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Efficient Communication in Organizations

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in Organizations

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agents within the organization have the knowledge required for optimal decision-making; (ii)
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activities; and (iii) informed agents can discuss their strategies before being consulted. Under
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Abstract

Organizations design their communication structures to improve decision-making while limiting wasteful influence activities. An efficient communication protocol grants complete-information payoffs to all organization members, thereby overcoming asymmetric information problems at no cost. This paper characterizes efficient protocols assuming that: (i) some agents within the organization have the knowledge required for optimal decision-making; (ii) both the organization and consulted agents incur losses proportional to the exerted influence activities; and (iii) informed agents can discuss their strategies before being consulted. Under these assumptions, "public advocacy" is the unique efficient communication protocol. This result provides a novel rationale for public advocacy.

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Contents

1 Introduction

Communication is an essential part of organizations. Decision-makers (owners, top management) often rely on better-informed parties within the same firm (lower-level managers, division heads) to provide relevant information. An agency problem arises when the informed parties' objectives are not aligned with the decision-makers'. In these cases, there are two potential sources of inefficiency. First, informed agents may dissipate considerable resources in influence activities. Second, decision-makers may make wrong decisions due to being poorly informed or swayed. As a result, organizations must structure communication to minimize wasteful influence activities while maximizing decision-makers' accuracy. This paper is concerned with communication protocols that achieve this goal.

To analyze communication protocols, I study a costly signaling game between an uninformed receiver and one or more informed senders. The receiver must select one of two actions. Senders know which action is better for the receiver. When communicating, senders can misreport information at a cost that is tied to the size of the lie. These costs represent the resources senders allocate to influence the receiver's decision. For example, a manager who shifts subordinates' labor to fabricate data will have fewer resources for the organization's production activities. As a result, the manager may underperform or incur penalties. From the organization's perspective, these influence activities are unproductive and wasteful. Before making a decision, the receiver interacts with the senders in a way pre-determined by a communication protocol.

Communication protocols specify the organization's mode of communication: how many senders to consult, their relative standing over decision-making, and the confidentiality of their recommendations. For example, a protocol may instruct the receiver to consult only one sender that favors a particular action (such as the head of a division that would benefit from a specific investment). Alternatively, it may specify to consult in a private setting two senders with aligned goals (e.g., members of the same department). The focus of this paper is to identify and study efficient communication protocols. Efficiency requires that all players obtain their complete-information payoff. An efficient protocol is critical in organizations because it solves asymmetric information problems without dissipating resources in unproductive signaling.

An additional desirable property of communication protocols is their robustness to senders' collusion. To study robust protocols, I use the notion of "coalition-proofness" developed by Bernheim, Peleg, and Whinston (1987). This solution concept allows testing whether a protocol remains effective when players can engage in non-binding pre-play communication. It allows senders to discuss their strategies before consultation, but not to make commitments. For example, managers may share their intentions with each other before filing a report to the CEO. Even though managers are unable to make credible and

binding commitments, they may be able to coordinate with significant consequences. As we shall see, coalition-proofness turns out to be crucial for the main result.

The first part of the paper establishes necessary conditions for efficiency and robustness to collusion. Single-sender arrangements always result in wasteful persuasion attempts, whereas no communication results in inaccurate decision-making. It follows that multi-sender protocols are necessary for efficiency. They are also sufficient, as the receiver can exploit the senders' inability to coordinate persuasion by privately consulting more than one sender. However, private communication protocols are susceptible to collusion: senders can restore coordination by discussing their strategies before being summoned for consultation. There is no private protocol that is both efficient and resilient to collusion.

Public protocols prescribe consulting senders through a sequential and public procedure. These arrangements are neither efficient nor robust to collusion when senders have relatively aligned preferences over decision-making. In these cases, there are always contingencies where senders can coordinate persuasion either on the spot or through pre-play communication.

The second part of this paper focuses on the last type of arrangement left to analyze: the sequential and public consultation of senders with conflicting interests over decision-making. The main results show that this protocol, dubbed "public advocacy," is both efficient and robust to collusion. Importantly, it is the only communication protocol to have both these desirable properties. A characterization of the efficient equilibrium is provided, showing the mechanism through which the receiver achieves efficiency: the report delivered by the first speaker sets the burden of proof borne by the second speaker, who has to prove its case "beyond a reasonable doubt." The endogenously determined burden of proof ensures that both senders consistently report truthfully. As a result, the receiver learns their private information and makes fully informed decisions. No resources are wasted in the attempt to persuade the receiver. All players obtain the payoff they would get if there were no information asymmetries in the first place.

The rest of the paper is organized as follows. Section 2 reviews the related literature, and Section 3 presents the model. The main results are in Section 4. Section 5 discusses the model's assumptions and the robustness of the results. Finally, Section 6 concludes.

2   Literature

This paper contributes to the literature on organization design. In this line of work, Milgrom (1988) recognizes that influence activities constitute a direct opportunity cost for organizations. Milgrom (1988) focuses on restrictions of decision makers' discretion as a tool to limit these costs. Differently, the current paper is concerned with the design of

communication protocols that eliminate influence activities. Jehiel (1999) and Deimen and Szalay (2019) also study optimal information structures in organizations. In contrast with the current paper, they consider settings where there is no disagreement between players. Without an agency problem, influence activities are not a concern.

A strand of literature finds that optimal organization design results in advocacy structures. Dewatripont and Tirole (1999) study the optimal provision of incentives for information gathering. They consider settings with verifiable information and no agency problem. Battaglini (2002) takes a different approach by studying strategic communication with biased senders in a cheap talk framework. Both Dewatripont and Tirole (1999) and Battaglini (2002) make a case for "static" types of advocacy. By contrast, Krishna and Morgan (2001) show the optimality of a "sequential" kind of advocacy in a cheap talk model where senders engage in an extended debate. The current work differs from these papers in three key aspects. First, it is a model of partially verifiable information. Second, it studies settings where influence activities yield direct costs to the organization that are not informational. Third, the analysis includes a wider array of arrangements, showing that "public advocacy" is the only protocol with some desirable characteristics.[1]

In this model, influence activities are costly due to the presence of misreporting costs. The signaling structure considered here makes this paper related to the "costly talk" literature (Kartik, 2009; Kartik, Ottaviani, & Squintani, 2007; Ottaviani & Squintani, 2006). These papers are mainly concerned with the single-sender case. Vaccari (2021) considers the case where two senders with conflicting goals communicate simultaneously. As in traditional signaling models, the equilibria of these papers involve wasteful signaling expenditures. By contrast, Emons and Fluet (2009) construct an efficient equilibrium in a costly talk setting similar to the public advocacy protocol studied here. Differently from all these papers, the current work considers a larger class of communication protocols and equilibria. As a result, the role of collusion, which is central here, is absent in this literature.

3   The Model

There are $N \geq 1$ senders in the set $S = \{1, \dots, N\}$, and one receiver (r). Nature selects a state θ according to some distribution F with density f and full support in $\Theta = \mathbb{R}$. Only the senders observe the realized state. Then, depending on the setting, communication takes place either sequentially or simultaneously. In a sequential protocol, the order of communication is determined by senders' indexes $j \in S$, with sender 1 reporting first,

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[1]The organization's problem considered here cannot be appreciated by models where information is not partially verifiable: influence activities are impossible when information is fully verifiable, and they come at no cost when information is not verifiable as in cheap talk models.

and so on. When communicating, sender $j \in S$ delivers a report $r_j \in \Theta$ with the literal or exogenous meaning "the state is $\theta = r_j$." After observing all the senders' reports, the receiver selects an alternative a in the binary set $\{a^+, a^-\}$.

Payoffs.— Player $i \in S \cup \{r\}$ obtains a payoff of $u_i(a, \theta)$ when the receiver selects action a in state θ. Define player i's payoff-difference in state θ as $\Delta u_i(\theta) := u_i(a^+, \theta) - u_i(a^-, \theta)$. I assume that $\Delta u_i(\theta)$ is weakly increasing in θ for every $i \in S \cup \{r\}$. Under this assumption, the state can be interpreted as a vertical differentiation parameter measuring the relative appeal of a^+ with respect to a^-. I normalize the receiver's payoffs by setting $\Delta u_r(\theta) > 0$ for all $\theta > 0$, $\Delta u_r(\theta) < 0$ for all $\theta < 0$, and $\Delta u_r(0) \geq 0$. For every sender $j \in S$, either $\Delta u_j(\theta) > 0$ for some $\theta < 0$ or $\Delta u_j(\theta) < 0$ for some $\theta > 0$. I say that two senders j and i are opposed-biased if $\Delta u_i(0) \cdot \Delta u_j(0) < 0$, and are like-biased otherwise.

Costly talk.— Sender j incurs a finite cost $C_j(r_j, \theta)$ when delivering report r_j in state θ. The cost function C_j is strictly increasing in $|r_j - \theta|$ for all $r_j \in \Theta$, with $C_j(\theta, \theta) = 0$. That is, misreporting is increasingly costly in the size of the lie, whereas truthful reporting is costless. Sender j's total utility is[2] $w_j(r_j, a, \theta) = u_j(a, \theta) - C_j(r_j, \theta)$.

Strategies.— When communication is simultaneous, a pure strategy for sender j is a function $\rho_j : \Theta \to \Theta$. When communication is sequential, a pure strategy for sender j is a function $\rho_j : \Theta^j \to \Theta$. A profile of reports $\{r_j\}_{j=1}^N$ is off-path if, given the senders' strategies, $\{r_j\}_{j=1}^N$ will never be observed by the receiver. A posterior belief function for the receiver is a mapping $p : \Theta^N \to \Delta(\Theta)$ that, given the senders' reports, generates posterior beliefs $p(\theta \mid \{r_j\}_{j \in S})$. Given the senders' reports and posterior beliefs p, the receiver selects an action in the sequentially rational set β, where

$$\beta(\{r_j\}_{j \in S}) = \arg\max_{a \in \{a^+, a^-\}} \mathbb{E}_p[u_r(a, \theta) \mid \{r_j\}_{j \in S}].$$

I assume that the receiver selects a^+ when indifferent between the two alternatives.

Equilibrium.— The equilibrium concept is the perfect Bayesian equilibrium (PBE). To test for the protocols' robustness against collusion, I use the two related concepts of strong Nash equilibrium (Aumann, 1959) and coalition-proof Nash equilibrium (Bernheim et al., 1987). An equilibrium is *strong* if no coalition of players can jointly deviate so that all players in the coalition get strictly better payoffs; it is *coalition-proof* if it is resilient against those coalitional deviations that are self-enforcing.[3]

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[2]$\mathbb{1}\{\cdot\}$ is the indicator function.

[3]A coalition is self-enforcing if there is no proper sub-coalition that, taking fixed the action of its complement, can agree to deviate from the deviation in a way that makes all of its members better off. The type of group deviations considered by the notion of coalition-proofness is consistent with the model because it preserves its non-cooperative nature. For a formal definition of strong and coalition-proof Nash equilibrium, see Aumann (1959) and Bernheim et al. (1987), respectively. For a textbook definition of perfect Bayesian equilibrium, see Fudenberg and Tirole (1991).

3.1 Definitions

Here I define concepts that are useful for the analysis that follows. A discussion of the model's assumptions ensue in Section 5.

Reach.— I define the reach of sender j in state θ as the report which associated cost offsets j's potential gains. Formally, the reach of sender j in state θ is $\bar{r}_j(\theta) := \max\{r_j \in \mathbb{R}$ s.t. $|\Delta u_j(\theta)| = C_j(r_j, \theta)\}$ if $\Delta u_j(0) > 0$, and it is $\underline{r}_j(\theta) := \min\{r_j \in \mathbb{R}$ s.t. $|\Delta u_j(\theta)| = C_j(r_j, \theta)\}$ if $\Delta u_j(0) < 0$. Intuitively, in equilibrium sender j will never deliver reports higher than $\bar{r}_j(\theta)$ or lower than $\underline{r}_j(\theta)$, as these reports are strictly dominated by truthful reporting independently of the receiver's decision.

Protocols.— A communication protocol specifies the number N of informed senders asked to deliver a report, their relative preferences over the final decision, and whether they communicate simultaneously (privately) or sequentially (publicly).

Efficiency.— In an efficient equilibrium, all players obtain their respective complete-information payoffs: the receiver selects action a^+ when $\theta \geq 0$ and action a^- otherwise; senders always report truthfully, i.e., $\rho_j(\cdot, \theta) = \theta$ for every $j \in S$ and $\theta \in \Theta$. I refer to equilibria where senders always report truthfully as truthful. A communication protocol is efficient if it allows for an efficient equilibrium. Since truthful equilibria are fully revealing while non-truthful ones are wasteful, an equilibrium is efficient if and only if it is truthful.

4 Communication Protocols

The end goal of the first part of this section is to rule out communication protocols that are either inefficient or not robust to senders' collusion. A protocol with no senders is not efficient because it involves decision-making under risk. The following proposition shows that even single-sender protocols are not efficient.

Proposition 1 (Single-sender protocols). *There are no efficient PBE if $N = 1$.*

Proof. Consider a protocol where $N = 1$ and $\Delta u_1(0) > 0$ (the proof is similar for $\Delta u_1(0) < 0$). Suppose that there exists an efficient PBE where $\rho_1(\theta) = \theta$ for every $\theta \in \Theta$. The receiver's posterior beliefs are degenerate on $\theta = r_1$. Sender 1 can profitably deviate by delivering $r_1 \in [0, \bar{r}_1(\theta'))$ in some $\theta' < 0$ where $\bar{r}_1(\theta') > 0$, contradicting the existence of a PBE in truthful strategies. $\square$

Single-sender protocols are inefficient because there are always states in which the consulted sender misrepresents information. With no other source of advice, the receiver cannot cross-validate reports to spur truthful reporting. Proposition 1 implies that multi-sender protocols are necessary for efficiency. The following proposition considers

arrangements where the receiver privately (or simultaneously) consults multiple senders with any bias configuration.

Proposition 2 (Simultaneous communication). *Consider protocols with $N \geq 2$ senders that communicate simultaneously. Efficient PBE of these protocols are not coalition-proof.*

Proof. Consider first the case where all senders are like-biased, i.e., $\Delta u_j(0) > 0$ for all $j \in S$ (the proof is similar if $\Delta u_j(0) < 0$ for all $j \in S$). There exists an efficient PBE where $\rho_j(\theta) = \theta$ for every $j \in S$ and $\theta \in \Theta$, and beliefs p are such that $\beta(\{r_j\}_{j\in S}) = a^-$ if $r_i \neq r_k$ for some $i, k \in S$. Given strategies and beliefs, no sender has an incentive to deviate from truthful reporting. Posterior beliefs are pinned down by Bayes' rule only for the case $r_i = r_j$ for all $i, j \in S$. When all reports are identical, the receiver assigns probability 1 to $\theta = r_j$. Off-path beliefs ensure that individual deviations are not profitable.

However, efficient equilibria of this configuration are not coalition-proof. Consider a state $\epsilon < 0$ such that $\min\{\bar{r}_j(\epsilon)\}_{j\in S} > 0$. There is a coalition formed by all senders in S such that, when the state is ϵ, each sender $j \in S$ deviates from truthful reporting by delivering $r_j = r' \in [0, \min\{\bar{r}_j(\epsilon)\}_{j\in S})$. Upon observing $\{r_j = r'\}_{j\in S}$, the receiver selects action a^+. Given p, if some sender delivers a negative report, then the receiver selects a^-. Therefore, this coalitional deviation is mutually beneficial and self-enforcing: there is no proper sub-coalition that, taking fixed the action of its complement, can agree to deviate from the deviation in a way that makes all of its members better off. As a result, every efficient PBE of this like-biased configuration is not coalition-proof.

Consider now the case where at least two senders are opposed-biased. That is, there are at least two senders $i, j \in S$, $i \neq j$, such that $\Delta u_i(0) \cdot \Delta u_j(0) < 0$. I cover this case in Vaccari (2021). There, I show that misreporting occurs in every PBE when the number of senders is $N = 2$. Therefore, no efficient PBE can exist with only two senders. For the case $N > 2$, efficient PBE exist but are not coalition-proof.[4] $\qquad\square$

There are two reasons why simultaneous communication protocols may seem a promising avenue toward efficiency. First, fully revealing equilibria in truthful strategies exist in simultaneous cheap talk games with three or more senders with any bias type.[5] Second, the receiver can achieve efficiency even by simultaneously consulting two (or more) like-biased senders. In this last case, the receiver can induce truthful reporting by applying skepticism when reports do not coincide. Simultaneous communication protocols can exploit senders' lack of coordination to make any individual persuasion attempt futile.

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[4]The omitted proofs are included in Appendix A.

[5]See, for example, the introductory section in Battaglini (2004). In these equilibria, individual deviations from truthful reporting are immediately detected. The same intuition carries over to the costly talk signaling structure considered here.

Proposition 2 shows that simultaneous protocols are ineffective when senders can engage in non-binding pre-play communication. Intuitively, the possibility of discussing strategies before consultation allows senders to coordinate persuasion in a self-enforcing way. This result implies that sequential communication protocols are necessary to achieve efficiency and robustness to collusion jointly. The following proposition considers arrangements where the receiver sequentially consults multiple like-biased senders.

Proposition 3 (Sequential consultation of like-biased senders)**.** *There are no efficient PBE if there are $N \geq 2$ like-biased senders that communicate publicly and sequentially.*

Proof. Suppose there is a PBE in truthful strategies where $\Delta u_j(0) > 0$ for all $j \in S$ (the proof is analogous if $\Delta u_j(0) < 0$ for all $j \in S$). In this equilibrium, $\rho_1(\theta) = \rho_n(\{r_j = \theta\}_{j=1}^{n-1}, \theta) = \theta$ for every $\theta \in \Theta$ and $n \in \{2, \ldots, N\}$. On-path, the receiver's beliefs are degenerate on $\theta = r_j$, $j \in S$. Consider a state $\theta' < 0$ and a report $r' \geq 0$ such that $\Delta u_j(\theta') > 0$ and $\bar{r}_j(\theta') > r' \geq 0$ for all $j \in S$. After observing the tuple of reports $\{r'\}_{j=1}^{N-1}$, sender N can profitably deliver $r_N = r'$, as $\beta(\{r'\}_{j=1}^{N}) = a^+$. By induction, the same is true for every sender $j \in S$. As a result, sender 1 can profitably deviate from truthful reporting by delivering $r_1 = r'$, and all subsequent senders would follow suit. This contradicts the existence of an equilibrium in truthful strategies. $\square$

Sequential protocols are problematic for efficiency because they allow like-biased senders to coordinate persuasion on the spot.[6] By publicly misreporting, the first-speaking sender can incentivize all subsequent senders to follow suit by misreporting as well. It follows that truthful equilibria cannot be supported by sequential communication protocols where all senders are like-biased.

4.1 Public Advocacy

Altogether, Propositions 1, 2, and 3 rule out a large class of communication protocols. This first batch of results implies that efficient and robust outcomes may be achieved only through a specific arrangement: multi-sender protocols where communication is sequential and senders are opposed-biased. I hereafter refer to these arrangements as *public advocacy*, as they involve the sequential and public consultation of senders with conflicting interests. The following proposition shows that public advocacy yields efficient equilibria.

Proposition 4 (Public advocacy)**.** *Consider a protocol with $N = 2$ senders that communicate sequentially and are opposed-biased, i.e., $\Delta u_2(0) < 0 < \Delta u_1(0)$. There exists an*

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[6]In many applications, it may not be feasible for senders to coordinate on the spot because, e.g., it takes time to prepare a report. In these cases, communication cannot be considered sequential. Efficiency would be compromised anyway by senders' collusion via pre-play communication (see Proposition 2).

efficient perfect Bayesian equilibrium where

$$\rho_1(\theta) = \theta \quad \forall\, \theta \in \Theta$$

$$\rho_2(r_1, \theta) = \begin{cases} \min\{\underline{r}_2(0), \theta\} & \text{if } \theta < 0 \leq r_1 \\ \theta & \text{otherwise.} \end{cases}$$

$$p \text{ are s.t. } \beta(r_1, r_2) = \begin{cases} a^+ & \text{if } r_1 \geq 0 \text{ and } r_2 > \underline{r}_2(0) \\ a^- & \text{otherwise.} \end{cases}$$

Proof. Given beliefs p and sender 2's strategy, truthful reporting is strictly dominant for sender 1 in every state. Given beliefs p and sender 1's strategy: (i) if $r_1 < 0$, then truthful reporting is always strictly dominant for sender 2, as $\beta(\cdot) = a^-$ for every r_2; (ii) if $r_1 \geq 0$ and $\theta \geq 0$, then truthful reporting is strictly dominant for sender 2 because action a^- can be induced only by delivering a $r_2 \leq \underline{r}_2(0)$ which, by definition of reach, is never profitable in non-negative states; (iii) if $r_1 \geq 0$ and $\theta < 0$, then sender 2 can induce action a^- only by delivering some $r_2 \leq \underline{r}_2(0)$. By definition of reach, $r_2 = \min\{\underline{r}_2(0), \theta\}$ is strictly dominant in this case. Given senders' strategies, beliefs p are pinned down by Bayes' rule only for $r_1 = r_2$, and are free otherwise. When reports are identical, the receiver assigns probability 1 to $\theta = r_1 = r_2$. Off-path beliefs are free and set as in Proposition 4. Since senders play truthful strategies, have no profitable individual deviations, and beliefs are according to Bayes' rule whenever possible, this is an efficient equilibrium. $\qquad\square$

Proposition 4 provides an equilibrium characterization, which allows us to understand the mechanism supporting truthful reporting on the equilibrium path. The key to efficiency in public advocacy stands in how the receiver allocates the burden of proof between the two senders.[7] Beliefs must be consistent with Bayes' rule when senders deliver identical reports in a truthful equilibrium. In these cases, the receiver always follows the senders' recommendations. By contrast, beliefs are free in all those cases where senders disagree. The construction of suitable off path beliefs is crucial in sustaining truthful equilibria.

To illustrate the role of beliefs, consider the case where sender 1 prefers a^+ and sender 2 prefers a^-. Recall that sender 1 speaks first.[8] When sender 1 recommends its least favorite action a^- (i.e., $r_1 < 0$), the receiver selects a^- no matter what sender 2 reports. By contrast, when sender 1 suggests its favorite action a^+ (i.e., $r_1 \geq 0$), the receiver's decision depends on what sender 2 reports. In this case, sender 2 can convince the receiver to select a^- only by delivering a report dominated in non-negative states (i.e., $r_2 \leq \underline{r}_2(0)$).

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[7]Since the receiver fully learns the state after sequentially consulting two opposed-biased senders, efficiency can be achieved by public advocacy protocols with $N \geq 2$ senders. The focus on $N = 2$, based on a minimality principle, is therefore without loss of generality.

[8]The order in which senders communicate is irrelevant for the result in Proposition 4.

Intuitively, the receiver follows sender 1's advice to choose a^+ only if sender 2 fails to provide undeniable evidence that the state is negative. The burden of proof allocation ensures that senders have no incentive to deviate from truthful reporting.[9]

The "adversarial" structure of public advocacy provides an additional benefit: the senders, having conflicting goals, cannot coordinate to influence the receiver's decision. Resilience to collusion is desirable in organizations where informed agents can discuss their intentions before being consulted by the receiver. The following corollary confirms that the protocol in Proposition 4 is robust to non-binding pre-play communication.

Corollary 1. *The PBE in Proposition 4 is strong.*

Proof. The proof follows from the observation that there is no profitable coalitional deviation involving two opposed-biased senders. Likewise, the receiver cannot gain from a coalitional deviation because the equilibrium is already efficient. Therefore, the equilibrium in Proposition 4 is strong (Aumann, 1959) and coalition-proof (Bernheim et al., 1987). □

5 Discussion

Findings in the previous section show that there is a unique communication protocol that is efficient and resilient to collusion. This protocol, called public advocacy, requires the receiver to consult sequentially and publicly (at least) two senders with conflicting interests. This section discusses the robustness of these findings.

The model assumes that senders can neither withhold information nor deliver vague reports. The results do not rely on these limitations. Consider an extended model where senders can omit or muddle information at a cost.[10] Every equilibrium of the main model is also an equilibrium of this extended model where the receiver interprets unexpected omissions or vagueness unfavorably. Augmenting the senders' action space cannot make them worse off, and therefore inefficient protocols remain inefficient in this extended model. As a result, public advocacy remains the only efficient and robust protocol.

Naturally, there some model variants that can make public advocacy sub-optimal. Hereafter, I identify some of these alterations. First, public advocacy requires the consultation of two senders with opposed goals. However, organizations may be constrained in the availability of informed agents, and have no advocates to consult. Alternatively, interactions with conflicting agents may have additional exogenous costs, e.g., due to

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[9]As set in Proposition 4, the burden of proof is reminiscent of the "onus" applied in trials before tribunals. In legal disputes, one party is initially presumed to be correct. In contrast, the other party is burdened by providing sufficiently persuasive evidence to prove its case "beyond a reasonable doubt."

[10]Vagueness and omissions are easily detectable, whereas misreporting is not. Organizations can replace or decrease the budget of managers known to be perfectly informed and yet purposefully refuse to provide accurate information.

diplomatic relations. The proof of Proposition 2 tells us that in these cases efficiency can be achieved by forbidding pre-play communication and then privately consulting two (or more) like-biased senders. Second, public advocacy has a sequential structure that is time consuming. Simultaneous or single-sender protocols may be optimal when time delays are prohibitively costly.

It is assumed that the receiver's action space is binary. This modeling choice introduces an element of limited liability: the receiver cannot discipline senders with the threat of taking extreme actions that damage everyone. Removing this assumption makes private advocacy (simultaneous protocols with opposed biased senders) also efficient and robust to collusion. Efficiency is obtained by triggering extreme actions when senders deliver different reports off the equilibrium path. This threat supports truthful reporting on-path, yielding efficient outcomes. Robustness to collusion is obtained as in Corollary 1.

Two additional extensions are worth discussing. First, the model assumes that senders know the state perfectly. A model variant with imperfectly informed senders injects an information aggregation problem over a purely strategic problem of information elicitation. The receiver's need to aggregate information makes protocols with more senders more appealing. Second, it is assumed that truthful reporting is costless. However, senders and the organization may incur substantial consultation costs. The need to economize on consultations makes protocols with fewer senders more appealing. Importantly, these two last model variants prevent efficient outcomes by default: without perfectly informed senders, the receiver cannot make fully informed decisions; without a costless report, communication always involves inefficient expenditures.

6   Concluding Remarks

This paper studies the optimal design of organizations that seek informed decision-making while limiting influence activities. Efficient communication protocols solve asymmetric information problems without wasteful signaling expenditures. The main result has potentially significant implications for the design of organizations. It suggests that, under the threat of senders' collusion, only one communication protocol can achieve efficiency. This protocol prescribes the sequential and public consultation of two informed agents with conflicting interests. This finding provides a rationale for public advocacy.

The model has two distinguishing features central to the main result. First, the organization incurs direct costs from influence activities. Public advocacy is uniquely optimal only if this is the case. Fully revealing equilibria exist in simultaneous protocols, and full revelation is sufficient for optimality when the organization does not incur direct influence costs. Second, senders can engage in non-binding, pre-play communication.

Public advocacy is not the uniquely efficient protocol when collusion is not a concern: the proof of Proposition 2 shows that, in these cases, simultaneous and like-bias protocols can also yield efficient outcomes.

Public advocacy is widespread. As an example, consider the justice system. Trials take place with an adversarial procedure of judicial decision-making, whereby two advocates – prosecutors and defendants – engage in public debates in the courtroom. The justice system cares about accurate decision-making: to acquit the innocent and convict the guilty. In addition, there are reasons to believe that the justice system also cares about the influence activities performed by its members. For example, it is surely preferred that attorneys dedicate their time to reducing court delays rather than tampering with evidence. Moreover, the system loses credibility when advocates interfere with investigations. Results from this paper suggest that private advocacy trials, where prosecutors and defendants submit their cases in a closed envelope to the judge, would result in systematic misreporting. Any arrangements of trials other than public advocacy would result in inefficiencies.[11]

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[11]Other examples of public advocacy include, e.g., managers and ministries competing for budget allocation. Budgeting processes are typically sequential. Both firms and governments prefer their members to dedicate resources to everyday job duties rather than unproductive influence activities.

A   Appendix

The following results are taken from Vaccari (2021). They are not meant for publication.

Result 1. *Misreporting occurs in every PBE of protocols with $N = 2$ opposed biased senders that communicate simultaneously.*

Proof. Suppose there exists a PBE where misreporting never occurs, that is, where $\rho_1(\theta) = \rho_2(\theta) = \theta$ for every $\theta \in \Theta$. Consider such a truthful equilibrium, two opposed biased senders with $\Delta u_2(0) < 0 < \Delta u_1(0)$, and a state $\theta = \epsilon > 0$, where ϵ is small enough. To discourage deviations, off path beliefs must be such that $\beta(\epsilon, -\epsilon) = a^+$. However, there always exists an $\epsilon > 0$ such that, when the state is $\theta = -\epsilon$, sender 1 can profitably deviate from the prescribed truthful strategy by reporting $r_1 = \epsilon$, as $\Delta u_1(-\epsilon) > C_1(\epsilon, -\epsilon)$. This contradicts that there exists an equilibrium where misreporting never occurs. $\square$

Result 2. *PBE in truthful strategies of protocols with $N > 2$ senders that communicate simultaneously are not coalition-proof.*

Proof. Consider protocols with more than two senders that communicate simultaneously. Define the sets of senders $Z = \{j \mid \Delta u_j(0) > 0\}$ and $Y = \{i \mid \Delta u_i(0) < 0\}$, and the profile of reports $\tilde{r}_Z = \{r_j\}_{j \in Z}$ and $\tilde{r}_Y = \{r_i\}_{i \in Y}$. Say that $\tilde{r}_L = x$ when $r_j = x$ for all $j \in L$. The receiver's decision rule is $\beta(\tilde{r}_Z, \tilde{r}_Y)$. In a truthful equilibrium, $\tilde{r}_Z = \tilde{r}_Y = \theta$ for all $\theta \in \Theta$. Given a state $\theta = -\epsilon < 0$, beliefs are such that $\beta(-\epsilon, -\epsilon) = a^-$ and $\beta(\epsilon, \epsilon) = a^+$. Suppose that off path beliefs are such that $\beta(\epsilon, -\epsilon) = a^+$, and take ϵ small enough[12] so that $\bar{r}_j(-\epsilon) \geq \epsilon$ for every $j \in Z$. Denote by $\tilde{r}_Z^* = \{r_j^*\}_{j \in Z}$ a profile of reports with the following features: $\beta(\tilde{r}_Z^*, -\epsilon) = a^+$, and $\beta(\{r_j\}_{j \in Z}, -\epsilon) = a^-$ if $C_j(r_j, -\epsilon) \leq C_j(r_j^*, -\epsilon)$ for every $j \in Z$, with a strict inequality for some j. We know that the report $\tilde{r}_Z^*$ exists because $\beta(\epsilon, -\epsilon) = a^+$, and therefore $r_j^* \leq \epsilon$ for every $j \in Z$. There is a coalition formed by all senders in Z such that, when the state is $\theta = -\epsilon$, each $j \in Z$ can deviate to $r_j^* \in \tilde{r}_Z^*$. This deviation is mutually beneficial and self-enforcing: by construction of $\tilde{r}_Z^*$, there is no proper sub-coalition that, taking fixed the action of its complement, can agree to deviate from the deviation in a way that makes all of its members better off. Therefore, equilibria in truthful strategies are not coalition-proof (Bernheim et al., 1987). $\square$

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[12]If instead beliefs are such that $\beta(\epsilon, -\epsilon) = a^-$, then the proof is similar by considering a state $\theta = \epsilon > 0$ small enough and a deviation from the coalition of senders $i \in Y$.

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