A, A) = 0$, illustrating the lack of anonymity. This social choice rule is monotone: switching any player's vote from rejection to acceptance, holding all other votes fixed, cannot switch the chosen action from acceptance to rejection.

Vote Profile: $(\mathbf{v_1}, \mathbf{v_2}, \mathbf{v_3})$	**Chosen Action**: $\mathbf{f}(\mathbf{v_1}, \mathbf{v_2}, \mathbf{v_3})$
$(A, A, A), (A, A, R)^*, (A, R, A)^*$	1 (accept)
$(R, R, R), (R, A, R), (A, R, R), (R, R, A), (R, A, A)^*$	0 (reject)

Figure 3: A Non-Anonymous Social Choice Rule, where the starred vote profiles indicate the lack of anonymity.

Before delving into the calculations, we describe the logic for why the Principal benefits from banning deliberation with this rule. The Principal sways the committee towards rejecting the alternative when player 1 obtains an unfavorable signal and players 2 and 3 each receive favorable signals. With deliberation, the committee would prefer to accept such an alternative. But without deliberation, f makes player 1 pivotal both in the cases where only one of players 2 and 3 are voting to accept and the case where *both* of them are doing so. Under parametric

[5] A solution exists, since the left hand side of (3) is continuous and decreasing in p, is equal to $\gamma/(1-\gamma) > q_C/(1-q_C)$ at $p = 0$, and is equal to $(1-\gamma)/\gamma < q_C/(1-q_C)$ at $p = 1$.

[6] We show numerically that this is the Principal's preferred equilibrium for an open set of parameters around $\gamma = .7$, $q_C = .65$ and $q_P = .8$. At these exact parameters, the Principal earns $V_N = -.0793$ in this mixed strategy equilibrium, while when allowing deliberation, she would earn $V_{O3} = -.1080$ with a three-member committee, $V_{O2} = -.0870$ with a two-member committee, $V_{O1} = -.1500$ with a one-member committee, and would earn $-.1000$ from not delegating to a committee and always rejecting. The probability of accepting following a low signal is quite small: for these exact parameters, it is $p_{eqm} = .0651$.

restrictions, pooling these three vote profiles maintains player 1's incentive to vote informatively, rather than switching to voting uninformatively in favor of the alternative. This leads the committee to reject the alternative when player 1 receives an unfavorable signal, even when players 2 and 3 receive favorable signals.

We formalize that logic below. If informative voting is a committee-optimal equilibrium under f, then the outcome induced by tacit collusion is identical to that induced by overt collusion unless the signal profile is (l, h, h). For that signal profile, tacit collusion leads to the alternative being rejected but overt collusion leads to the alternative being selected. Since the Principal prefers for the alternative to be rejected in this case, she benefits from banning deliberation. So for the Principal to gain from banning deliberation, it suffices to show that informative voting is a committee-optimal equilibrium of the game without deliberation.

Consider a strategy profile in which each committee member votes informatively. It is straightforward to see that each of members 2 and 3 has a strict incentive to vote informatively conditioning on being pivotal, since in both cases member 1 is voting A and the other member must be voting R. Consider member 1. He is pivotal when at least one of members 2 and 3 is voting in favor of the alternative. While he does not have an incentive to vote informatively when both members 2 and 3 vote in favor of the alternative, for generic parameter values of γ and q_C, it is still strictly optimal for member 1 to vote informatively when averaging across all voting profiles at which he is pivotal.[7] Not only is informative voting an equilibrium under f, but under our parametric restrictions, it is also the committee-optimal equilibrium.[8]

We have shown that the Principal is better off banning deliberation when there are three committee members. Moreover, her payoff from tacit collusion given a three-member committee is better than her payoff from overt collusion in a one or two-member committee, and under certain parametric restrictions, is better than rejecting all alternatives.[9] Therefore, if there are at most three committee members and the Principal can use a non-anonymous social choice rule, she benefits from banning deliberation.

5 Conclusion

Many organizations, firms, and legislatures rely on committees to evaluate proposals. It is often the case that the preferences of those who serve on these committees conflict with those of the Principal who appoints the committee. A ubiquitous feature of committee-design is that

[7] Voting informatively is an equilibrium for an open set of parameters around $\gamma = .7$ and $q_C = .49$.

[8] Given Lemma 1, it suffices to compare informative voting to each pure strategy equilibrium. We omit these straightforward calculations.

[9] It is straightforward to show that each smaller committee leads the Principal to accept the alternative on a strictly larger set of signal profiles than the full committee with no deliberation, which leads to a strictly lower payoff. A one-member committee will accept if the member receives a high signal, while a two-member committee will accept if there is at least one favorable signal (since $q_C < 1/2$). The Principal prefers the three-member committee with no deliberation to always rejecting for an open set of parameters around $\gamma = .7$, $q_C = .49$ and $q_P = .71$. At these exact parameters, she earns $-.1070$ when using this non-anonymous rule and $-.1450$ from not delegating and always rejecting.

committees are given opportunities to secretly deliberate, communicate, and coordinate prior to voting. This feature may appear puzzling insofar as the Principal may be hurt by allowing the committee to have this informational superiority.

One rationale for this procedure is technological: it may simply be too costly to ban deliberation. Our analysis offers a different, *strategic* rationale. In particular, we show that if the Principal anticipates that the committee can tacitly coordinate on a committee-optimal equilibrium if she bans deliberation, then she is not better off doing so than if she were to allow deliberation. In other words, she shouldn't ban straw polls, even if she can.

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A Online Appendix

Proof of second statement in Lemma 1. We first show that in any committee-optimal pure strategy profile σ, generically, any player who is pivotal with positive probability strictly prefers σ_i to any alternative strategy σ_i', i.e. $W(\sigma) > W(\sigma_i', \sigma_{-i})$. Let α_i be the set of action profiles at which member i is pivotal and let $\mu_\sigma(s_i, v_{-i})$ be the posterior belief that the state is H when other members play action profile v_{-i} and member i observes signal s_i. Let M be the set of posterior beliefs that can be induced by the signal profile for a subset of committee members. Given that all other members are playing a pure strategy, the support of μ_σ is a subset of M. Since M is a measure zero set for any finite committee size, $\operatorname{supp}\mu_\sigma$ is also a measure zero set. Similarly, let P_s be the set of probabilities of subsets of other members' signal profiles. Then the probability of any pure strategy action profile v_{-i} under strategy σ, denoted $P_\sigma(v_{-i})$, is in $P_s \cup \{0, 1\}$. The set P_s is also measure zero for any finite committee size. Member i is willing to mix between choosing to accept and reject at signal s_i if

$$\sum_{v_{-i} \in \alpha_i} P_\sigma(v_{-i})(2f(A, v_{-i}) - 1)(\mu_\sigma(s_i, v_{-i}) - q_C) = 0, \tag{4}$$

which holds for a measure zero set of q_C. If (4) does not hold for either signal, then member i strictly prefers a pure strategy. But then generically, all players strictly prefer the committee-optimal pure strategy σ. Therefore, a mixed strategy profile cannot achieve the same value as a committee-optimal pure strategy profile, as with positive probability, this results in committee members playing pure strategy profiles have a strictly lower payoff than $W(\sigma)$.