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Persuasion strategies for a committee with reputational concerns

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Abstract

I analyse the optimal persuasion strategy of a sponsor to obtain approval from a committee with affiliated benefits, heterogeneous abilities to acquire information, and reputational concerns. I uncover the effect of reputational concerns on the behaviour of committee members and new persuasion strategies of the sponsor. Committee members trade off a lower expected project payoff for a higher reputational payoff. The sponsor employs a persuasion cascade strategy where she requests approval first from a sceptical or high-reputation member, whose approval is the most convincing signal to a member next in line that he stands to gain from the project. Alternatively, her strategy is to request approval first from a low-reputation member to reduce his expected project payoff, thereby increasing the relative strength of his incentive to approve and obtain a higher reputational payoff.

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1. Introduction

Imagine a sponsor seeking unanimous approval from a parliamentary committee for her project of a tax decrease. The committee is composed of two members of two different parties from different ends of the political spectrum, and the members wish to take the decision that is best for their constituencies. Perhaps the left-wing member fights fervently to increase the welfare of low-income families, whereas the right-wing member is an ardent supporter of a favourable business climate for SMEs. Both evaluate the sponsor's project in line with their signal, which are affiliated. For example through stimulating economic growth, the tax decrease is more likely to advance both or neither members' goals than it is likely to benefit one but not the other. In line with their political backgrounds, the left-wing member is a priori sceptical about the positive effects of a tax decrease, and the right-wing member instead is rather enthusiastic. Furthermore, imagine that tax policy is known not to be the left-wing member's forte, whereas the right-wing member is well versed in the subject. Although principally concerned with the material outcome of the project, the parliamentary committee members care about their reputation as smart decision makers as well, which, after all, is what may secure votes. Therefore, even though our left-wing member does not understand the subject matter of the proposed tax decrease beyond his initial scepticism, he still wishes to pretend to take an informed decision.

The sponsor can decide to ask for approval instantly, in response to which both members make judgment based solely on their prior view of the project. That is, the sceptical left-wing member would reject and the enthusiastic right-wing member would accept. Alternatively, the sponsor can provide one or both members with detailed information about the project. She requests them to investigate the material, at a cost to the member, and to make a judgment subsequently. Investigating reveals to the right-wing member, well versed in the subject, the true outcome of the project, either confirming or dismissing his prior enthusiasm. The left-wing member however, not understanding the subject matter, receives no information from an investigation and sticks to his prior sceptical view of the project. Although useless, may still investigate, for the sole purpose of appearing informed or 'smart'. Furthermore, in his desire to appear smart, he may even accept the project, notwithstanding that his only information about the project is his prior scepticism.

The sponsor's task is to design a persuasion strategy that maximises the probability with which her project is approved. Is it optimal to ask the sceptical or enthusiastic member to investigate, and whom to ask first? Can she make use of the reputations and reputational concerns of the members to design a persuasion cascade? Or can she put a member in a position where he is willing to take more risk by approving in order to bolster his reputation? This thesis presents a theoretical model to determine a sponsor's optimal persuasion strategy vis-à-vis a committee in which members derive a material payoff as well as a reputational payoff from their decision. I uncover a rich set of new persuasion strategies for the sponsor by extending the seminal model of Caillaud & Tirole (2007) on group persuasion, by introducing reputational concerns in similar fashion to Swank & Visser (2008). Committee members are of type "smart" or "dumb" and receive a reputational payoff as a function of the posterior probability that they are smart.[1]

The reason for introducing reputational concerns is threefold. First, decision maker's reputations may explain why an approval from one member is a more convincing signal about the project than another member's approval is. This has consequences for sequential persuasion strategies. Second, to decision makers, a sound reputation is nearly always as important as a decision itself. Be it as a public official, or as a book publisher or mortgage officer (Swank & Visser, 2008), a reputation for taking informed decisions, for being 'smart', is valuable as it leads to votes, promotions, or simply increased credibility (Morris, 2001). Often it is the current action of the decision-maker, and how that compares with prior views of the project, that matters for his reputation, either because the actual material outcome of a project is obscured by confounding factors or simply because it is publicly observable only in the long term. Third, reputational concerns have long been a favourite of game theoretical research and explain a variety of behaviours, principally herding behaviour and perverse incentives (Banarjee, 1992; Hölmstrom, 1999; Morris, 2001). By weaving the established game theoretical topic of reputational concerns into the relatively new topic of group persuasion, this thesis comes to new insights.

The game is a persuasion game with a sponsor (sender) and two committee members (receivers) that receive a project and a reputational payoff. The sponsor maximises the probability with which her project is approved. Committee members are a priori enthusiastic or sceptical about the project, represented by heterogeneous prior probabilities with which they incur a positive or negative payoff from its approval. A committee member's type is his private information, but common knowledge are the probabilities with which each is smart. The sponsor selectively and sequentially requests the members to approve. Members make their decision either based on their

[1] Less pungent synonyms are 'high-ability' and 'low-ability.' However, for consistency with S&V and ease of exposition, I retain their terms "smart" and "dumb".

prior beliefs about the project, or after investigation of hard information. Investigation reveals to a member his true project, but only if he is smart. If dumb, he obtains no information. Lastly, project payoffs are affiliated. When one member gains from the project, the probability that the gains as well increases. This allows members to learn about their project payoff from each other's decisions. Although reputational concerns can be modelled as exclusively instrumental (Morris, 2001), here reputational payoffs are 'intrinsic' and a direct function of beliefs about a player's type, conditional on whether he investigates or not and his subsequent approval or rejection.

Without loss of generality, I deviate from Caillaud & Tirole's (2007) mechanism design approach. Instead, I model the sponsor's optimisation problem as a dynamic game of incomplete perfect information, with a rational expectations equilibrium concept to account for the receiver's reputational payoffs. The optimal strategy is determined using backward induction to find the equilibria to the various strategies that the sponsor can employ and subsequently to choose the strategy that yields the highest probability of approval. The analysis starts by determining the sponsor's strategy when faced with a one-member committee. The analysis of a two-member committee presents the main insights into new persuasion strategies employed by the sponsor, which are extrapolated to an n-member committee in the discussion.

Without reputational concerns, a member, if dumb, rejects the sponsor's project if his expected project payoff is negative ('sceptical'), and approves when positive ('enthusiastic'). When smart, he investigates the project to find his true project payoff and accepts if he stands to gain. Thus, if a member accepts while his expected project is negative – and vice versa – he perfectly reveals that he his smart. As his reputational payoff increases in importance relative to his project payoff, a dumb member becomes incentivised to take actions as if he were smart (the 'pretence effect'). He engages in a costly and otherwise useless investigation. Moreover, he may approve contrary to his scepticism, and so trade off a negative project payoff for a higher reputational payoff.

The sponsor's persuasion strategy exploits the pretence effect. The committee member for whom the pretence effect is weakest becomes the optimal choice for the sponsor to request for approval first in her 'persuasion cascade strategy'. Provided he is smart with sufficiently high probability, his approval is the most convincing message to the next committee member that the project, by affiliation, yields him a positive payoff. Principally, the most sceptical committee member is the sponsor's optimal choice to request for approval first. However, the sponsor is better off to choose the smartest member instead when reputational concerns further increase in relative importance, either directly or because the difference in scepticism between members is low or the number of members increases. If none of the members is sufficiently smart to engineer a persuasion cascade, the sponsor can exploit reputational concerns by engaging in a 'position risk strategy'. She places the dumbest committee member first in line to decrease to him the risk of a lower project payoff. This allows him to approve with higher probability to increase his reputational payoff.

In addition to the example of parliamentary committees, the applications of group persuasion with reputational concerns and the recommendations of this thesis are manifold. Any setting that requires group persuasion where receivers have different reputations and reputational concerns is applicable. Two specific examples illustrate:

After months of deadlock on a financial services deal, UK Brexit secretary David Davis appealed directly to German business,[2] thereby favouring group persuasion over bilateral negotiations with the EU chief negotiator. Besides that Germany wields substantial power in the EU, the country is also an excellent choice as a start for a persuasion cascade. Among the EU27, Germany can be considered both highly sceptical and reputably smart with respect to a financial services deal,[3] in line with this thesis' recommendations for the player first in line of a cascade. Were Germany to investigate and approve a deal, other countries would increase their belief that the deal is beneficial for them as well, and have a stronger incentive to approve to appear smart too, as a signal to international financial markets and to bolster their standing in the European Council.

Consultancy services firms commonly finish their assignments by having their research reports approved by their clients. The client company appoints a committee of employees to maintain contact with the consultancy and to approve their work, but how well-versed its members are in the subject material of the assignment varies greatly. Given a sceptical prior view of the consultancy's report, the committee members can appear 'smart' by approving the report, contrary to scepticism. However, this comes at the risk that if all members approve, they receive a bad report. Consultancy firms that notice can make use of it by employing the position risk strategy. Asking the dumbest member first yields his approval with higher probability. Approval obtains him a higher reputation, while its negative project payoff is decreased given that his colleagues have to approve after him still.

[2] www.theguardian.com/politics/2018/jan/10/davis-and-hammond-make-plea-to-germany-in-pursuit-of-brexit-deal
[3] Germany's financial services centre, Frankfurt, stands to gain greatly from restricted access of UK services to the EU market. In other words, Germany is highly sceptical of any UK proposal that includes full access for the City of London. Furthermore, the German banking sector is one of the most successful on the European continent, which guarantees expert scrutiny of any proposed deal and as such a reputation of being 'smart'.

1.1 Relationship to the Literature

This thesis is most closely related to the model of group persuasion by Caillaud & Tirole (2007), of which it is an extension. More generally, its results are a tenet of the literature on the optimal disclosure of hard information, initiated in seminal papers by Grossman & Hart (1980) and Grossman (1981). However, equally pertinent is the recent strand of literature on information design. A sender with an informational advantage induces a group of receivers to certain actions by selectively providing receivers with certain information about the state of the world (Bergemann & Morris, 2017). For example, in the model Kamenica & Gentzkow (2011) the sender makes it more likely that the receiver takes the desired action by manipulating the updated probability that the receiver holds about the state of the world, a strategy similar to the persuasion cascade strategy in this thesis. Also closely related is the model of Bardhi & Guo (2017), who study persuasion of a group with affiliated benefits and heterogeneous priors. The sponsor can adjust the quality of the hard information he provides, and their main question concerns whom to provide information of what quality to engineer a persuasion cascade.

My contribution to the literature is to add an additional layer of complexity to group persuasion by introducing reputational concerns on the end of the receiver. To my current knowledge, neither the information design literature nor the group persuasion literature in general explore persuasion strategies that exploit reputational incentives and that account for receivers of heterogeneous types with respect to their ability to acquire information. Such complexity reveals new insights into the optimal persuasion cascade and other persuasion strategies.

The current results with respect to the pretence effect are tangent to those of the literature on herd behaviour. The herding literature's main result is how agents ignore or act contrarily to their private information (Banarjee, 1992) and take a conventional, publically accepted action for the sake of their reputation (Scharfstein & Stein, 1990; Holmström 1999). However, my results differ at two points. The current model rewards a higher reputation to the *un*conventional decision, that is, to the decision with a lower expected payoff, which is an agent's signal to the public that he is smart and can investigate a project for its true payoff. More fundamentally, in the herding literature an agent receives a noisy but informative signal about the state of the world, whereas in the current model I follow Swank & Visser (2008) and have agents differ by type and either receive a true signal or an empty signal. Only by allowing different types for receivers can reputational concerns be introduced. As such, the pretence effect is more closely related to Morris' (2001) model of political correctness where advisors, knowing their type, manipulate their actions to obtain a better reputation.

The remainder of this thesis is organised as follows. An explanation of the model in section 2 precedes analysis of one-member and two-member committees in sections 3 and 4, respectively. The discussion in section 5 generalises the results to an n-member committee and verifies their robustness with respect to three assumptions, before section 6 concludes. Appendix A presents proofs of all lemmas and propositions, and Appendix B presents full expressions of all variables.

2. The Model

The model is a sender/multi-receiver persuasion model. It follows from extending the model of Caillaud & Tirole (2007) on group persuasion with hard and soft information, by introducing reputational concerns of decision makers in similar fashion to Swank & Visser (2008). A sponsor S (sender) aims to persuade two committee members $R_i, i \epsilon \{1,2\}$ (receivers) to approve her project unanimously. The committee members care about their material project payoff and their reputational payoff for appearing 'smart'.

The sponsor receives positive utility from the project if approved, which is common knowledge, and hence she maximises the probability Q that all committee members approve. She approaches her optimisation problem by selectively and sequentially approaching committee members with a request for action. The committee members either stand to gain or to lose from the project, represented by their binary project payoff $v_i \epsilon \{-L, G\}$, where $L, G \epsilon \mathbb{R}_{>0}$. The status quo yields zero to all players. The committee members' project payoffs are a priori unknown and remain unobservable even if the project is approved, but common knowledge are the probabilities with which they stand to gain, $p_i = \Pr[v_i = G]$. Inevitably, some committee members are more able than others to grasp the details of the project in full, and to confirm or dismiss their initial scepticism or enthusiasm in doing so. I capture this by defining a member's type as a simple binary, $\theta_i \epsilon \{smart, dumb\}$, which is his private information. With some probability a member is 'smart,' $\Pr[\theta_i = smart] = \pi_i \epsilon (0, 1)$, and fully understands any hard information about the project, and otherwise he is 'dumb' and does not. π_i is common knowledge. A member's project payoff v_i does not depend on his type. Committee members gain from a successfully executed tax decrease (it benefits their constituencies), a good UK-EU financial services deal (economic growth), or an approved consultancy assignment (bills are paid) irrespective of whether they are smart or dumb. At the start of the game, Nature determines v_i and θ_i for R_1 and R_2, in line with p_i and π_i, respectively.

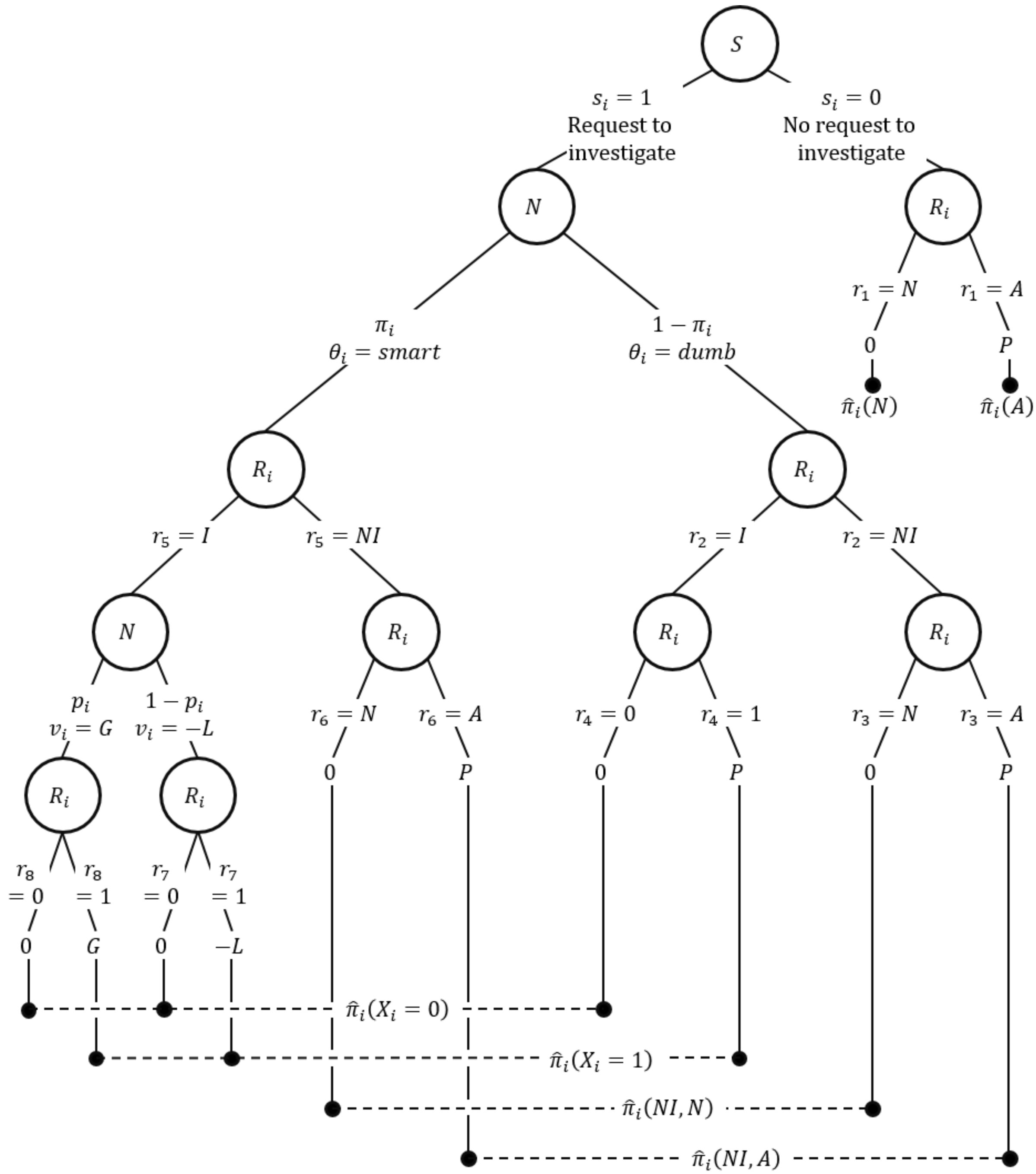

Figure 1. Game tree with actions, project payoffs, and reputations for the sponsor and R_i.

2.1 Strategies

The sponsor's pure strategy is denoted by $\sigma = (s_1, s_2)$, where action s_i is her choice between two ways to obtain approval from committee member R_i, as illustrated in the game tree in Figure 1. Either she asks for an approval based on his prior belief p_i ($s_i = 0$), or she provides him with hard information and requests him to investigate it ($s_i = 1$). If so, a committee member chooses between the actions to investigate at cost c or to not investigate. A member can investigate only if provided hard information by S. Investigating reveals truthfully to R_i his project payoff if he is of type $\theta_i = smart$. By contrast, committee members of type $\theta_i = dumb$ do not receive any valuable information from investigating (an empty signal $\{\emptyset\}$), and maintain their prior beliefs about their payoff. After investigating or not, R_i chooses to accept or reject the project. S's request and R_i's action whether or not to investigate and his subsequent approval are observable. Transfers or bribes are ruled out. Let the (behavioural) strategy profile of R_i be denoted by:

$$\rho_i = (r_1, r_2, r_3, r_4, r_5, r_6, r_7, r_8) \tag{1}$$

where r_1 is the action if not requested to investigate, r_2 through r_4 are his actions if $\theta_i = dumb$, and r_5 through r_8 are his actions if $\theta_i = smart$. Specifically:

Notation	where	in response to	for $\theta_i =$
$r_1 \epsilon \{N, A\}$	N is 'reject' and A is 'accept'	$s_i = 0$	
$r_2 \epsilon \{I, NI\}$	I is to investigate and NI is not to	$s_i = 1$	$dumb$
$r_3 \epsilon \{N, A\}$	N is 'reject' and A is 'accept'	$r_2 = NI$	$dumb$
$r_4 \epsilon \{0, 1\}$	0 is 'reject' and 1 is 'accept'	$r_2 = I$	$dumb$
$r_5 \epsilon \{I, NI\}$	I is to investigate and NI is not to	$s_i = 1$	$smart$
$r_6 \epsilon \{N, A\}$	N is 'reject' and A is 'accept'	$r_5 = NI$	$smart$
$r_7 \epsilon \{0, 1\}$	0 is 'reject' and 1 is 'accept'	$r_5 = I$ and $v_i = -L$	$smart$
$r_8 \epsilon \{0, 1\}$	0 is 'reject' and 1 is 'accept'	$r_5 = I$ and $v_i = G$	$smart$

Table 1. Actions of committee member R_i.

As examples of hard information that the sponsor can provide to a committee member for investigation, Caullaid & Tirole (2007) mention a written document or face-to-face tutorial, containing the technical details or a track record of the sponsor. Both illustrate investigation as a publicly observable action. Provided with a document or tutorial, a smart player will learn about his payoff. A dumb player is unable to grasp its contents and obtains no information. However, when the time comes for approval, both are expected to justify their decision publicly. This requires the dumb player to pretend to be informed if he wishes a ‘smart’ reputation. That is, he must find some detail of the project – e.g. “I reject the tax decrease because I foresee its effects to be regressive” – which, true or not, convinces the public that he is smart and understands the project.

2.2 Payoffs

The sponsor’s payoff from her project is normalised to one, hence her expected utility is denoted by $u_S = Q$. Committee member i’s utility is determined by his project and reputational payoff.

$$u_i = v_i + \lambda \, \hat{\pi}_i \tag{2}$$

where $\lambda \in \mathbb{R}_{>0}$ denotes the weight of R_i’s reputational payoff. Committee members have three sources of information from which they infer about their project payoff from approval or rejection. First, they possess the common knowledge of the prior probabilities with which each member stands to gain or lose from the project, p_i. Accepting without investigation, then, yields an expected project payoff of $P_i = p_i \, G - (1 - p_i)L$. Second, if of type $\theta_i = smart$, they can learn their project payoff by investigating any hard information provided by the sponsor. Third, the committee members’ gains from the project are affiliated such that $\Pr[v_1 = v_2 = G] > p_1 p_2$. If actions occur sequentially, R_i can use the updated probability $\hat{p}_i = \Pr\left[v_i = G \mid X_j = 1\right]$ that he has a positive project payoff, based on the approval decision of the other player and the correlational structure of benefits.

R_i’s reputational payoff is a direct function of the Bayesian update of the probability that $\theta_i = smart$, conditional on the sponsor’s request, his own action to investigate or not, and his subsequent approval decision. Therefore, the set Π_i of reputations that R_i may obtain consists of six elements. Figure 1 illustrates how each reputation is obtained, and Table 2 provides details. The observed approval decision of R_i after investigation is denoted by $X_i \in \{0, 1\}$.

$\hat{\pi}_i(X_i = 0)$	=	$\Pr[\theta_i = smart \mid \text{investigate and reject}]$
$\hat{\pi}_i(X_i = 1)$	=	$\Pr[\theta_i = smart \mid \text{investigate and accept}]$
$\hat{\pi}_i(NI, N)$	=	$\Pr[\theta_i = smart \mid \text{not investigate and reject}]$
$\hat{\pi}_i(NI, A)$	=	$\Pr[\theta_i = smart \mid \text{not investigate and accept}]$
$\hat{\pi}_i(N)$	=	$\Pr[\theta_i = smart \mid \text{no request for investigation and reject}]$
$\hat{\pi}_i(A)$	=	$\Pr[\theta_i = smart \mid \text{no request for investigation and accept}]$

Table 2. Set of updated reputations of committee member R_i.

Committee members of type $\theta_i = dumb$ may be incentivised by their reputational payoff to engage in a costly mimicking of smart committee members by investigating at cost c without it yielding any valuable information about their project payoff, and moreover to take an action that yields a lower expected project payoff. One of the sponsor's opportunities is to exploit this incentive.

2.3 Equilibrium conditions

I define the equilibrium conditions for an n-member committee so that it can be flexibly adapted to the cases of one, two, and n members. The sponsor's optimisation problem is modelled as a dynamic game of perfect incomplete information, with the rational expectations equilibrium ("REQ") as equilibrium concept. An REQ consists of a strategy profile $\sigma = \{s_i\}_{i=1}^{n}$ for S, and sets of strategies $\rho = \{\rho_i\}_{i=1}^{n}$ and beliefs $\Pi = \{\Pi_i\}_{i=1}^{n}$ about θ_i for all $R_i, i \epsilon \{1, 2, \dots, n\}$, such that given Π, σ and ρ_i maximise the respective expected payoffs u_S and u_i of S and R_i at each information set, and that given σ and ρ, all beliefs are determined by Bayes' rule. I solve the game by means of backward induction.

By modelling the sponsor's persuasion strategy as part of a dynamic game of incomplete information, I depart from the mechanism design approach of Caullaid & Tirole (2007). Even though a mechanism design approach reflects well the sponsor's freedom in designing a persuasion strategy by allowing her to, literally, design the rules of the game, it adds unnecessary complexity to the equilibrium concept given that the players have only limited and discrete actions. The simpler and more effective approach of a dynamic game yields the same results and is better suited to the introduction of reputational concerns.

3. The Case of a One-Member Committee

The aim of this section to determine the best responses of a single committee member R ('the dictator'),[4] and to derive from that the optimal persuasion strategy for the sponsor S. I concentrate the analysis on pooling and semi-pooling equilibria in which the dumb dictator mimics the investigative behaviour of the smart dictator.[5] That is, either both types investigate or both types do not investigate, and therefore separation between the types occurs as the result of the action after investigation. Equilibria in which both types have the same investigative behaviour allow to isolate

[4] For simplicity, I drop the subscript i.
[5] The 'smart dictator' and the 'dumb dictator' are two types of the same player R, but are described as separate persona (not unlike Dr Jekyll and Mr Hyde).

clearly the effect of reputational concerns by contrast to the case without reputational concerns in Caillaud & Tirole (2007).

The analysis proceeds as follows. By way of backward induction, I determine first the optimal action of the dictator when not requested to investigate. Second, I establish six equilibria for the subgame where S does request R to investigate. Having established the equilibrium actions of the dictator allows me, last, to derive the optimal persuasion strategy for S.

3.1. No Request to Investigate

If not requested to investigate by S, R's respective expected payoffs from rejecting $(r_1 = N)$ or accepting ($r_1 = A$, "rubberstamping") the project without investigation are:

$$u^N = \lambda\,\pi \tag{3}$$

$$u^A(p) = P + \lambda\,\pi \tag{4}$$

Lemma 1. Committee member R prefers rubberstamping to rejecting without investigation when:

$$u^A > u^N \Leftrightarrow p > p_0 = \frac{L}{G+L}. \tag{5}$$

Proof: Appendix A.

R rubberstamps when he faces a positive expected project payoff, $P > 0$. Without investigation, payoffs are independent of whether the dictator is smart or dumb. Both types possess the same information p and choose the same action. Because R does not reveal any information about his type, the posterior probability that R is smart is equal to the prior probability, $\hat{\pi} = \pi$. Thus, an equilibrium in which both types reject or rubberstamp without investigation is a simple pooling equilibrium. The result of Lemma 1 is identical with Caillaud & Tirole (2007), for the reason that neither reputational concerns nor loss of information by the dumb dictator come into play.

3.2 Request to Investigate

If S provides hard information and requests R to investigate, the smart dictator faces the following expected payoff from a strategy $(r_5, r_6, r_7, r_8) = (I, r_6, 0, 1)$ where he investigates and approves whenever he finds that $v = G$:

$$u_{sm}^{I}(p) = p\big(G + \lambda\, \hat{\pi}(X = 1)\big) + (1 - p)\, \lambda\, \hat{\pi}(X = 0) - c. \tag{6}$$

With probability p, R finds that $v = G$ and approves the project, resulting in the reputational payoff of $\hat{\pi}(X = 1)$. With probability $1 - p$, R finds that $v = -L$ and rejects the project, resulting in a project payoff of zero and the reputational payoff of $\hat{\pi}(X = 0)$.

Instead, for the dumb dictator, the expected payoff from investigating and subsequently rejecting $(r_2, r_3, r_4) = (I, r_3, 0)$ is:

$$u_{du}^{I\,X=0}(p) = \lambda\, \hat{\pi}(X = 0) - c. \tag{7}$$

His expected payoff from investigating and subsequently approving $(I, r_3, 1)$ is:

$$u_{du}^{I\,X=1}(p) = P + \lambda\, \hat{\pi}(X = 1) - c. \tag{8}$$

The dumb dictator's payoff from investigating is strictly lower than the smart dictator's, which results from that he does not obtain information from investigation.

For the subgame where S requests R to investigate, there exists a pooling equilibrium where both the smart and the dumb dictator do not investigate (NI) and accept when $P > 0$ or reject when $P < 0$. This occurs at very high or very low values of p as well as for very high values of c, when:[6]

$$u_{sm}^{I}(p) < u^{N} \;\Leftrightarrow\; p < p_{-} \tag{9}$$

$$u_{sm}^{I}(p) < u^{A}(p) \;\Leftrightarrow\; p > p_{+} \tag{10}$$

For the smart dictator, the expected payoff from investigating, relative to that from accepting or rejecting without investigation, is not high enough to outweigh its cost. The dumb dictator's mimics the smart dictator, and without investigation, the smart and dumb dictator do not separate, hence the posterior probability that $\theta_i = smart$ equals the prior probability, $\hat{\pi}(NI, N) = \hat{\pi}(NI, A) = \pi$.

Though not formally part of the analysis, there exists a separating equilibrium where the smart dictator investigates and accepts whenever $v = G$ and the dumb dictator accepts or rejects without investigation. This occurs for moderately high or low values of p and c. The expected payoff from investigating, relative to that from accepting or rejecting without investigation, is high enough to outweigh the cost for the smart dictator but not for the dumb dictator.

[6] Expanded versions of all expressions can be found in Appendix B.

Assumption 1: $c < \bar{c}$ such that:

i. $\underset{p \, \epsilon \, [0,p_0]}{\arg\min} \hat{\pi}(X = 0) > c$

ii. $\underset{p \, \epsilon \, [p_0,1]}{\arg\min} \hat{\pi}(X = 1) > c$

I restrict the analysis to equilibria where the dumb dictator mimics the smart dictator's investigative behaviour. Therefore, Assumption 1 poses a restriction on c such that the dumb dictator can always obtain higher utility from investigating and accepting or rejecting in line with his expected project payoff than he can from not investigating and perfectly revealing his type, thereby incurring a reputation of zero. The corollary of Assumption 1 is that there exists a range of values for p for which the smart dictator investigates, because the smart dictator has a strictly higher payoff from investigating. Lastly, Assumption 1 rules out a semi-pooling equilibrium where the dumb dictator mixes between $r_2 = I$ and $r_2 = NI$ so that the expected reputation after investigating equals to c.

Intuitively, in any equilibrium where both types investigate, the approval decision that yields a lower expected project payoff must yield a higher reputational payoff. The smart dictator investigates and approves whenever he finds that $v = G$. The dumb dictator, however, does not obtain information from investigating. Hence he bases his action on the expected project payoff P, namely to reject when negative and to accept when positive. An approval while the expected project payoff is negative (or vice versa) then either, in a semi-pooling equilibrium, reveals perfectly that the dictator is smart, or, in a pooling equilibrium, must certainly offer a strictly higher reputation to incentivise the dumb dictator to incur a negative expected project payoff (or to forgo on a positive expected project payoff) with positive probability.

I introduce some additional notation before formalising this intuition into a proposition. The dumb dictator may play a mixed strategy where with probability $\gamma^Y = \Pr[X = Y], Y \, \epsilon \, \{0, 1\}$ he incurs (forgoes) on a negative (positive) project payoff to obtain a higher reputational payoff. He does so when $p_-^* < p < p_+^*$, thresholds for which a detailed description will follow.

Proposition 1 formalises the dictator's behaviour in six equilibria, each identified by a restriction on p. Figure 2 illustrates the intuition by graphing γ and $\hat{\pi}$, and Figure 3 graphs the smart and dumb dictator's payoffs.

Proposition 1. For $c < \bar{c}$, there exist six Rational Expectations Equilibria for the subgame where the sponsor S requests the dictator R to investigate, each indicated by a strategy profile $\rho = (r_2, r_3, r_4, r_5, r_6, r_7, r_8)$ and a set of beliefs $\Pi = \{\hat{\pi}(X = 0), \hat{\pi}(X = 1), \hat{\pi}(NI, N), \hat{\pi}(NI, A)\}$. Table 3 presents:

	Strategy ρ	$\hat{\pi}(X = 0)$	$\hat{\pi}(X = 1)$	$\hat{\pi}(NI, N)$	$\hat{\pi}(NI, A)$
1.a $p < p_-$	$(NI, N, 0,$ $NI, N, 0, 1)$	$\frac{\pi(1-p)}{\pi(1-p) + (1-\pi)}$	1	π	π
where both the smart and the dumb dictator reject without investigation.					
1.b $p < p_-^*$	$(I, N, 0,$ $I, N, 0, 1)$	$\frac{\pi(1-p)}{\pi(1-p) + (1-\pi)}$	1	0	0
where the smart dictator investigates and approves whenever $v = G$ and the dumb dictator investigates and rejects.					
1.c $p_-^* < p < p_0$	$(I, N, (1-\gamma^1, \gamma^1),$ $I, N, 0, 1)$	$\frac{\pi(1-p)}{\pi(1-p) + (1-\pi)(1-\gamma^1)}$	$\frac{\pi\, p}{\pi p + (1-\pi)\gamma^1}$	0	0
where the smart dictator investigates and approves whenever $v = G$ and the dumb dictator investigates and approves with probability γ^1 so that $\lambda \frac{\pi(1-p)}{\pi(1-p)+(1-\pi)(1-\gamma^1)} = P + \lambda \frac{\pi\, p}{\pi\, p+(1-\pi)\gamma^1}$.					
1.d $p_0 < p < p_+^*$	$(I, A, (\gamma^0, 1-\gamma^0),$ $I, A, 0, 1)$	$\frac{\pi(1-p)}{\pi(1-p) + (1-\pi)\gamma^0}$	$\frac{\pi\, p}{\pi p + (1-\pi)(1-\gamma^0)}$	0	0
where the smart dictator investigates and approves whenever $v = G$ and the dumb dictator investigates and rejects with probability γ^0 so that $\lambda \frac{\pi(1-p)}{\pi(1-p)+(1-\pi)\gamma^0} = P + \lambda \frac{\pi\, p}{\pi\, p+(1-\pi)(1-\gamma^0)}$.					
1.e $p > p_+^*$	$(I, A, 0,$ $I, A, 0, 1)$	1	$\frac{\pi\, p}{\pi\, p + (1-\pi)}$	0	0
where the smart dictator investigates and approves whenever $v = G$ and the dumb dictator investigates and accepts.					
1.f $p > p_+$	$(NI, A, 0,$ $NI, A, 0, 1)$	1	$\frac{\pi\, p}{\pi p + (1-\pi)}$	π	π
where both the smart and the dumb dictator accept without investigation.					

Table 3. Proposition 1.

Proof: Appendix A.

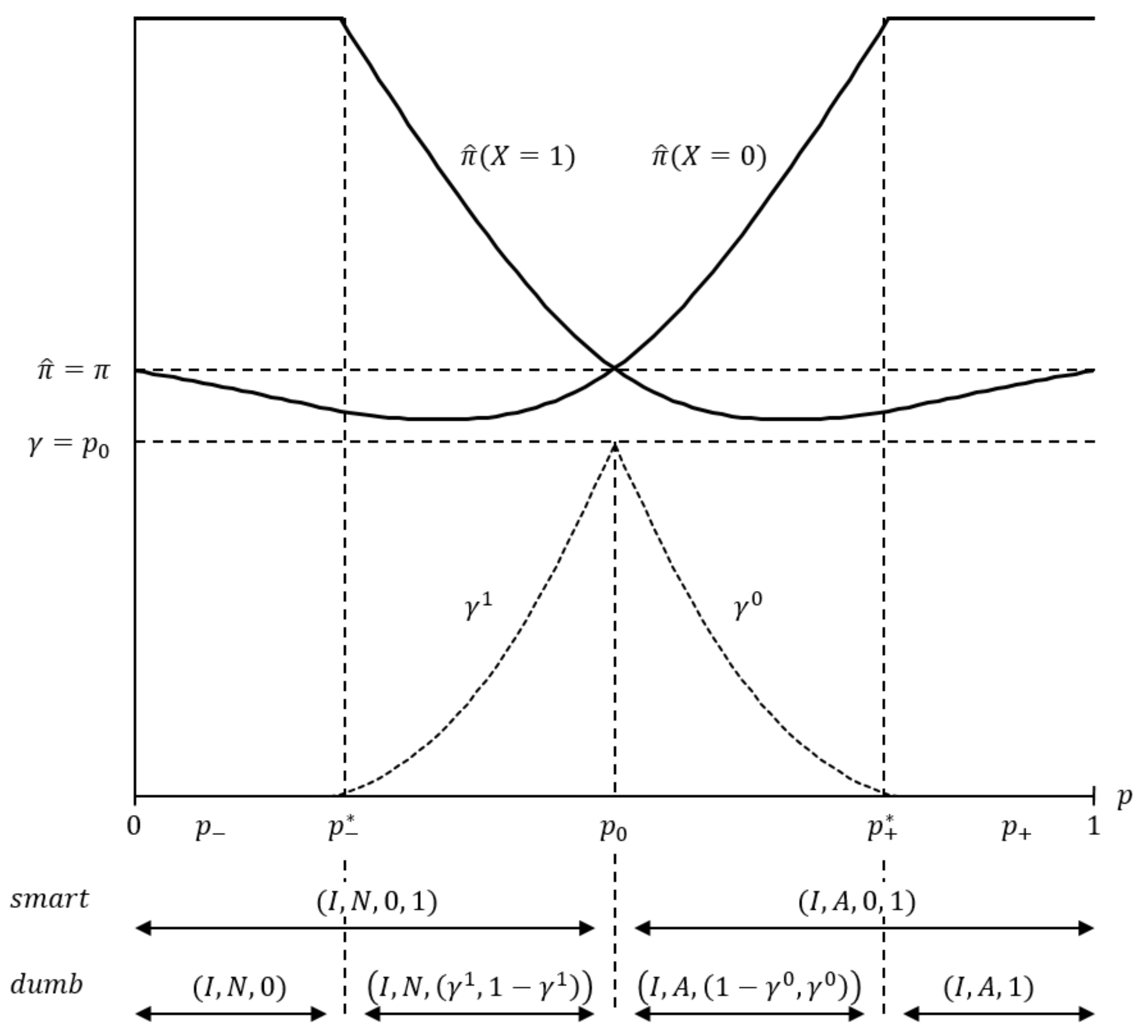

Figure 2. Reputations and γ as a function of p for the equilibria of Proposition 1.b, 1.c, 1.d, and 1.e.

I continue by providing intuition for the findings of Proposition 1. 1.a, where $p < p_-$, formalises the pooling equilibrium where both types of the dictator do not investigate because its expected benefit does not outweigh the cost.

If instead investigating, the smart dictator investigates and approves whenever he finds that $v = G$. He does so whenever the out-of-equilibrium action not to investigate leads to a reputation of zero.[7] Because the dumb dictator is strictly better off in a pooling equilibrium without investigation, the out-of-equilibrium action to not investigate leads to the belief that $\theta = dumb$. Hence, not investigating renders a reputation of zero, $\hat{\pi}(NI, N) = \hat{\pi}(NI, A) = 0$. Therefore, by Assumption 1, it is strictly more profitable for dumb dictator to investigate also.

[7] Therefore, for $p < p_-$ the equilibria of both 1.a and of 1.b exist, and for $p > p_+$, the equilibria of both 1.e and 1.f.

Does the dumb dictator approve or reject after investigation? In the semi-pooling equilibrium of 1.b, where $p < p_{-}^{*}$, he always rejects since $P < 0$. He has a strong incentive from his reputational payoff to deviate to $X = 1$ and obtain $\hat{\pi}(X = 1) = 1$, yet this is outweighed by the resulting decrease in his project payoff. A high probability of incurring $v = -L$ after approving the project makes the deviation unprofitable. However, this cost to his project payoff decreases as p increases. Furthermore, a higher p makes that the smart dictator is less likely to play $X = 0$, which decreases $\hat{\pi}(X = 0)$, making deviation to obtain $\hat{\pi}(X = 1)$ relatively even more attractive. Therefore, the dumb dictator is disincentivised from deviating only so long as:

$$\lambda\, \hat{\pi}(X = 0) < P + \lambda\, \hat{\pi}(X = 1) \Leftrightarrow p < p_{-}^{*}. \tag{11}$$

Proposition 1.c and 1.d formalise the 'pretence effect'. For $p_{-}^{*} < p < p_0$, the dumb dictator deviates to playing a mixed strategy $\left(I, N, (1-\gamma^1, \gamma^1)\right)$ to investigate and accept (reject) with probability γ^1 $(1-\gamma^1)$. As such, γ^1 signifies the pretence effect: it is the probability with which the dumb dictator obtains a higher reputational payoff at a cost to his project payoff. The dumb dictator sets a value for γ^1 such that the payoff from rejecting equals that from accepting:[8]

$$\lambda\, \frac{\pi(1-p)}{\pi(1-p) + (1-\pi)(1-\gamma^1)} = P + \lambda\, \frac{\pi\, p}{\pi\, p + (1-\pi)\gamma^1}. \tag{12}$$

As long as $p > p_{-}^{*}$, there always exists a unique positive solution for γ^1, as the left hand side is strictly increasing in in γ^1 whereas the right-hand side is strictly decreasing in γ^1. Figure 2 shows how γ^1 increases as p increases up until it reaches $\gamma^1 = p$ at $p = p_0$, where $\hat{\pi}(X = 0) = \hat{\pi}(X = 1) = \pi$. γ^1 is strictly lower than p for $p < p_0$. Because $P < 0$, it must be that $\gamma^1 < p$ to increase the right-hand side of Equation 12 and offset the negative P. The intuition remains unchanged. As p increases, the cost to the dumb dictator's project payoff as well as $\hat{\pi}(X = 0)$ decrease, allowing for a higher γ^1. At $p = p_0$, $P = 0$, hence the dumb dictator accepts and rejects with probabilities equal to those of the smart dictator: p_0 and $1 - p_0$. As a result, the posterior reputation is equal to the prior.

The same intuition applies symmetrically to the three equilibria where $p > p_0$. Here, $\hat{\pi}(X = 0) > \hat{\pi}(X = 1)$ since the dumb dictator would choose to approve based on his project payoff

[8] The smart dictator never has incentive to deviate to a mixed strategy where, after finding $v = -L$, he would play $X = 1$ with positive probability to obtain a higher reputational payoff. Such a mixed strategy would require that $\lambda\, \hat{\pi}(X = 0) = -L + \lambda\, \hat{\pi}(X = 1)$, yet from $-L < P$ and either $p < p_{-}^{*}$ or the restriction on γ^1 follows that the left-hand side is strictly larger than the right-hand side.

as $P > 0$. However, he has a strong incentive to play $X = 0$ to obtain a higher reputational payoff, but this goes at the expense of forgoing on his positive project payoff. Therefore, for $p_0 < p < p_+^*$, the dumb dictator mixes between $X = 0$ and $X = 1$ with probabilities γ^0 and $1 - \gamma^0$. He sets a value for γ^0 such that:

$$\lambda \frac{\pi(1-p)}{\pi(1-p) + (1-\pi)\gamma^0} = P + \lambda \frac{\pi\, p}{\pi\, p + (1-\pi)(1-\gamma^0)} \tag{13}$$

for which there always exists a unique positive solution as long as $p < p_+^*$, and where $\gamma^0 < (1-p)$ so as to increase the left-hand side to match the positive P on the right-hand side. However, as p increases beyond p_+^*, P increases a it is no longer profitable to deviate for the dumb dictator, given that:

$$P + \lambda\, \hat{\pi}(X = 1) > \lambda\, \hat{\pi}(X = 0) \Leftrightarrow p > p_+^*. \tag{14}$$

Therefore, for $p > p_+^*$, the dumb dictator plays a pure strategy to always approve after investigation. At $p > p_+$ and $\hat{\pi} = \pi$, both types resort to rubberstamping. For the smart dictator, the expected benefit of investigating does not outweigh its cost, and the dumb dictator is always better off in a pooling equilibrium where both types do not investigate.

I now turn to the dictator's payoffs. Figure 3 graphs his payoffs conditional on his type as a function of p across the six equilibria. The payoffs for u^N and u^R exist only for $p < p_-$ and $p > p_+$, where beliefs are $\hat{\pi}(NI, N) = \hat{\pi}(NI, A) = \pi$. Figure 3 provides three insights. First, the dumb dictator's payoff is not just strictly lower than the smart dictator's, but also strictly lower than his payoffs in the pooling equilibria where both types reject without investigation or rubberstamp. The reason is that, after investigation, the dumb dictator separates from the smart dictator and ends up with a decreased reputation. Only at $p = 0$, $p = 1$, and $p = p_0$ are his actions after investigation indistinguishable from the smart dictator, yet only because he incurs an otherwise useless cost c. Second, playing a mixed strategy moderates the decline or even increases the dumb dictator's payoff. In the pure strategy equilibrium of $p < p_-^*$, his payoff decreases in p because his reputation declines. However, in the equilibrium of $p_-^* < p < p_0$, his payoff decreases at a slower rate, and in fact he is able to increase his payoff by obtaining a higher reputation with probability γ^1. Third, the smart dictator is harmed in his payoff by the dumb dictator's mixed strategy. He is no longer able to fully reveal he is smart by taking the action that yields the dumb dictator a lower expected project payoff.

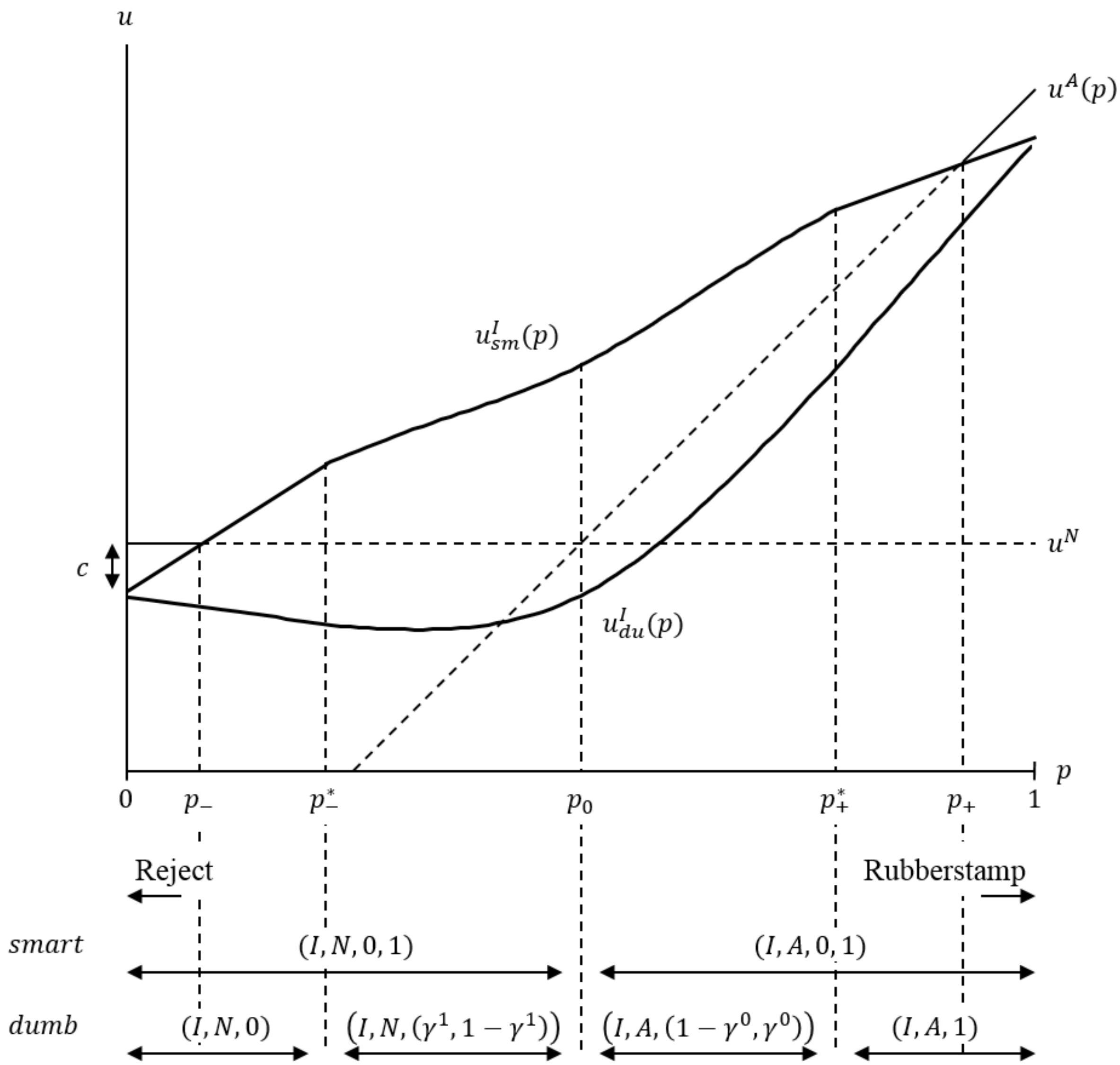

Figure 3. The dictator's payoffs conditional on his type θ.

The following terminology may illustrate the intuition behind the thresholds for p. If $p < p_0$, and R is unwilling to approve without investigation, I label R as 'sceptic'. For $p > p_0$, R is an 'enthusiast': he is willing to approve the project without investigation.[9] I further discriminate by calling a sceptic who still approves with positive probability γ^1 if dumb a 'moderate sceptic', which applies when for $p_-^* < p < p_0$. A 'hard sceptic' is a committee member who always rejects if dumb, that is, for whom $p < p_-^*$. Likewise, a moderate enthusiast still rejects with positive probability γ^0 if dumb, which is when $p_0 < p < p_+^*$. A 'hard enthusiast' never rejects if dumb, which is when $p > p_+^*$.

[9] Caillaud & Tirole (2007) describe use "opponent" and "ally" instead. I believe 'sceptic' and 'enthusiast' to be more appropriate, given that for $p < p_0$ R is not so much opposed to the project – he is willing to approve if it turns out that $v = G$ – as that his prior probability tells him that the project is unlikely to benefit him. Vice versa for an enthusiast.

3.3. Optimal Persuasion Strategy

The sponsor designs her persuasion strategy vis-à-vis the dictator such that it maximises Q, the probability that the dictator approves her project. To refine the persuasion strategy, I assume that if a request and no request for investigation yield the same Q, to request comes at an infinitesimal and otherwise negligible cost $\varepsilon > 0$.

Proposition 2. The sponsor designs her persuasion strategy for a one-member committee as follows. For $p < p_0$, she request R to investigate. For $p < p_-$, R may reject without investigation and $Q = 0$. For $p < p_-^*$, R is a hard sceptic and investigates and approves if $\theta = smart$ and $v = G$, but rejects if $\theta = dumb$, rendering $Q = \pi\, p$. For $p_-^* < p < p_0$, R is a moderate sceptic and investigates and approves if $\theta = smart$ and $v = G$, or if $\theta = dumb$ with positive probability γ^1, leaving $Q = \pi\, p + (1 - \pi)\gamma^1$. The sponsor asks R to rubberstamp if R is an enthusiast ($p > p_0$), resulting in $Q = 1$.

Proof: Appendix A.

The sponsor asks the dictator to rubberstamp the project if $p > p_0$. For these values of p, the dictator is enthusiastic and strictly better off rubberstamping than rejecting, hence $Q = 1$. For $p < p_+$, the smart dictator would have preferred to investigate if given the opportunity, since to him it yields a higher expected payoff. To the dumb dictator, on the other hand, the absence of the opportunity to investigate is optimal. Without having to incur the cost of a (to him useless) investigation, and a reputation indistinguishable from that of the smart dictator, his payoff is strictly higher than if he were to investigate.

Second, the sponsor must request a sceptic dictator to investigate. Because $p < p_0$, the dictator would always reject the project without the opportunity to investigate. For $p < p_-^*$, the dictator investigates. The smart dictator approves if $v = G$, and the dumb dictator always rejects. For $p_-^* < p < p_0$, however, the dumb dictator approves with positive probability γ^1.

Last, there exist two options if $p < p_-$. In the equilibrium where the dictator plays strategy $\rho = (I, N, 0, I, N, 0, 1)$ and investigates, the sponsor can still request to investigate. However, in the equilibrium where the dictator does not investigate and plays $\rho = (NI, N, 0, NI, N, 0, 1)$, there is no benefit to requesting to investigate as the dictator will refuse and reject the project without investigation. Therefore, to save herself the cost ε, the sponsor decides for no request.

4. The Two-Member Committee Case

This section analyses the optimal persuasion strategy of the sponsor to obtain approval from a two-member committee, building on the equilibrium strategies of the single committee member case.[10]

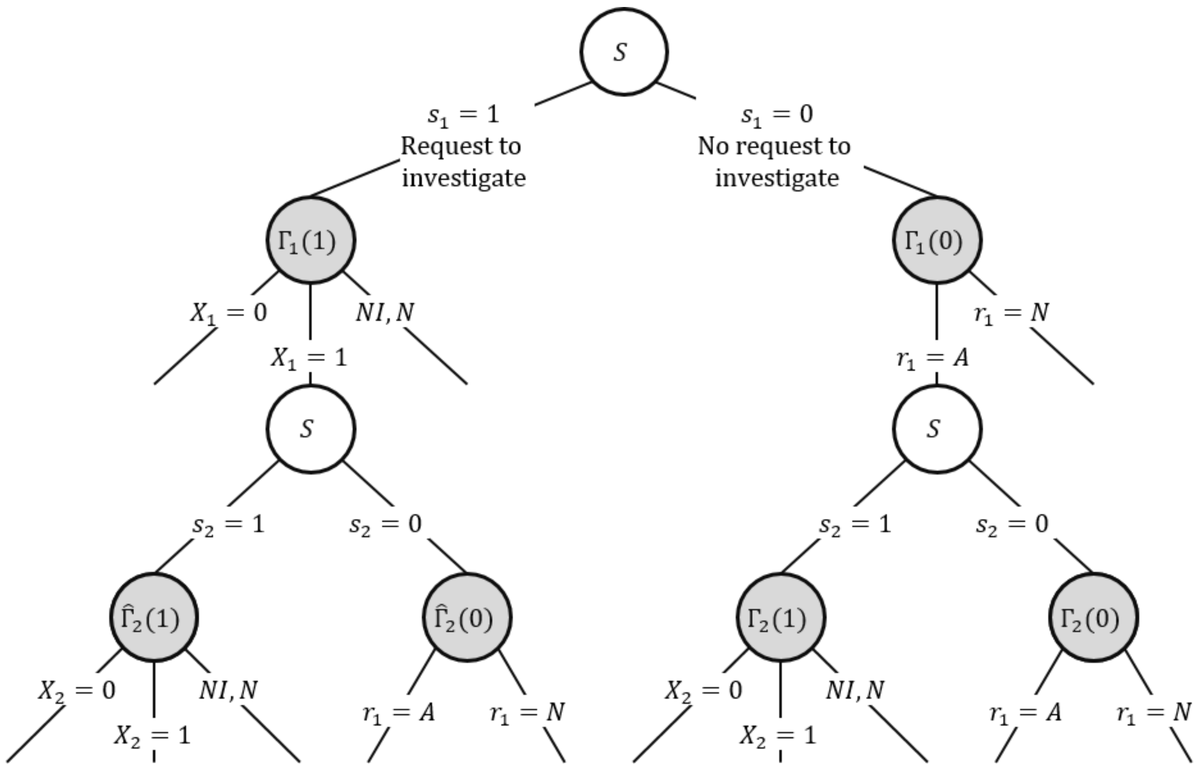

Figure 4. Game tree for the two-member case.

The two-member committee consists of members R_1 and R_2, who stand to gain from the sponsor's project with prior probabilities p_1 and p_1, respectively. The two members have affiliated benefits from the project and update their belief about their payoff of the project to $\hat{p}_j = \Pr[v_j = G \mid X_i = 1]$ if the other committee member investigates and approves. The game tree in Figure 4 illustrates how the sponsor can approach the two members sequentially with the request to investigate and/or approve. For clarity of exposition, R_1 is 'first in line' for the sponsor and R_2 is second in line. $\Gamma_i(s_i)$ denotes the subgame played by R_i in response to s_i. Furthermore, $\hat{\Gamma}_2(s_2)$ denotes the subgame that R_2 plays after observing that R_1 investigates and approves $(s_1 = 1, X_1 = 1)$, that is, where he updates p_2 to $\hat{p}_2$. I rule out a simultaneous request for investigation to R_1 and R_2 as it is never

[10] The subscript to R_i returns. p_-, p_-^*, p_+^*, and p_+, as derived in the previous sections, are functions of π_i and therefore become p_{i-}, p_{i-}^*, p_{i+}^*, and p_{i+}.

optimal for the sponsor. Sequential investigation yields a higher or equal Q, and assuming a request comes at cost ε, sequential investigation has a lower expected cost as R_1 may reject.

The analysis proceeds as follows. First, I narrow down the analysis to cases where at least one member investigates so that reputational concerns come into play. Second, I analyse how committee members learn about their payoff if their actions occur sequentially and how this changes their strategies. Subsequently, I analyse the equilibria to the subgame where S requests one or both members to investigate. Fourth and last, I determine the optimal persuasion strategy of the sponsor.

4.1. Narrowing Down the Analysis

Cauillaud & Tirole (2007) derive three strategies at the disposal of the sponsor, each with specific restrictions on p_1 and p_2. The sponsor has a clear "pecking order". She prefers best a strategy in which both members rubberstamp the project based on their prior p_i. For this to be successful, it requires $p_1, p_2 > p_0$, and yields $Q = 1$. Second best to the sponsor is a strategy where one member investigates and the other rubberstamps based on his updated probability, requiring that $\hat{p}_2 > p_0$. Least preferred by the sponsor is the strategy where both members investigate, which requires that if any $p_i, \hat{p}_i < p_{i-}$, R_i's equilibrium action is to investigate.

Lemma 2. If $p_1, p_2 > p_0$, S's optimal strategy is to request both members to rubberstamp, which yields approval with probability $Q = 1$. If one member is never willing to investigate, S's optimal strategy is also to request both members to rubberstamp but never receives approval, $Q = 0$.

Proof: Appendix A.

The same optimal strategy, independent of the presence of dumb committee members, applies to the case of a committee of enthusiasts, where $p_1, p_2 > p_0$ and both members rubberstamp, or where any $\hat{p}_i < p_{i-}$ and the equilibrium strategy of R_i is to reject without investigation, so that S can never obtain unanimous approval. The sponsor requests the members to approve without investigation, resulting in $Q = 1$ and $Q = 0$, respectively. The focus here is on those strategies of which the outcome differs from Cauillaud & Tirole (2007) because committee members are of type $\theta_i = dumb$ with positive probability and care about their reputation for being of type $\theta_i = smart$. Therefore, the cases of interest are where at least one committee member is a sceptic and must be requested to investigate and no member remains unwilling to investigate: $p_i < p_0$ and if $p_i, \hat{p}_i <$

p_{i-}, the equilibrium action is to investigate. Specifically, I organise the analysis around 'Regime I', where p_1 and p_2 are such that the sponsor requests R_1 to investigate and R_2 to rubberstamp, and 'Regime II' where the sponsor requests both members to investigate.

4.2 How Committee Members Update Their Beliefs

Committee members R_1 and R_2 have affiliated benefits from the sponsor's project. It is common knowledge that if the one stands to gain from the project, the other is more likely to gain as well relative to his prior probability. Specifically,

$$\Pr[v_j = G \mid v_i = G] = (1+\alpha)p_j, \qquad \text{where } \alpha \in \left(0, \min\left\{\frac{1}{\max\{p_1, p_2\}} - 1, 1\right\}\right). \quad (15)$$

The full stochastic structure of payoffs is displayed in Table 4 and Figure A1. α represents how aligned member's preferences are, in other words the 'internal congruence' of the committee.[11] I model internal congruency technically different from but in effect the same as Caillaud & Tirole do (2007), in order to simplify the relation between π_i and $\hat{p}_i$.[12]

	$v_1 = G$	$v_1 = -L$
$v_2 = G$	$\Pr = p_1p_2 + p_1p_2\alpha =$ $= (1+\alpha)p_1p_2$	$\Pr = (1-p_1)p_2 - p_1p_2\alpha =$ $= (1-(1+\alpha)p_1)p_2$
$v_2 = -L$	$\Pr = p_1(1-p_2) - p_1p_2\alpha =$ $= p_1(1-(1+\alpha)p_2)$	$\Pr = (1-p_1)(1-p_2) + p_1p_2\alpha$

Table 4. Stochastic structure of affiliated benefits v_1 and v_2.

Benefits are equal for both members ($v_1 = v_2 = G$ or $v_1 = v_2 = -L$) with increased probability of $p_1p_2\alpha$. They differ with decreased probability of $p_1p_2\alpha$. The difficulty for committee member R_j is that if member R_i approves after investigation, he does not know with certainty that in fact $v_i = G$. After all, R_i may be dumb and therefore acting on his prior probability and reputational incentive, rather than on sound investigation. Therefore, the value of $\hat{p}_j$ depends crucially on the probability with which R_i of type $\theta_i = dumb$ approves. Table 5 specifies.

[11] Formally, the Bayesian update of $\hat{\pi}_i$ is also a function of α.
[12] Identical with Caillaud & Tirole, Q weakly increases in the internal congruence parameter.

$\Pr[X_i = 1 \mid \theta_i = dumb]$		$\Pr[v_j = G \mid X_i = 1]$	
$\Pr = 0$	'Hard sceptic'	$\hat{p}_j = (1+\alpha)p_j$	(16)
$\Pr = \hat{\gamma}_i^1$	'Moderate sceptic'	$\hat{p}_j = \frac{\pi_i p_i(1+\alpha) + (1-\pi_i)\hat{\gamma}_i^1}{\pi_i p_i + (1-\pi_i)\hat{\gamma}_i^1} p_j$	(17)
$\Pr = \left(1-\hat{\gamma}_i^0\right)$	'Moderate enthusiast'	$\hat{p}_j = \frac{\pi_i p_i(1+\alpha) + (1-\pi_i)\left(1-\hat{\gamma}_i^0\right)}{\pi_i p_i + (1-\pi_i)\left(1-\hat{\gamma}_i^0\right)} p_j$	(18)
$\Pr = 1$	'Hard enthusiast'	$\hat{p}_j = \frac{\pi_i p_i(1+\alpha) + (1-\pi_i)}{\pi_i p_i + (1-\pi_i)} p_j$	(19)

Table 5. Updated probabilities of R_j that $v_j = G$.

These four expressions for R_j's updated probabilities provide three insights. First, $\hat{p}_j$ is strictly larger than p_j given $\pi_i > 0$. Therefore, approval by R_i is always good news for R_j – he is more likely to gain from the project. Second, $\hat{p}_j$ is weakly increasing in π_i. An increase in π_i makes it more likely that R_i's approval actually follows from the result of a sound investigation finding that $v_i = G$, and that hence $\hat{p}_j = (1+\alpha)p_j$. The exception is when R_i is a hard sceptic and all approvals already occur exclusively when he is smart. Third, perhaps counterintuitively, the relation between $\hat{p}_j$ and p_i is ambiguous. If R_i is a moderate sceptic or enthusiast, $\hat{p}_j$ decreases in p_i. An increase in p_i increases the probability with which the dumb R_i approves. Since he approves without observing whether $v_i = G$ or $v_i = -L$, a larger share of projects approved by the dumb R_i decreases the benefits of affiliation to R_j. Contrarily, $\hat{p}_j$ increases in p_i when R_i is a hard enthusiast. The dumb R_2 approves with constant probability one, and an increase in p_i simply increases the probability that, albeit unwittingly, he approves a project for which $v_i = G$ and after which $\hat{p}_j = (1+\alpha)p_j$.

4.3 Equilibrium Analysis

This section analyses equilibria for the subgame where S requests either one or both committee members to investigate. Equilibria occur either under Regime I, where only R_1 is requested to investigate, or under Regime II, where both R_1 and R_2 are requested to investigate.

Regime		
I.	R_1: investigate R_2: update and rubberstamp	$p_2 < p_0 < \hat{p}_2$
II.	R_1: investigate R_2: update and investigate	$\hat{p}_1, \hat{p}_2 < p_0$

Table 6. Regimes and restrictions under which equilibria occur.

Regime I. The equilibria under Regime I are formed by combining elements from Proposition 1 with Lemma 1. R_1 sets his strategy in accordance with the thresholds that apply to p_1. R_2, second in line, observes X_1 and sets his strategy to reject or rubberstamp without investigation in line with Lemma 1, applied to $\hat{p}_2$. For the sake of brevity, I do not give a full characterisation of each equilibrium but refer to Appendix A and Proposition 1 for a detailed description of strategy profiles and beliefs.

Proposition 3. For $c < \bar{c}$ and $p_2 < p_0$ there exist four Rational Expectations Equilibria for the subgame where the sponsor S requests member R_1 to investigate and member R_2 to rubberstamp, each indicated by restrictions on p_1, strategy profiles $\rho_1 = (r_2, r_3, r_4, r_5, r_6, r_7, r_8)$ and $\rho_2 = (r_1)$, and a set of beliefs Π. R_1 sets ρ_1 in line with Proposition 1.b, 1.c, 1.d, or 1.e, depending on the value of p_1, and beliefs about $\hat{\pi}_1$ are determined by Bayes' rule. R_2 updates p_2 to $\hat{p}_2$ in line with the relevant equation from Table 5,[13] where p_2 and α are such that $\hat{p}_2 > p_0$. R_2 sets his strategy $\rho_2 = A$ to rubberstamp in line with Lemma 1, and beliefs about $\hat{\pi}_2$ are determined by Bayes' rule.

Proof: Appendix A.

The actions and beliefs of R_1 and R_2 under Regime I are nearly identical with those in the dictator case. R_1 sets his strategy to investigate as the dictator would have, and R_2 subsequently rubberstamps. Because $\hat{p}_2$ decreases in p_1, a higher p_1 requires a higher α for $\hat{p}_2 > p_0$. In words, a more enthusiastic R_1 requires stronger affiliation for the sceptic R_2 to be sufficiently convinced to rubberstamp. This adds another dimension to Caillaud & Tirole's (2007) finding that "too strong support is [less] useful support". A project overly attractive to R_1 makes approving with large probability his equilibrium action if dumb, which diminishes his credibility to R_2.

[13] Under Regime I, $\hat{\gamma}_1^Y = \gamma_1^Y$ in Equation 17 and 18.

Regime II. Being first in line, R_1 knows that any project he approves only yields project payoff v_1 if R_2 also approves. R_1 can act like the dictator under Regime I, only because he knows that R_2 rubberstamps with probability one. By contrast, under Regime II R_2 also investigates and approves with probability less than one. Let q_2 be the probability with which R_2 approves, so that R_1 of type $\theta_1 = smart$ is willing to investigate only if:

$$p_1\big(q_2 G + \lambda\,\hat{\pi}_1(X_1 = 1)\big) + (1 - p_1)\,\lambda\,\hat{\pi}_1(X_1 = 0) - c > \lambda\,\pi_1 \Leftrightarrow p_1 > \hat{p}_{1-}. \quad (20)$$

Given that $q_2 < 1$, $\hat{p}_{1-} > p_{1-}$ and R_1 is less willing to investigate. A decreased likelihood that he receives positive project payoff G after approving makes investigating relatively less attractive.

R_1's expected project payoff, previously P_1, is now $q_2\,\hat{P}_1$, where $\hat{P}_i = \hat{p}_i G - (1 - \hat{p}_i)L$ is the expected project payoff based on updated probability $\hat{p}_i$. Both R_1 and R_2 calculate their expected project payoff using the updated probability $\hat{p}_i$. R_1, despite being first in line, knows that any project investigated and approved by R_2 is one that, by affiliation, he himself is more likely to gain from as well. R_2 thus decreases the risk for R_1 of type $\theta_1 = dumb$ that a project he approves but from which he stands to lose is actually implemented. Specifically, if R_1 unwittingly approves a project for which $v_1 = -L$, R_2 is more likely to find $v_2 = -L$ as well and hence disapprove the project, saving R_1 the loss, whereas if $v_1 = G$, R_2 is more likely to find $v_2 = G$ as well and approve. The result is that R_1's expected project payoff is a function of his updated $\hat{p}_1$, in identical fashion with if he had been second in line.

Assumption 2: $c < \hat{\hat{c}}$ such that $\underset{p_i \in [0, p_0]}{\arg\min}\, \hat{\pi}_i(X_i = 0) > c$, $i \in \{1, 2\}$.

Assumption 2 replaces Assumption 1 and ensures both members can obtain higher utility from investigating and rejecting than they can from rejecting without investigation. It ensures that, also in the two-member case, all equilibria are such that either both or neither types of a player investigate.

$\hat{P}_i$ replaces P_i in the function of $\hat{\gamma}_i$, the probability with which R_i incurs a negative project payoff to obtain a higher reputational payoff.[14] R_1 updates the threshold p^*_{1-} to $\hat{p}^*_{1-}$, for which a detailed expression will follow. Proposition 4 formalises four equilibria for the game where both R_1 and R_2 are requested to investigate, and both do. Figure 5 graphs posterior reputations and $\hat{\gamma}_i$.

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[14] For simplicity, I drop the superscript in $\gamma_i^1 = \Pr[X_i = 1 \mid \theta_i = dumb]$ when discussing Regime II. Because $\hat{p}_i < p_0$, $X_i = 1$ is always the action that committee members of $\theta_i = dumb$ must take to obtain a higher reputation. Hence, γ_i^0 is never part of the analysis.

Proposition 4. For $c < \hat{\hat{c}}$ and $\hat{p}_1, \hat{p}_2 < p_0$, there exist four Rational Expectations Equilibria for the subgame where the sponsor S requests both committee members R_1 and R_2 to investigate, each indicated by restrictions on p_i, a strategy profile $\rho_i = (r_2, r_3, r_4, r_5, r_6, r_7, r_8)$, and a set of beliefs $\Pi_i = \{\hat{\pi}_i(X_i = 0), \hat{\pi}_i(X_i = 1), \hat{\pi}_i(NI, N), \hat{\pi}_i(NI, A)\}$ for $i \in \{1, 2\}$:

4.a.

Both R_1 and R_2 play a pure strategy. If $\theta_i = smart$, they investigate and approve whenever $v_i = G$. If $\theta_i = dumb$ they investigate and reject. Hence, $q_2 = \pi_2\, \hat{p}_2$.

	Player R_1	Player R_2
p	$p_1 < \hat{p}^*_{1-}$	$\hat{p}_2 < p^*_{2-}$
ρ	$\rho_1 = (I, N, 0, I, N, 0, 1)$	$\rho_2 = (I, N, 0, I, N, 0, 1)$
$\hat{p}$	$\hat{p}_1$ = Equation 16	$\hat{p}_2$ = Equation 16
$\hat{\pi}_i(X_i = 0)$	$\frac{\pi_1(1 - p_1)}{\pi_1(1 - p_1) + (1 - \pi_1)}$	$\frac{\pi_2(1 - \hat{p}_2)}{\pi_2(1 - \hat{p}_2) + (1 - \pi_2)}$
$\hat{\pi}_i(X_i = 1)$	1	1
	$\hat{\pi}_1(NI, N) = \hat{\pi}_1(NI, A) = 0$	$\hat{\pi}_2(NI, N) = \hat{\pi}_2(NI, A) = 0$

Table 7. Proposition 4.a.

4.b.

Both R_1 and R_2, if $\theta_i = smart$, investigate and approve whenever $v_i = G$. R_1, if $\theta_1 = dumb$, investigates and rejects. R_2, if $\theta_2 = dumb$, investigates and approves with probability $\hat{\gamma}_2$ so that $\lambda \frac{\pi_2(1-\hat{p}_2)}{\pi_2(1-\hat{p}_2)+(1-\pi_2)(1-\hat{\gamma}_2)} = \hat{P}_2 + \lambda \frac{\pi_2\hat{p}_2}{\pi_2\hat{p}_2+(1-\pi_2)\hat{\gamma}_2}$, hence $q_2 = \pi_2\, \hat{p}_2 + (1 - \pi_2)\hat{\gamma}_2$.

p	$p_1 < \hat{p}^*_{1-}$	$p^*_{2-} < \hat{p}_2 < p_0$
ρ	$\rho_1 = (I, N, 0, I, N, 0, 1)$	$\rho_2 = (I, N, (1 - \hat{\gamma}_2, \hat{\gamma}_2), I, N, 0, 1)$
$\hat{p}$	$\hat{p}_1$ = Equation 17	$\hat{p}_2$ = Equation 16
$\hat{\pi}_i(X_i = 0)$	$\frac{\pi_1(1 - p_1)}{\pi_1(1 - p_1) + (1 - \pi_1)}$	$\frac{\pi_2(1 - \hat{p}_2)}{\pi_2(1 - \hat{p}_2) + (1 - \pi_2)(1 - \hat{\gamma}_2)}$
$\hat{\pi}_i(X_i = 1)$	1	$\frac{\pi_2\hat{p}_2}{\pi_2\hat{p}_2 + (1 - \pi_2)\hat{\gamma}_2}$
	$\hat{\pi}_1(NI, N) = \hat{\pi}_1(NI, A) = 0$	$\hat{\pi}_2(NI, N) = \hat{\pi}_2(NI, A) = 0$

Table 8. Proposition 4.b.

4.c.

Both R_1 and R_2, if $\theta_i = smart$, investigate and approve whenever $v_i = G$. R_2, if $\theta_2 = dumb$, investigates and rejects, hence $q_2 = \pi_2\, \hat{p}_2$. R_1, if $\theta_1 = dumb$, investigates and approves with probability $\hat{\gamma}_1$ so that $\lambda \frac{\pi_1(1-p_1)}{\pi_1(1-p_1)+(1-\pi_1)(1-\hat{\gamma}_1)} = q_2\hat{P}_1 + \lambda \frac{\pi_1 p_1}{\pi_1 p_1+(1-\pi_1)\hat{\gamma}_1}$.

p_i	$\hat{p}^*_{1-} < p_1, \hat{p}_1 < p_0$	$\hat{p}_2 < p^*_{2-}$
ρ	$\rho_1 = (I, N, (1-\hat{\gamma}_1, \hat{\gamma}_1), I, N, 0, 1)$	$\rho_2 = (I, N, 0, I, N, 0, 1)$
$\hat{p}_i$	$\hat{p}_1 =$ Equation 16	$\hat{p}_2 =$ Equation 17
$\hat{\pi}_i(X_i = 0)$	$\frac{\pi_1(1-p_1)}{\pi_1(1-p_1)+(1-\pi_1)(1-\hat{\gamma}_1)}$	$\frac{\pi_2(1-\hat{p}_2)}{\pi_2(1-\hat{p}_2)+(1-\pi_2)}$
$\hat{\pi}_i(X_i = 1)$	$\frac{\pi_1 p_1}{\pi_1 p_1+(1-\pi_1)\hat{\gamma}_1}$	1
	$\hat{\pi}_1(NI, N) = \hat{\pi}_1(NI, A) = 0$	$\hat{\pi}_2(NI, N) = \hat{\pi}_2(NI, A) = 0$

Table 9. Proposition 4.c.

4.d.

Both R_1 and R_2, if $\theta_i = smart$, investigate and approve whenever $v_i = G$. R_2, if $\theta_2 = dumb$, investigates and approves with probability $\hat{\gamma}_2$ so that $\lambda \frac{\pi_2(1-\hat{p}_2)}{\pi_2(1-\hat{p}_2)+(1-\pi_2)(1-\hat{\gamma}_2)} = \hat{P}_2 + \lambda \frac{\pi_2\hat{p}_2}{\pi_2\hat{p}_2+(1-\pi_2)\hat{\gamma}_2}$, hence $q_2 = \pi_2\, \hat{p}_2 + (1-\pi_2)\hat{\gamma}_2$. R_1, if $\theta_1 = dumb$, investigates and approves with probability $\hat{\gamma}_1$ so that $\lambda \frac{\pi_1(1-p_1)}{\pi_1(1-p_1)+(1-\pi_1)(1-\hat{\gamma}_1)} = q_2\hat{P}_1 + \lambda \frac{\pi_1 p_1}{\pi_1 p_1+(1-\pi_1)\hat{\gamma}_1}$.

p	$\hat{p}^*_{1-} < p_1, \hat{p}_1 < p_0$	$p^*_{2-} < \hat{p}_2 < p_0$
ρ	$\rho_1 = (I, N, (1-\hat{\gamma}_1, \hat{\gamma}_1), I, N, 0, 1)$	$\rho_2 = (I, N, (1-\hat{\gamma}_2, \hat{\gamma}_2), I, N, 0, 1)$
$\hat{p}$	$\hat{p}_1 =$ Equation 17	$\hat{p}_2 =$ Equation 17
$\hat{\pi}_i(X_i = 0)$	$\frac{\pi_1(1-p_1)}{\pi_1(1-p_1)+(1-\pi_1)(1-\hat{\gamma}_1)}$	$\frac{\pi_2(1-\hat{p}_2)}{\pi_2(1-\hat{p}_2)+(1-\pi_2)(1-\hat{\gamma}_2)}$
$\hat{\pi}_i(X_i = 1)$	$\frac{\pi_1 p_1}{\pi_1 p_1+(1-\pi_1)\hat{\gamma}_1}$	$\frac{\pi_2\hat{p}_2}{\pi_2\hat{p}_2+(1-\pi_2)\hat{\gamma}_2}$
	$\hat{\pi}_1(NI, N) = \hat{\pi}_1(NI, A) = 0$	$\hat{\pi}_2(NI, N) = \hat{\pi}_2(NI, A) = 0$

Table 10. Proposition 4.d.

Proof: Appendix A.

I continue by providing intuition for the findings of Proposition 4. In all parts of Proposition 4, R_2 acts as if in the dictator case, the sole difference being that, second in line, his strategy and reputation follow from his updated probability $\hat{p}_2$. R_1's strategy, instead, changes. R_1 sets a value for $\hat{\gamma}_1$ in his mixed strategy such that:[15]

$$\lambda \frac{\pi_1(1-p_1)}{\pi_1(1-p_1)+(1-\pi_1)(1-\hat{\gamma}_1)} = q_2\,\hat{P}_1 + \lambda \frac{\pi_1\,p_1}{\pi_1\,p_1+(1-\pi_1)\hat{\gamma}_1}. \tag{21}$$

The threshold for p_1 above which R_1 plays a mixed strategy, $\hat{p}^*_{1-}$, is the value for p_1 such that Equation 21 holds for $\hat{\gamma}_1 = 0$. The resulting $\hat{p}^*_{1-}$ is lower than p^*_{1-}, and the resulting $\hat{\gamma}_1$ is higher than it would be in the dictator case. R_1 is a moderate sceptic already for lower values of p_1, and, when so, approves with higher probability $\hat{\gamma}_1$. This makes intuitive sense. The moderate sceptic's mixed strategy requires him to incur a negative project payoff $\hat{P}_1$ in return for a higher reputation $\hat{\pi}_1(X_1 = 1)$. A less negative project payoff, because R_2 rejects with a certain probability – moreover, by affiliation he is more likely to reject when $v_1 = v_2 = -L$ – then makes it relatively more attractive for the dumb R_1 to play his mixed strategy, and to imitate more closely the smart R_1 by setting a value of $\hat{\gamma}_1$ close to p_1.

Furthermore, only an extreme value for L, and hence $\hat{P}_1$, is sufficient for $\hat{p}_{1-} < \hat{p}^*_{1-}$.[16] In words, R_1's expected projected payoff must be extremely negative for there to exist still a range of values for p_1 in which he is a hard sceptic and always rejects if dumb. For a moderate value for L, it is strictly optimal for the dumb R_1 to play a mixed strategy whenever investigating.

In Proposition 4.d, R_1 and R_2 jointly determine $\hat{\gamma}_1$ and $\hat{\gamma}_2$. R_2 determines $\hat{\gamma}_2$ as in the dictator case, but now as a function of $\hat{p}_2$. R_1 sets $\hat{\gamma}_1$ in line with Equation 21, which now results in an even higher value due to R_2's mixed strategy, for two reasons. An increasing probability $\hat{\gamma}_1$ with which the dumb R_1 approves decreases R_2's posterior $\hat{p}_2$ and thereby $\hat{\gamma}_2$. In turn, a decreasing $\hat{\gamma}_2$ increases $\hat{p}_1$ and thus makes expected project payoff $\hat{P}_1$ less negative, and at the same time decreases q_2, the probability with which R_1 in fact incurs a negative project payoff because the project is implemented. Both make approving more attracting to the dumb R_1, hence $\hat{\gamma}_1$ increases. In sum, the pretence effect increases in strength when a dumb committee member is first in line. Knowing that

[15] Formally, because by affiliation $\hat{\pi}_1(X_1 = 1, X_2 = 0) \neq \hat{\pi}_1(X_1 = 1, X_2 = 1)$, R_1's payoff when dumb from playing $X_1 = 1$ is $q_2\hat{P}_1 + \lambda\left((1-q_2)\hat{\pi}_1(X_1 = 1, X_2 = 0) + q_2\hat{\pi}_1(X_1 = 1, X_2 = 1)\right)$. However, by Bayes rule, this simplifies to $q_2\hat{P}_1 + \lambda \frac{\pi_1\,\hat{p}_1}{\pi_1\,\hat{p}_1+(1-\pi_1)\hat{\gamma}_1}$.

[16] Values that are extreme relative to the dictator case, e.g. increased by a factor of ten.

his project payoff materialises conditional on approval by the second member only, he is more willing to take the action that yields him a higher reputation.

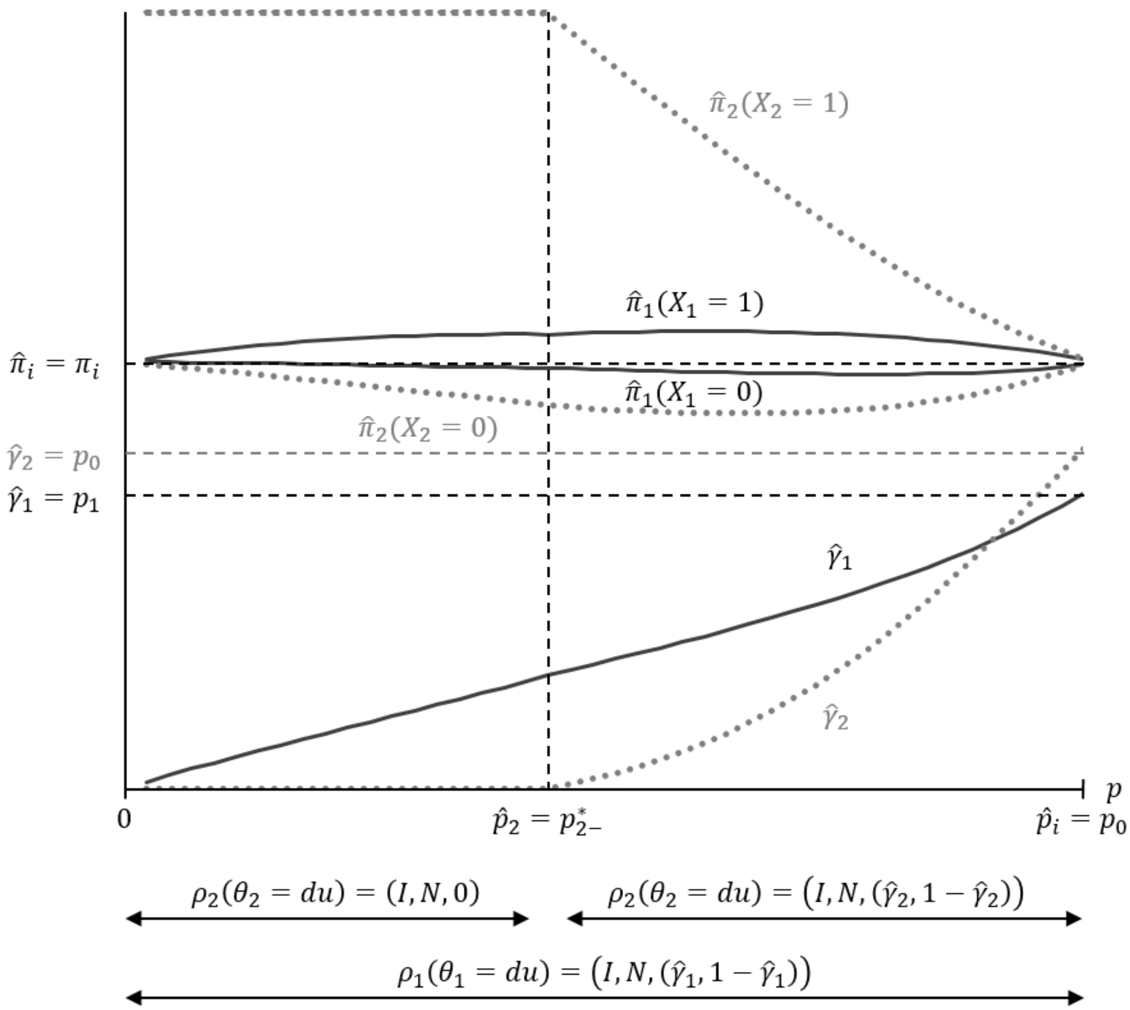

Figure 5. Reputations and approval probabilities for R_1 and R_2 for the special case where $p = p_1 = p_2$. Figure A2 shows π_1 and $\hat{\gamma}_1$ as functions of p_1 with p_2 held constant.

Figure 5 illustrates the reputations $\hat{\pi}_i$ and approval probabilities $\hat{\gamma}_i$ for R_1 and R_2, for the special case where $p = p_1 = p_2$. The functions for $\hat{\pi}_2$ and $\hat{\gamma}_2$ (the grey dotted lines) follow a path shaped identically with the dictator case for $p \in (0, p_0]$ in Figure 2. Here, however, for lower values of p already does $\hat{\gamma}_2$ become positive and rises to the level $\hat{\gamma}_2 = p_0$ at which the dumb R_2 is indistinguishable from the smart R_2, since affiliation makes his expected project payoff less negative. The function for $\hat{\gamma}_1$, positive already at $p = 0$ because $\hat{p}^*_{1-} < 0 < \hat{p}_{1-}$ in the case of Figure 5, closely traces the line $\hat{\gamma}_1 = p$. This illustrates that there is little cost to the dumb R_1 to closely mimic the smart R_1. It approaches $\hat{\gamma}_1 = p$ most closely at high or low values of p, but diverges in between. At low values of p, q_2 is low hence there is little cost in terms of project payoff to the dumb R_1 to set a value for $\hat{\gamma}_1$ close to p. The same mechanism applies to high values of p, where $\hat{P}_1$ approaches zero. Only for intermediate values of p is the project payoff cost substantial enough for the dumb R_1 to separate more distinctly from the smart R_1.

4.4 Optimal persuasion strategy

When designing her persuasion strategy vis-à-vis a two-member committee, the sponsor must decide whom to request to investigate, and in which order. Is she better off approaching the member who has the highest probability of being smart first, or second? I consider this question in turn for both regimes. Let the 'smartest' committee member R_{sm} have $\pi = \pi_{sm}$ and $p = p_{sm}$, and the other committee member R_{du} have $\pi = \pi_{du}$ and $p = p_{du}$, where $\pi_{sm} > \pi_{du}$. The respective values for p may be any that satisfy the restrictions of Regime I or II. Formally then, the question for S is whether to choose R_1 such that $\pi_1 = \pi_{sm}$ or that $\pi_1 = \pi_{du}$.

Regime I. How can the sponsor maximise the probability that his project sees approval, Q, under Regime I? The sponsor must be able to rely on a persuasion cascade where R_2 is willing to rubberstamp because R_1's approval after investigation is sufficiently convincing to increase $\hat{p}_2$ beyond p_0. Approval from R_1 is more convincing if R_1 is smarter when $\hat{p}_2$ increases in π_1. If an approval coming from $R_1 = R_{du}$ is insufficient for $R_2 = R_{sm}$ to rubberstamp, the sponsor has no choice but to choose instead $R_1 = R_{sm}$ to keep her persuasion cascade intact.

However, if $\hat{p}_2 > p_0$ irrespective of whether R_{sm} or R_{du} is first in line, the sponsor principally prefers to choose the least sceptic committee member (with the highest value for p_i) to be first in line and investigate. There is one exception, however. A moderately sceptic committee member, if dumb, approves with lower probability than if smart. For this reason, it may be advantageous for S to choose $R_1 = R_{sm}$ to investigate, despite that $p_{sm} < p_{du}$.[17] For example, in a committee of two moderate sceptics where $p_{sm} = p_{du}$, it is strictly optimal for the sponsor to choose $R_1 = R_{sm}$, which minimises the probability that R_1 is dumb and hence approves with lower probability γ_1^1 instead of p_{sm}. Proposition 5 formalises this strategy.

[17] Vice versa for $p_i > p_0$. Yet under Regime I there can only be one committee member for whom $p_i > p_0$, who becomes automatically the sponsor's optimal choice for R_1.

Proposition 5. Given sufficient affiliation for the second member R_2 to rubberstamp ($\hat{p}_2 > p_0$), the sponsor's optimal strategy is to request the first member R_1 to investigate, and the second member to rubberstamp, achieving:

- $Q = \pi_1 p_1$ if $p_1 < p^*_{1-}$
- $Q = \pi_1 p_1 + (1 - \pi_1)\gamma_1^1$ if $p^*_{1-} < p_1 < p_0$
- $Q = \pi_1 p_1 + (1 - \pi_1)(1 - \gamma_0^1)$ if $p_0 < p_1 < p^*_{1+}$
- $Q = \pi_1 p_1 + (1 - \pi_1)$ if $p^*_{1+} < p_1$

S chooses $R_1 = R_{sm}$ if approval by R_{du} is insufficiently convincing for a persuasion cascade, i.e. $\hat{p}_2 = \hat{p}_{sm} < p_0$ if $R_1 = R_{du}$. Otherwise, S chooses the most enthusiastic committee member (having the highest p_i) to be R_1, with some preference for R_{sm}, that is, she chooses $R_1 = R_{sm}$ if $\beta\, p_{sm} \geq p_{du}$, where $\beta > 1$.

Proof: Appendix A.

The preference of the sponsor to choose the smartest member to be first in line if the difference in scepticism is relatively small is reflected in β, which increases as $\pi_{sm} - \pi_{du}$ increases.

Regime II. How can the sponsor maximise Q under Regime II, where both members must be requested to investigate? Given the stochastic structure of benefits, the committee members, if both smart, approve after investigation with probability $(1 + \alpha)p_{sm}p_{du}$ irrespective of who is first in line. Therefore, if the committee consists of two hard sceptics that never approve if dumb, in line with Proposition 4.a, the sponsor achieves the probability of approval $Q = (1 + \alpha)p_{sm}p_{du}$ with any order of investigation. If one or both members are moderately sceptic and do approve with positive probability if dumb, maximising that probability within the restrictions posed by the regime is the sponsor's solution for maximising Q.

First of all, if one sequence of approval can lift a hard sceptic to moderate scepticism, whereas the other does not, the sponsor is strictly better off choosing that sequence. For example, if approval from R_{sm} first in line can lift R_{du}, second in line, from hard moderate scepticism, but an approval from R_{du} first in line does not do so for R_{sm}, second in line, the sponsor chooses $R_1 = R_{sm}$. Proposition 6 and 7 describe the sponsor's optimal strategies if members remain at hard or moderately sceptic irrespective of the sequence of investigation.

Proposition 6. The sponsor faces a committee consisting of a hard and a moderate sceptic ($\hat{p}_i < p_{i-}^*$ and $p_{j-}^* < \hat{p}_j < p_0$). The optimal persuasion strategy is to choose R_1 to be the moderate sceptic, irrespective of whether that is R_{sm} or R_{du}. R_1 and R_2's strategies and beliefs follow Proposition 4.b. The sponsor achieves $Q = (\pi_1 p_1 + (1 - \pi_1)\hat{\gamma}_1)\pi_2 \hat{p}_2$.

Proof: Appendix A.

Proposition 6 formalises the 'position risk strategy'. Faced by a committee of a hard and moderate sceptic, it is the position of the moderate sceptic that matters to the sponsor. In either position, the moderate sceptic updates P_i to $\hat{P}_i$. Yet, only by placing him first in line does the sponsor takes advantage that, if dumb, he approves with higher probability because his project payoff becomes less negative. In effect, the strategy of the sponsor is to put the member for whom loss of information plays a role in the position where it poses the least risk to that member.

Proposition 7. The sponsor faces a committee consisting of two moderate sceptics ($p_{i-}^* < \hat{p}_i < p_0$, $i \epsilon \{1, 2\}$). The optimal persuasion strategy is to choose R_1 to be least moderate sceptic (having the lowest p_i), with some preference for R_{sm} if $\pi_{sm} > \bar{\pi}_{sm}$ or for R_{du} when otherwise. That is, S chooses $R_1 = R_{sm}$ if $\delta\, p_{sm} < p_{du}$, where $\delta < 1$ if $\pi_{sm} > \bar{\pi}_{sm}$ and $\delta > 1$ otherwise. R_1 and R_2's strategies and beliefs follow Proposition 4.d. The sponsor achieves $Q = (\pi_1 p_1 + (1 - \pi_1)\hat{\gamma}_1)(\pi_2 \hat{p}_2 + (1 - \pi_2)\hat{\gamma}_2)$.

Proof: Appendix A.

Proposition 7 formalises the 'persuasion cascade strategy'. The strategy of the sponsor faced by a committee of two moderate sceptics is to maximise $\hat{p}_2$, which amounts to optimising the use of a persuasion cascade. R_1 must be the member whose approval gives the most convincing signal to R_2 that $v_2 = G$. Consequently, the smart R_2 approves with higher probability, which gives the dumb R_2 a reputational incentive to approve with higher probability as well. R_2's expected project payoff $\hat{P}_2$ does not improve as a result of observing R_1's approval. In either position, a committee member knows the other member investigates and thus calculates $\hat{P}_i$ using updated probability $\hat{p}_i$. The sponsor's persuasion cascade strategy, therefore, relies on exploiting R_2's reputational incentive.

The most convincing signal comes from the member for whom the pretence effect is least present, that is, whose approval is least likely to have come from his dumb type. Perhaps counterintuitively, this is not principally from the smartest member, but rather from the most sceptical one. Specifically, R_2 distrusts an approval from a less sceptical R_1 for the reason that he has a stronger incentive to approve when dumb, the more so because he is first in line. Approval from a more sceptical R_1 provides a more accurate signal to R_2 that he stands to gain from the project.

However, as the difference in scepticism between R_{sm} and R_{du} decreases, the values for π_{sm} and π_{du} play a stronger role in determining who is the better choice to be first in line. If R_{sm} is sufficiently smart ($\pi_{sm} > \bar{\pi}_{sm}$), S may prefer to choose $R_1 = R_{sm}$ in her persuasion cascade, even if he is less sceptical than R_{du} ($p_{sm} < p_{du}$). This is reflected in $\delta < 1$. The higher value for π_{sm} dominates the difference in scepticism in maximising $\hat{p}_2$. By contrast, if R_{sm} is not sufficiently smart to effect any substantial increase in $\hat{p}_2$, S may prefer to choose $R_1 = R_{du}$ even if he is less sceptical than R_{sm}. This is reflected in $\delta > 1$. The sponsor does not employ a persuasion cascade and resorts to the other trick up her sleeve: the position risk strategy. If dumb, members approve with higher probability when first in line because their expected project payoff decreases. Hence choosing $R_1 = R_{du}$ maximises Q.

5. Discussion

I discuss the persuasion of an n-member committee and the robustness of the results to three assumptions: that players know their type, that investigation is observable, and that the decision rule is unanimity. Caillaud & Tirole (2007) discuss mixed strategies for the sponsor, an informed sponsor, and side communication between members. Their discussion of these assumptions in the setting without reputational concerns applies to the current setting with reputational concerns too.

5.1 n-Member Committee

Caillaud & Tirole (2007) determine the sponsor's optimal strategy vis-à-vis a symmetrical n-member committee of sceptics, where $p_1 = p_2 = \cdots p_n = p < p_0$ and reputational concerns are absent because $\pi_i = 1, i \in \{1, 2, \ldots, n\}$. S requests the minimum $k^*, k \in \{1, 2, \ldots, n-1\}$ number of members to investigate sequentially such that $\hat{p}_{k^*+1} = \Pr[v_{k^*+1} = G | X_1 = X_2 = \cdots = X_{k^*} = 1] > p_0$, and to request all other members $R_{k^*+1}, \dots, R_n$ to rubberstamp.[18]

The same strategy holds when I introduce reputational concerns[19] and the committee is asymmetric but still consisting of sceptics, $p_i < p_0$. Minimising k^* so that $\hat{p}_{k^*+1} > p_0$ equals to maximising each $\hat{p}_i, i \epsilon \{1, 2, \dots, k^*\}$. Essentially, this is identical with the sponsor's strategy when she engineers her persuasion cascade strategy for a two-member committee of sceptics. The question then becomes in which sequence S must request the committee members to investigate and which members she must ask to rubberstamp. Specifically, S must choose $R_k, k < k^*$ to request to investigate after $k - 1$ members have been requested to investigate already. The three relevant choices for S are the most sceptical remaining R_i such that $p_i = \min\{p_k, p_{k+1}, \dots, p_n\}$, denoted by R_{sc}, the smartest remaining R_i such that $\pi_i = \max\{\pi_k, \pi_{k+1}, \dots, \pi_n\}$, denoted by R_{sm}, or the dumbest remaining R_i such that $\pi_i = \min\{\pi_k, \pi_{k+1}, \dots, \pi_n\}$, denoted by R_{du}.

Relative to the two-member case, S's preference to choose the smartest committee member to be next in line, rather than the most sceptical one, increases strongly (δ decreases). Committee member R_k's expected project payoff is $Q_{n-k}\hat{P}_k$, where Q_{n-k} is the probability that all members $R_{k+1}, \dots, R_n$ approve the project. Therefore, the earlier in line, the less negative is R_k's expected project payoff. Specifically, as $n - k$ approaches infinity, Q_{n-k} goes to zero, given that each investigating member approves with probability less than one. The result is that $\hat{\gamma}_k \to \hat{p}_k$ as their remains no cost to the dumb R_k to achieve the best possible reputation by approving and disapproving with probabilities equal to those of the smart R_k. With $\hat{\gamma}_k = \hat{p}_k$, $\hat{p}_{k+1}$ is no longer a function of R_k's scepticism $\hat{p}_k$ but only a function increasing in π_k. Therefore, S maximises $\hat{p}_{k+1}$ by choosing $R_k = R_{sm}$.

As $n - k$ decreases and Q_{n-k} increases, S employs the same strategies as in the two-member case. That is, she chooses the most sceptical remaining member R_{sc} to be next in line, with two exceptions. If R_{sm} is sufficiently smart and $p_{sm} - p_{sc}$ is relatively small, S chooses $R_k = R_{sm}$. If R_{du} is sufficiently dumb and $p_{du} - p_{sc}$ is relatively small, S chooses $R_k = R_{du}$.

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[18] All investigating members must have positive expected utility from investigating.

[19] All investigating members must have investigating as their equilibrium action. See Appendix B for the full expression of this restriction, as well as for full expressions of $\hat{p}_k$ and $\hat{\gamma}_k$.

5.2 Reputational Concerns and Sponsor's Expected Payoff

The main purpose of introducing reputational concerns to group persuasion was to uncover new behaviours of committee members and new persuasion strategies of the sponsor. In addition, here I investigate whether the sponsor is better or worse off in terms of her payoff Q. The answer is ambiguous and depends on the values of p_i.[20] For that reason, I draw conclusions – valid for the dictator, two-member, and n-member case – based on the sponsor's expected payoff, that is, prior to the realisation of each $p_i \sim U([0,1])$ from a uniform distribution.

The sponsor's payoff remains unaffected in a pooling equilibrium without investigation, and is higher when an enthusiastic member investigates ($1 - \gamma_i^0 > p_i$). In the most pertinent case where she faces a sceptic, the effect is ambiguous. On the one hand, a dumb sceptic approves with lower probability than a smart one does, or with equal probability at best. This decreases the sponsor's payoff. On the other hand, a reputational payoff extends the range of values for which a committee member investigates and thus for which he approves with positive probability. Furthermore, the higher the reputational payoff is relative to the project payoff (λ increases), the more prevalent the pretence effect (p_{i-}^* decreases, γ_i^1 increases). Both increase the sponsor's payoff. Altogether, the sponsor's expected payoff increases as a result of the introduction of reputational concerns only when those concerns are sufficiently strong, that is, when λ is sufficiently high.

The sponsor always prefers a sceptic committee member to be smart, as it increases his approval probability as well as its convincingness to members next in line. On the contrary, she prefers enthusiastic committee members to be dumb, except for when, if smart(er), he could lift a colleague from scepticism to enthusiasm and thus to a rubberstamp.

5.2 Robustness Checks

Players know their type. The model simplifies substantially if committee members 'don't know when they don't know' and do not possess information whether they are smart or dumb. Suppose investigating yields signal $v_i = G$ with probability m_i to R_i of type $\theta_i = dumb$, independent of the true state of the world, and that approving in line with the signal yields a positive expected project payoff. If requested to investigate, R_i's strategy is equal to that of the smart R_i in the preceding analysis. He investigates and approves whenever he receives signal $v_i = G$. However, the range of

[20] For example, reputational concerns generally leave the sponsor better off when an enthusiastic R_1 investigates, but not if π_1 is too low to turn R_2 from a sceptic into an enthusiast and obtain his rubberstamp.

values for which he is willing to investigate decreases, given that with some probability he is dumb and approves a project for which $v_i = -L$. He never has an incentive to act contrarily to his signal to obtain a higher reputation. Bayes' rule implies that his higher reputation decreases proportional to the probability with which he obtains it. The sponsor's optimal persuasion strategy is to choose as R_1 whichever R_i hast the highest value for $\pi_i p_i + (1 - \pi_i)m_i$, if that yields $\hat{p}_2 > p_0$ and R_2 can be asked to rubberstamp. Instead, if both members must investigate she is strictly better off choosing $R_1 = R_{sm}$. In addition to the qualitative reasons why committee members know their type, the simplicity of results from such a model provides further reason to have assumed that players know their types.

Investigation is observable. Were investigation unobservable, the qualitative conclusions and main results would not alter, but the equilibria strategies of the committee members change. Committee members would never engage in investigation if dumb. To the dumb committee member, investigation is costly and reveals no information, and served only to mimic the smart committee member. However, the probabilities with which the dumb R_i approves remain unchanged, from which the main results have followed. Furthermore, the equilibrium in which the smart R_i investigates no longer applies for $p_i < p_{i-}$ or $p_i > p_{i+}$. With investigation observable, the smart committee member was incentivised to investigate because the action to not investigate yielded a reputation of zero. This incentive ceases to exist with investigation unobservable, and the only equilibrium for $p < p_{i-}$ is the pooling equilibrium where both types reject without investigation.

Unanimity. Were the committee's decision rule to change from unanimity to majority approval, the sponsor's optimal strategy would not change. However, when designing it she would have a larger pool of committee members to choose from. This allows her, facing an n-member committee of sceptics, to optimise her strategy by choosing principally the least sceptic members. Otherwise, she chooses the smartest members when the difference in scepticism is low or when n is high. When a member rejects, the sponsor is required to 'redesign' her strategy with respect to the pool of remaining members in accordance with the same principles.

6. Conclusion

Many decisions are taken in groups, where the members' decisions signal something not only about the subject but also about their reputations as decision makers. A sponsor who wishes a committee to approve her project must take into account such reputational concerns when designing her optimal persuasion strategy. In this thesis, I contribute to the literature on optimal disclosure of hard information and the upcoming topic of group persuasion by weaving in the phenomenon of reputational concerns. I present a sender-multi receiver persuasion game to analyse the behaviour of committee members with reputational concerns and two ensuing persuasion strategies for the sponsor.

Committee members, if smart, follow their signal after investigation. If dumb, and therefore not receiving an informative signal, they follow their prior belief or may incur a decreased expected project payoff to obtain a higher reputation. The sponsor requests either the most sceptical or the smartest member to investigate first, so that his approval is a convincing signal to committee members next in line that that they stand to gain from the project. Subsequently, those members have a stronger incentive from their reputational payoff to approve as well. If none of the members is sufficiently smart to engineer a persuasion cascade, the sponsor asks a dumb sceptical committee member for approval first. This decreases to him the risk with which he incurs a negative project payoff and thereby increases his incentive to approve and obtain a higher reputational payoff.

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Appendix A

Proofs

Lemma 1.

Follows from the statement of the Lemma itself and the text succeeding it.

Proposition 1.a.

Region	$p < p_{-}$
Strategy profile	$(NI, N, 0, NI, N, 0, 1)$

Beliefs

$\hat{\pi}(X=0) = \dfrac{\pi(1-p)}{\pi(1-p)+(1-\pi)}$ $\quad\quad$ $\hat{\pi}(X=1) = 1$

$\hat{\pi}(NI, N) = \hat{\pi}(NI, A) = \pi$

$\hat{\pi}(NI, N)$ is determined by Bayes' rule. $\hat{\pi}(X=0)$ and $\hat{\pi}(X=1)$ are not reached with positive probability and determined by $\lim_{q \to 0} \frac{q\,\pi(1-p)}{q\,\pi(1-p)+q\,(1-\pi)}$ and $\lim_{q \to 0} \frac{q\,\pi\,p}{q\,\pi\,p}$, respectively, where q $(1-q)$ is the probability that R plays I (NI) in the strategy profile $\big((q, 1-q), 0, N, (q, 1-q), 0, 1, N\big)$. $\hat{\pi}(NI, A)$ is also not reached with positive probability and determined by $\lim_{s \to 0} \frac{s\,\pi}{s\,\pi + s(1-\pi)}$ where s $(1-s)$ is the probability that R plays A (N) in the strategy profile $\big(NI, 0, (1-s, s), NI, 0, 1, (1-s, s)\big)$.

	Equilibrium conditions	**Satisfied by**
(1)	$u_{sm}(NI, N, 0, 1) \geq u_{sm}(I, N, 0, 1)$	$p < p_{-}$
(2)	$u_{sm}(NI, N, 0, 1) \geq u_{sm}(NI, N, 1, 1)$	follows fom (6)given $-\mathrm{L} \leq \mathrm{P}$
(3)	$u_{sm}(NI, N, 0, 1) \geq u_{sm}(NI, N, 0, 0)$	$\hat{\pi}(X=1) > \hat{\pi}(X=0)$ and $G > 0$
(4)	$u_{sm}(NI, N, 0, 1) \leq u_{sm}(NI, A, 0, 1)$	$p < p_0$
(5)	$u_{du}(NI, N, 0) \geq u_{du}(I, N, 0)$	follows from (1)
(6)	$u_{du}(NI, N, 0) \geq u_{du}(NI, N, 1)$	$p < p_{-}^{*}$
(7)	$u_{du}(NI, N, 0) \leq u_{du}(NI, A, 0)$	$p < p_0$

Expanded form

(1)	$\lambda\,\pi \geq p\big(G + \lambda\,\hat{\pi}(X=1)\big) + (1-p)\lambda\,\hat{\pi}(X=0) - c$
(2)	$\lambda\,\hat{\pi}(X=0) \geq -L + \lambda\,\hat{\pi}(X=1)$
(3)	$G + \lambda\,\hat{\pi}(X=1) \geq \lambda\,\hat{\pi}(X=0)$
(4)	$p\,G + (1-p)L \leq 0$
(5)	$\lambda\,\pi \geq \lambda\,\hat{\pi}(X=0) - c$
(6)	$\lambda\,\hat{\pi}(X=0) \geq P + \lambda\,\hat{\pi}(X=1)$
(7)	$p\,G + (1-p)L \leq 0$

■

Table A 1. Proof of proposition 1.a.

Proposition 1.b.

Region	$p < p_{-}^{*}$
Strategy profile	$(I, N, 0, I, N, 0, 1)$

Beliefs

$\hat{\pi}(X = 0) = \dfrac{\pi(1-p)}{\pi(1-p) + (1-\pi)}$ $\hat{\pi}(X = 1) = 1$

$\hat{\pi}(NI, N) = \hat{\pi}(NI, A) = 0$

$\hat{\pi}(X = 0)$ and $\hat{\pi}(X = 1)$ are determined by Bayes' rule. $\hat{\pi}(NI, N)$ and $\hat{\pi}(NI, A)$ are not reached with positive probability. Given that R receives no valuable information from a costly investigation and that strictly $u_{du}(I, 0, N) = \lambda\,\hat{\pi}(X = 0) - c < \lambda\,\pi$, beliefs about θ after observing the out-of-equilibrium action NI are that $\theta = dumb$. Therefore, $\hat{\pi}(NI, N) = \lim_{q\to 0} \frac{0}{(1-\pi)q} = 0$ where q $(1-q)$ is the probability with which R of type $\theta = dumb$ plays NI (I) in the strategy profile $\big((1-q, q), 0, N, I, 0, 1, N\big)$ and $\hat{\pi}(NI, A) = \lim_{q,s\to 0} \frac{0}{(1-\pi)q\,s} = 0$ where in addition s $(1-s)$ is the probability with which he plays A (N) in the strategy profile $\big((1-q, q), 0, (1-s, s), I, 0, 1, N\big)$.

	Equilibrium conditions	Satisfied by
(1)	$u_{sm}(I, N, 0, 1) \geq u_{sm}(NI, N, 0, 1)$	follows from (5)
(2)	$u_{sm}(I, N, 0, 1) \geq u_{sm}(I, N, 1, 1)$	follows fom (6)given $-\mathrm{L} \leq \mathrm{P}$
(3)	$u_{sm}(I, N, 0, 1) \geq u_{sm}(I, N, 0, 0)$	$\hat{\pi}(X = 1) > \hat{\pi}(X = 0)$ and $G > 0$
(4)	$u_{sm}(I, N, 0, 1) \leq u_{sm}(I, A, 0, 1)$	$p < p_0$
(5)	$u_{du}(I, N, 0) \geq u_{du}(NI, N, 0)$	$c < \bar{c}$
(6)	$u_{du}(I, 0, N) \geq u_{du}(I, N, 1)$	$p < p_{-}^{*}$
(7)	$u_{du}(I, 0, N) \leq u_{du}(I, A, 0)$	$p < p_0$

Expanded form

(1)	$p\big(G + \lambda\,\hat{\pi}(X = 1)\big) + (1-p)\lambda\,\hat{\pi}(X = 0) - c \geq 0$
(2)	$\lambda\,\hat{\pi}(X = 0) \geq -L + \lambda\,\hat{\pi}(X = 1)$
(3)	$G + \lambda\,\hat{\pi}(X = 1) \geq \lambda\,\hat{\pi}(X = 0)$
(4)	$p\,G + (1-p)L \leq 0$
(5)	$\lambda\,\hat{\pi}(X = 0) - c \geq 0$
(6)	$\lambda\,\hat{\pi}(X = 0) \geq P + \lambda\,\hat{\pi}(X = 1)$
(7)	$p\,G + (1-p)L \leq 0$

■

Table A 2. Proof of proposition 1.b.

Proposition 1.c.

Region	$p_-^* < p < p_0$
Strategy profile	$(I, N, (1-\gamma^1, \gamma^1), I, N, 0, 1)$

Beliefs

$\hat{\pi}(X=0) = \dfrac{\pi(1-p)}{\pi(1-p)+(1-\pi)(1-\gamma^1)}$ $\qquad$ $\hat{\pi}(X=1) = \dfrac{\pi\, p}{\pi p + (1-\pi)\gamma^1}$

$\hat{\pi}(NI, N) = \hat{\pi}(NI, A) = 0$

$\hat{\pi}(X=0)$ and $\hat{\pi}(X=1)$ are determined by Bayes' rule. $\hat{\pi}(NI, N)$ and $\hat{\pi}(NI, A)$ are not reached with positive probability. Given that R receives no valuable information from a costly investigation and that strictly $u_{du}(I, (1-\gamma^1, \gamma^1), N) < \lambda\,\pi$, beliefs about θ after observing the out-of-equilibrium action NI are that $\theta = dumb$. Therefore, $\hat{\pi}(NI, N) = \lim_{q\to 0} \frac{0}{(1-\pi)q(1-s)} = 0$ where q $(1-q)$ is the probability with which R of type $\theta = dumb$ plays NI (I) in the strategy profile $\big((1-q, q), (1-\gamma^1, \gamma^1), N, I, 0, 1, N\big)$ and $\hat{\pi}(NI, A) = \lim_{q,s\to 0} \frac{0}{(1-\pi)q(1-s)} = 0$ where in addition s $(1-s)$ is the probability with which he plays A (N) in the strategy profile $\big((1-q, q), (1-\gamma^1, \gamma^1), (1-s, s), I, 0, 1, N\big)$.

	Equilibrium conditions	**Satisfied by**
(1)	$u_{sm}(I, N, 0, 1) \geq u_{sm}(NI, N, 0, 1)$	follows from (5)
(2)	$u_{sm}(I, N, 0, 1) \geq u_{sm}(I, N, 1, 1)$	follows fom (6)given $-\mathrm{L} < \mathrm{P}$
(3)	$u_{sm}(I, N, 0, 1) \geq u_{sm}(I, N, 0, 0)$	$\hat{\pi}(X=1) > \hat{\pi}(X=0)$ and $G > 0$
(4)	$u_{sm}(I, N, 0, 1) \leq u_{sm}(I, A, 0, 1)$	$p < p_0$
(5)	$u_{du}\big(I, N, (1-\gamma^1, \gamma^1)\big) \geq u_{du}\big(NI, N, (1-\gamma^1, \gamma^1)\big)$	$c < \bar{c}$
(6)	$u_{du}(I, N, 0) = u_{du}(I, N, 1)$	$p \geq p_-^*$
(7)	$u_{du}\big(I, N, (1-\gamma^1, \gamma^1)\big) \leq u_{du}\big(I, A, (1-\gamma^1, \gamma^1)\big)$	$p < p_0$

Expanded form

(1)	$p\big(G + \lambda\,\hat{\pi}(X=1)\big) + (1-p)\lambda\,\hat{\pi}(X=0) - c \geq 0$
(2)	$\lambda\,\hat{\pi}(X=0) \geq -L + \lambda\,\hat{\pi}(X=1)$
(3)	$G + \lambda\,\hat{\pi}(X=1) \geq \lambda\,\hat{\pi}(X=0)$
(4)	$p\,G + (1-p)L \leq 0$
(5)	$\gamma^1\big(P + \lambda\,\hat{\pi}(X=1)\big) + (1-\gamma^1)\lambda\,\hat{\pi}(X=0) - c \geq 0$
(6)	$\lambda\,\hat{\pi}(X=0) = P + \lambda\,\hat{\pi}(X=1)$
(7)	$p\,G + (1-p)L \leq 0$

■

Table A 3. Proof of proposition 1.c.

Proposition 1.d.

Region	$p_0 < p < p_+^*$
Strategy profile	$(I, A, (\gamma^0, 1-\gamma^0), I, A, 0, 1)$

Beliefs

$\hat{\pi}(X=0) = \dfrac{\pi(1-p)}{\pi(1-p)+(1-\pi)\gamma^0}$ $\qquad$ $\hat{\pi}(X=1) = \dfrac{\pi\, p}{\pi p+(1-\pi)(1-\gamma^0)}$

$\hat{\pi}(NI, N) = \hat{\pi}(NI, A) = 0$

$\hat{\pi}(X=0)$ and $\hat{\pi}(X=1)$ are determined by Bayes' rule. $\hat{\pi}(NI, N)$ and $\hat{\pi}(NI, A)$ are not reached with positive probability. Given that R receives no valuable information from a costly investigation and that strictly $u_{du}(I, (\gamma^0, 1-\gamma^0), A) < P + \lambda\, \pi$, beliefs about θ after observing the out-of-equilibrium action NI are that $\theta = dumb$. Therefore, $\hat{\pi}(NI, A) = \lim_{q\to 0} \frac{0}{(1-\pi)q} = 0$ where q $(1-q)$ is the probability with which R of type $\theta = dumb$ plays NI (I) in the strategy profile $\big((1-q, q), (\gamma^0, 1-\gamma^0), A, I, 0, 1, A\big)$ and $\hat{\pi}(NI, N) = \lim_{q,s\to 0} \frac{0}{(1-\pi)q\, s} = 0$ where in addition s $(1-s)$ is the probability with which he plays N (A) in the strategy profile $(1-q, q), (\gamma^0, 1-\gamma^0), (s, 1-s), (I, 0, 1, A)$.

	Equilibrium conditions	**Satisfied by**
(1)	$u_{sm}(I, A, 0, 1) \geq u_{sm}(NI, A, 0, 1)$	follows from (5)
(2)	$u_{sm}(I, A, 0, 1) \geq u_{sm}(I, A, 0, 0)$	$\hat{\pi}(X=0) > \hat{\pi}(X=1)$ and $L > 0$
(3)	$u_{sm}(I, A, 0, 1) \geq u_{sm}(I, A, 1, 1)$	follows fom (6)given $G > P$
(4)	$u_{sm}(I, A, 0, 1) \geq u_{sm}(I, N, 0, 1)$	$p > p_0$
(5)	$u_{du}(I, A, (\gamma^0, 1-\gamma^0)) \geq u_{du}\big(NI, A, (\gamma^0, 1-\gamma^0)\big)$	$c < \bar{c}$
(6)	$u_{du}(I, A, 1) = u_{du}(I, A, 0)$	$p \leq p_+^*$
(7)	$u_{du}(I, A, (\gamma^0, 1-\gamma^0)) \geq u_{du}\big(I, N, (\gamma^0, 1-\gamma^0)\big)$	$p > p_0$

Expanded form

(1)	$p\big(G + \lambda\, \hat{\pi}(X=1)\big) + (1-p)\lambda\, \hat{\pi}(X=0) - c \geq P$
(2)	$\lambda\, \hat{\pi}(X=0) \geq -L + \lambda\, \hat{\pi}(X=1)$
(3)	$G + \lambda\, \hat{\pi}(X=1) \geq \lambda\, \hat{\pi}(X=0)$
(4)	$p\, G + (1-p)L \geq 0$
(5)	$(1-\gamma^0)\big(P + \lambda\, \hat{\pi}(X=1)\big) + \gamma^0 \lambda\, \hat{\pi}(X=0) - c \geq P$
(6)	$P + \lambda\, \hat{\pi}(X=1) = \lambda\, \hat{\pi}(X=0)$
(7)	$p\, G + (1-p)L \geq 0$

■

Table A 4. Proof of proposition 1.d.

Proposition 1.e.

Region	$p > p_+^*$
Strategy profile	$(I, A, 1, I, A, 0, 1)$

Beliefs

$\hat{\pi}(X = 0) = 1$ $\qquad$ $\hat{\pi}(X = 1) = \dfrac{\pi\, p}{\pi p + (1 - \pi)}$

$\hat{\pi}(NI, N) = \hat{\pi}(NI, A) = 0$

$\hat{\pi}(X = 0)$ and $\hat{\pi}(X = 1)$ are determined by Bayes' rule. $\hat{\pi}(NI, N)$ and $\hat{\pi}(NI, A)$ are not reached with positive probability. Given that R receives no valuable information from a costly investigation and that strictly $u_{du}(I, 1, A) < P + \lambda\, \pi$, beliefs about θ after observing the out-of-equilibrium action NI are that $\theta = dumb$. Therefore, $\hat{\pi}(NI, A) = \lim_{q \to 0} \frac{0}{(1-\pi)q} = 0$ where q $(1 - q)$ is the probability with which R of type $\theta = dumb$ plays NI (I) in the strategy profile $\big((1 - q, q), 1, A, I, 0, 1, A\big)$ and $\hat{\pi}(NI, N) = \lim_{q,s \to 0} \frac{0}{(1-\pi)q\, s} = 0$ where in addition s $(1 - s)$ is the probability with which he plays N (A) in the strategy profile $\big((1 - q, q), 1, (s, 1 - s), I, 0, 1, A\big)$.

	Equilibrium conditions	**Satisfied by**
(1)	$u_{sm}(I, A, 0, 1) \geq u_{sm}(NI, A, 0, 1)$	follows from (5)
(2)	$u_{sm}(I, A, 0, 1) \geq u_{sm}(I, A, 1, 1)$	$\hat{\pi}(X = 0) > \hat{\pi}(X = 1)$ and $L > 0$
(3)	$u_{sm}(I, A, 0, 1) \geq u_{sm}(I, A, 0, 0)$	follows fom (6)given $G \geq P$
(4)	$u_{sm}(I, A, 0, 1) \geq u_{sm}(I, N, 0, 1)$	$p > p_0$
(5)	$u_{du}(I, A, 1) \geq u_{du}(NI, A, 1)$	$c < \bar{c}$
(6)	$u_{du}(I, A, 1) \geq u_{du}(I, A, 0)$	$p > p_+^*$
(7)	$u_{du}(I, A, 1) \geq u_{du}(I, N, 1)$	$p > p_0$

	Expanded form
(1)	$p\big(G + \lambda\, \hat{\pi}(X = 1)\big) + (1 - p)\lambda\, \hat{\pi}(X = 0) - c \geq P$
(2)	$\lambda\, \hat{\pi}(X = 0) \geq -L + \lambda\, \hat{\pi}(X = 1)$
(3)	$G + \lambda\, \hat{\pi}(X = 1) \geq \lambda\, \hat{\pi}(X = 0)$
(4)	$p\, G + (1 - p)L \geq 0$
(5)	$P + \lambda\, \hat{\pi}(X = 1) - c \geq P$
(6)	$P + \lambda\, \hat{\pi}(X = 1) \geq \lambda\, \hat{\pi}(X = 0)$
(7)	$p\, G + (1 - p)L \geq 0$

■

Table A 5. Proof of proposition 1.e.

Proposition 1.f.

Region	$p > p_+$
Strategy profile	$(NI, A, 1, NI, A, 0, 1)$

Beliefs

$\hat{\pi}(X = 0) = 1$ $\quad$ $\hat{\pi}(X = 1) = \dfrac{\pi\, p}{\pi p + (1 - \pi)}$

$\hat{\pi}(NI, N) = \hat{\pi}(NI, A) = \pi$

$\hat{\pi}(NI, A)$ is determined by Bayes' rule. $\hat{\pi}(X = 0)$ and $\hat{\pi}(X = 1)$ are not reached with positive probability and determined by $\lim_{q\to 0} \frac{q\,\pi(1-p)}{q\,\pi(1-p)}$ and $\lim_{q\to 0} \frac{q\,\pi\, p}{q\,\pi\, p+q(1-\pi)}$, respectively, where q $(1 - q)$ is the probability that R plays I (NI) in the strategy profile $\big((q, 1 - q), 0, N, (q, 1 - q), 0, 1, N\big)$. $\hat{\pi}(NI, N)$ is also not reached with positive probability and determined by $\lim_{s\to 0} \frac{s\,\pi}{s\,\pi+s(1-\pi)}$ where s $(1 - s)$ is the probability that R plays A (N) in the strategy profile $\big(NI, 1, (1 - s, s), NI, 0, 1, (1 - s, s)\big)$

	Equilibrium conditions	Satisfied by
(1)	$u_{sm}(NI, A, 0, 1) \geq u_{sm}(I, A, 0, 1)$	$p > p_+$
(2)	$u_{sm}(NI, A, 0, 1) \geq u_{sm}(NI, A, 1, 1)$	$\hat{\pi}(X = 0) > \hat{\pi}(X = 1)$ and $L > 0$
(3)	$u_{sm}(NI, A, 0, 1) \geq u_{sm}(NI, A, 0, 0)$	follows fom (6)given G ≥ P
(4)	$u_{sm}(NI, A, 0, 1) \geq u_{sm}(NI, N, 0, 1)$	$p > p_0$
(5)	$u_{du}(NI, A, 1) \geq u_{du}(I, A, 1)$	follows from (1)
(6)	$u_{du}(NI, A, 1) \geq u_{du}(NI, A, 0)$	$p > p_+^*$
(7)	$u_{du}(NI, A, 1) \geq u_{du}(NI, N, 1)$	$p > p_0$

Expanded form

(1)	$P + \lambda\,\pi \geq p\big(G + \lambda\,\hat{\pi}(X = 1)\big) + (1 - p)\lambda\,\hat{\pi}(X = 0) - c$
(2)	$\lambda\,\hat{\pi}(X = 0) \geq -L + \lambda\,\hat{\pi}(X = 1)$
(3)	$G + \lambda\,\hat{\pi}(X = 1) \geq \lambda\,\hat{\pi}(X = 0)$
(4)	$p\,G + (1 - p)L \geq 0$
(5)	$P + \lambda\,\pi \geq P + \lambda\,\hat{\pi}(X = 1) - c$
(6)	$P + \lambda\,\hat{\pi}(X = 1) \geq \lambda\,\hat{\pi}(X = 0)$
(7)	$p\,G + (1 - p)L \geq 0$

■

Table A 6. Proof of proposition 1.f.

Proposition 2.

The sponsor S's optimal persuasion strategy is the REQ to the game of the dictator case. The sponsor chooses between her action $s = 0$ 'no request' and $s = 1$ 'request' to the committee member R to investigate the project. Table A.7 shows the payoffs for S from each of her two actions, for the six regions of p identified in Proposition 1. In equilibrium, S chooses the action with the highest payoff Q. If payoffs are equal S prefers to play $\mathrm{s} = 0$ by the assumption that $s = 1$ comes at an infinitesimal and otherwise negligible cost $\varepsilon > 0$.

A request to investigate, depending on the value of p, results in one out of six subgame equilibria strategies and beliefs described in Proposition 1. No request to investigate results in R rejecting if $p < p_0$ and accepting if $p > p_0$, in line with Lemma 1.

	$s = 1$ 'request'		$s = 0$ 'no request'
$p < p_-$ R plays NI	$Q = 0$, cost $-\varepsilon$	$<$	$Q = 0$
$p < p_-$ R plays I	$Q = \pi\, p$	$\geq$	$Q = 0$
$p_- < p < p_-^*$	$Q = \pi\, p$	$>$	$Q = 0$
$p_-^* < p < p_0$	$Q = \pi\, p + (1 - \pi)\gamma^1$	$>$	$Q = 0$
$p_0 < p < p_+^*$	$Q = \pi\, p + (1 - \pi)(1 - \gamma^0)$	$<$	$Q = 1$
$p_+^* < p < p_+$	$Q = \pi\, p + (1 - \pi)$	$<$	$Q = 1$
$p_+ < p$ R plays I	$Q = \pi\, p + (1 - \pi)$	$\leq$	$Q = 1$
$p_+ < p$ R plays NI	$Q = 1$, cost $-\varepsilon$	$<$	$Q = 1$

Table A 7. Proof of proposition 2.

■

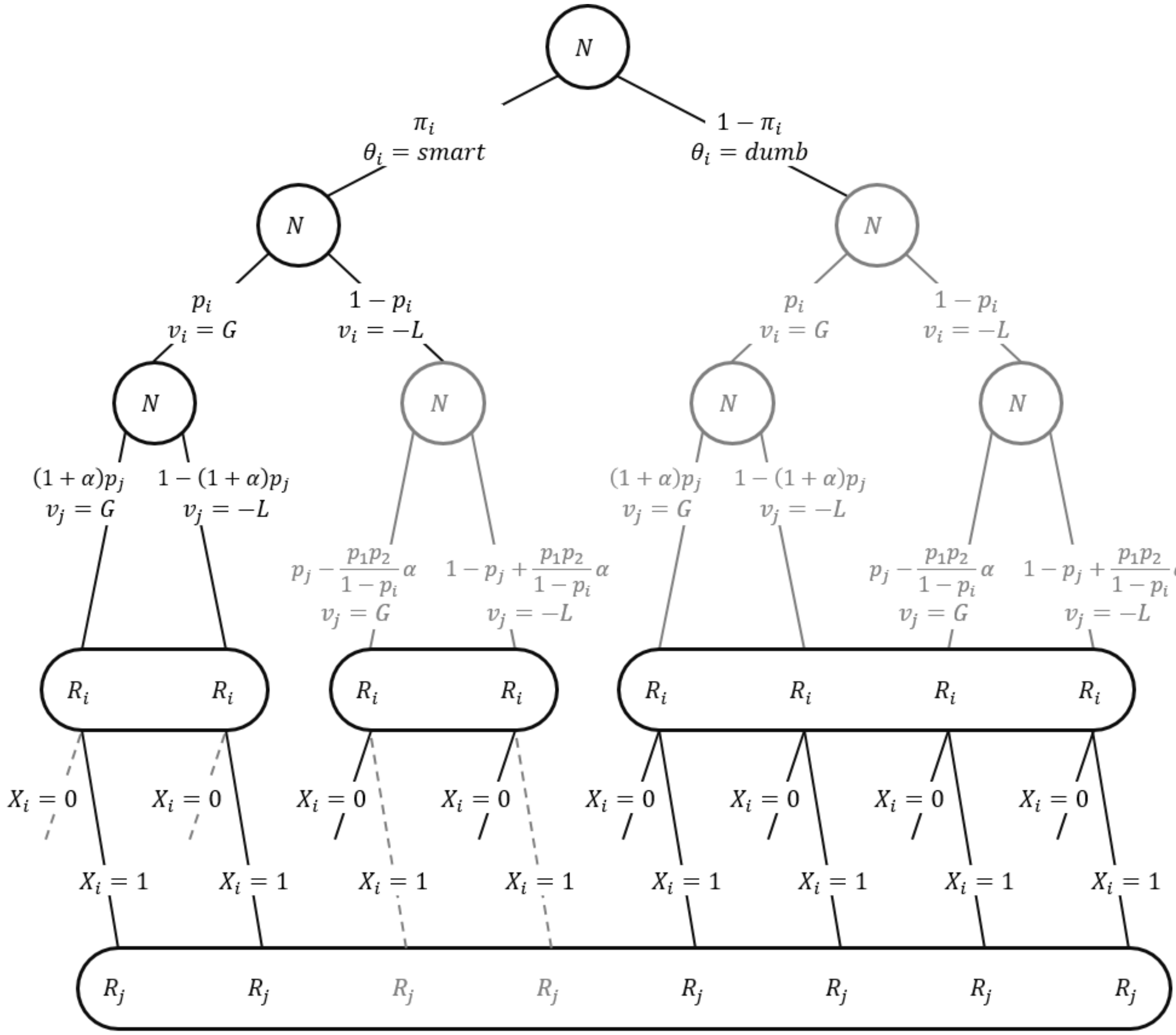

Figure A 1. Game tree illustrating $\hat{p}_j = \Pr[v_j = G \mid X_i = 1]$

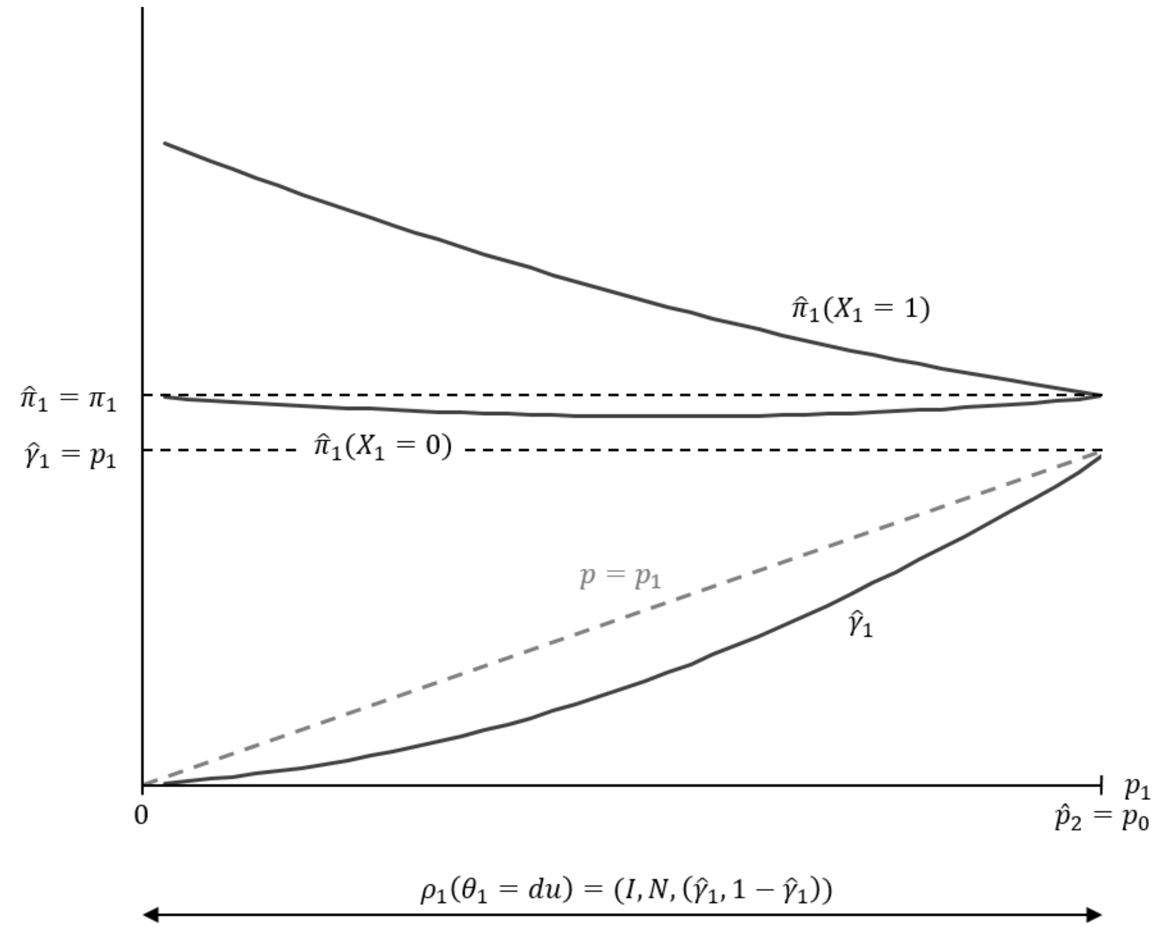

Figure A 2. π_1 and $\hat{\gamma}_1$ as functions of p_1 with p_2 held constant.

Lemma 2.

If $p_1, p_2 > p_0$, both R_1 and R_2 will rubberstamp in the game where S requests both to approve without investigation, yielding $Q = 1$. If S does request either or both to investigate, either $Q < 1$ if any $\hat{p}_i < p_{i+}$, or $Q = 1$ if whichever member is requested to investigated has $\hat{p}_i > p_{i+}$ and his equilibrium is to not investigate and accept. However, in the latter case, S still prefers the action no request given that if yielding equal values for Q, request comes at infinitesimal and otherwise negligible cost ε and no request does not.

■

Proposition 3.

Regime I allows S to request R_1 to investigate and R_2 to rubberstamp. Regime I poses restriction $p_2 < p_0 < \hat{p}_2$. Therefore, the equilibrium strategy of R_1 is determined by Proposition 1. R_2 sets his equilibrium strategy $\rho_2 = (r_1)$ to reject without investigation (N) or to rubberstamp (A) in line with

Lemma 1. I characterise the four equilibria by referring to the relevant part of Proposition 1 and by providing the action and belief about the type of R_2.

1.

$p_1 < p_{1-}^*$, hence R_1 sets his strategies and beliefs about $\hat{\pi}_2$ are formed in line with Proposition 1.b: $\rho_1 = (I, 0, N, I, 0, 1, N)$. The smart R_1 investigates and approves whenever $v_1 = G$. The dumb R_1 investigates and rejects. Beliefs are:

$$\Pi_1 = \left\{\frac{\pi_1(1-p_1)}{\pi_1(1-p_1)+(1-\pi_1)}, 1, 0, 0\right\}$$

Proof: Proposition 1.b.

$\hat{p}_2 = (1+\alpha)p_2 > p_0$, hence R_2 sets $\rho_2 = (A)$ rubberstamps as $u_2^A = \hat{P}_2 + \lambda\,\pi_2 > \lambda\,\pi_2 = u_2^N$. Posteriors beliefs about θ_2 are determined by Bayes' rule: $\hat{\pi}_2(A) = \hat{\pi}_2(N) = \pi_2$.

■

2.

$p_{1-}^* < p_1 < p_0$, hence R_1 sets his strategies and beliefs about $\hat{\pi}_2$ are formed in line with Proposition 1.c: $\rho_1 = (I, (1-\gamma^1, \gamma^1), N, I, 0, 1, N)$. The smart R_1 investigates and approves whenever $v_1 = G$. The dumb R_1 investigates and approves with probability γ_1^1 so that $\lambda\,\frac{\pi_1(1-p_1)}{\pi_1(1-p_1)+(1-\pi_1)(1-\gamma_1^1)} = P_1 + \lambda\,\frac{\pi_1 p_1}{\pi_1 p_1+(1-\pi_1)\gamma_1^1}$. Beliefs are

$$\Pi_1 = \left\{\frac{\pi_1(1-p_1)}{\pi_1(1-p_1)+(1-\pi_1)(1-\gamma_1^1)}, \frac{\pi_1 p_1}{\pi_1 p_1+(1-\pi_1)\gamma_1^1}, 0, 0\right\}$$

Proof: Proposition 1.c.

$$\hat{p}_2 = \frac{\pi_1 p_1(1+\alpha)+(1-\pi_1)\gamma_1^1}{\pi_1 p_1+(1-\pi_1)\gamma_1^1}\, p_2 > p_0$$

hence R_2 sets $\rho_2 = (A)$ rubberstamps as $u_2^A = \hat{P}_2 + \lambda\,\pi_2 > \lambda\,\pi_2 = u_2^N$. Posteriors beliefs about θ_2 are determined by Bayes' rule: $\hat{\pi}_2(A) = \hat{\pi}_2(N) = \pi_2$.

■

3.

$p_0 < p_1 < p_{1+}^*$, hence R_1 sets his strategies and beliefs about $\hat{\pi}_2$ are formed in line with proposition 1.d: $\rho_1 = (I, (\gamma^0, 1-\gamma^0), A, I, 0, 1, A)$. The smart R_1 investigates and approves whenever $v_1 = G$.

The dumb R_1 investigates and approves with probability γ_1^0 so that $\lambda \frac{\pi_1(1-p_1)}{\pi_1(1-p_1)+(1-\pi_1)\gamma_1^0} = P_1 + \lambda \frac{\pi_1 p_1}{\pi_1 p_1+(1-\pi_1)(1-\gamma_1^0)}$. Beliefs are

$$\Pi_1 = \left\{\frac{\pi_1(1-p_1)}{\pi_1(1-p_1)+(1-\pi_1)\gamma_1^0}, \frac{\pi_1 p_1}{\pi_1 p_1+(1-\pi_1)(1-\gamma_1^0)}, 0, 0\right\}$$

Proof: Proposition 1.d.

$$\hat{p}_2 = \frac{\pi_1 p_1(1+\alpha)+(1-\pi_1)(1-\hat{\gamma}_1^0)}{\pi_1 p_1+(1-\pi_1)(1-\gamma_1^0)} p_2 > p_0$$

hence R_2 sets $\rho_2 = (A)$ rubberstamps as $u_2^A = \hat{P}_2 + \lambda\,\pi_2 > \lambda\,\pi_2 = u_2^N$. Posteriors beliefs about θ_2 are determined by Bayes' rule: $\hat{\pi}_2(A) = \hat{\pi}_2(N) = \pi_2$.

■

4.

$p_1 > p_{1+}^*$, hence R_1 sets his strategies and beliefs about $\hat{\pi}_2$ are formed in line with proposition 1.e. $\rho_1 = (I, 0, A, I, 0, 1, A)$. The smart R_1 investigates and approves whenever $v_1 = G$. The dumb R_1 investigates and accepts. Beliefs are

$$\Pi_1 = \left\{1, \frac{\pi_1 p_1}{\pi_1 p_1+(1-\pi_1)}, 0, 0\right\}$$

Proof: Proposition 1.d.

$$\hat{p}_2 = \frac{\pi_1 p_1(1+\alpha)+(1-\pi_1)}{\pi_1 p_1+(1-\pi_1)} p_2 > p_0$$

hence R_2 sets $\rho_2 = (A)$ rubberstamps as $u_2^A = \hat{P}_2 + \lambda\,\pi_2 > \lambda\,\pi_2 = u_2^N$. Posteriors beliefs about θ_2 are determined by Bayes' rule: $\hat{\pi}_2(A) = \hat{\pi}_2(N) = \pi_2$.

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Proposition 4.

4.a

Proof for ρ_1 and Π_1 follows from proposition 1.b.

Proof for ρ_2 and Π_2 follows from proposition 1.b, where p is substituted by $\hat{p}_2$ from Equation 16.

■

4.b

Proof for ρ_1 and Π_1 follows from proposition 1.b.

Proof for ρ_2 and Π_2 follows from proposition 1.c, where p is substituted by $\hat{p}_2$ from Equation 16 and γ^1 by $\hat{\gamma}_2$.

■

4.c

Proof for ρ_1 and Π_1 follows from proposition 1.c, where γ^1 is substituted by $\hat{\gamma}_1$ such that it satisfies Equation 21.

Proof for ρ_2 and Π_2 follows from proposition 1.b, where p is substituted by $\hat{p}_2$ from Equation 17.

■

4.d

Proof for ρ_1 and Π_1 follows from proposition 1.c, where γ^1 is substituted by $\hat{\gamma}_1$ such that it satisfies Equation 21.

Proof for ρ_2 and Π_2 follows from proposition 1.c, where p is substituted by $\hat{p}_2$ from Equation 17 and γ^1 by $\hat{\gamma}_2$.

■

Proposition 5.

Given sufficient affiliation for the second member R_2 to rubberstamp ($\hat{p}_2 > p_0$), the sponsor's optimal strategy is to choose $R_1 = R_{sm}$ if $\beta\, p_{sm} > p_{du}$.

If $p_i > p_0$, S achieves a strictly higher Q by choosing that that $R_i = R_1$. The restriction of Regime I implies that if $p_i > p_0$, then $p_j < p_0$, which implies that R_i approves with higher probability if smart as well as if dumb than R_j does.

If $p^*_{i-} < p_i < p_0$ and $p_j < p^*_{j-}$, and $R_j = R_{du}$, S achieves a strictly higher Q choosing $R_1 = R_{sm}$. If $R_j = R_{sm}$, S achieves a higher Q by choosing $R_1 = R_{sm}$ if

$$\pi_{sm} p_{sm} > \pi_{du} p_{du} + (1 - \pi_{du})\gamma^1_{du}$$

where solving for p_{du} yields $\beta\, p_{sm} > p_{du}$, and $\beta > 1$. If $p^*_{i-} < p_i < p_0, i\, \epsilon\, \{sm, du\}$, S achieves a higher Q if

$$\pi_{sm} p_{sm} + (1 - \pi_{sm})\gamma^1_{sm} > \pi_{du} p_{du} + (1 - \pi_{du})\gamma^1_{du}$$

where solving for p_{du} yields $\beta\, p_{sm} > p_{du}$and $\beta > 1$. ■

Proposition 6.

The restrictions $p_{i-}^{*} < p_i < p_0$ and $p_j < p_{j-}^{*}$, (i is the moderate sceptic and j the hard sceptic, $i, j \in \{sm, du\}, i \neq j$) are such that

$$Q = \Pr\left[\theta_i = \theta_j = smart\right] \Pr\left[v_i = v_j = G\right] + \Pr\left[\theta_i = dumb, \theta_j = smart\right] \hat{\gamma}_i \Pr\left[v_j = G\right]$$
$$\Leftrightarrow \pi_i \pi_j (1+\alpha) p_i p_j + (1-\pi_i)\pi_j \hat{\gamma}_i p_j.$$

Let $\hat{\gamma}_1$ be $\hat{\gamma}_i$ if $R_i = R_1$, and $\hat{\gamma}_2$ be $\hat{\gamma}_i$ if $R_i = R_2$. S chooses $R_1 = R_i$ if

$$\pi_i \pi_j (1+\alpha) p_i p_j + (1-\pi_i)\pi_j \hat{\gamma}_1 p_j > \pi_i \pi_j (1+\alpha) p_i p_j + (1-\pi_i)\pi_j \hat{\gamma}_2 p_j$$
$$\Leftrightarrow \hat{\gamma}_1 > \hat{\gamma}_2.$$

Given $p_{i-}^{*} < p_i < p_0$ and $p_j < p_{j-}^{*}$, where $i, j \in \{sm, du\}, i \neq j$, $\hat{\gamma}_1$ is such that

$$\lambda \frac{\pi_i (1-p_i)}{\pi_i (1-p_i) + (1-\pi_i)(1-\hat{\gamma}_1)} = \pi_j p_j \hat{P}_i + \lambda \frac{\pi_i p_i}{\pi_i p_i + (1-\pi_i)\hat{\gamma}_1}$$

and $\hat{\gamma}_2$ such that

$$\lambda \frac{\pi_i (1-\hat{p}_i)}{\pi_i (1-\hat{p}_i) + (1-\pi_i)(1-\hat{\gamma}_i)} = \hat{P}_i + \lambda \frac{\pi_i \hat{p}_i}{\pi_i \hat{p}_i + (1-\pi_i)\hat{\gamma}_2}.$$

Because $\pi_j p_j < 1$, $\hat{\gamma}_1$ increases relative to γ_1. Because $\hat{p}_i > p_i$, $\hat{\gamma}_2$ increases relative to γ_2. R_j remains a hard sceptic even when first in line, which requires an extreme value for L. $\hat{P}_i$ becomes more negative. As a result, the increase in $\hat{\gamma}_1$ because $\hat{P}_i$ is multiplied by $\pi_j p_j$ in determining $\hat{\gamma}_1$, is larger than the increase in $\hat{\gamma}_1$ because p_i is updated to $\hat{p}_i$. S maximises Q by choosing $R_1 = R_i$.

■

Proposition 7.

Let $\gamma_{i\,\theta}$, $\theta \in \{sm, du\}, i \in \{1, 2\}$ be the probability with which R of type θ approves when in position i. S chooses $R_1 = R_{sm}$ when

$$(\pi_{sm} p_{sm} + (1-\pi_{sm})\hat{\gamma}_{1\,sm})(\pi_{du} p_{du} + (1-\pi_{du})\hat{\gamma}_{2\,du})$$
$$> (\pi_{du} p_{du} + (1-\pi_{du})\hat{\gamma}_{1\,du})(\pi_{sm} p_{sm} + (1-\pi_{sm})\hat{\gamma}_{2\,sm}).$$

Solving for p_{du} yields:

$$\delta\, p_{sm} > p_{du}$$

where $\delta < 1$ if $\pi_{sm} > \bar{\pi}_{sm}$ and $\delta > 1$ otherwise. $\bar{\pi}_{sm}$ can be found by solving

$$\delta = 1 \Leftrightarrow \pi_{sm} = \bar{\pi}_{sm}.$$

■

Appendix B

Full expressions

To save tens of pages of rather uninsightful formulas, I provide full expressions only if they do not exceed 200 characters. For expressions in excess of 200 characters, I present the equality to be solved in order to obtain the full expression. The interested reader can enter these into any regular algebra programme.[21]

Equation 9: $\boldsymbol{p_-}$

Solve for p:

$$p(G+\lambda)+(1-p)\,\lambda\,\frac{\pi(1-p)}{\pi(1-p)+(1-\pi)}-c=\lambda\,\pi$$

$$\Leftrightarrow p=p_-=\frac{G+\lambda+\pi\,(c-2\,\lambda+\lambda\,\pi)-\sqrt{\big(G+\lambda+\pi\,(c-2\lambda+\lambda\,\pi)\big)^2-4\,c\,G\,\pi}}{2\,G\,\pi}$$

Equation 10: $\boldsymbol{p_+}$

Solve for p:

$$p\left(G+\lambda\,\frac{\pi\,p}{\pi\,p+(1-\pi)}\right)+(1-p)\,\lambda-c=p\,G-(1-p)L+\lambda\,\pi$$

$$\Leftrightarrow p=p_+=\frac{\pi\,(2(L+\lambda)-c-\lambda\,\pi)-L-\lambda}{2\,L\,\pi}+\frac{\sqrt{(\pi\,(2\,(L+\lambda)-c-\lambda\,\pi)-L-\lambda)^2+4\,L\,\pi\,(\pi\,(2\,(L+\lambda)-c-\lambda\,\pi)-L-\lambda+c)^2}}{2\,L\,\pi}$$

Assumption 1: $\boldsymbol{\bar{c}}$

Solve for c:

$$\underset{p\,\epsilon\,[0,p_0]}{\arg\min}\,\lambda\,\frac{\pi(1-p)}{\pi(1-p)+(1-\pi)(1-\gamma^1)}=c\Leftrightarrow c=\hat{c}$$

$$\underset{p\,\epsilon\,[p_0,1]}{\arg\min}\,\lambda\,\frac{\pi\,p}{\pi\,p+(1-\pi)(1-\gamma^0)}=c\Leftrightarrow c=\hat{c}$$

Equation 11: $\boldsymbol{p_-^*}$

Solve for p:

$$\lambda\,\frac{\pi(1-p)}{\pi(1-p)+(1-\pi)}=p\,G-(1-p)L+\lambda$$

[21] I have used Wolfram Mathematica Online and Microsoft Excel to solve all equations.

$$\Leftrightarrow p = p_-^* = \frac{G + (1+\pi)L - \sqrt{(-G-(1+\pi)L)^2 - 4\,\pi\,(G+L)(L-(1-\pi)\lambda)}}{2\,\pi\,(G+L)}$$

Equation 12: $\boldsymbol{\gamma^1}$

Solve for γ^1:

$$\lambda\,\frac{\pi(1-p)}{\pi(1-p)+(1-\pi)(1-\gamma^1)} = p\,G - (1-p)L + \lambda\,\frac{\pi\,p}{\pi\,p+(1-\pi)\gamma^1}$$

$$\Leftrightarrow \gamma^1 = \frac{-G\,p + 2\,G\,p^2\,\pi + L\,(p-1)(2\,p\,\pi - 1) + \pi\,\lambda}{2\,(L\,(p-1)+G\,p)(\pi-1)} - \frac{\sqrt{L^2\,(p-1)^2 + G^2\,p^2 + 2\,G\,p\,(2p-1)\pi\,\lambda + \pi^2\,\lambda^2 + 2\,L\,(p-1)(G\,p + (2p-1)\pi\,\lambda)}}{2\,(L\,(p-1)+G\,p)(\pi-1)}$$

Equation 13: $\boldsymbol{\gamma^0}$

Solve for γ^0:

$$\lambda\,\frac{\pi(1-p)}{\pi(1-p)+(1-\pi)\gamma^0} = p\,G - (1-p)L + \lambda\,\frac{\pi\,p}{\pi\,p+(1-\pi)(1-\gamma^0)}$$

$$\Leftrightarrow \gamma^0 = -\frac{(G\,p - 2\,G\,p\,\pi + 2\,G\,p^2\,\pi + L\,(p-1)(1+2\,(p-1)\pi) + \pi\,\lambda}{2\,(L\,(p-1)+G\,p)(\pi-1)} - \frac{\sqrt{L^2\,(p-1)^2 + G^2\,p^2 + 2\,G\,p\,(2p-1)\,\pi\,\lambda + \pi^2\,\lambda^2 + 2\,L\,(p-1)(G\,p + (2p-1)\pi\,\lambda)}}{2\,(L\,(p-1)+G\,p)(\pi-1)}$$

Equation 14: $\boldsymbol{p_+^*}$

Solve for p:

$$\lambda = p\,G - (1-p)L + \lambda\,\frac{\pi\,p}{\pi\,p + (1-\pi)}$$

$$p = p_+^* = \frac{-(1-\pi)\,G - (1-2\,\pi)L}{2\,\pi\,(G+L)} + \frac{\sqrt{\big((1-\pi)\,G + (1-2\,\pi)L\big)\text{^}2 - 4\,(G+L)\,(\pi-1)\,\pi\,(L+\lambda)}}{2\,\pi\,(G+L)}$$

Equation 20: $\boldsymbol{\hat{p}_{1-}}$

Solve for p_1:

$$p_1(q_2G+\lambda) + (1-p_1)\lambda\,\frac{\pi_1(1-p_1)}{\pi_1(1-p_1)+(1-\pi_1)} - c = \lambda\,\pi_1 \Leftrightarrow p_1 = \hat{p}_{1-}.$$

Assumption 2: $\boldsymbol{\hat{\hat{c}}}$

Solve for c:

$$\underset{p_i \, \epsilon \, [0,p_0]}{\arg\min} \, \lambda \, \frac{\pi_i(1-p_i)}{\pi_i(1-p_i)+(1-\pi_i)} = c, \text{where } \pi_i = \min\{\pi_1, \pi_2\} \Leftrightarrow c = \hat{\hat{c}}$$

Equation 21: $\boldsymbol{\hat{\gamma}_1}$

Solve for $\hat{\gamma}_1$:

$$\lambda \frac{\pi_1(1-p_1)}{\pi_1(1-p_1)+(1-\pi_1)(1-\hat{\gamma}_1)} = q_2(\hat{p}_1 G - (1-\hat{p}_1)L) + \lambda \frac{\pi_1 \, p_1}{\pi_1 \, p_1 + (1-\pi_1)\hat{\gamma}_1}$$

Proposition 5: $\boldsymbol{\beta}$

See the proof of Proposition 5.

Proposition 7: $\boldsymbol{\delta}$ and $\boldsymbol{\overline{\pi}_{sm}}$

See the proof of Proposition 6.

$\boldsymbol{n}$-member committee

I define affiliation in the n-member committee as:

$$\Pr[v_k = G | v_1 = v_2 = \cdots = v_{k-1} = 1] = (1+\alpha)^{k-1} p_k, \qquad \alpha \, \epsilon \left(0, \min\left\{\left(\frac{1}{p_n}\right)^{\frac{1}{n-1}} - 1, 1\right\}\right) \tag{22}$$

from which follows that:

$$\hat{p}_k = \frac{\prod_{i=1}^{k-1} \pi_i p_i \; (1+\alpha) + \prod_{i=1}^{k-1} (1-\pi_i)\hat{\gamma}_i}{\prod_{i=1}^{k-1} (\pi_i p_i + (1-\pi_i)\hat{\gamma}_i)} p_k \tag{23}$$

where $\Pi_{i=1}^{k-1}$ is the product operator and not the set of updated reputations. R_k sets $\hat{\gamma}_k$ such that

$$\lambda \frac{\pi_k(1-\hat{p}_k)}{\pi_k(1-\hat{p}_k)+(1-\pi_k)(1-\hat{\gamma}_k)} = Q_{n-k} \, \hat{P}_k + \lambda \frac{\pi_k \hat{p}_k}{\pi_k \hat{p}_k + (1-\pi_k)\hat{\gamma}_k} \tag{24}$$

where Q_{n-k} is the probability that all members $R_{k+1}, \ldots, R_n$ approve the project. Lastly, for k^* to exist, every investigating R_i must have that

$$\hat{p}_k \big(Q_{k+1} G + \lambda \, \hat{\pi}_k(X_k = 1)\big) + (1-\hat{p}_k) \, \lambda \, \hat{\pi}_k(X_k = 0) - c > \lambda \, \pi_k. \tag{25}$$