The Choice of Political Advisors*

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July, 2025

Abstract

We study a leader's choice of advisors, balancing political alignment, informational competence, and diversity of views. The leader can consult one or two advisors: one is politically aligned but less informed or shares potentially redundant information; the other is better informed but more biased. The leader's optimal strategy can exhibit reversals. If both advisors are initially consulted, increasing the bias of the more biased advisor may cause the leader to exclude the aligned advisor to preserve truthfulness from the informed one. As bias rises further, the leader ultimately replaces the informed advisor if his bias becomes too large. When the leader is uncertain about the bias of the more informed advisor, increasing the chance of alignment can justify consulting both advisors.

*For helpful comments and discussions we thank Kim Sau Chung, Wouter Dessein, Torun Dewan, Marina Halac, Navin Kartik, Adam Meirowitz, Meg Meyer, Giacomo Ponzetto, Jesse Shapiro, Mike Ting and Leonard Wantchekon, as well as audiences at seminars/conferences, including Barcelona GSE Summer Forum, Columbia University, Harvard University, Kellogg School of Management, University of Michigan, NYU Abu Dhabi, Princeton University, and Yale University. This paper also benefitted from conversations with Dr. Davide Taliente, Advisor at the *Ministero per lo Sviluppo Economico,* and then *Ministero delle Imprese e del Made in Italy,* Italian Government. (The views expressed in this paper do not necessarily reflect the views of the Italian Government, or of any of its bodies).

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1 Introduction

Political leaders rely on a variety of advisors—including experts, consultants, and political associates. The quality of this advice often makes the difference between sound and poor decisions. As Niccolò Machiavelli noted in *The Prince* (Ch. 22):

> The first opinion that one forms of a prince, and of his understanding, is by observing the men he has around him.

This paper studies how a political leader should select one or more advisors among candidates who differ in political alignment, competence, and informational diversity. The leader faces key trade-offs: Should she favor aligned advisors or more competent experts? Under what conditions should the leader include ideologically distant advisors to gain from diverse perspectives?

These questions are of both theoretical and practical interest. Since the emergence of the modern state in the nineteenth century, effective governance has become increasingly reliant on technical expertise. This means that leaders can no longer rely solely on personal networks and must increasingly depend on bureaucracies and expert advisors to govern effectively.[1] Yet, identifying the right advisors is not as simple as selecting the most competent advisors. As Max Weber noted in "Economy and Society" (Ch. XI), leaders face a fundamental dilemma under informational asymmetry – how to evaluate and exploit expert knowledge without ceding authority to those who hold it:

> Since the specialized knowledge of the expert became more and more the foundation for the power of the officeholder, an early concern of the ruler was how to exploit the special knowledge of experts without having to abdicate in their favor.

Selecting only the most competent advisors risks empowering those who may pursue their own agendas. Hence, a natural trade-off arises between political alignment and competence.

Apart from the challenge of balancing loyalty and competence, democratic leaders must also decide how much ideological diversity to incorporate into their advisory teams.

[1] In the U.S., for example, a series of reforms throughout the twentieth century, from the Pendleton Act to the Civil Service Reform Act of 1978 led to institutionalized professional, merit-based civil service (Ash, Morelli and Vannoni, 2022).

Overreliance on ideologically similar advisors can produce "groupthink" and impair deliberation, leading to poorly informed decisions. Bringing in a broader spectrum of perspectives – including ideologically distant voices – can mitigate this risk and improve decision-making. Indeed, empirical studies on presidential appointments highlight the strategic inclusion of advisors with diverse viewpoints (Ingraham, Thompson and Eisenberg, 1995; Bertelli and Feldmann, 2007; Lewis, 2008). But doing so may also increase the risk of receiving biased or strategically manipulated advice.

These strategic tensions – between loyalty, competence, and ideological diversity – are present across political systems. Rooted in the Weberian tradition that separates administration from politics, many European countries and the UK expect senior civil servants to provide impartial advice (Putnam, 1973). Yet, the political context in which advice is given often blurs this boundary. Civil servants may be formally neutral but still perceived as ideologically misaligned, prompting political leaders to question their objectivity. Simply mandating neutrality may in fact reduce the effectiveness of advice by suppressing independence rather than ensuring it.

To navigate these trade-offs, leaders often turn to multiple advisors. Doing so can improve information aggregation and reduce overreliance on any single perspective. For instance, the Bush administration appointed both Colin Powell, who opposed the Iraq War, and Donald Rumsfeld, who supported it (Saunders, 2018). President Obama appointed Republican Ray LaHood as Secretary of Transportation to foster bipartisan collaboration (Newton-Small, 2008).

This paper provides a formal analysis of the strategic selection of political advisors using a cheap talk framework in the tradition of Crawford and Sobel (1982). Unlike prior work, we consider multiple advisors who differ not only in political alignment, but also in their competence and in the distinctiveness of the information they are endowed with.

Our setting models a political leader who faces a decision under uncertainty and must choose whether to consult one or two advisors. Each advisor differs in political alignment and in the accuracy or independence of their private signal. Specifically, one advisor is more closely aligned with the leader but either holds a noisier signal or observes information correlated with the leader's. The other advisor is more informed – he always receives an independent signal of the same precision as the leader's – but is less politically aligned. The leader must weigh the benefits of improved information against the risks of ideological misalignment. Formally, the leader seeks to minimize the squared distance between her chosen action and an unknown uniformly distributed policy-relevant state.

She observes a binary signal that is informative about the state. Each advisor observes a private binary signal regarding the state and communicates via cheap talk. The leader may consult either or both advisors, incurring a cost for each advisor consulted. Both advisors have known biases, with advisor 1's bias being closer to the leader's ideal point. While the more informed advisor 2 always receives a signal that is independent of, and of identical precision to, the leader's, the less informed advisor 1 either observes a noisier binary signal or a binary signal correlated with the leader's. In the former case, we say that advisor 1 is less competent than advisor 2; in the latter, that he is less independent.

We characterize the set of pure strategy equilibria, where advisors either report their signals truthfully or send signal-independent reports (i.e., babble), depending on whether their biases fall below endogenously derived thresholds. These thresholds depend on whether the other advisor is consulted: truth-telling becomes harder when multiple advisors are present. As a result, equilibrium informativeness is not monotonic in the number of advisors consulted.

We show that the leader's optimal strategy involves a subtle relationship between advisor bias and consultation. When both advisors have sufficiently small biases, consulting both maximizes welfare. However, when advisor 2's increases, the leader drops advisor 1 – despite their alignment – to preserve truthful reporting from advisor 2. If advisor 2's bias increases further, the leader reverts to consulting the less competent but more politically aligned advisor 1. Further, we show that this reversals also hold when including mixed-strategy equilibria in the analysis, and in a model with continuous uniformly-distributed signals.

We link these patterns to advisor turnover during leadership transitions. When a new leader takes office with an ideology far from that of her predecessors, the alignment with inherited career advisors often deteriorates. Our model shows that if this misalignment is large enough, the leader should dismiss even highly competent advisors – especially when combining them with loyal but inexperienced ones would undermine truthful communication. While past leaders could effectively pair loyal appointees with experienced bureaucrats, an ideologically distant successor may find that such combinations degrade the quality of advice. This mechanism helps explain the observed patterns of advisor turnover following leadership transitions, as discussed in Section 2.

We extend the baseline model by allowing for uncertainty over the political alignment of the better-informed advisor. Specifically, it is uncertain whether he is as aligned with the leader as the less informed expert, whose preferences are known. This framework is motivated by the observation that, while elected leaders need to make their political views manifest to gain electoral support, unelected advisors often keep their political leanings confidential. Indeed, refraining from disclosing one's political views is a crucial aspect of an expert's professional conduct aimed at establishing credibility of his advice.

Many of our earlier findings carry over to this model of "uncertain trade-off." However, the comparative static results are now richer. We demonstrate instances where, beginning with a situation in which the leader consults both experts, raising the bias of the more aligned advisor results in the dismissal of the better-informed expert. This cannot happen when the better-informed advisor is known to more biased: There, an increase in the bias of the more aligned advisor leads to his termination. When the more informed expert is possibly equally biased as the other advisor, the former becomes more attractive ex-ante, yet it is the latter who is consulted more.

Most importantly, the main comparative static results are no longer limited to changes in advisors' biases. We show that increasing the likelihood that the better-informed expert is not more biased than the other advisor can lead the leader to shift from consulting solely the better-informed expert to relying on both advisors. This finding complements our earlier results that a newly-elected leader should primarily rely on pre-existing experienced advisors. Over time, if the leader discovers that the views of experienced advisors are more aligned with hers than initially expected, she can improve decision-making by teaming them up with loyal consultants, even if they are less experienced. As we detail later in the paper, such dynamics are not uncommon in government appointments.

The paper is organized as follows. Section 2 presents the model of political advice, solving for pure and mixed strategy equilibria and studies robustness to continuous signals. Section 3 introduces uncertainty over advisor bias, and Section 4 examines conditional correlation in signals. Section 5 concludes. All proofs are provided in the Appendix.

Literature review Our work contributes to the broader political economy literature on leadership and information acquisition, where a central question concerns how a leader's ability to gather advice shapes decision quality.[2]

Several studies explore this research topic under various assumptions regarding the verifiability of advice and the motives of advisors. For instance, Battaglini (2002) shows

[2] A separate, related strand of literature emphasizes the role of communication as a central determinant of leadership effectiveness. Canes-Wrone, Herron and Shotts (2001) argue that leadership serves as a counter to "pandering," whereby leaders implement policies that the public values even when the leader believes them to be suboptimal. Dewan and Myatt (2007, 2008, 2012) investigate the interplay between a leader's judgment and communication skills as key determinants of influence and leadership success.

that full information revelation is attainable in equilibrium even with biased experts, as long as they are perfectly informed and the policy space is multidimensional. Dewatripont and Tirole (1999) analyze organizational decision-making under competing advocates who strategically conceal information unfavorable to their cause, but cannot forge evidence. Che and Kartik (2009) show that an advisor whose prior differs from the leader's may exert more effort to acquire and disclose verifiable information. Morris (2001) studies communication by a single advisor who is motivated to appear impartial, whereas Ottaviani and Sørensen (2001) analyze the optimal order of speech among advisors with heterogeneous expertise who aim to signal competence. Dewan and Squintani (2018) model leadership as emerging from communication among ideologically diverse group members, showing that a leader's judgment depends on the number of trustworthy associates and may trade off with moderation in leader selection. None of these studies examine the leader's fundamental trade-off between advisor alignment and competence, which is the focus of our work.

Methodologically, our model extends the cheap talk framework of Crawford and Sobel (1982). Building upon the work of Galeotti, Ghiglino and Squintani (2013), we formulate a rich yet tractable model for a leader's choice of advisors.[3] We introduce several features that have not been analyzed jointly before, along with others that are entirely novel to the literature. The decision maker is imperfectly informed (see also Moreno de Barreda, 2024), and may consult multiple experts who are also imperfectly informed. We consider players with heterogeneous information and formalize the notions of signal bias, precision, and correlation.[4] We also allow for the possibility that the preference of one of the advisors is private information.[5]

[3]The framework developed by Galeotti, Ghiglino and Squintani (2013) has served as the foundation for several formal studies of multi-agent communication in political economy. Patty and Penn (2014) study information transmission and aggregation in small networks of decision makers; Dewan et al. (2015) investigate the optimal assignment of decision-making authority in the executive of a parliamentary democracy; Penn (2016) studies the formation of equilibrium associations of groups that voluntarily choose to communicate and associate; Dewan and Squintani (2016) analyze the endogenous emergence of ideological factions as a means of delegating influence to moderate leaders; Schnakenberg and Turner (2021) analyze how campaign contributions affect elections and influence politicians' policy choices through informational signaling, whereas Schnakenberg and Turner (2025) examine how dark money undermines this informational value by weakening the credibility of transparent contributions; and Patty (2024) analyzes how inclusion and exclusion of agents in deliberation affect information aggregation in decentralized decision-making.

[4]Ottaviani and Sørensen (2006) and Denisenko, Hafer and Landa (2024) analyze single-expert models where signal precision reflects competence. The former emphasizes concerns for competence; the latter focuses on strategic disclosure under verifiable communication.

[5]The literature has focused on the case in which there is a single expert, and only his bias is private information (e.g., Morgan and Stocken (2003) Morgan and Stocken, 2003, and Li and Madarász (2008).

Our study contributes to the literature on presidential appointments, where the trade-off between advisor alignment and competence has been recognized as a central concern.[6] Appointing politicians can result in an "amateur government," as they often lack administrative expertise and prioritize short-term gains. Cohen (1998) therefore advocates appointing senior career executives as a remedy. Conversely, Moe (1985) argues that presidents require "responsive competence" to meet voter expectations, and experienced officers may lack such responsiveness. A large body of research shows that presidents make partisan appointments to enhance policy responsiveness. Parsneau (2013) shows that presidents prioritize political loyalty over experience when nominating sub-cabinet officials to high-priority departments. This trade-off becomes even more pronounced for top-level executive appointments, where loyalty tends to crowd out policy-specific expertise (Krause and O'Connell, 2019).

The trade-off we investigate between selecting aligned or competent subordinates is not exclusive to democracies. However, the dynamics of advisor selection in autocratic settings are likely to differ markedly from those that characterize democratic systems. The leader in our model does not face internal power challenges or threats to their authority. In contrast, Egorov and Sonin (2011) examine how dictators choose advisors under the threat of treason. Appointing competent advisors enhances regime stability, but their competence may also heighten the risk of rebellion. To mitigate this risk, leaders in fragile regimes tend to appoint loyal but less competent subordinates.

2 Model of Advice and Advisor Choice

A leader (player 0, "she") must choose an action $\hat{y} \in \mathbb{R}$ to maximize her utility

$$u_0(\hat{y}, x) = -(\hat{y} - x)^2, \tag{1}$$

where x is an unknown state, uniformly distributed on $[0, 1]$. Before making her decision, the leader receives a private binary signal $s_0 \in \{0, 1\}$, with $\Pr(s_0 = 1 \mid x) = x$.

Prior to observing s_0, the leader has the option to consult one or two advisors (both "he"), indexed by $i = 1, 2$. Each advisor i observes a private binary signal $s_i \in \{0, 1\}$ informative about x, and, if consulted, sends a message $\hat{m}_i \in M$ to the leader where the

[6] A structurally similar trade-off has been formally analyzed in the context of candidate selection under list proportional representation. Buisseret and Prato (2022) examine how parties allocate list ranks to candidates by balancing competence with electability.

message space M contains at least two elements. If both advisors are consulted, they send their messages simultaneously.

Each advisor i maximizes

$$u_i(\hat{y}, x) = -(\hat{y} - x - b_i)^2,$$

where b_i is advisor i's known bias.

Advisor 1 is more closely aligned with the leader than advisor 2, in the sense that $|b_1| < |b_2|$ and $b_1 \neq 0$. Advisor 2, however, possesses higher-quality information than advisor 1. Specifically, advisor 2's signal s_2 is independent of the leader's signal s_0 and satisfies

$$\Pr(s_2 = 1 \mid x) = x.$$

Advisor 1's signal s_1 is less precise than s_2. Specifically, there exists an unobserved auxiliary signal $s_1' \in \{0, 1\}$, independent of s_0 and s_2, such that $\Pr(s_1' = 1 \mid x) = x$. The observed signal s_1 is a noisy version of s_1': with probability $p \in (1/2, 1)$, $s_1 = s_1'$, and with probability $1 - p$, $s_1 = 1 - s_1'$, making s_1 a less accurate indicator of x compared to s_2.

For any given choice set of advisors A, the leader's decision rule is a function

$$y : (s_0, \hat{\mathbf{m}}_{\mathbf{A}}) \mapsto \mathbb{R},$$

mapping her own signal and the received advisor messages $\hat{\mathbf{m}}_{\mathbf{A}} \in M^{|A|}$ to a decision in $\mathbb{R}$. For each $i \in A$, the advisor i's strategy is a mapping

$$m_i : s_i \mapsto \Delta(M).$$

Consultation Costs. Consulting each advisor costs the leader $c > 0$. Accordingly, the leader chooses the advisor set A and a decision rule y to maximize her expected net utility:

$$\mathbb{E}\left[-(\hat{y} - x)^2 \mid s_0, \hat{\mathbf{m}}_{\mathbf{A}}\right] - c \cdot |A|.$$

The analysis in the following section studies pure-strategy Bayesian equilibria $(A, \mathbf{m}, y)$. The mixed strategy equilibria are characterized in Section 2.1. As is standard in the literature (e.g., Crawford and Sobel, 1982), when multiple equilibria exist, we select the equilibrium yielding the highest ex-ante welfare.

In Section 4 we consider the possibility that advisor 1's signal is correlated with the leader's private signal s_0. Specifically, with probability $\rho \in (0,1)$, $s_1 = s_0$, and otherwise $s_1 = s'_1$. We show that allowing for such correlation yields qualitatively similar results to the model of competence described above.

Analysis

Pure Strategy Equilibrium For clarity of exposition, we begin by characterizing pure-strategy equilibria. Firstly, it is immediate from the leader's objective function (1) that the equilibrium decision rule is such that the leader's action matches her posterior expectation of the state x, $y(s_0, \hat{\mathbf{m}}_{\mathbf{A}}) = E[x \mid s_0, \hat{\mathbf{m}}_{\mathbf{A}}]$.

Secondly, in any communication equilibrium, each consulted advisor i either reports his signal truthfully or babbles. Without loss of generality, set the message space to be $M = \{0,1\}$. We call a pure strategy m_i *truthful* if $m_i = s_i$ for all $s_i \in \{0,1\}$, and *babbling* if $m_i(s_i = 0) = m_i(s_i = 1)$. Consider any non-empty choice set of consulted advisors A. Up to relabeling the messages $\hat{m}_i$, every pure strategy equilibrium is uniquely identified by a set of advisors $T \subseteq A$ who choose to report truthfully. Because consultation is costly, the leader consults an advisor only if she expects that he will be truthful in equilibrium.[7]

Proposition 1 *Let $(A, \mathbf{m}, y)$ be any pure strategy equilibrium with $A \neq \emptyset$. Then, all consulted advisors are truthful, $T = A$, and for each advisor $i \in A$, the truthtelling condition, given the strategy m_j of the other advisor j (if consulted), is*

$$|b_i| \leq \left| \frac{\sum_{s_0 \in \{0,1\}} \sum_{m_j \in \{0,1\}} \Delta_i (s_0, \hat{m}_i, m_j)^2 \Pr(s_0, m_j | s_i)}{2 \sum_{s_0 \in \{0,1\}} \sum_{m_j \in \{0,1\}} \Delta_i (s_0, \hat{m}_i, m_j) \Pr(s_0, m_j | s_i)} \right|, \tag{2}$$

where $\Delta_i(s_0, \hat{m}_i, m_j) = E[x \mid s_0, 1 - \hat{m}_i, m_j] - E[x \mid s_0, \hat{m}_i, \hat{m}_j]$. The leader's equilibrium decision rule is $y(s_0, \hat{\mathbf{m}}_{\mathbf{A}}) = E[x \mid s_0, \hat{\mathbf{m}}_{\mathbf{A}}]$, for each message profile $\hat{\mathbf{m}}_{\mathbf{A}} \in \{0,1\}^A$. The leader's ex-ante equilibrium payoff is $Eu_0(A, \mathbf{m}, y) = -E_{s_0, \hat{\mathbf{m}}_{\mathbf{A}}} [\mathrm{Var}(x \mid s_0, \hat{\mathbf{m}}_{\mathbf{A}})]$, and the ex-ante payoff of each advisor i is $Eu_i(A, \mathbf{m}, y) = Eu_0(A, \mathbf{m}, y) - b_i^2$.

An immediate implication is that, omitting consultation cost c, all players rank equilibria in the same order according to ex-ante welfare. The term $E_{s_0, \hat{\mathbf{m}}_{\mathbf{A}}} [\mathrm{Var}(x \mid s_0, \hat{\mathbf{m}}_{\mathbf{A}})]$ captures the residual uncertainty about the state after observing both the leader's private signal and the advisors' messages.

[7] By a standard argument in cheap talk games, babbling equilibrium always exists.

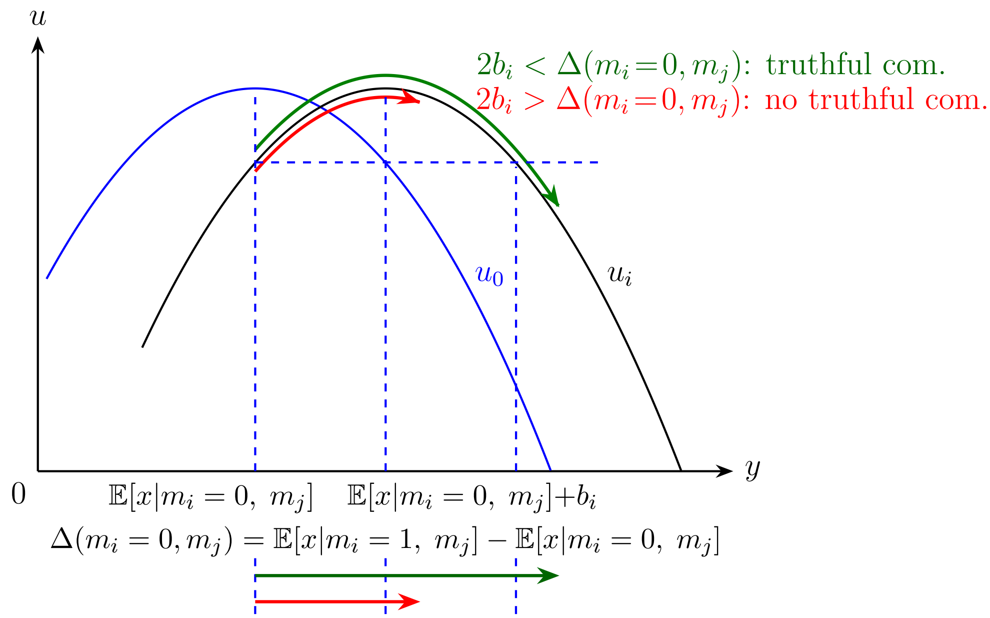


Figure 1: Heuristic argument for the truthtelling condition (2).

Consider now the equilibrium characterization in expression (2) assuming that two advisors are consulted and are believed to be truthful. $\Pr(s_0, s_i, \hat{m}_j)$ denotes the total probability that advisor i receives signal s_i, the leader observes signal s_0 and receives message m_j from the other advisor. Because the equilibrium decision of the leader is $y\,(s_0, \hat{\mathbf{m}}_A) = E[x|s_0, \hat{\mathbf{m}}_A]$, for every $\hat{\mathbf{m}}_A \in \{0,1\}^A$, the expression $\Delta_i\,(s_0, \hat{m}_i, \hat{m}_j) = E[x|s_0, \hat{m}_i, \hat{m}_j] - E[x|s_0, 1 - \hat{m}_i, \hat{m}_j]$ captures by how much advisor i would move the leader's decision if lying, i.e., if sending message $1 - \hat{m}_i$ instead of the truthful message $\hat{m}_i = s_i$.

To gain intuition about the truthtelling condition (2), we provide the following heuristic argument. Consider Figure 1, and say that player i is rightward biased $b_i > 0$. Fix any realization of the leader's signal s_0 and of the message $\hat{m}_j$ sent by the other consulted advisor. For any signal $s_i = 0, 1$, advisor i may deviate from equilibrium, by sending the false message $1 - \hat{m}_i$ instead of the truthful message $\hat{m}_i = s_i$. By doing this, i moves the leader's decision $\hat{y}$ from $E[x|s_0, \hat{m}_i, \hat{m}_j]$ to $E[x|s_0, 1 - \hat{m}_i, \hat{m}_j]$ by $\Delta_i(s_0, \hat{m}_i, \hat{m}_j)$. Of course, advisor i has no reason to lie when $s_i = 1$, as this can only move $\hat{y}$ to the left and he is biased rightward. When $s_i = 0$, advisor i gains by lying if and only if he moves $\hat{y}$ to the right by not too much. Specifically, suppose that the leader's response $\Delta_i(s_0, \hat{m}_i = 0, \hat{m}_j)$ to i's lie $1 - \hat{m}_i = 1$ is such that $\Delta_i(s_0, \hat{m}_i = 0, \hat{m}_j) > 2b_i$. Then, the leader's response to i's lie "overshoots" i's bliss point $E[x|s_0, \hat{m}_i = 0, \hat{m}_j] + b_i$ so much that it makes advisor i worse off relative to sending the truthful message $m_i = s_i = 0$. Conversely, when instead

$\Delta_i(s_0, \hat{m}_i = 0, \hat{m}_j) < 2b_i$, advisor i is better off deviating from equilibrium and lying.

Our truthtelling condition highlights that equilibrium communication becomes more demanding when the leader consults multiple advisors. Intuitively, each advisor is only concerned with how the leader's action compares to her own bliss point. When there are more advisors, any single report moves the leader's posterior by less, which reduces the risk of "overshooting" one's ideal point. This makes deviations more attractive and makes truthful reporting harder to sustain. This contrasts with environments where advisors are in competition for reputation: there, having more advisors allows the leader to cross-check reports. We conjecture that this disciplines advisors and facilitates truthful communication. In our pure cheap talk setting, the opposite effect arises.

Building upon Proposition 1 we now consider four possible equilibria: (1) both advisors are truthful and consulted; (2) only advisor 1 is truthful and consulted; (3) only advisor 2 is truthful and consulted; and (4) the babbling equilibrium in which neither advisor is truthful and consulted.

Before proceeding, we recall a useful result from Galeotti et al. (2013) in a setting where each signal $s_i \in \{0, 1\}$ is an i.i.d. Bernoulli trial with $\Pr(s_i = 1 \mid x) = x$. They show that in any communication equilibrium $(\mathbf{m}, y)$ in which the leader has access to k independent Bernoulli signals, the bias b_i of each truthful advisor must satisfy $|b_i| \leq \frac{1}{2(k+2)}$, and the leader's equilibrium welfare is $W(\mathbf{m}, y) = -\frac{1}{6(k+2)}$.

Consultation values To systematically analyze the leader's advisor selection problem, we first examine the *consultation values* – the gross expected payoffs from different advisor configurations before accounting for consultation costs. These values, denoted V_A for advisor set $A \subseteq \{\emptyset, 1, 2, \{1, 2\}\}$, measure the pure informational benefit of accessing advisors' signals. The leader's payoff under accounting of consultation costs is denoted by W_A, and is defined as $W_A \equiv V_A - c|A|$.

Both advisors are truthful. Let $\mathcal{E}_{12}$ denote the equilibrium in which both advisors are truthful and consulted. In the appendix, we derive the thresholds $\eta_{12.1}(p)$ and $\eta_{12.2}(p)$ such that the equilibrium exists if and only if $|b_1| \leq \eta_{12.1}(p)$ and $|b_2| \leq \eta_{12.2}(p)$. These thresholds are displayed in Figure 2 (top).

As the precision of signal s_1 increases (i.e., as p increases), the threshold $\eta_{12.1}(p)$ becomes less stringent, whereas $\eta_{12.2}(p)$ becomes more demanding. Intuitively, as advisor 1 becomes more informed, the burden of truthfulness on advisor 1 is relaxed, but the cred-

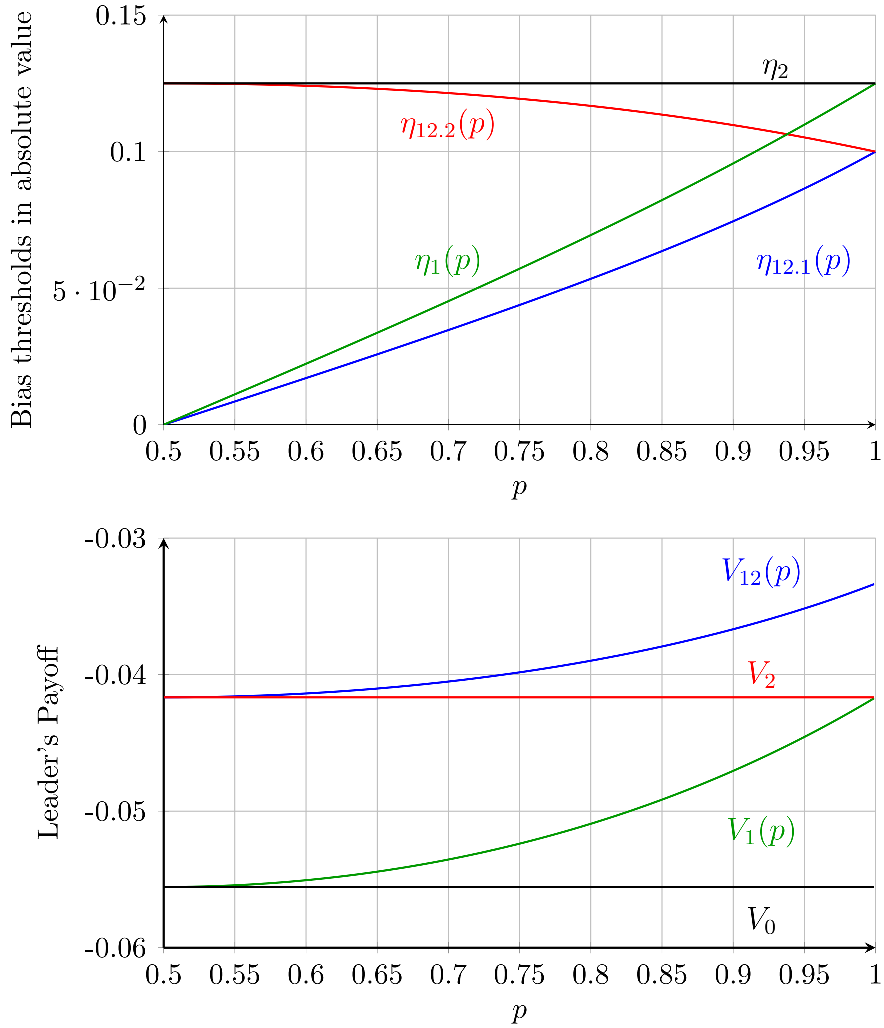


Figure 2: Top: Bias thresholds as functions of signal precision $p \in (1/2, 1]$. Bottom: Leader's payoff under different equilibria.

ibility requirement on advisor 2 rises. The leader's consultation value in this equilibrium, denoted $V_{12}(p)$, increases with p (displayed in Figure 2 (bottom)).[8]

Only advisor 1 is truthful. In an equilibrium $\mathcal{E}_1$ only advisor 1 is truthful and consulted. The corresponding threshold $\eta_1(p)$ for the absolute value of 1's bias, calculated in the appendix and plotted in Figure 2 (top), is increasing in p and always lies above $\eta_{12.1}(p)$. This reflects the fact that, firstly, a more informative signal induces a larger change in leader's posterior belief about x: were the advisor to deviate, lying would become costlier for a larger p. Secondly and relatedly, the incentive constraint for advisor 1 is

[8] When $p = 1$, the leader effectively receives three i.i.d. Bernoulli signals (her own plus the two advisors'), which yields $\eta_{12.1} = \eta_{12.2} = \frac{1}{10}$ and $V_{12} = -\frac{1}{30}$. Similarly, when $p = 0$, the leader receives only two i.i.d. signals, so that $\eta_{12.1} = 0$, $\eta_{12.2} = 1$, and $V_{12} = -\frac{1}{24}$.

more demanding when advisor 2 is consulted and is truthful (i.e., $\eta_{12,1}(p) < \eta_1(p)$ for all $p > 1/2$). The leader's consultation value in this equilibrium, $V_1(p)$, increases as 1's signals becomes more informative.

Only advisor 2 is truthful. In equilibrium $\mathcal{E}_2$, only advisor 2 is truthful and consulted. Because signal s_2 is always an i.i.d. Bernoulli trial with $\Pr(s_2 = 1 \mid x) = x$, this equilibrium always yields two independent Bernoulli signals to the leader. The equilibrium exists if and only if $|b_2| \leq \eta_2 := \frac{1}{8}$, and the corresponding welfare is $V_2 = -\frac{1}{24}$.

Babbling. Finally, if both advisors' biases exceed their respective thresholds (i.e., $|b_1| > \eta_1(p)$ and $|b_2| > \eta_2$), neither advisor is truthful and consulted. The leader relies solely on her own signal, resulting in equilibrium $\mathcal{E}_0$, with consultation value $V_0 = -\frac{1}{18}$.

Optimal choice of advisor The results illustrated in Figure 2 show that $\eta_{12.1} < \{\eta_{12.2}, \eta_1\} < \eta_2$, implying that there exist bias pairs (b_1, b_2) such that only the least biased advisor 1 is truthful in equilibrium, as well as bias pairs for which only the more biased advisor 2 is truthful. Specifically, only advisor 1 is truthful when $|b_1| \leq \eta_1$ and $|b_2| > \eta_2$, while only advisor 2 is truthful when $\eta_1 < |b_1| < |b_2| \leq \eta_2$.

More generally, when $|b_1| \leq \eta_1$ and $|b_2| \leq \eta_2$, but either $|b_1| > \eta_{12.1}$ or $|b_2| > \eta_{12.2}$ holds, the leader can extract truthful information from one advisor but not both.

When only one advisor can be truthful, the leader optimally chooses the more informed one (provided that the consultation cost is not too large). Since we established that for all $p < 1$, $V_2 > V_1(p)$, she consults advisor 2 in this case. This leads to our key insight: for not too large consulation cost, the leader prefers the more biased but better-informed advisor 2 whenever he is truthful, and includes the more aligned advisor 1 only if doing so does not jeopardize truthfulness from advisor 2.[9]

The following proposition accounts for the leader's consultation costs, and characterizes the optimal consultation strategy.

Proposition 2 *There exist thresholds $\bar{c}_{12}(p), \bar{c}_1(p)$ and $\bar{c}$, defined in the appendix, such that for any signal precision $p \in (1/2, 1]$ and $c \leq \bar{c}$, the optimal equilibria are as follows.*

(i) When both advisors' biases are sufficiently small, $|b_1| \leq \eta_{12.1}$ and $|b_2| \leq \eta_{12.2}$, the leader consults both advisors if $c \leq \bar{c}_{12}(p)$, and only consults advisor 2 if $c > \bar{c}_{12}(p)$.

(ii) When $|b_1| > \eta_{12.1}$ and $|b_2| \leq \eta_{12.2}$, or $b_2 \in (\eta_{12.2}, \eta_2]$, the leader consults advisor 2 who is truthful in this region.

[9]We show that this finding also holds under continuous signals – see Section 2.1.

(iii) When only advisor 1 can be truthful, $|b_2| > \eta_2$ and $|b_1| \leq \eta_1$, the leader consults advisor 1 if $c \leq \bar{c}_1(p)$ and otherwise consults none.

If either $c > \bar{c}$ or $b_1 > \eta(p), b_2 > \eta_2$, then no advisors are consulted.

In the appendix we show that the cost thresholds $\bar{c}_{12}(p)$ and $\bar{c}_1(p)$ increase in p, reflecting that higher signal precision makes consultation more valuable.

We now present our key comparative statics.

Proposition 3 *Suppose that $c < \bar{c}_{12}(p)$ and $|b_1| \leq \eta_{12.1}$ and $|b_2| \leq \eta_{12.2}$, so that both advisors are initially consulted. As the bias b_2 of the more biased advisor increases in absolute value, so that $\eta_{12.2} < |b_2| \leq \eta_2$, the leader drops advisor 1 but retains advisor 2. If $|b_2|$ increases further so that $b_2 > \eta_2$, the leader dismisses advisor 2 and hires back advisor 1.*

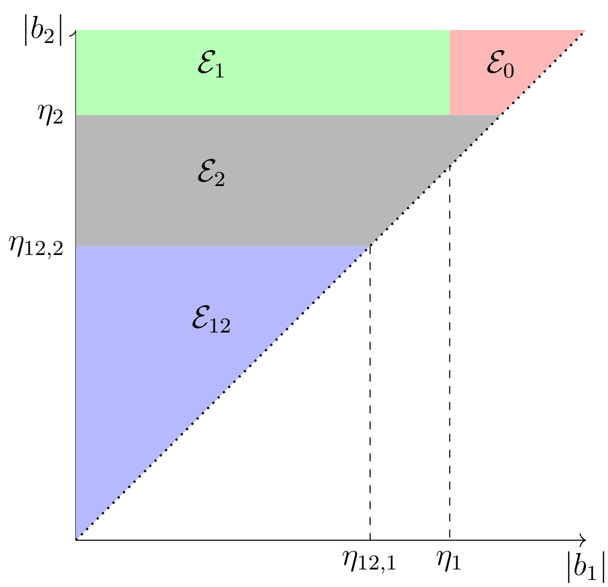


Figure 3: Illustration of optimal equilibria when consultation cost is not too high ($c < \bar{c}_{12}(p)$).

To illustrate the proposition, consider the case of positive biases. It may seem counterintuitive that increasing the bias of advisor 2 leads to dropping advisor 1. However, this result is easily understood through the lens of the model. Starting from a situation where the consultation cost is not too high, $c < \bar{c}_{12}(p)$, and the biases are sufficiently low, $b_1 \leq \eta_{12.1}$ and $b_2 \leq \eta_{12.2}$, the leader benefits from truthful advice from both advisors (see the region $\mathcal{E}_{12}$ in Figure 3). As b_2 increases to a level where $\eta_{12.2} < b_2 \leq \eta_2$, it becomes impossible for both advisors to be truthful in equilibrium. The leader must choose, and given that advisor 2 is more informative, she retains him (region $\mathcal{E}_2$ in Figure 3). As b_2 continues to rise beyond η_2, advisor 2 becomes no longer truthful, and the leader instead turns to the less informative but more aligned advisor 1 (region $\mathcal{E}_1$ in Figure 3). We emphasize that this finding holds under continuous signals, and when allowing for randomization, as shown in later sections.

Proposition 3 speaks directly to the organization of political advice during leadership transitions. When a newly elected policymaker departs ideologically from previous administrations, the resulting shift widens the gap between the leader's preferences and those of the most experienced advisors – individuals typically appointed under prior governments. In our framework, this maps to an increase in the bias b_2 of the more competent expert (advisor 2). The central question becomes whether the leader should retain these seasoned but potentially misaligned advisors or replace them with more ideologically aligned, yet less experienced, consultants (advisor 1).

The proposition shows that while previous leaders might have benefited from consulting both advisors, the new leader is better off relying exclusively on an experienced advisor, provided that the mutual gap in preferences is not too large. Were the new leader to combine advice from both experienced advisor and a less informed loyalist, the former advisor's truthtelling incentives would be disrupted. Only if the gap in preferences between the new leader and the experienced advisor is sufficiently large, would the leader resort to only consulting a loyal advisor while dismissing the experienced consultant.

This theoretical insight is reflected in how political leaders choose their advisors in practice. Newly elected policymakers often prioritize competence and continuity alongside political alignment when selecting key collaborators. For example, President Obama reappointed Robert Gates – Secretary of Defense under President George W. Bush – to continue in that role in 2008. This decision stood out given the significant differences between the Bush and Obama administrations, particularly regarding the Iraq War. While President Bush had initiated the conflict, President Obama entered office committed to drawing it to a close. To facilitate an orderly and effective transition in military engagement, Obama retained Gates, valuing his institutional experience, pragmatic approach, and leadership during the Iraq surge and ongoing operations in Afghanistan. This decision illustrated a preference for cross-administration continuity and technical expertise (Gates, 2010; Suri, 2018).

There are also prominent instances in which newly elected leaders emphasized political alignment over continuity and expertise. When Boris Johnson became UK Prime Minister in July 2019, his policy orientation – especially regarding Brexit – differed markedly from that of his predecessors. Unlike the United States, the UK does not operate under a spoils system: permanent secretaries and senior civil servants typically remain in place across administrations, providing institutional memory and policy expertise. Traditionally, these career officials serve as principal advisors, occasionally supplemented by external consultants for specific initiatives.

Breaking with this tradition, Johnson appointed Dominic Cummings – an architect of the "Leave" campaign with no prior policy experience – as his most senior advisor. Rather than relying on competent, albeit potentially misaligned, career civil servants, Johnson entrusted a politically aligned but inexperienced consultant with a central advisory role. This departure from established norms can be attributed to their shared ideological commitment to Brexit.

Cummings' tenure was widely viewed as disastrous and ultimately led to his dismissal. His inexperience and combative approach generated significant internal conflict, undermining effective governance. As our analysis suggests, his presence inhibited other advisors from providing honest and constructive input (Seldon and Newell, 2023). One emblematic episode was his dismissal of Sonia Khan, a special advisor to Chancellor Sajid Javid, which precipitated Javid's resignation. In line with Proposition 3, this episode illustrates that Johnson would have achieved better outcomes by refraining from elevating an inexperienced, ideologically aligned advisor to such prominence.

On the other hand, if the leader is ideologically too distant from the incumbent bureaucracy, she may be forced to rely solely on her own, less experienced advisors who share her ideological views. This is exemplified in Jimmy Carter's presidency, where appointments were driven more by personal loyalty than by federal governance expertise. As a political outsider with no prior national office, Carter distrusted the Washington establishment, especially amid the broader crisis of trust in government following the Watergate scandal. His anti-elitist, reform-driven campaign promise to clean up Washington led him to prioritize loyal confidants (Kaufman and Kaufman, 2006). Many senior staff, informally known as the "Georgia Mafia," were longtime associates from his Georgia years, including Hamilton Jordan, Jody Powell, and Frank Moore—all of whom lacked experience in national politics (Fallows, 1979; Barrow, 2023).

While our analysis focuses on pure strategy equilibria, we conclude this section by demonstrating that our main results are robust to the inclusion of mixed strategy equilibria.

2.1 Mixed Strategy Equilibria

For clarity of exposition, we focus on the case where both advisors have positive biases; the analysis for advisors with negative biases is symmetric, and the case with opposite-signed biases is qualitatively similar and presented in the Supplementary appendix.

In our binary-type framework, by standard arguments it is sufficient to focus on the binary message space for each advisor, $M = \{0, 1\}$. An equilibrium in which an advisor i employs a mixed strategy is such that he always sends $m_i = 1$ when $s_i = 1$ and randomizes between $m_i = 0$ and $m_i = 1$ when $s_i = 0$. In the appendix, we establish that generically there cannot exist equilibria in which both advisors mix.

Hence, suppose that the biases b_1 and b_2 are such that truthful communication by both advisors is impossible in equilibrium, but nevertheless it is possible that either of them is truthful and the other babbles. Specifically, we assume that $b_1 < \eta_1$ and $b_2 < \eta_2$, but either $b_1 > \eta_{12.1}$ or $b_1 > \eta_{12.2}$. In this range, there are only two candidates for mixed strategy equilibria: either advisor 1 is truthful and advisor 2 mixes, or vice versa.

The former equilibrium, call it $\mathcal{M}_{1.2}$, exists only when $b_2 < \eta_{12.2}$ – a region in which the fully revealing equilibrium $\mathcal{E}_{12}$ also exists and dominates in terms of welfare. Therefore, consider $b_1 \leq \eta_{12.1}$ and suppose that $b_2 \in (\eta_{12.2}, \eta_2]$. In this region, there exists an equilibrium with strict mixing where advisor 1 randomizes while advisor 2 is truthful, call this equilibrium $\mathcal{M}_{2.1}$. Furthermore, there exist two other equilibria in pure strategies, $\mathcal{E}_1$ and $\mathcal{E}_2$, where only advisor 1 or advisor 2 are truthful.

The equilibrium $\mathcal{M}_{2.1}$ is more informative than either $\mathcal{E}_1$ or $\mathcal{E}_2$, and the respective consultation values satisfy $V_{12} > V_2 > V_1$. The leader prefers $\mathcal{M}_{2.1}$ to $\mathcal{E}_2$ if

$$V_{2.1} - 2c > V_2 - c.$$

Therefore, there exists a cost threshold $\hat{c}_2(p) > 0$, such that the leader prefers $\mathcal{M}_{2.1}$ to $\mathcal{E}_2$ if $c < \hat{c}_2(p)$. We show in the appendix that $\hat{c}_2(p)$ strictly increases in p – the value of consulting advisor 1 increases in the precision of 1's signal.

Proposition 4 *Suppose $b_1 \leq \eta_{12.1}$ and $b_2 \in (\eta_{12.2}, \eta_2]$. Then, there exists a threshold $\eta_{2M}(c) \in (\eta_{12.2}, \eta_2)$ such that the optimal mixed strategy equilibrium is as follows:*

1. *if $b_2 \leq \eta_{2M}(c)$, the leader consults both advisors, and equilibrium $\mathcal{M}_{2.1}$ is played. Advisor 2 reports truthfully; advisor 1 mixes with probability σ_1, where $\sigma_1 \to 0$ as $b_2 \to \eta_2$,*

2. if $b_2 > \eta_{2M}(c)$, the leader consults only advisor 2.

For all other bias profiles, the equilibrium coincides with the characterization from the pure strategy case (Proposition 2).

To illustrate optimal equilibria, consider Figure 4. Suppose that b_1 does not exceed $\eta_{12.1}$ and the consultation cost is not too high, $c < \hat{c}_2(p)$. There exists a threshold for the bias b_2, $\eta_{2M}(c)$, that exceeds $\eta_{12.2}$, such that below the threshold both advisors are hired and the optimal equilibrium $\mathcal{M}_{2.1}$ involves strict mixing by advisor 1. As b_2 increases within this range, the probability of 1 being truthful continuously decreases, and converges to 0 at $b_2 = \eta_{2M}(c)$. Above the threshold $\eta_{2M}(c)$ and below η_2 the leader only consults 2. In the appendix we show that $\eta_{2M}(c)$ strictly decreases in c: a higher consultation cost makes ceteris paribus hiring both advisors less beneficial. For $b_2 > \eta_2$, advisor 2 babbles and only the equilibrium $\mathcal{E}_1$ remains feasible.

As shown in Figure (4) the region over which only advisor 2 is consulted lies between $\eta_{2M}(c)$ and η_2. Since $\eta_{2M}(c) < \eta_2$ for all $c > 0$, the region of exclusive consultation with advisor 2 has a positive measure.

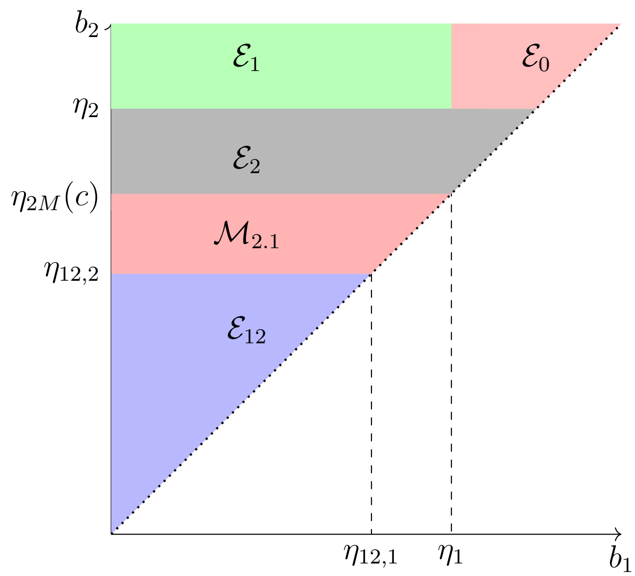


Figure 4: Optimal consultation under mixed strategies for $c \in (0, \hat{c}_2(p, \sigma_1))$

The key results are summarized in the following corollary.

Corollary 1 *Suppose $b_1 \leq \eta_{12,1}$, and assume a sufficiently small cost c of consultation, $c < \hat{c}_2(p, \sigma_2)$. When $b_1 \leq \eta_{12,1}$ and $b_2 \leq \eta_{2M}(c)$, the leader consults both advisors 1 and 2. If b_2 increases such that $b_2 \in (\eta_{2M}(c), \eta_2)$, the leader consults advisor 2. If b_2 increases* *further such that $b_2 > \eta_2$, the leader consults advisor 1 only. No advisors are consulted for $b_1 > \eta_1$ and $b_2 > \eta_2$.*

The analysis of mixed strategies generalizes Proposition 2, showing the key comparative static result: as b_2 increases, starting from a sufficiently low range, the leader first stops consulting both advisors and only consults the more biased advisor 2. As the bias b_2 increases further, the leader drops advisor 2 and switches to consulting advisor 1 instead.

Continuous signals

The pattern of reversals in the optimal consultation identified in the binary-signal case is also present with continuous signals. This is because there is only a finite number of decisions made by the leader in any equilibrium. Each advisors' signal space is partitioned into a finite set of intervals, each associated with a unique message issued to the leader (up to outcome equivalence). The advisors with a signal at the margin of adjacent intervals are indifferent between issuing the messages associated with the two intervals.

Consider a leader who chooses to consult an additional advisor. This makes the leader's decision more informed, just as in the binary case. Consequently, an advisor with a signal close to the marginal one moves the leader's decision less by "lying," i.e., by sending the message associated with an interval different from his own. The equilibrium condition for the marginal signals can only be rebalanced by broadening the intervals that make up the equilibrium partition, which makes communication less informative. Hence, the same trade-off between advisors' informativeness and biases arises as in the binary case, generating the same reversals between consultation choices as a function of advisors' biases.

To illustrate, consider the simplest continuous-signal environment. The state is uniformly distributed on the unit interval, $x \sim U[0,1]$. Each advisor observes a noisy private signal uniformly distributed in an interval around the true state (truncated to the $[0,1]$ interval). Formally, each advisor $i \in \{1,2\}$ observes a noisy signal

$$s_i \mid x \sim U\left[\max\{0, x-\delta_i\}, \min\{x+\delta_i, 1\}\right],$$

with $\delta_2 < \delta_1$, so that advisor 2 receives a more precise signal. For tractability we assume that the leader has no exogenous source of information – this feature is inessential for illustrating the trade off. Each advisor has access to a rich enough message space M.

We focus on single-threshold equilibria: each consulted advisor $i \in \{1, 2\}$ sends a low message m^i_L if $s_i \leq \hat{s}_i$, and a high message m^i_H otherwise, with $\hat{s}_i \in [0, 1]$. The restriction to single-threshold equilibria is without loss of generality for the parameter space of interest. Our focus is on the leader's switching behavior from two advisors to a single advisor, which occurs once b_2 is sufficiently high. In this range, any informative two-advisor equilibrium is necessarily of the coarsest form i.e., is comprised of two distinct messages per advisor.

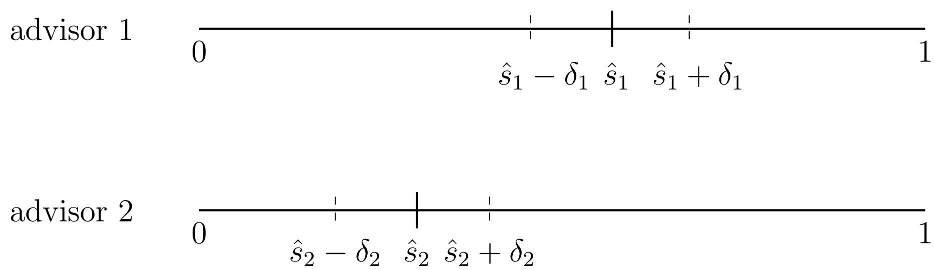


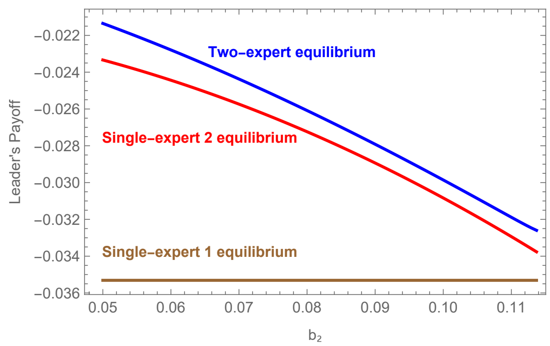
Figure 5: Partitional communication structure in a two-step equilibrium if both advisors are consulted.

Consider the equilibrium partitions depicted in Figure 5. We consider a parameter region where these partitions are non-overlapping i.e., $\hat{s}_2 + \delta_2 < \hat{s}_1 - \delta_1$. This condition ensures that when both advisors are consulted, only three message pairs occur on the equilibrium path: (m^1_L, m^2_L), (m^1_L, m^2_H), and (m^1_H, m^2_H). The message (m^1_H, m^2_L) is never observed on path, and its beliefs can be specified to support the equilibrium (see the appendix). Further, in the appendix we obtain the corresponding leader's posterior beliefs and the advisors' equilibrium indifference conditions.

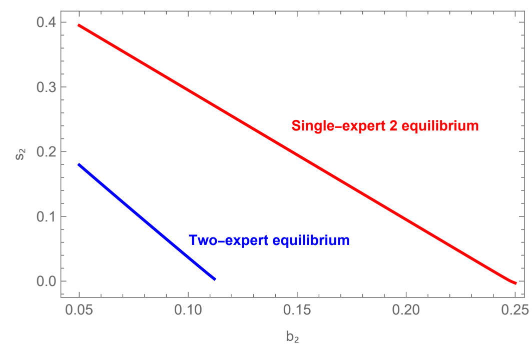
We now examine the leader's expected payoffs under three regimes for a fixed parameter range: consulting only the less informed but more loyal advisor 1 ($b_1 = 0.05$), consulting only the more informed but less loyal advisor 2 (varying b_2), or consulting both. We set $\delta_1 = 0.25$ and $\delta_2 = 0.005$ to maintain a clear precision difference.

Our calculations confirm the core insight from the discrete model. Figure 6, panel (a) plots the leader's expected payoff under each regime. The equilibrium with informative communication by two advisors dominates single-advisor equilibria. However, the equilibrium where both advisors communicate informatively exists only for an intermediate range of b_2, namely $b_2 \lesssim 0.113$ as panel (b) demonstrates.

The intuition is straightforward: as advisor 2's bias increases, his communication must become less informative to deter deviations at the threshold s_2. Panel (b) illustrates that as b_2 increases, s_2 decreases and converges to 0. When both advisors are consulted, in



(a) The comparison of leader's expected payoffs under the three advisor regimes.



(b) Range of biases of advisor 2 supporting equilibria with 2 versus 1 advisor.

Figure 6: Illustration of payoffs and bias ranges.

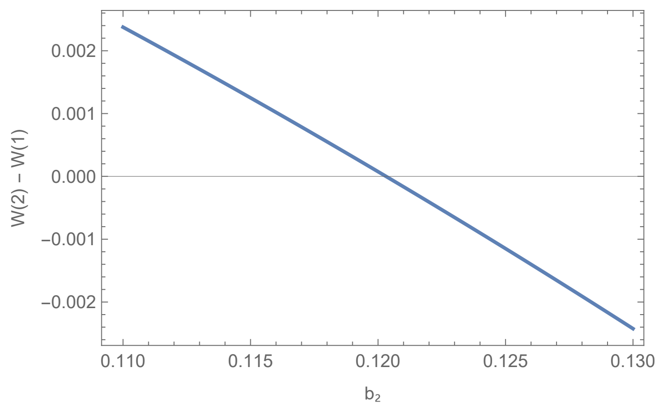


Figure 7: Difference in leader's payoffs, $W(2) - W(1)$, as a function of b_2.

the limit case when $s_2 = 0$ is indifferent between m_L^2 and m_H^2, the 2's incentive constraint yields

$$\bar{b}_2 \;=\; \psi(\delta_1, \delta_2, \hat{s}_1(s_2 = 0), s_2 = 0), \tag{3}$$

where $\hat{s}_1(s_2 = 0)$ is the best response of advisor 1. The function $\psi(\cdot)$ is derived in the appendix, and under the chosen parameters we obtain $\bar{b}_2 \simeq 0.113$. For $b_2 > \bar{b}_2$ the leader must therefore choose between only consulting advisor 1 or advisor 2.

Figure 7 shows that $W(2) > W(1)$ holds for $b_2 \leq 0.12$. Therefore, as long as $0.113 < b_2 \leq 0.12$ and the consultation cost is not too high, the leader optimally consults advisor 2 alone. However, as b_2 increases above 0.12, the leader switches to advisor 1. This happens even though an informative equilibrium with advisor 2 only, continues to exist for $b_2 > 0.12$, as Figure 6 (b) illustrates. However, the communication by advisor 2 becomes too noisy for $b_2 > 0.12$, compared to advisor 1, so that the leader optimally switches to 1. This confirms the main comparative statics from the baseline model.

3 Uncertain Trade-Off

We generalize the model of Section 2 by assuming that advisor 2's bias is private information. Specifically, advisor 2 has bias $b_1 > 0$ with probability $q \in [0, 1]$, and a higher bias $b_2 > b_1$ with probability $1 - q$. In words, advisor 2 is either equally or less aligned than advisor 1, and the leader does not know which.

As before, advisor 1's signal s_1 is less informative than that of advisor 2. Recall that there exists a latent signal $s'_1 \in \{0, 1\}$, independent of s_0 and s_2, such that $\Pr(s'_1 = 1 \mid x) = x$. Advisor 1 observes the signal s_1 such that $\Pr(s_1 = s'_1 \mid s'_1) = p \in (1/2, 1)$.

Throughout the following Section 3.1, for clarity of exposition we focus on the case of small consultation cost. In Section 3.2, we show how results change allowing for arbitrary costs.

3.1 Optimal equilibria with small consultation costs

Equilibrium Characterization. Two types of equilibria arise in this setting. First, both types of advisor 2 follow the same strategy, yielding equilibria $\mathcal{E}_{12}$, $\mathcal{E}_1$, $\mathcal{E}_2$, and $\mathcal{E}_0$. Second, the two types of 2 behave differently, in which case two equilibria arise as we show in the appendix. In an equilibrium $\mathcal{E}_{12A}$ both advisor 1 and the aligned type of 2 are truthful, while in the other equilibrium $\mathcal{E}_{2A}$ only the aligned type of 2 is truthful whereas both advisor 1 and b_2-type of 2 babble.

In the appendix we obtain bias thresholds for the two equilibria. $\mathcal{E}_{12A}$ exists if both $b_1 \leq \eta_{12A.1}(p, q)$ and $b_1 \leq \eta_{12A.2}(p, q)$ – the bounds for advisor 1 and for advisor 2's b_1 type – hold, resulting in the constraint $b_1 \leq \eta_{12A} \equiv \min\{\eta_{12A.1}, \eta_{12A.2}\}$.

The equilibrium $\mathcal{E}_{2A}$ exists for $b_1 \leq \eta_{2A}(q)$. We use these thresholds further below to derive optimal equilibria. Here we note, firstly, that $\eta_{12A.1}(p, q)$ increases in p and decreases in q, whereas $\eta_{12A.2}(p, q)$ decreases in p and increases in q: this mirrors exactly the logic of the baseline model illustrated in Figure 2. Secondly, $\eta_{2A}(q)$ increases in q.

We now turn to the welfare ranking of equilibria.

Lemma 1 *Equilibrium welfare is ranked as follows:*

$$W_{12} > \{W_2, W_{12A}\} > \{W_{2A}, W_1\}.$$

There exist functions $g_1, g_2 : [0, 1] \to [0, 1]$ *such that:*

- *$W_2 > W_{12A}(p,q)$ if and only if $p < g_2(q)$;*

- *$W_{2A}(q) > W_1(p)$ if and only if $p < g_1(q)$.*

The function g_1 strictly increases with $g_1(0) = 0$ and $g_1(1) = 1$, while g_2 strictly decreases with $g_2(0) = 1$ and $g_2(1) = 0$.

Naturally, the fully revealing equilibrium $\mathcal{E}_{12}$ yields the highest welfare for all (p,q) - this is the maximum amount of information the leader can receive. The equilibria $\mathcal{E}_2$ and $\mathcal{E}_{12A}$ follow – recall that in $\mathcal{E}_2$ advisor 2 is truthful whereas in $\mathcal{E}_{12A}$ advisors 1 and the loyal type of 2 are truthful.

The relative ranking between $\mathcal{E}_2$ and $\mathcal{E}_{12A}$ depends on (p,q): if both parameters are low, then $\mathcal{E}_2 \succ \mathcal{E}_{12A}$: in this case, the signal of advisor 1 is not too informative and advisor 2 is unlikely to be aligned.

Further, Lemma 1 shows that $\mathcal{E}_2, \mathcal{E}_{12A}$ dominate both $\mathcal{E}_{2A}$ and $\mathcal{E}_1$ since the latter deliver less information to the leader, in expectation.

Lemma 1 partitions the (p,q) space into four regions, using the functions $g_1(q)$ and $g_2(q)$. Consider Figure 8 and disregard for the moment g_3 that will be introduced later. If the probability of advisor 2 being loyal, q, is high – in the region above g_2 – the leader consults both 1 and 2. The leader also consults 2 if p is low – in the region below g_1 – where the signal of 1 is not very informative. In the region to the left of g_1 and g_2 where the probability of alignmment q is not too high, the leader consults advisor 2 only if both types of the advisor are truthful.

To complete the characterization of optimal equilibria, we now turn to the existence conditions among the set of equilibria $\{\mathcal{E}_{12A}, \mathcal{E}_1, \mathcal{E}_2, \mathcal{E}_{2A}\}$.

First, recall that $\mathcal{E}_{12A}$ exists if $b_1 \leq \eta_{12A}$. In the appendix we calculate all relevant bias thresholds, and demonstrate the following inequality

$$\eta_{12.1} < \eta_{12A} < \{\eta_1, \eta_{2A}, \eta_{12.2}\} < \eta_2. \tag{4}$$

Observe that some of the existence ranges are ordered in terms of inclusion. $\mathcal{E}_{12}$ requires smaller values of both b_1 and b_2 compared to the equilibria $\mathcal{E}_{12A}$ and $\mathcal{E}_2$ respectively. The equilibrium $\mathcal{E}_{12A}$ is supported by a smaller range of the bias b_1 than $\mathcal{E}_{2A}$ and $\mathcal{E}_1$.

The existence ranges of $\mathcal{E}_{2A}$ and $\mathcal{E}_1$, however, are not ordered in terms of inclusion. We now define a third threshold function g_3 based on the equality $\eta_1(p) = \eta_{2A}(q)$ that

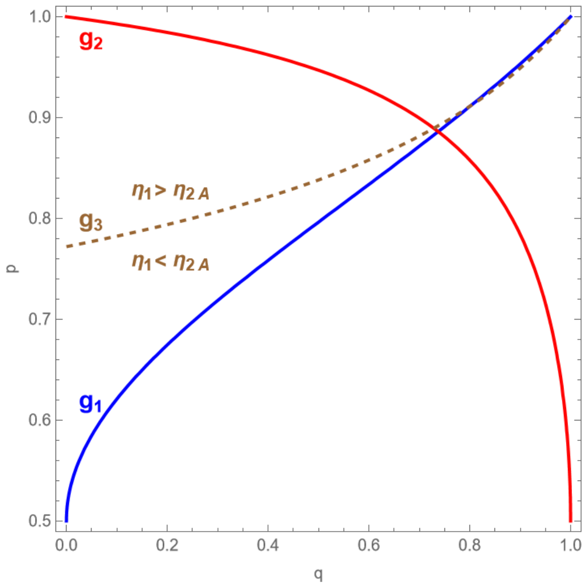


Figure 8: Illustrations for Lemmas 1 and 2

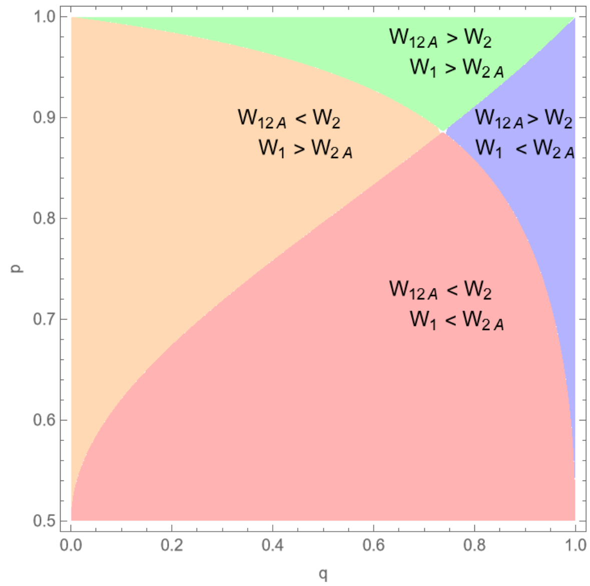


Figure 9: Optimal equilibrium regions

identifies whether the existence condition of $\mathcal{E}_1$ is tighter or looser in terms of b_1, compared to the existence condition for $\mathcal{E}_{2A}$

Lemma 2 *There exists a strictly increasing function* $g_3 : [0,1] \to [0,1]$ *such that:*

$$\eta_1(p) > \eta_{2A}(q) \iff p > g_3(q).$$

Moreover, for low q*, we have* $g_1(q) < g_3(q) < g_2(q)$*. As* q *increases,* g_3 *first crosses* g_2*, then* g_1*, and eventually coincides with* g_1 *at* $q = 1$*, with* $g_3(1) = 1$*.*

While the function g_1 defined in Lemma 1 determines whether equilibrium $\mathcal{E}_1$ is welfare-superior to $\mathcal{E}_{2A}$, g_3 determines which of the two exists for lower values of b_1. To illustrate, consider both Figure 8 and Figure 9. In the region above both g_1 and g_3, equilibrium $\mathcal{E}_1$ dominates $\mathcal{E}_{2A}$ and exists for a wider range of b_1. If none of the superior equilibria $\mathcal{E}_{12}$, $\mathcal{E}_2$, or $\mathcal{E}_{12A}$ are feasible, the leader hires only advisor 1 making $\mathcal{E}_1$ the optimal communication equilibrium. In the region above g_1 but below g_3 – where $\eta_1(p) < \eta_{2A}(p)$ – equilibrium $\mathcal{E}_1$ again dominates $\mathcal{E}_{2A}$ in terms of welfare. Therefore, provided that the advisors' biases are such that the other equilibria $\mathcal{E}_{12}, \mathcal{E}_2$ and $\mathcal{E}_{12A}$ are unavailable (i.e., the respective biases exceed the thresholds stated in (4)), the optimal equilibrium is $\mathcal{E}_1$ if advisor 1's bias is not too high, $b_1 \leq \eta_1(p)$. For intermediate values of advisor 1's bias, $\eta_1(p) < b_1 \leq \eta_{2A}(q)$, the optimal equilibrium is $\mathcal{E}_{2A}$. Similar logic applies to the region below g_1.

Optimal advisor choice We first formally characterize the optimal communication equilibrium, denoted $\mathcal{E}^*$, and then illustrate our findings in a figure.

Proposition 5 *The optimal equilibrium $\mathcal{E}^*$ in the game with uncertain bias is as follows:*

1. If $b_1 \leq \eta_{12.1}(p)$ and $b_2 \leq \eta_{12.2}(p)$, then $\mathcal{E}^* = \mathcal{E}_{12}$. If $b_1 > \eta_{12A}(p,q)$ and $b_2 \leq \eta_2$, then $\mathcal{E}^* = \mathcal{E}_2$. If $b_1 \leq \eta_{12A}(p,q)$ and $b_2 > \eta_2$, then $\mathcal{E}^* = \mathcal{E}_{12A}$.

2. If $\eta_{12.1}(p) < b_1 \leq \eta_{12A}(p,q)$ and $\eta_{12.2}(p) < b_2 \leq \eta_2$, then $\mathcal{E}^* = \mathcal{E}_2$ if $p < g_2(q)$, and $\mathcal{E}^* = \mathcal{E}_{12A}$ if $p > g_2(q)$.

3. If $\eta_{12A}(p,q) < b_1 \leq \max\{\eta_{2A}(q), \eta_1(p)\}$ and $b_2 > \eta_2$, then $\mathcal{E}^* = \mathcal{E}_{2A}$ when $p < g_1(q)$ or $\eta_1(p) < b_1 \leq \eta_{2A}(q)$, and $\mathcal{E}^* = \mathcal{E}_1$ when $p > g_1(q)$ or $\eta_{2A}(q) < b_1 \leq \eta_1(p)$.

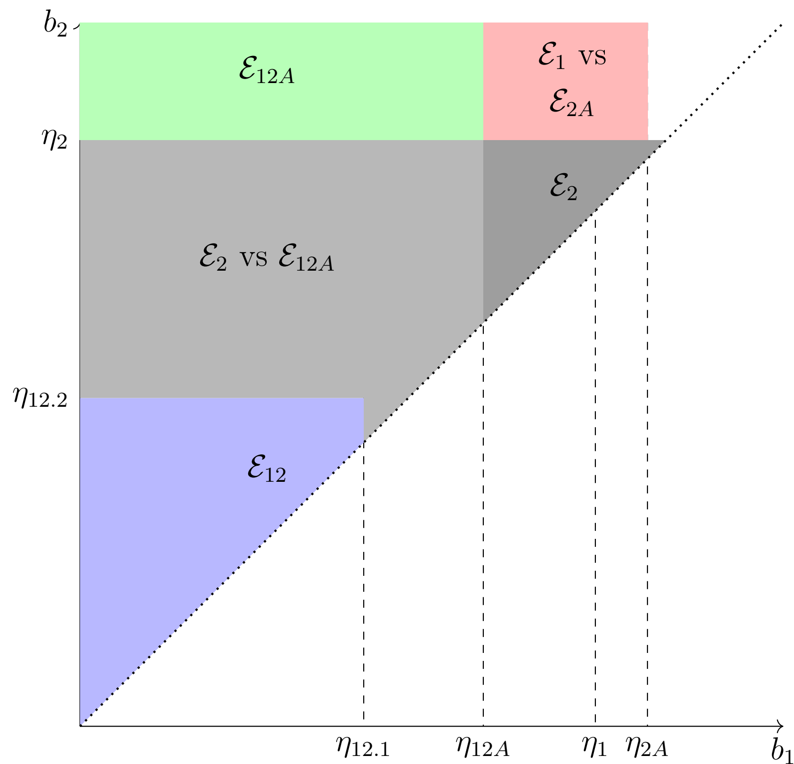


Figure 10: Uncertain trade-off: optimal equilibrium

Figure 10 illustrates the optimal equilibrium $\mathcal{E}^*$. In the south-west area marked $\mathcal{E}_{12}$, both advisors are consulted because neither is highly biased. In the north-west region marked $\mathcal{E}_{12A}$ the leader also consults both advisors: here, advisor 1 and the more aligned type of advisor 2 are truthful, while the less aligned type of advisor 2 babbles. In constrast, in the south-east region marked $\mathcal{E}_2$ where b_1 is sufficiently large, only advisor 2 is hired.

Consider next the "inverse L-shaped" region where $\eta_{12.1}(p) < b_1 \leq \eta_{12A}(p,q)$ and $\eta_{12.2}(p) < b_2 \leq \eta_2$. Here, both equilibria $\mathcal{E}_2$ and $\mathcal{E}_{12A}$ exist. The leader chooses between them based on whether advisor 1 is sufficiently informative and advisor 2 likely enough to be aligned with the leader, i.e., whether (p, q) lies above g_2. As a result, within this region as q rises, the leader may shift from hiring only advisor 2 to consulting both advisors.

Finally, consider the north-east region, with $\eta_{12A}(p, q) < b_1 \leq \max\{\eta_{2A}(q), \eta_1(p)\}$ and $b_2 > \eta_2$. When $b_1 \leq \min\{\eta_{2A}(q), \eta_1(p)\}$, both $\mathcal{E}_1$ and $\mathcal{E}_{2A}$ exist, and the leader's choice depends on whether advisor 1 is more informative or advisor 2 more aligned – determined by the location of (p, q) relative to g_1. When $\min\{\eta_{2A}(q), \eta_1(p)\} < b_1 \leq \max\{\eta_{2A}(q), \eta_1(p)\}$ only one equilibrium within the set $\{\mathcal{E}_{2A}, \mathcal{E}_1\}$ exists, namely $\mathcal{E}_1$ if (p, q) is above g_3, and $\mathcal{E}_{2A}$ otherwise. Therefore, if (p, q) is above g_1 *and* below g_3, the leader must resort to hiring only expert 2 because the equilibrium $\mathcal{E}_1$ does not exist. The opposite happens when (p, q) is below g_1 and above g_3.

We conclude that with uncertain bias, advisor 2 is now retained under a broader range of (b_1, b_2) compared to the baseline model with no uncertainty. Even for large b_2, advisor 2 may still be hired as long as $b_1 \leq \eta_{12A}$. In this case, the truthful reports from the aligned type of advisor 2 are valuable enough to seek 2's advice. Moreover, the leader may even consult only advisor 2 for high b_2 when b_1 lies in $[\eta_{12A}(p, q), \eta_{2A}(q)]$ and q is sufficiently high relative to p – i.e., when (p, q) lies below g_1 or g_3 in Figure 8.

We now turn to main comparative statics results.

Proposition 6 *The main comparative statics results for the case of uncertain trade-off are as follows:*

1. *Suppose $b_1 \leq \eta_{12.1}(p)$ and $b_2 \leq \eta_{12.2}(p)$ so that both advisors are consulted, and bias b_2 increases. When $p > g_2(q)$, neither advisor is dismissed. If $p < g_2(q)$, then advisor 1 is fired when $\eta_{12.2}(p) < b_2 \leq \eta_2$, and hired back as b_2 increases above η_2.*

2. *Suppose that $b_1 \leq \eta_{12A}(p, q)$ and $b_2 > \eta_2$, so that the leader hires both 1 and 2, and b_1 increases. If $p > g_1(q)$, then advisor 2 is dismissed when $b_1 > \eta_{12A}(p, q)$.*

   If, additionally, $p < g_3(q)$—which happens for intermediate p and low q—-then 2 is hired back, and 1 discharged, when $\eta_{12A}(p, q) < b_1 \leq \eta_1(p)$.

   If, instead, $g_3(q) < p < g_1(p)$—-for high p and q—-then advisor 1 is fired when $\eta_{12A}(p, q) < b_1 \leq \eta_{2A}(q)$, and hired back as $b_1 > \eta_{2A}(q)$, while 2 is dismissed.

3. *Suppose that $\eta_{12.1}(p) < b_1 \leq \eta_{12A}(p, q)$, $\eta_{12.2}(p) < b_2 \leq \eta_2$, and $p < g_2(q)$: the leader only consults advisor 2. An increase in the probability q that 2 is aligned leads to hiring also advisor 1, when $p > g_2(q)$.*

To understand the additional lessons from the above analysis, recall our results from the baseline model where 2's bias is always b_2. If b_1 is not too high, ($b_1 \leq \eta_{12.1}(p)$), the increase of b_2 leads first to dismissing advisor 1, and then hiring him back to fire advisor 2. In contrast, if the bias of advisor 2 is either b_1 or b_2, increasing b_2 may only lead to dismissing advisor 1 when $p < g_2(q)$, and does not lead to dismissing either advisor 1 or 2 when $p > g_2(q)$. Interestingly, the most biased-in-expectation advisor 2 is never fired, and making his bias more likely equal to 1's bias leads to consulting expert 1 more often.

Moreover, increasing bias b_1 may now lead to dismissing advisor 2, instead of only advisor 1. This occurs in the region above g_1 in Figure 8, when $b_2 > \eta_2$, when the increase in b_1 is such that it crosses $\eta_{12A}(p, q)$ (cf. Figure 10). In this scenario, because $b_2 > \eta_2$, the equilibrium $\mathcal{E}_2$ does not exist. When $b_1 < \eta_{12A}(p, q)$, the optimal equilibrium is $\mathcal{E}_{12A}$, where both expert 1 and the aligned type of 2 are consulted. However, as b_1 increases and crosses $\eta_{12A}(p, q)$, the equilibrium $\mathcal{E}_{12A}$ ceases to exist. Since $p > g_1(q)$, the optimal equilibrium becomes $\mathcal{E}_1$, and the leader dismisses expert 2 to gather information only from expert 1. As in the case of a certain trade-off, increasing one expert's bias may lead to dismissing the other advisor due to their strategic interaction. Here, however, this occurs not only when advisor 2's bias increases, but also when 1's bias is raised.[10]

We also examine comparative statics as advisor 2 becomes more likely to be loyal to the leader with the other two players i.e., when q increases. Here, the leader may switch from consulting only advisor 2, to consulting *both* advisors. To see why, consider the "inverse-L" shaped region of Figure 10, where $\eta_{12.1}(p) < b_1 \leq \eta_{12A}(p, q)$ and $\eta_{12.2}(p) < b_2 \leq \eta_2$. Suppose that (p, q) is located to the left of g_2 in Figure 9. As advisor 2 becomes more likely aligned (i.e., q increases) and the function g_2 is crossed from the left, the equilibrium $\mathcal{E}_{12A}$ now dominates $\mathcal{E}_2$: the leader additionally hires advisor 1. Under the new, higher q, the type b_2 of advisor 2 is no longer truthful. However, the leader is willing to forgo truthful advice from type b_2 of expert 2 to gain the benefit of hiring advisor 1 and receiving his truthful report.

These findings naturally relate to our results in Proposition 3. There, we found that a newly-elected leader should primarily rely on pre-existing experienced advisors, rather

[10]In the region above both g_1 and g_3 in Figure 8, further increasing b_1 leads to dismissing advisor 1 as well when b_1 crosses $\eta_1(p)$. In the region above g_1 and below g_3, increasing b_1 above $\eta_1(p)$ leads to dismissing advisor 1 and rehiring advisor 2, who is then dismissed when b_1 crosses $\eta_{2A}(q)$. The opposite pattern of dismissals occurs as b_1 increases when $g_3(q) < p < g_1(q)$. First, advisor 1 is dismissed as b_1 crosses $\eta_{12A}(p, q)$, then advisor 2 is dismissed and 1 rehired when b_1 crosses $\eta_{2A}(q)$, and finally 1 is dismissed again when b_1 crosses $\eta_1(p)$.

than bringing in less competent, politically loyal consultants. Here, we complement this by considering the implications of learning the views of the pre-existing advisors over time. The final part of Proposition 6 suggests that if the leader learns that the views of experienced advisors are not as different from hers as expected, she can improve decision-making by teaming them up with other loyal consultants, even if they are less experienced.

The dynamics we identify are also found in real-world politics. One such dynamic – initially relying on a potentially misaligned yet experienced advisor followed by the addition of a politically aligned advisor upon observing closer-than-expected alignment – appears in South Korea under President Moon Jae-in. In 2018, Moon appointed Hong Nam-ki, a longstanding technocrat who had served under both liberal and conservative administrations, as Minister of Economy and Finance. While there were concerns that he was at odds with the new administration's agenda (e.g., Choi, 2018), Hong soon showed signs of adherence to the administration's direction.[11] Several months later, Moon brought in Kim Sang-jo, a professor with strong progressive credentials but no bureaucratic background, as Chief Presidential Secretary for Policy (JoongAng Ilbo, 2019). This pairing – of technocratic competence and political alignment – gave them a leading role in shaping the Moon administration's economic policy. During the COVID-19 pandemic, they jointly oversaw South Korea's economic response, combining fiscal agility with political coordination. Their contribution to the Moon administration's economic response was reflected in South Korea recording one of the mildest economic contractions in the OECD in 2020 (-0.8%) and rebounding with approximately 4% growth in 2021 – figures that have been widely cited as evidence of a highly effective response (O'Neill, 2020).

Another dynamic – initially hiring both competent and loyal advisors, then dismissing the competent one if found to be ideologically too distant – is found in the Nixon administration. The administration, inheriting a federal bureaucracy shaped by Johnson-era Democrats, saw it as a potentially hostile force obstructing its policy goals. However, Nixon did not undertake wholesale replacement; instead, he retained some bureaucratic experts for their policy competence. In an early press conference following his inauguration, Nixon stated, "We will do what we think will best serve the interest of effective government, and if the individual who has been frozen in can do the job, we are going to keep him," indicating a willingness to prioritize policy competence over partisan alignment by retaining some holdover officials (Nixon, 1969). And, over time, he increasingly side-

[11] President Moon's rejection of Hong's resignation in November 2020, despite his political controversy, is widely viewed as a clear indication of presidential trust (Yonhap News, 2020).

lined officials who did not share his conservative outlook.[12] This approach contributed to a gradual but significant realignment of the senior civil service, without pursuing explicit partisan replacement.[13]

3.2 Allowing for arbitrary consultation costs

In this section we allow for any positive consultation cost $c > 0$ and focus on the most interesting case for comparative statics. For this we assume that $p > g_2(q)$ meaning that without consulation costs $\mathcal{E}_{12A} \succ \mathcal{E}_2$. Moreover, we consider $b_1 < \eta_{12A}$ to study the bias range where the equilibrium $\mathcal{E}_{12A}$ exists.

For the following, it will be useful to consider the following two cost thresholds. First, there exists a threshold $\hat{c}_{12}(p, q) > 0$ such that

$$\mathcal{E}_{12A} \succ \mathcal{E}_2 \iff V_{12A}(p, q) - 2c > V_2 - c \text{ if } c < \hat{c}_{12A}(p, q).$$

Second, there exists a different threshold $\hat{c}_1(p, q) > 0$ such that

$$\mathcal{E}_{12A} \succ \mathcal{E}_1 \iff V_{12A}(p, q) - 2c > V_1(p) - c \text{ if } c < \hat{c}_1(p, q).$$

To state the main result, we make the use of the following comparison.

Lemma 3 *For any (p, q) the cost thresholds satisfy $\hat{c}_{12A}(p, q) < \hat{c}_1(p, q)$.*

The main comparative statics result is as follows.

Proposition 7 *Suppose $b_2 > \eta_{12.2}$ and $c < \hat{c}_{12A}(p, q)$ making $\mathcal{E}_{12A}$ the optimal equilibrium.*

(i) If c increases and crosses $\hat{c}_{12A}(p, q)$, for intermediate bias $b_2 \leq \eta_2$ the leader switches from consulting both advisors to consulting advisor 2: the optimal equilibrium is $\mathcal{E}_2$.

(ii) if c increases further, and crosses $\hat{c}_1(p, q)$, for $b_2 > \eta_2$ the leader switches from consulting both advisors to consulting advisor 1 alone: the optimal equilibrium is $\mathcal{E}_1$.

This result follows immediately from Lemma 3 and the existence results from the preceding section. For intermediate values of b_2, advisor 2 communicates truthfully, so

[12] This pattern exemplified what came to be known as Nixon's "administrative presidency" strategy, which prioritized political loyalty over bureaucratic expertise, aiming to bring the federal executive firmly under presidential control (Aberbach and Rockman, 1976; Lewis, 2008).

[13] Cole and Caputo (1979) suggest that career executives calling themselves Independents during the Nixon years were significantly more likely than before to resemble Republicans in their support for Nixon's domestic policy agenda.

that whenever the consultation cost crosses $\hat{c}_{12A}(p,q)$, the leader switches from consulting both advisors to consulting the most informed advisor 2. As long as $c < \hat{c}_1(p,q)$, the leader continues consulting both advisors for $b_2 > \eta_2$. Here, advisor 2 provides valuable partial information while advisor 1 is truthful. Only when c crosses the threshold $\hat{c}_1(p,q)$, does the leader abandon the two-advisor configuration altogether in favor of the more aligned advisor 1. In other words, for $c > \hat{c}_1(p,q)$, the optimal consultation structure resembles the consultation pattern from the baseline model with known advisor biases.

The consultation cost c in our model may represent the political capital a leader must expend when making advisor appointments. This cost varies with the leader's political strength: it is high for politically weakened leaders (e.g., amidst a scandal or low approval ratings), making personnel decisions risky, and low for leaders with strong mandates who can afford bolder choices. Proposition 7 predicts how leaders navigate these high-cost scenarios, showing they will either consolidate around a highly competent expert or retreat to a compliant loyalist, depending on the perceived risk of their advisors.

President Reagan's 1987 appointment of Howard Baker as Chief of Staff exemplifies the first part of Proposition 7. Before the Iran-Contra scandal, Reagan's advisory structure included both competent and loyal advisors, with figures like the pragmatic James Baker and the loyalist Donald Regan in key positions (Baker and Glasser, 2020; Weinraub, 1986).[14] However, the scandal both necessitated a strategic shift and created enormous political costs for making one (Cohen, 2024). Rather than retaining both types of advisors, Reagan dismissed the more politically aligned Donald Regan and consolidated decision-making around Howard Baker—-a former Senate Majority Leader, one-time presidential rival, and a figure with bipartisan credibility in crisis management (Gerstenzang, 1987). This demonstrates how rising political costs can lead a leader to abandon a mixed advisory structure in favor of relying solely on the most competent advisor, even when that advisor may be less politically aligned.

French President Chirac's 2005 appointment of Dominique de Villepin illustrates the second part of Proposition 7. Following the failed EU constitution referendum, Chirac faced a high-cost political environment (Henley, 2005; de Boisgrollier, 2005). Initially, he had benefited from advice from both competent figures like Nicolas Sarkozy (then Interior Minister) and loyal associates (Buchan, 2025). However, as political costs mounted, Chirac faced a choice between appointing the highly competent but ambitious Sarkozy

[14] Notably, James Baker had managed the presidential campaign of George H.W. Bush, Reagan's chief rival for the 1980 Republican nomination. Reagan's decision to appoint his top rival's campaign manager as his own Chief of Staff is often cited as a prime example of his political pragmatism.

as Prime Minister—-whose independent agenda represented high bias ($b_2 > \eta_2$)—-or the loyal but less experienced Villepin. Facing high consultation costs, Chirac decided to entrust the government not to his ambitious and popular rival, Nicolas Sarkozy, but to the far more dependable Dominique de Villepin, despite his lack of any electoral experience.(Henley, 2005; de Boisgrollier, 2005). This demonstrates how extreme political pressure can drive leaders toward compliant loyalists over more competent but potentially unreliable alternatives.

4 Correlation in signals

We study the following variation of the baseline model. All model assumptions remain the same apart from the information structure for the advisor 1, whose signal now may be correlated with the leader's signal. Specifically, there is an unobserved signal $s_1' \in \{0, 1\}$,independent of s_0 and s_2, such that $\Pr(s_1' = 1|x) = x$. With probability $\rho \in (0, 1)$ $s_1 = s_0$ meaning that the advisor 1's signal s_1 is correlated with the leader's signal. Otherwise, $s_1 = s_1'$.

Similar to the baseline model, there are four equilibria in pure strategies. The equilibrium where both advisors tells the truth, the two equilibria where only one expert, either 1 or 2, is truthful, and the babbling equilibrium.[15]

Equilibria and Welfare as a Function of ρ Consider the equilibrium $\mathcal{E}_{12}$, in which both advisors are truthful and hence consulted. The thresholds $\eta_{12.1}(\rho)$ and $\eta_{12.2}(\rho)$, derived in the appendix, determine the maximum biases under which full revelation is sustainable. Figure 11 depicts these thresholds, along with the leader's welfare $W_{12}(\rho)$.

The threshold $\eta_{12.1}(\rho)$ lies below $\eta_{12.2}(\rho)$ for all values of ρ, and is decreasing in ρ. Conversely, $\eta_{12.2}(\rho)$ increases in ρ. That is, as signal s_1 becomes less correlated with the leader's prior (i.e., ρ decreases), advisor 1's bias threshold $\eta_{12.1}$ becomes less stringent, while advisor 2's threshold $\eta_{12.2}$ becomes more demanding. The leader's equilibrium welfare $W_{12}(\rho)$ decreases in ρ and is convex, reflecting diminishing value from signal s_1 as it becomes more redundant with the leader's own information.

In the equilibrium $\mathcal{E}_1$, where only advisor 1 is consulted, the threshold $\eta_1(\rho)$ increases in ρ, reflecting that advisor 1 must be more aligned with the leader when their signal is highly correlated with the leader's prior. The threshold $\eta_1(\rho)$ always lies above $\eta_{12.1}(\rho)$,

[15] The exact calculations are shown in Appendix A2.

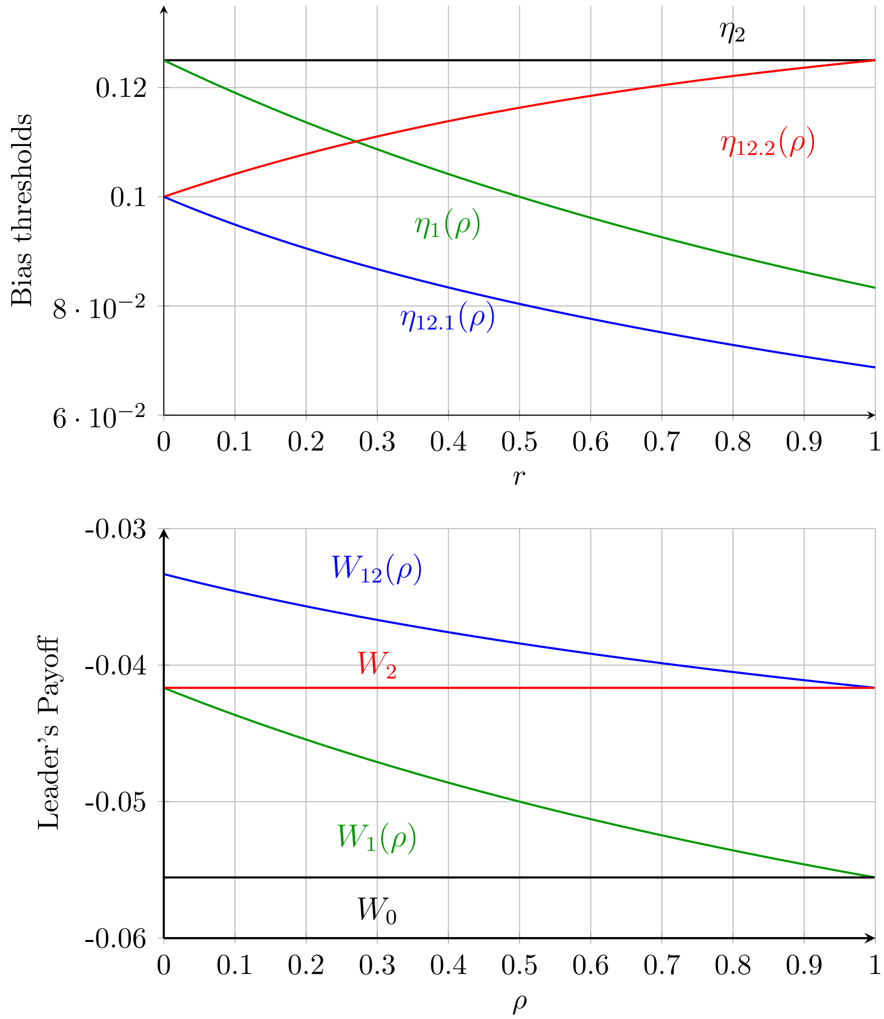


Figure 11: Equilibrium Bias Thresholds and Leader's Welfare as Functions of ρ.

and crosses $\eta_{12.2}(\rho)$: truthtelling by advisor 1 requires a less strict alignment when she is the sole informant (and it may be less stringent than advisor 2's condition under full revelation).

The leader's welfare in this case, $W_1(\rho)$, also decreases in ρ and is convex. It is always strictly lower than $W_{12}(\rho)$ for all ρ – naturally, consulting both advisors dominates single-advisor consultation.

The equilibria $\mathcal{E}_2$ and $\mathcal{E}_0$, in which only advisor 2 is consulted or no advisor is consulted respectively, yield constant welfare levels $W_2 = -1/24$ and $W_0 = -1/18$, as in the baseline model.

The optimal equilibrium is characterized in the following proposition.

Proposition 8 *If $b_1 \leq \eta_{12.1}(\rho)$ and $b_2 \leq \eta_{12.2}(\rho)$, then the leader optimally consults both* *experts. If $\eta_{12.2}(\rho) < b_2 \leq \eta_2$, then she hires only advisor 2, the better informed expert. If $b_2 > \eta_2$ and $b_1 \leq \eta_1$, then the leader consults only advisor 1, the less biased expert. If $b_1 > \eta_1(\rho)$ and $b_2 > \eta_2$, then the leader does not consult any expert.*

We observe that this characterization of the optimal consultation choice is identical to Proposition 2 in the baseline model. The same logic applies despite the different informational structure: whether signals differ in precision or in correlation with the leader's prior, the leader follows the same threshold-based strategy. Therefore, qualitatively the same comparative statics holds as in the baseline model.

5 Conclusions

Advisor selection is a critical yet often overlooked component of effective leadership. This paper examines how a leader chooses among advisors who differ in political alignment and informational quality. The leader may consult one or both advisors—one more closely aligned but less informed, the other more informed but potentially biased.

We show that advisor selection requires a careful balance between political alignment and information quality. The leader's optimal strategy includes subtle comparative statics: when both biases are low she consults both experts; as the more informed advisor's bias rises, she dismisses the aligned advisor to preserve credibility; and if that bias increases further, she replaces the informed advisor with the more aligned one.

This illustrates how leaders navigate the trade-off between richer information and reliable communication, and helps explain why new administrations sometimes retain seasoned, misaligned advisors but avoid pairing them with loyal novices.

The paper also shows that when the leader is uncertain about an advisor's true alignment, the set of circumstances in which she retains the informed expert expands. As the likelihood of alignment increases, it may become optimal to reintegrate the loyal advisor into the team. We relate our results to practices of appointing career civil servants who conceal their private views, and highlight the value of learning about advisors' preferences over time.

Our framework contributes to the broader literature on political leadership by formalizing how informational value and alignment shape optimal advisory teams. While previous work has emphasized institutional constraints on advisor appointments, such as separation of powers or regime type, it has largely overlooked the fundamental trade-off between political alignment and informational quality.

While our model focuses on advisors who care only about influencing the leader's decision, future work could expand the framework to include other motivations. In practice, political advisors often care about their reputation for competence and integrity. Existing research has analyzed reputational concerns in settings with one expert and one decision maker. Extending this to a context where the leader chooses among multiple advisors – who differ in both alignment and expertise and care about their reputation – offers a promising direction. Repeated interactions could enable the leader to evaluate past advice, encouraging even misaligned advisors to communicate truthfully. Similarly, when multiple experts are consulted simultaneously, the potential for cross-verification may strengthen incentives for honest reporting.

Advisors may also value being consulted for its own sake, creating additional incentives to both acquire valuable information and signal alignment with the leader. These incentives shape not only the advisor's credibility but also their strategic behavior in forming relationships and positioning themselves within political networks. Leaders may, in turn, use informal screening processes or competitive mechanisms—such as advisory tournaments—to assess whose input is most useful.

Another fruitful direction involves studying the dynamic nature of advisory relationships. Advisors and leaders often shift roles over time, with former adversaries becoming allies and vice versa. In such environments, the timing of an advisor's dismissal may depend not only on the quality of advice but also on its broader political implications.

Finally, another dimension worth exploring is how a leader's personal style shapes the composition and functioning of advisory teams. Leaders more open to conflict and decentralised information flow often cultivate informal, task-oriented structures that foster diverse input and flexible role shifts. By contrast, those who prioritise control and consensus tend to prefer hierarchical, loyalty-driven arrangements with tightly managed access and influence (Hermann and Preston, 1994). These styles affect not only who is consulted, but also how their input is processed and weighted in decisions. Within such teams, distinct advisor roles often emerge, and complementarities between "idea persons" and implementation-focused advisors become key to effective leadership.

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Appendix A: General Equilibrium Results

We formulate and prove a more general result that will cover Proposition 1 as a corollary. Suppose there are N advisors. Each advisor i's bias b_i is private and may take a finite set of values. Consider any non-empty choice set of consulted advisors $A \subseteq N$. Up to relabeling the messages $\hat{m}_i$, every (possibly mixed strategy) equilibrium is characterized as follows. For each consulted advisor $i \in A$, there is a set T_i of bias types who choose to report truthfully with positive probability. Each advisor type $b_i \notin T_i$ babbles: she pools on message $\hat{m}_i = 1$ if she is biased rightward ($b_i > 0$), and on $\hat{m}_i = 0$ if biased leftward ($b_i < 0$).[16] Any equilibrium with non-empty consultation set A is characterized by the following truthtelling conditions for each consulted advisor.[17]

Theorem 2 *Let $(A, \mathbf{m}, y)$ be any equilibrium with $A \neq \emptyset$: then for each $i \in A$, the set T_i of bias types who are truthful with positive probability is non-empty. Moreover, for each advisor $i \in A$ and $b_i \in T_i$, the truthtelling condition, given the strategy $\mathbf{m}_{-i}$ of the other consulted advisors, is*

$$|b_i| \leq \left| \frac{\sum_{s_0 \in \{0,1\}} \sum_{\mathbf{m}_{-i} \in \{0,1\}^{|A|-1}} \Delta_i \left(s_0, \hat{m}_i, \mathbf{m}_{-i}\right)^2 \Pr(s_0, \mathbf{m}_{-i}|s_i)}{2 \sum_{s_0 \in \{0,1\}} \sum_{\mathbf{m}_{-i} \in \{0,1\}^{|A|-1}} \Delta_i \left(s_0, \hat{m}_i, \mathbf{m}_{-i}\right) \Pr(s_0, \mathbf{m}_{-i}|s_i)} \right|,$$

holding as an equality if b_i randomizes the message m_i for s_i, where $\Delta_i(s_0, \hat{m}_i, \mathbf{m}_j) = E[x \mid s_0, 1 - \hat{m}_i, \mathbf{m}_j] - E[x \mid s_0, \hat{m}_i, \mathbf{m}_j]$. The leader's equilibrium decision rule is $y(s_0, \hat{\mathbf{m}}_{\mathbf{A}}) = E[x \mid s_0, \hat{\mathbf{m}}_{\mathbf{A}}]$, for each message profile $\hat{\mathbf{m}}_{\mathbf{A}} \in \{0,1\}^A$.

Proof of Theorem 2. In equilibrium, the leader chooses y to maximize $Eu_0\left(y, x|s_0, \hat{\mathbf{m}}_{\mathbf{A}}\right) = -E[(y-x)^2 \,|s_0, \hat{\mathbf{m}}_{\mathbf{A}}]$. By taking a first-order and second-order condition, the optimal strategy becomes $y\left(s_0, \hat{\mathbf{m}}_{\mathbf{A}}\right) = E\left(x|s_0, \hat{\mathbf{m}}_{\mathbf{A}}\right)$.

Hence, the leader's ex-ante payoff is

$$\begin{aligned} W(A, \mathbf{m}, y) &= Eu_0\left(y, \mathbf{m}\right) = -E_{s_0, \hat{\mathbf{m}}_{\mathbf{A}}} E_x \left[(y(s_0, \hat{\mathbf{m}}_{\mathbf{A}}) - x)^2 | s_0, \hat{\mathbf{m}}_{\mathbf{A}}\right] \\ &= -E_{s_0, \hat{\mathbf{m}}_{\mathbf{A}}}[E_x \left[(E\left(x|s_0, \hat{\mathbf{m}}_{\mathbf{A}}\right) - x)^2 | s_0, \hat{\mathbf{m}}_{\mathbf{A}}\right]] = -E_{s_0, \hat{\mathbf{m}}_{\mathbf{A}}} Var(x|s_0, \hat{\mathbf{m}}_{\mathbf{A}}). \quad (5) \end{aligned}$$

[16]To accommodate the possibility that all types of an advisor babble, we adopt the convention that they all pool on the same message. Since off-path beliefs are unrestricted, this is without loss of generality.

[17]By a standard argument in cheap talk games, babbling equilibrium always exists.

The ex-ante payoff of each advisor i of type b_i is:

$$\begin{aligned} Eu_i(y, \mathbf{m}; b_i) &= -E_{s_0, \hat{\mathbf{m}}_{\mathbf{A}}} E_x \left[(y(s_0, \hat{\mathbf{m}}_{\mathbf{A}}) - x - b_i)^2 | s_0, \hat{\mathbf{m}}_{\mathbf{A}} \right] \\ &= -E_{s_0, \hat{\mathbf{m}}_{\mathbf{A}}} E_x \left[(E(x|s_0, \hat{\mathbf{m}}_{\mathbf{A}}) - x - b_i)^2 | s_0, \hat{\mathbf{m}}_{\mathbf{A}} \right] \\ &= -E_{s_0, \hat{\mathbf{m}}_{\mathbf{A}}} \left[E_x \left(E(x|s_0, \hat{\mathbf{m}}_{\mathbf{A}}) - x \right)^2 + b_i^2 + 2b_i E_x \left(E(x|s_0, \hat{\mathbf{m}}_{\mathbf{A}}) - x \right) | s_0, \hat{\mathbf{m}}_{\mathbf{A}} \right] \\ &= -E_{s_0, \hat{\mathbf{m}}_{\mathbf{A}}} E_x \left[\left(E(x|s_0, \hat{\mathbf{m}}_{\mathbf{A}}) - x \right)^2 | s_0, \hat{\mathbf{m}}_{\mathbf{A}} \right] - b_i^2 \\ &= Eu_0(y, \mathbf{m}) - b_i^2. \end{aligned}$$

Consider a communication strategy profile $\hat{m}_A$ and suppose that it is an equilibrium together with the strategy y. Consider a rightward biased advisor i of bias type $b_i \in T_i$. Given signal s_i, and the strategy m_{-i} of the other advisor $-i$ the advisor chooses $\hat{m}_i$ to maximize her equilibrium utility

$$\begin{aligned} Eu_i(y, \mathbf{m}; b_i|s_i) &= -E_{s_0, \hat{\mathbf{m}}_{\mathbf{A}}|s_i} E_x \left[(y(s_0, \hat{\mathbf{m}}_{\mathbf{A}}) - x - b_i)^2 | s_0, \hat{\mathbf{m}}_{\mathbf{A}}, s_i \right] \\ &= -E_{s_0, \hat{\mathbf{m}}_{\mathbf{A}}|s_i} E_x \left[(E(x|s_0, \hat{m}_i, m_{-i}) - x - b_i)^2 | s_0, s_i, m_{-i} \right]. \end{aligned}$$

When $s_i = 1$, the advisor's dominant strategy is to truthfully report $\hat{m}_i = s_i$. Because $b_i > 0$, the advisor would lose by lowering $E(x|s_0, \hat{\mathbf{m}}_{\mathbf{A}})$ by sending $\hat{m}_i = 0$.

When $s_i = 0$, the advisor does not deviate from reporting truthfully $\hat{m}_i = s_i$ to the leader if and only if

$$-\int_0^1 \sum_{s_0 \in \{0,1\}} \sum_{\mathbf{m}_{-i} \in \{0,1\}^{|A|-1}} \left[(y(s_0, \hat{m}_i, \mathbf{m}_{-i}) - x - b_i)^2 - (y(s_0, 1 - \hat{m}_i, \mathbf{m}_{-i}) - x - b_i)^2 \right] \cdot f(x, s_0, \mathbf{m}_{-i}|s_i) dx \geq 0.$$

If the advisor randomizes the message for s_i, the above inequality must hold as an equality.

Simplifying, we obtain:

$$-\int_0^1 \sum_{s_0 \in \{0,1\}} \sum_{\mathbf{m}_{-i} \in \{0,1\}^{|A|-1}} (y(s_0, \hat{m}_i, \mathbf{m}_{-i}) - y(s_0, 1 - \hat{m}_i, \mathbf{m}_{-i})) \cdot \left[\frac{y(s_0, \hat{m}_i, \mathbf{m}_{-i}) + y(s_0, 1 - \hat{m}_i, \mathbf{m}_{-i})}{2} - (x + b_i) \right] f(x, s_0, \mathbf{m}_{-i}|s_i) dx \geq 0.$$

Next, observing that

$$y(s_0, \hat{m}_i, \mathbf{m}_{-i}) = E[x|s_0, \hat{m}_i, \mathbf{m}_{-i}],$$

we obtain

$$-\int_0^1 \sum_{s_0\in\{0,1\}} \sum_{\mathbf{m}_{-i}\in\{0,1\}^{|A|-1}} \left(E\left[x|s_0,\hat{m}_i,\mathbf{m}_{-i}\right] - E\left[x|s_0,1-\hat{m}_i,\mathbf{m}_{-i}\right]\right) \cdot \left[\frac{E\left[x|s_0,\hat{m}_i,\mathbf{m}_{-i}\right] + E\left[x|s_0,1-\hat{m}_i,\mathbf{m}_{-i}\right]}{2} - x - b_i\right] f(x,s_0,\mathbf{m}_{-i}|s_i)dx \geq 0.$$

Denoting

$$\Delta_i\left(s_0,\hat{m}_i,\mathbf{m}_{-i}\right) = E\left[x|s_0,1-\hat{m}_i,\mathbf{m}_{-i}\right] - E\left[x|s_0,\hat{m}_i,\mathbf{m}_{-i}\right],$$

observing that:

$$f(x,s_0,\mathbf{m}_{-i}|s_i) = f(x|s_0,\mathbf{m}_{-i},s_i)\Pr(s_0,\mathbf{m}_{-i}|s_i),$$

and simplifying, we get:

$$\sum_{s_0\in\{0,1\}} \sum_{\mathbf{m}_{-i}\in\{0,1\}^{|A|-1}} \int_0^1 \Delta_i\left(s_0,\hat{m}_i,\mathbf{m}_{-i}\right) \left(\frac{E\left[x|s_0,\hat{m}_i,\mathbf{m}_{-i}\right] + E\left[x|s_0,1-\hat{m}_i,\mathbf{m}_{-i}\right]}{2} - x - b_i\right) \cdot f(x|s_0,\mathbf{m}_{-i},s_i)\Pr(s_0,\mathbf{m}_{-i}|s_i) \geq 0.$$

Furthermore, note that

$$\int_0^1 xf(x|s_0,\mathbf{m}_{-i},s_i)dx = E\left[x|s_0,s_i,\mathbf{m}_{-i}\right],$$

and that, because advisor i is rightward biased, $\hat{m}_i = 0$ only if $s_i = 0$,

$$E\left[x|s_0,s_i,\mathbf{m}_{-i}\right] = E\left[x|s_0,\hat{m}_i,\mathbf{m}_{-i}\right].$$

Hence, we obtain:

$$\sum_{s_0\in\{0,1\}} \sum_{\mathbf{m}_{-i}\in\{0,1\}^{|A|-1}} \Delta_i\left(s_0,\hat{m}_i,\mathbf{m}_{-i}\right) \left(\frac{\Delta_i\left(s_0,\hat{m}_i,\mathbf{m}_{-i}\right)}{2} - b_i\right) \Pr(s_0,\mathbf{m}_{-i}|s_i) \geq 0,$$

and, rearranging:

$$b_i \leq \frac{\sum_{s_0\in\{0,1\}} \sum_{\mathbf{m}_{-i}\in\{0,1\}^{|A|-1}} \Delta_i\left(s_0,\hat{m}_i,\mathbf{m}_{-i}\right) \frac{\Delta_i(s_0,\hat{m}_i,\mathbf{m}_{-i})}{2} \Pr(s_0,\mathbf{m}_{-i}|s_i)}{\sum_{s_0\in\{0,1\}} \sum_{\mathbf{m}_{-i}\in\{0,1\}^{|A|-1}} \Delta_i\left(s_0,\hat{m}_i,\mathbf{m}_{-i}\right) \Pr(s_0,\mathbf{m}_{-i}|s_i)}$$

The argument for a leftward biased advisor i is symmetric, leading to the condition:

$$b_i \geq \frac{\sum_{s_0\in\{0,1\}}\sum_{\mathbf{m}_{-i}\in\{0,1\}^{|A|-1}} \Delta_i\left(s_0,\hat{m}_i,\mathbf{m}_{-i}\right)\left(\frac{\Delta_i(s_0,\hat{m}_i,\mathbf{m}_{-i})}{2}\right)\Pr(s_0,\mathbf{m}_{-i}|s_i)}{\sum_{s_0\in\{0,1\}}\sum_{\mathbf{m}_{-i}\in\{0,1\}^{|A|-1}} \Delta_i\left(s_0,\hat{m}_i,\mathbf{m}_{-i}\right)\Pr(s_0,\mathbf{m}_{-i}|s_i)},$$

where both the left-hand side and the right-hand side are negative.

Combining these elements, we arrive at the condition (2). ■

We continue with derivations that will be useful to calculate the welfare expression (5), as well as the terms $\Delta_i\left(s_0,\hat{m}_i,\mathbf{m}_{-i}\right)$ and $\Pr(s_0,s_i,\mathbf{m}_{-i})$ in condition (2), useful for the following equilibrium calculations. We assume henceforth that $N=2$ and write m_j instead of $\mathbf{m}_{-i}$.

For any player i and profile of leader's information $\left(s_0,\hat{m}_i,m_j\right)$, we let the n-th moment of x be:

$$P_n\left(s_0,\hat{m}_i,m_j\right)=\int_0^1 x^n \Pr\left(s_0,\hat{m}_i,m_j|x\right)dx.$$

Further, using the fact that the prior of x is uniform, we obtain:

$$\begin{aligned} E[x|s_0,\hat{m}_i,m_j] &= \frac{\int_0^1 x\Pr\left(s_0,\hat{m}_i,m_j|x\right)dx}{\int_0^1 \Pr\left(s_0,\hat{m}_i,m_{-i}|x\right)dx}=\frac{P_1\left(s_0,\hat{m}_i,m_j\right)}{P_0(s_0,\hat{m}_i,m_j)}, \\ \Delta_i\left(s_0,\hat{m}_i,m_j\right) &= \frac{P_1\left(s_0,1-\hat{m}_i,m_j\right)}{P_0\left(s_0,1-\hat{m}_i,m_j\right)}-\frac{P_1\left(s_0,\hat{m}_i,m_j\right)}{P_0\left(s_0,\hat{m}_i,m_j\right)}. \end{aligned}$$

Expression (5) can be written as:

$$\begin{aligned} W(A,\mathbf{m},y) &= -E_{s_0,\hat{\mathbf{m}}_{\mathbf{A}}}\left[E_x\left[(y(s_0,\hat{\mathbf{m}}_{\mathbf{A}})-x)^2|s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right]\right] \\ &= -\sum_{s_0\in\{0,1\}}\sum_{\hat{\mathbf{m}}_{\mathbf{A}}\in\{0,1\}^{|A|}} E_x\left[\left(\frac{P_1\left(s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right)}{P_0\left(s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right)}-x\right)^2\middle|s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right]\Pr\left(s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right) \\ &= -\sum_{s_0\in\{0,1\}}\sum_{\hat{\mathbf{m}}_{\mathbf{A}}\in\{0,1\}^{|A|}}\left[\frac{P_1\left(s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right)^2}{P_0\left(s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right)^2}+\frac{P_2\left(s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right)}{P_0\left(s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right)}-2\frac{P_1\left(s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right)^2}{P_0\left(s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right)^2}\right]\Pr\left(s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right) \\ &= -\sum_{s_0\in\{0,1\}}\sum_{\hat{\mathbf{m}}_{\mathbf{A}}\in\{0,1\}^{|A|}} w\left(s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right),\ w\left(s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right)\equiv\left[P_2\left(s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right)-\frac{P_1\left(s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right)^2}{P_0\left(s_0,\hat{\mathbf{m}}_{\mathbf{A}}\right)}\right]. \end{aligned}$$

Further, we expand the following terms used in equilibrium calculations below, for $N=2$.

First, we calculate:

$$\Pr\left(s_0, s_1, s_2\right) = \sum_{\mathbf{s}\in\{0,1\}^3} \prod_{i=1,2} \int_0^1 \Pr\left(s_1|s_1'\right) \Pr\left(s_0|s_1', s_2\right) \Pr\left(s_1', s_2|x\right) dx$$

where (s_1', s_2) is the profile of true signal realizations, and (s_1, s_2) is the profile of observed signals. The above yields the following expansion

$$\begin{aligned} P_n\left(s_0, \hat{m}_i, m_j\right) &= \int_0^1 x^n \Pr\left(s_0, \hat{m}_i, m_j|x\right) dx \\ &= \int_0^1 \sum_{\mathbf{s}\in\{0,1\}^3} x^n \Pr\left(\hat{m}_i, m_j|s_1', s_2\right) \Pr\left(s_0|s_1', s_2\right) \Pr\left(s_1', s_2|x\right) dx \\ &= \sum_{\mathbf{s}\in\{0,1\}^3} \prod_{i=1,2} \int_0^1 x^n \Pr\left(\hat{m}_i|s_1', s_2\right) \Pr\left(s_0|s_1', s_2\right) \Pr\left(s_1', s_2|x\right) dx, \end{aligned} \tag{6}$$

Finally, for any signal realization profile (s_0, s_1', s_2) define $\gamma \equiv s_0 + s_1' + s_2$. Then,

$$\Pr\left(s_0, s_1', s_2|x\right) = x^{\gamma}(1-x)^{3-\gamma}. \tag{7}$$

Appendix B: Equilibria with certain bias

Equilibrium $\mathcal{E}_{12}$: both advisors are truthful

Using Theorem 2 and the formula (6), the upper bias for the advisor 1 can be written as:

$$\eta_{12.1} = \frac{\sum_{s_0\in\{0,1\}} \sum_{s_2\in\{0,1\}} \Delta_1\left(s_0, s_2\right)^2 P_0(s_0, s_1 = 0, s_2)}{2\sum_{s_0\in\{0,1\}} \sum_{s_2\in\{0,1\}} \Delta_1\left(s_0, s_2\right) P_0(s_0, s_1 = 0, s_2)}, \tag{8}$$

where

$$\Delta_1\left(s_0, s_2\right) = \frac{P_1(s_0, s_1 = 1, s_2)}{P_0(s_0, s_1 = 1, s_2)} - \frac{P_1(s_0, s_1 = 0, s_2)}{P_0(s_0, s_1 = 0, s_2)}$$

We observe that due to the uncertainty in the true signal s_1' given the observation of s_1, we have

$$\begin{aligned} P_n\left(s_0, s_1, s_2\right) =& p\frac{\left(s_0 + s_1 + s_2 + n\right)!\left(3 - s_0 - s_1 - s_2\right)!}{(4+n)!} + \\ & (1-p)\frac{\left(s_0 - s_1 + s_2 + n + 1\right)!\left(2 + s_1 - s_0 - s_2\right)!}{(4+n)!}. \end{aligned}$$

We can then immediately calculate $P_0\left(s_0, s_1, s_2\right)$ and $P_1\left(s_0, s_1, s_2\right)$, given the observed signal $s_1 = 0$, which we use for the expression (8):

$$P_0(0,0,0) = \frac{2p+1}{12},\ P_1(0,0,0) = \frac{p+2}{60},$$
$$P_0(0,0,1) = P_0(1,0,0) = \frac{1}{12},\ P_1(0,0,1) = P_1(1,0,0) = \frac{3-p}{60},$$
$$P_0(1,0,1) = \frac{3-2p}{12},\ P_1(1,0,1) = \frac{4-3p}{20}.$$

Moreover, because

$$P_n(s_0, s_1 = 1, s_2) = pP_n(s_0, s_1' = 1, s_2) + (1-p)P_n(s_0, s_1' = 0, s_2)$$
$$P_n(s_0, s_1 = 0, s_2) = pP_n(s_0, s_1' = 0, s_2) + (1-p)P_n(s_0, s_1' = 1, s_2)$$

$P_n(s_0, s_1 = 1, s_2)$ can be obtained from $P_n(s_0, s_1 = 0, s_2)$ by interchanging p with $1-p$:

$$P_0(0,1,0) = \frac{3-2p}{12},\ P_1(0,1,0) = \frac{3-p}{60},$$
$$P_0(0,1,1) = P_0(1,1,0) = \frac{1}{12},\ P_1(0,1,1) = P_1(1,1,0) = \frac{2+p}{60},$$
$$P_0(1,1,1) = \frac{2p+1}{12},\ P_1(1,1,1) = \frac{3p+1}{20}.$$

Plugging in $P_0(s_0, s_1, s_2)$, and $P_1(s_0, s_1, s_2)$ into $\Delta_1(s_0, s_2)$, for $(s_0, s_2) \in \{0,1\}^2$ and simplifying:

$$\Delta_1(0,0) = \frac{3}{5}\frac{2p-1}{(2p+1)(3-2p)},\ \Delta_1(0,1) = \Delta_1(1,0) = \frac{1}{5}(2p-1),\ \Delta_1(1,1) = \frac{3}{5}\frac{2p-1}{(2p+1)(3-2p)}.$$

Substituting $\Delta_1(s_0, s_2)$ and $P_0(s_0, s_1 = 0, s_2)$ into the expression (8), and simplifying, we get:

$$\eta_{12.1}(p) = \frac{1}{10}\frac{(27 + 24p - 8p^2 - 32p^3 + 16p^4)(2p-1)}{(2p+1)(3-2p)(9+4p-4p^2)}.$$

Due to symmetry, the constraint is $|b_1| \leq \eta_{12.1}$

The truthtelling constraint of advisor 2 in equilibrium $\mathcal{E}_{12}$ is $|b_2| \leq \eta_{12.2}$, with, again simplifying (2),

$$\eta_{12.2} \equiv \frac{\sum_{s_0\in\{0,1\}}\sum_{s_1\in\{0,1\}}\Delta_2(s_0,s_1)^2 P_0(s_0,s_1,s_2=0)}{2\sum_{s_0\in\{0,1\}}\sum_{s_1\in\{0,1\}}\Delta_2(s_0,s_1) P_0(s_0,s_1,s_2=0)}, \tag{9}$$

where

$$\Delta_2(s_0,s_1) = \frac{P_1(s_0,s_1,s_2=1)}{P_0(s_0,s_1,s_2=1)} - \frac{P_1(s_0,s_1,s_2=0)}{P_0(s_0,s_1,s_2=0)}.$$

Plugging in $P_0(s_0, s_1, s_2)$ and $P_1(s_0, s_1, s_2)$ derived above into $\Delta_2(s_0, s_1)$, and simplifying,

$$\Delta_2(0,0) = \frac{1}{5}\frac{4p - 2p^2 + 1}{2p + 1},\ \Delta_2(0,1) = \frac{1}{5}\frac{3 - 2p^2}{3 - 2p},\ \Delta_2(1,0) = \frac{1}{5}\frac{3 - 2p^2}{3 - 2p},\ \Delta_2(1,1) = \frac{1}{5}\frac{4p - 2p^2 + 1}{2p + 1}.$$

Substituting $\Delta_2(s_0, s_1)$ and $P_0(s_0, s_1, s_2 = 0)$ into (9), and simplifying, we obtain:

$$\eta_{12.2}(p) = \frac{1}{10}\frac{27 + 132p + 88p^2 - 360p^3 - 20p^4 + 240p^5 - 80p^6}{(2p + 1)(3 - 2p)(9 + 4p - 4p^2)(1 + 2p - 2p^2)}.$$

To calculate the welfare $W_{12}(p)$, we simplify formula (5) and use the symmetry of the prior $\Pr(s_0, s_1, s_2)$, $\Pr(s_0, s_1, s_2) = \Pr(1 - s_0, 1 - s_1, 1 - s_2)$ for all $(s_0, s_1, s_2) \in \{0,1\}^3$, to obtain:

$$W_{12}(p) = -2 \sum_{(s_1,s_2)\in\{0,1\}^2} w(s_0 = 0, s_1, s_2),$$

$$w(0, s_1, s_2) = P_2(0, s_1, s_2) - \frac{P_1(0, s_1, s_2)^2}{P_0(0, s_1, s_2)} \text{ for } (s_1, s_2) \in \{0,1\}^2. \tag{10}$$

Using the above expressions for $P_0(0, s_1, s_2)$ and $P_1(0, s_1, s_2)$, together with: $P_2(0,0,0) = p\frac{2!3!}{6!} + (1-p)\frac{3!2!}{6!} = \frac{1}{60}$, $P_2(0,0,1) = p\frac{3!2!}{6!} + (1-p)\frac{4!1!}{6!} = \frac{2-p}{60}$, $P_2(0,1,0) = \frac{1}{60}$, $P_2(0,1,1) = \frac{1+p}{60}$, we obtain, after simplification:

$$w(0,0,0) = \frac{1 + 6p - p^2}{300(2p + 1)},\ w(0,0,1) = w(0,1,0) = \frac{1 + p - p^2}{300},\ w(0,1,1) = \frac{6 - 4p - p^2}{300(3 - 2p)}.$$

Plugging these expressions into (10), we obtain, after simplification:

$$W_{12}(p) = -\frac{1}{150}\frac{15 + 38p - 30p^2 - 16p^3 + 8p^4}{(2p + 1)(3 - 2p)}.$$

Equilibrium $\mathcal{E}_1$: only advisor 1 is truthful

Simplifying condition (2), we obtain the truthtelling constraint:

$$|b_1| \le \eta_1 \equiv \frac{\sum_{s_0\in\{0,1\}} \Delta_1(s_0)^2 P_0(s_0, s_1 = 0)}{2\sum_{s_0\in\{0,1\}} \Delta_1(s_0) P_0(s_0, s_1 = 0)},\ \Delta_1(s_0) = \frac{P_1(s_0, s_1 = 1)}{P_0(s_0, s_1 = 1)} - \frac{P_1(s_0, s_1 = 0)}{P_0(s_0, s_1 = 0)}, \text{ for } s_0 = 0, 1. \tag{11}$$

Further, using symmetry of prior $\Pr(s_0, s_1)$, we obtain:

$$W_1 = -2 \sum_{s_1 \in \{0,1\}} w(0, s_1), \text{ where } w(0, s_1) = P_2(0, s_1) - \frac{P_1(0, s_1)^2}{P_0(0, s_1)}, \text{ for all } s_1 \in \{0, 1\}.$$

When signal s_1 is imprecise, using (6) and (7), $P_n(s_0, s_1)$ take the form, for $(s_0, s_1) \in \{0, 1\}^2$,

$$P_n(s_0, s_1) = p\frac{(s_0 + s_1 + n)!(2 - s_0 - s_1)!}{(3 + n)!} + (1 - p)\frac{(s_0 - s_1 + 1 + n)!(3 - s_0 + s_1)!}{(3 + n)!}.$$

Once we obtain $P_n(s_0, s_1)$ for $n = 0, 1$ and $(s_0, s_1) \in \{0, 1\}^2$, we plug them into expression (11) and obtain the threshold η_1 and welfare formula W_1 (detailed calculations are in a supplementary appendix):

$$\eta_1(p) = \frac{1}{4}\frac{2p - 1}{(p + 1)(2 - p)} \text{ and } W_1(p) = -\frac{1}{12}\frac{1 + 2p - 2p^2}{(p + 1)(2 - p)}.$$

When s_1 is correlated with signal s_0:

$$\eta_1(\rho) = \frac{1}{4(2 + \rho)} \text{ and } W_1(\rho) = -\frac{1}{12}\frac{1 + \rho}{2 + \rho}.$$

It is easy to show that $\eta_{12.1} < \eta_{12.2} < \eta_2$ and $\eta_{12.1} < \eta_1 < \eta_2$, and that $W_0 < W_1 < W_2 < W_{12}$ for all $p \in (1/2, 1)$.

Proof of Proposition 2 To obtain the optimal equilibrium, we proceed in steps as follows. Firstly, fix $p > 1/2$ and let us calculate the following thresholds for c, denoted by c_{12}, c_1, c_2, assuming that the respective allocations $\mathcal{E}_1, \mathcal{E}_2, \mathcal{E}_{12}$ are implementable:

$$\begin{aligned} W_{12} \geq V_0 \iff c \leq c_{12} \equiv \frac{p(p(12(p-2)p + 5) + 7) - 15}{450(2p - 3)(2p + 1)}, \\ W_1 \geq V_0 \iff c \leq c_1 \equiv \frac{(1 - 2p)^2}{36(1 + p)(2 - p)}, \\ W_2 \geq V_0 \iff c \leq c_2 \equiv \frac{1}{72}. \end{aligned}$$

Since

$$c_2 > \max\{c_{12}, c_1\} \text{ for } p \in (1/2, 1)$$

we conclude that for $c > 1/72$, $\mathcal{E}_0 \succ \max\{\mathcal{E}_{12}, \mathcal{E}_1, \mathcal{E}_2\}$: no advisor is hired in this case.

For the following, assume $c < 1/72$.

(i) Because $\mathcal{E}_2$ outperforms $\mathcal{E}_0$ in this range, we have $W_2 \geq \max\{W_1(p), V_0\}$. Suppose that $|b_i| \leq \eta_{12.i}$ for each $i = 1, 2$. To derive the optimal equilibrium in this range, we need to establish the comparison between W_{12} and W_2.[18] It is optimal to implement $\mathcal{E}_{12}$ provided that $|b_i| \leq \eta_{12.i}$ for each $i = 1, 2$ if

$$-2c - \frac{8p^4 - 16p^3 - 30p^2 + 38p + 15}{150(3-2p)(2p+1)} \geq -\frac{1}{24} - c.$$

Therefore, for each $p \in (1/2, 1]$ there exists a cost threshold

$$\bar{c}_{12}(p) = \frac{(1-2p)^2(8(p-1)p - 15)}{600(2p-3)(2p+1)}$$

weakly increasing in p, such that for all $c \leq \bar{c}_{12}(p)$ it is optimal to consult two advisors; and for all $c \in (\bar{c}_{12}(p), 1/72]$ it is optimal to consult advisor 2 (for $p = 1$ is it weakly optimal to consult advisor 2 as s_1 and s_2 are equally informative).

(ii) Next, suppose that either $|b_1| > \eta_{12.1}$ and $|b_2| \leq \eta_{12.2}$, or $|b_2| \in (\eta_{12.2}, \eta_2]$. Then, $\mathcal{E}_{12}$ is not implementable. Here, $\mathcal{E}_2$ is the optimal equilibrium, and it is implementable since $|b_2| < \eta_2$.

(iii) Finally, suppose that $|b_2| > \eta_2$ and $|b_1| \leq \eta_1$, so that both $\mathcal{E}_{12}$ and $\mathcal{E}_2$ are not feasible, while $\mathcal{E}_1$ is feasible. The equilibrium $\mathcal{E}_1$ is optimal if

$$W_1 > V_0 \iff -c - \frac{-2p^2 + 2p + 1}{12(2-p)(p+1)} \geq -\frac{1}{18}.$$

Therefore, for each $p \in (1/2, 1]$ there exists a cost threshold

$$\bar{c}_1(p) = -\frac{(1-2p)^2}{36(p-2)(p+1)}$$

weakly increasing in p, such that for all $c \leq \bar{c}_1(p)$ it is optimal to implement $\mathcal{E}_1$, and otherwise it is optimal to implement $\mathcal{E}_0$ i.e., not consulting any advisors. Q.E.D.

Proof of Proposition 4. Recall that we only need to characterize the mixed strategy equilibrium $\mathcal{M}_{2.1}$, as in all other cases strict mixing is either not implementable, or dominated by pure strategy equilibria.

In particular, denote by $V_{2.1}$ the principal's consultation value (i.e., principal's payoff

[18]At $p = 1$, the expected leader's payoffs from consulting advisor 1 only, and from consulting advisor 2 only, are the same; therefore we only focus on the comparison between W_{12} and W_2.

net of consultation costs).

Consider an equilibrium $\mathcal{M}_{2.1}$ where expert 1 uses the strategy $\sigma_1 \in (0,1)$, and recall that V_2 denotes the consultation value if only expert 2 is consulted. We first calculate the following cost bound $V_{2.1} - 2c > V_2 - c$, if and only if:

$$c \leq \hat{c}_2(p,\sigma_1) = -\frac{1}{600(2p-3)(2p+1)(\sigma_1-2)(2p\sigma_1+\sigma_1-4)((2p-3)\sigma_1+4)} \cdot (1-2p)^2\sigma_1$$
$$(32p^4\sigma_1^2 - 64p^3\sigma_1^2 + 4p^2\left(5\sigma_1^2+14\sigma_1-32\right) + 4p\left(3\sigma_1^2-14\sigma_1+32\right) + 3\left(21\sigma_1^2-86\sigma_1+80\right)).$$

The key characteristic of the above threshold is that

$$\frac{\partial \hat{c}_2(p,\sigma_1)}{\partial \sigma_1} = \frac{(1-2p)^2\left(-\frac{9(2p-3)}{(2p\sigma_1+\sigma_1-4)^2} + \frac{6-8(p-1)p}{(\sigma_1-2)^2} + \frac{9(2p+1)}{((2p-3)\sigma_1+4)^2}\right)}{300(3-4(p-1)p)} > 0$$

which implies that a higher σ_1 – resulting in a more informative signal for the leader – is associated with a higher cost threshold to use the team of both experts, instead of only expert 2.

Next, fix a bias b_1, which is associated with the mixing probability σ_1 which solves

$$b_1 = \frac{\sum_{s_0\in\{0,1\}}\sum_{s_2\in\{0,1\}}\Delta_1(s_0,s_2)^2 P_0(s_0,s_1=0,s_2)}{2\sum_{s_0\in\{0,1\}}\sum_{s_2\in\{0,1\}}\Delta_1(s_0,s_2) P_0(s_0,s_1=0,s_2)},$$

where:

$$\Delta_1(s_0,s_2) = \frac{P_1(s_0,\hat{m}_1=1,s_2)}{P_0(s_0,\hat{m}_1=1,s_2)} - \frac{P_1(s_0,\hat{m}_1=0,s_2)}{P_0(s_0,\hat{m}_1=0,s_2)},$$

$$P_n(s_0,\hat{m}_1=1,s_2) = p\sigma_1\frac{(s_0+1+s_2+n)!\,(4-s_0-s_2)!}{(4+n)!} + (1-p)\,\sigma_1\frac{(s_0-1+s_2+n+1)!\,(3-s_0-s_2)!}{(4+n)!},$$

$$\begin{aligned}P_n(s_0,\hat{m}_1 &= 0,s_2) = p\frac{(s_0+s_2+n)!\,(3-s_0-s_2)!}{(4+n)!} + (1-p)\,\frac{(s_0+1+s_2+n)!\,(4-s_0-s_2)!}{(4+n)!}\\ &+p(1-\sigma_1)\frac{(s_0+1+s_2+n)!\,(2-s_0-s_2)!}{(4+n)!} + (1-p)\,(1-\sigma_1)\frac{(s_0+s_2+n)!\,(3-s_0-s_2)!}{(4+n)!}.\end{aligned}$$

Note that $\sigma_1 \to 1$ as $b_1 \to \eta_{12.1}$.

The corresponding upper bound on b_2 is defined in equation

$$\eta_{2M} = \frac{\sum_{s_0\in\{0,1\}}\sum_{\hat{m}_1\in\{0,1\}}\Delta_2(s_0,\hat{m}_1)^2 P_0(s_0,\hat{m}_1,s_2=0)}{2\sum_{s_0\in\{0,1\}}\sum_{\hat{m}_1\in\{0,1\}}\Delta_2(s_0,\hat{m}_1) P_0(s_0,\hat{m}_1,s_2=0)},$$

and satisfies the following properties:

$$\eta_{2M}(\sigma_1) \to \eta_2 \text{ as } \sigma_1 \to 0.$$

The leader hires both experts when $c < \hat{c}_2(p, \sigma_1)$ and $b_2 \leq \eta_{2M}(p, \sigma_1)$ and only expert 2 for $c \geq \hat{c}_2(p, \sigma_1)$. We note that $\eta_{2M}(p, \sigma_1) \to \eta_2$ as $\sigma_1 \to 0$: a higher b_2 is associated with lower σ_1; in turn, $b_2 \to \eta_2$ requires a higher $\eta_{2M}(c)$, which means that c has to go down. In the limit, in equilibrium $\mathcal{M}_{2.1}$, as $b_2 \to \eta_2$, we require $\sigma_1 \to 0$, and $c \to 0$.

For all other bias profiles, either there is a pure strategy equilibrium in which both advisers are truthful, or there is a unique pure strategy equilibrium with truthful communication. Hence, the optimal pure strategy equilibrium is also the optimal mixed strategy equilibrium.Q.E.D.

Appendix C: Uncertain bias

Equilibrium $\mathcal{E}_{12A}$. The equilibrium $\mathcal{E}_{12A}$ in which expert 1 and type b_1 of expert 2 are truthful exists if and only if $b_1 \leq \eta_{12A.1}(p, q)$ and $b_1 \leq \eta_{12A.2}(p, q)$, i.e., $b_1 \leq \eta_{12A}(p, q) \equiv \min\{\eta_{12A.1}(p, q), \eta_{12A.2}(p, q)\}$. Simplifying condition (2), we obtain:

$$\eta_{12A.2} \equiv \frac{\sum_{(s_0,s_1)\in\{0,1\}^2} \Delta_{2A}(s_0, s_1)^2 \Pr(s_0, s_1, s_2 = 0)}{2\sum_{(s_0,s_1)\in\{0,1\}^2} \Delta_{2A}(s_0, s_1) \Pr(s_0, s_1, s_2 = 0)},$$
$$\Delta_{2A}(s_0, s_1) = \frac{P_1(s_0, s_1, \hat{m}_2 = 1)}{P_0(s_0, s_1, \hat{m}_2 = 1)} - \frac{P_1(s_0, s_1, \hat{m}_2 = 0)}{P_0(s_0, s_1, \hat{m}_2 = 0)}. \tag{12}$$

Using (6), we calculate $P_n(s_0, s_1, \hat{m}_2)$ for $n = 0, 1, 2$, and $(s_0, s_1, \hat{m}_2) \in \{0, 1\}^3$:

$$P_n(s_0, s_1, 0) = qp\frac{(s_0 + s_1 + n)!\,(3 - s_0 - s_1)!}{(4 + n)!} + q(1 - p)\frac{(1 + s_0 - s_1 + n)!\,(2 - s_0 + s_1)!}{(4 + n)!}.$$

$$\begin{aligned} P_n(s_0, s_1, 1) = {} & (1 - q)p\frac{(s_0 + s_1 + n)!\,(2 - s_0 - s_1)!}{(3 + n)!} + (1 - q)(1 - p)\frac{(s_0 + 1 - s_1 + n)!\,(1 - s_0 + s_1)!}{(3 + n)!} \\ & + qp\frac{(s_0 + s_1 + 1 + n)!\,(2 - s_0 - s_1)!}{(4 + n)!} + q(1 - p)\frac{(s_0 - s_1 + 2 + n)!\,(1 - s_0 + s_1)!}{(4 + n)!}, \end{aligned}$$

as well as $\Pr(s_0, s_1, s_2)$ for $(s_0, s_1, s_2) \in \{0, 1\}^3$,

$$\Pr(s_0, s_1, s_2) = p\frac{(s_0 + s_1 + s_2)!\,(3 - s_0 - s_1 - s_2)!}{4!} + (1 - p)\frac{(s_0 - s_1 + s_2 + 1)!\,(2 - s_0 + s_1 - s_2)!}{4!}.$$

Proceeding as with equilibria $\mathcal{E}_{12}$ and $\mathcal{E}_1$, we then derive $\Delta_{2A}(s_0, s_1)$ and $\Pr(s_0, s_1, 0)$ for $(s_0, s_1) \in \{0,1\}^2$, and substitute them into (12) to obtain:

$$\eta_{12A.2}(p,q) = \frac{\left(\frac{1+4p-2p^2}{2+2p-q-2qp}\right)^2 \frac{1}{2p+1} + \left(\frac{3-2p^2}{4-3q-2p+2qp}\right)^2 \frac{1}{3-2p} + \left(\frac{2p^2-3}{q+2p-4}\right)^2 + \left(\frac{1+4p-2p^2}{2+2p-q}\right)^2}{10\left(\frac{1+4p-2p^2}{2+2p-q-2qp} + \frac{3-2p^2}{4-3q-2p+2qp} + \frac{2p^2-3}{q+2p-4} + \frac{1+4p-2p^2}{2+2p-q}\right).}.$$

Proceeding in the same fashion as for $\eta_{12A.2}$,, we obtain:

$$\eta_{12A.1}(p,q) = (2p-1)\frac{\left(\frac{3}{3-2p}\right)^2 q\frac{1}{2p+1} + q + \left(\frac{10-12q+3q^2}{4-3q-2p+2qp}\right)^2 \frac{1}{2-q+2p-2qp} + \left(\frac{10-8q+q^2}{(2+2p-q)}\right)^2 \frac{1}{4-q-2p}}{10\left(\frac{3q}{3-2p} + q + \frac{10-12q+3q^2}{4-3q-2p+2qp} + \frac{10-8q+q^2}{2+2p-q}\right)}.$$

Simplifying expression (5) obtain:

$$W_{12A}(p,q) = -\sum_{(s_0,s_1,\hat{m}_2)\in\{0,1\}^3} w(s_0,s_1,\hat{m}_2),\ w(s_0,s_1,\hat{m}_2) = P_2(s_0,s_1,\hat{m}_2) - \frac{P_1(s_0,s_1,\hat{m}_2)^2}{P_0(s_0,s_1,\hat{m}_2)},$$

so that substituting in $P_n(s_0,s_1,\hat{m}_2)$ for $(s_0,s_1,\hat{m}_2) \in \{0,1\}^3$, and simplifying, we get:

$$\begin{aligned}
W_{12A}(p,q) = &-\frac{1}{300}q\frac{1+6p-p^2}{2p+1} - \frac{1}{300}q\left(1+p-p^2\right) - \frac{1}{300}q\frac{6-4p-p^2}{3-2p} - \frac{1}{300}q\left(1+p-p^2\right) \\
&- \frac{1}{300}\frac{5-p^2q^2+10p^2q-10p^2+6pq^2-25pq+20p+q^2-5q}{2+2p-q-2pq} \\
&- \frac{1}{300}\frac{15-10q+pq^2+10p^2q-p^2q^2-5pq-10p^2+q^2+}{4-q-2p} \\
&- \frac{1}{300}\frac{15-p^2q^2+10p^2q-10p^2-4pq^2+5pq+6q^2-20q}{4-2p-3q+2pq} \\
&- \frac{1}{300}\frac{5+20p-5q+pq^2+10p^2q-p^2q^2-15pq-10p^2+q^2}{2+2p-q}.
\end{aligned}$$

Equilibrium $\mathcal{E}_{2A}$. Only the aligned advisor 2 is trutful. Using (2), the equilibrium condition is

$$b_1 \leq \eta_{2A}(q) \equiv \frac{\sum_{s_0\in\{0,1\}} \Delta_{2A}(s_0)^2 \Pr(s_0, s_2=0)}{2\sum_{s_0\in\{0,1\}} \Delta_{2A}(s_0)\Pr(s_0,s_2=0)},\ \Delta_{2A}(s_0) = \frac{P_1(\hat{m}_2=1,s_0)}{P_0(\hat{m}_2=1,s_0)} - \frac{P_1(\hat{m}_2=0,s_0)}{P_0(\hat{m}_2=0,s_0)}. \tag{13}$$

Again, using (**??**)-(7), and simplifying, we obtain:

$$\Pr\left(s_0, s_2 = 0\right) = \frac{2 - s_0}{6},\ P_n\left(s_0, \hat{m}_2 = 1\right) = (1-q)\frac{(s_0+n)!\,(1-s_0)!}{(2+n)!} + q\frac{(1+s_0+n)!\,(1-s_0)!}{(3+n)!},$$

$$P_n\left(s_0, \hat{m}_2 = 0\right) = q\frac{(s_0+n)!\,(2-s_0)!}{(3+n)!},\ \text{for } s_0 \in \{0,1\}.$$

This allows us to find $\Delta_{2A}(s_0)$ for $s_0 \in \{0,1\}$ so that, substituting into (13) and simplifying, we conclude:

$$\eta_{2A}(q) = \frac{1}{8}\frac{9 - 10q + 3q^2}{(3-2q)(3-q)(2-q)}.$$

Simplifying expression (5) we obtain

$$W_{2A}(q) = -\sum_{(s_0,\hat{m}_2)\in\{0,1\}^2} w_2\left(s_0, \hat{m}_2\right),\ w_2\left(s_0, \hat{m}_2\right) \equiv P_2\left(s_0, \hat{m}_2\right) - \frac{P_1\left(s_0, \hat{m}_2\right)^2}{P_0\left(s_0, \hat{m}_2\right)} \text{ for } \left(s_0, \hat{m}_2\right) \in \{0,1\}^2. \tag{14}$$

Substituting in $P_n(\hat{m}_2, s_0)$, $n = 1, 2, 3$ and simplifying:

$$W_{2A}(q) = -\frac{1}{48}\frac{24 - 27q + 7q^2}{(3-2q)(3-q)}.$$

Proof of Proposition 5. We verified that some equilibria are Pareto ranked in terms of ex-ante welfare. The equilibrium $\mathcal{E}_{12}$ is top ranked. Both equilibria $\mathcal{E}_{12A}$ and $\mathcal{E}_2$ dominate $\mathcal{E}_{2A}$ and $\mathcal{E}_1$. However $\mathcal{E}_{12A}$ and $\mathcal{E}_2$ are not ranked among each other, and nor are $\mathcal{E}_{2A}$ and $\mathcal{E}_1$. Further, we determined that there exist functions $g_1, g_2 : q \mapsto p$ such that $W_2(p,q) > W_{12A}(p,q)$ if and only if $p < g_2(q)$ and $W_{2A}(p,q) > W_1(p,q)$ if and only if $p < g_1(q)$. The function g_1 strictly increases in q with $g_1(0) = 0$ and $g_1(1) = 1$, whereas g_2 strictly decreases in q with $g_2(0) = 1$ and $g_2(1) = 0$.

Turning to consider equilibrium existence, we first note that $\mathcal{E}_{12}$ is the only equilibrium whose existence requires joint conditions on b_1 and b_2. The existence of equilibria η_{12A}, $\mathcal{E}_{2A}$ and $\mathcal{E}_1$ requires only conditions on b_1, and the existence of $\mathcal{E}_2$ only conditions on b_2. Then, we verified that some equilibrium existence thresholds are ordered for all (p,q), and specifically: $\eta_{12.1} < \eta_{12A.1} < \eta_1 < \eta_2$, $\eta_{12.1} < \eta_{12.2} < \eta_2$, $\eta_{12A.2} < \eta_{12.2} < \eta_2$, $\eta_{12A.2} < \eta_{2A} < \eta_2$. Hence $\eta_{12A} = \min\{\eta_{12A.1}, \eta_{12A.2}\} < \{\eta_1, \eta_{2A}, \eta_{12.2}\}$, and we obtain the threshold ordering $\eta_{12.1} < \eta_{12A} < \{\eta_1, \eta_{2A}, \eta_{12.2}\} < \eta_2$.

This means that for any fixed b_1, the existence range $[0, \eta_2]$ of equilibrium $\mathcal{E}_2$ in the

b_2 dimension strictly contains the existence range $[0, \eta_{12.2}]$ of equilibrium $\mathcal{E}_{12}$ (which is empty if $b_1 > \eta_{12.1}$). Most importantly, for any fixed b_2, the existence regions $[0, \eta_{2A}]$ and $[0, \eta_1]$ of equilibria $\mathcal{E}_{2A}$ and $\mathcal{E}_1$ in the b_1 dimension strictly contain the existence range $[0, \eta_{12A}]$ of equilibrium $\mathcal{E}_{12A}$, and the latter strictly contains the existence range $[0, \eta_{12.1}]$ of equilibrium $\mathcal{E}_{12}$ (which is empty when $b_2 > \eta_{12.2}$). Whether the existence range of equilibrium $\mathcal{E}_1$ contains the range of $\mathcal{E}_{2A}$ or viceversa depends on p and q. We determined that there is a strictly increasing function $g_3 : q \mapsto p$ such that $\eta_1(p) > \eta_{2A}(q)$ if and only if $p > g_3(q)$. The function g_3 is such that $g_1(q) < g_3(q) < g_2(q)$ for low q. As q grows, g_3 first crosses g_2 and then g_1 to finally join g_1 again at $q = 1$, with $g_3(1) = 1$.

Jointly taken, these results yield the complete characterization of the optimal equilibrium $\mathcal{E}^*$ as a function of (p, q) and (b_1, b_2) reported in Proposition 5. ■

Proof of Lemma 3. To calculate the threshold $\hat{c}_{12A}(p, q)$, we compare $W_{12A}(p, q, c) = V_{12A}(p, q) - 2c$ and $W_2(c) = V_2 - c$. In particular $W_{12A}(p, q, c) \geq W_2(c)$ if $c \leq \hat{c}_{12A}(p, q)$, where

$$\begin{aligned}\hat{c}_{12A}(p,q) =& \frac{1}{600}\Big(\frac{2\left(3-2p^2\right)^2}{(3-2p)^2(2p(q-1)-3q+4)} + \frac{16(p-1)p(2(p-1)p(14(p-1)p-37)+39)-63}{(3-4(p-1)p)^2} + \\ & - \frac{2\left(3-2p^2\right)^2}{2p+q-4} + \frac{2(1-2(p-2)p)^2}{2p-q+2} - \frac{2(1-2(p-2)p)^2}{(2p+1)^2(2p(q-1)+q-2)}\Big).\end{aligned}$$

To calculate the threshold, we compare $W_{12A}(p, q, c) = V_{12A}(p, q) - 2c$ and $W_1(p, c) = V_1(p) - c$. In particular $W_{12A} \geq W_1(p, c)$ if $c \leq \hat{c}_1(p, q)$, where

$$\begin{aligned}\hat{c}_1(p,q) =& \frac{1}{300}\Big(\frac{2(p-1)p(2(p-1)p(2(p-1)p(28(p-1)p-55)+149)-159)+63}{(p-2)(p+1)(3-4(p-1)p)^2} + \\ & \frac{\left(3-2p^2\right)^2}{(3-2p)^2(2p(q-1)-3q+4)} - \frac{\left(3-2p^2\right)^2}{2p+q-4} + \frac{(1-2(p-2)p)^2}{2p-q+2} - \\ & \frac{(1-2(p-2)p)^2}{(2p+1)^2(2p(q-1)+q-2)}\Big).\end{aligned}$$

We now calculate the difference between the thresholds $\hat{c}_{12A}(p, q)$ and $\hat{c}_1(p, q)$ calculated above

$$\hat{c}_1(p,q) - \hat{c}_{12A}(p,q) = \frac{(1-p)p}{8(2-p)(p+1)} > 0,$$

for $p < 1$. ■