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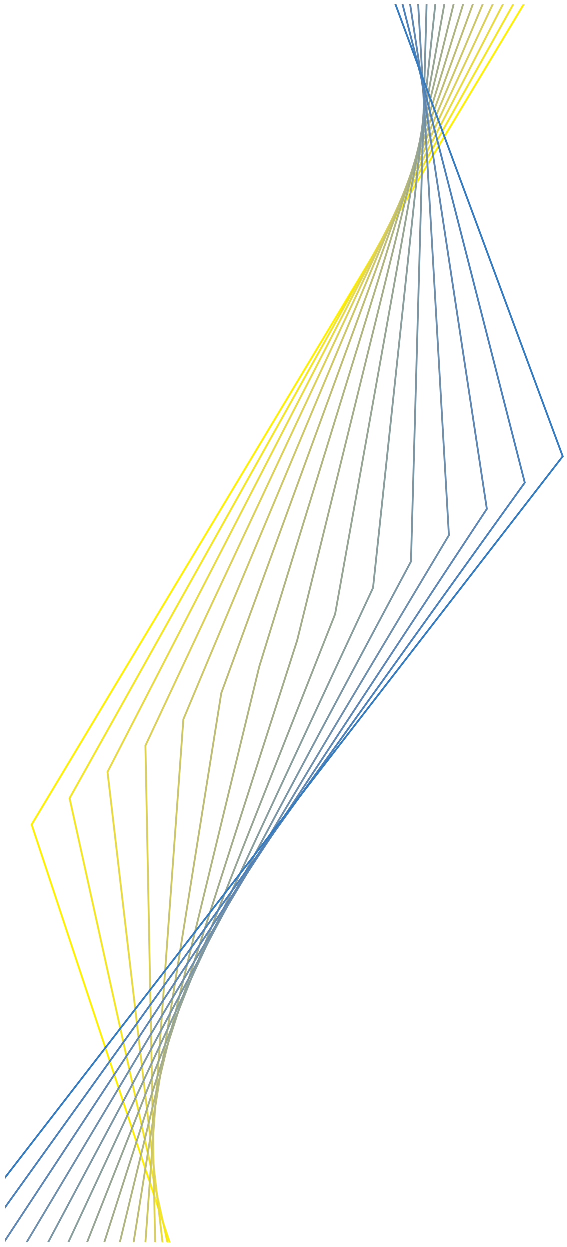

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COMMITTEES AND SPECIAL INTERESTS[1]

BY MIKE FELGENHAUER[2] AND HANS PETER GRÜNER[3]

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Contents

Abstract Some committees convene behind closed doors while others publicly discuss issues and make their decisions. This paper studies the role of open and closed committee decision making in presence of external influence. We show that restricting the information of interest groups may reduce the bias towards special interest politics. Moreover, there are cases where benefits from increasing the number of decision makers can only be reaped if the committee's sessions are not public. In open committees benefits from voting insincerely accrue not only when a decision maker's vote is pivotal. As the number of voters increases, the cost of voting insincerely declines in an open committee because the probability of being pivotal declines. This is not the case in a closed committee where costs and benefits of insincere voting only arise when a voter is pivotal.

Keywords: Committees, interest groups, voting, common agency.

JEL classification: D71, D72, D73.

Non-technical summary

Some committees and decision making bodies convene behind closed doors while others openly discuss issues and/or publicly make their decisions. Examples for the former category are juries in courts, boards of management, school admission committees and some central bank councils. Examples for the latter category are parliaments, some parliament subcommittees, and juries in sports (among them ice skating and boxing). Some of the committees that belong to the former category are criticized because they lack democratic accountability. If votes are taken secretly, individual statements and voting behavior cannot easily be tracked and constituencies can no longer verify the activities of their representatives. Secret voting councils are nevertheless widespread. Are there are any reasons to make secret committee decisions?

This paper provides a simple argument why a closed committee may be an appropriate institution in some cases. Our argument focuses on the possibility that an external interest group attempts to influence committee decisions. We analyze whether open or secret majority voting should be the rule from a social perspective in such a situation. A committee is viewed as a group of specialists with expert knowledge which has to take a policy decision. The members have private information about what might be the best policy and they have in principle the same interests as the public. However, members may be subject to external influence from an interest group, which favors a certain policy above all others.

In general, an interest group's attempts to influence the policy of a committee may take several - legal or illegal - forms. Committee members may e.g. expect to be molested by complaining interest group members after having made their decision. The interested party may decide to threaten jury members, or it may promise to make monetary transfers that are conditioned on committee members' voting behavior. In our model we will stick to the latter form of interest group influence.

We consider two institutional arrangements. The first one is a committee that decides and discusses behind closed doors and only releases the outcome. The second one is a committee which releases both individual voting behavior and the outcome of the vote. We assume that an interest group can credibly promise to condition payments on the observable behavior of decision makers. In our context this means that either the action of the interest group can be linked to individual voting behavior (open voting) or to the outcome of the vote (closed voting).

We show that restricting information of interest groups may reduce the bias towards special interest politics. The underlying reason for our main result is the following. Consider a committee member that receives a transfer if it votes in favor of a certain policy. A cost arises due to an insincere vote if this voter is pivotal. In this case an insincere vote reduces the probability that the decision is the appropriate one. The cost of voting insincerely is low if the probability of being pivotal is small. The benefit (the transfer) however is certain. This is the reason why - even with small transfers equilibria exist in open committees where members vote insincerely. Consider instead the same voter in a closed committee. He knows that both cost and benefit only matter in the situation where he is pivotal. He therefore only compares transfer and benefit but neglects the probability of being pivotal. Therefore the price of an insincere vote is higher.

Our paper also provides a new interesting insight into the role of the size of a committee. One of the fundamental results in voting theory, Condorcet's famous jury theorem, states that the delegation of a decision to more decision makers yield better results. We show that under interest group influence this need not be the case when committees meet openly. As the number of voters increases (in our example from one to three), the cost of voting insincerely declines because the probability of being pivotal declines. This is why in a larger open committee individual voters may be more likely to vote insincerely.

1 Introduction

Some committees and decision making bodies convene behind closed doors while others openly discuss issues and/or publicly make their decisions. Examples for the former category are juries in courts, boards of management, school admission committees and some central bank councils. Examples for the latter category are parliaments, some parliament subcommittees, and juries in sports (among them ice skating and boxing). Some of the committees that belong to the former category are criticized because they lack democratic accountability[1]. If votes are taken secretly, individual statements and voting behavior cannot easily be tracked and constituencies can no longer verify the activities of their representatives. Secret voting councils are nevertheless widespread. Are there are any reasons to make secret committee decisions?

This paper provides a simple argument why a closed committee may be an appropriate institution in some cases. Our argument focuses on the possibility that an external interest group attempts to influence committee decisions. We analyze whether open or secret majority voting should be the rule from a social perspective in such a situation. A committee is viewed as a group of specialists with expert knowledge which has to take a policy decision. The members have private information about what might be the best policy and they have in principle the same interests as the public. However, members may be subject to external influence from an interest group, which favors a certain policy above all others.[2]

[1]A prominent recent example is the report by Blinder et. al. (2001) on the benefits of central bank transparancy.

[2]There are many economic situations, where the true state of the world matters for the socially desirable policy decision but not for an interest group. Consider for example corporate taxes. It may be socially desirable to relieve corporate taxes if economic circumstances are truly bad and to increase them otherwise. An interest group, consisting of firms, on the other hand always prefers to pay less taxes independently of the economic situation. Another example is a central bank's interest rate

In general, an interest group's attempts to influence the policy of a committee may take several - legal or illegal - forms. Committee members may e.g. expect to be molested by complaining interest group members after having made their decision. The interested party may decide to threaten jury members, or it may promise to make monetary transfers that are conditioned on committee members' voting behavior. In our model we will stick to the latter form of interest group influence.[3]

We consider two institutional arrangements. The first one is a committee that decides and discusses behind closed doors and only releases the outcome. The second one is a committee which releases both individual voting behavior and the outcome of the vote. Similarly to Grossman and Helpman (1996) we assume that an interest group can credibly promise to condition payments on the observable behavior of decision makers. In our context this means that either the action of the interest group can be linked to individual voting behavior (open voting) or to the outcome of the vote (closed voting).

We show that restricting information of interest groups may reduce the bias towards special interest politics. The underlying reason for our main result is the following. Consider a committee member that receives a transfer if it votes in favor of a certain policy. A cost arises due to an insincere vote if this voter is pivotal. In this case an insincere vote reduces the probability that the decision is the appropriate one. The cost of voting insincerely is low if the probability of being pivotal is small. The benefit (the transfer) however is certain. This is the reason why - even with small transfers - trembling hand perfect equilibria exist in open committees where

decision. Some interest groups may always favor lower or higher rates while the general public may be interested in a state-dependent decision. Another example is an academic institution deciding whether a student may pass an exam. The student is interested to pass the exam independently of his true achievements while society may want to condition the outcome on these achievements.

[3] Our model actually fits well with any situation where the interest group has to invest more ressources in order to change the payoff of a committee member.

members vote insincerely. Consider instead the same voter in a closed committee. He knows that both cost and benefit only matter in the situation where he is pivotal. He therefore only compares transfer and benefit but neglects the probability of being pivotal. Therefore the price of an insincere vote is higher.

Communication among committee members may severely limit an interest group's ability to influence decisions. We analyze the role of communication among committee members before voting. With communication it is never optimal for the interest group to pay transfers to a minority in the open voting setting. Making payments contingent on the minority´s voting behavior leads to windfall gains and therefore the transfers are only made contingent on the actual policy chosen by the committee. Consider for example the case of paying a transfer to one committee member in an open voting setting contingent on his individual vote. In the communication stage the member who votes insincerely will reveal his true type to the other members, and accept the payment, while the other members will vote strategically. It follows that the best policy from the public´s point of view is chosen. Anticipating this behavior the interest group will not be willing to make payments contingent on individual votes of minorities in the open majority voting setting.

Our paper also provides a new interesting insight into the role of the size of a committee. One of the fundamental results in voting theory, Condorcet's famous jury theorem, states that the delegation of a decision to more decision makers yield better results. We show that under interest group influence this need not be the case when committees meet openly. As the number of voters increases (in our example from one to three), the cost of voting insincerely declines because the probability of being pivotal declines. This is why a larger open committee may make individual voters more vulnerable to external pressure.

The paper is related to a growing literature on strategic voting in committees (See Gerling et al., 2003, for a recent survey). Austen Smith and Banks (1996) and

Feddersen and Pesendorfer (1996, 1997, 1999a,b) have pioneered the role of strategic voting which plays a major role in our analysis as well. Coughlan (2000), Gerardi and Yariv (2002), and Doraszelski, Gerardi and Squintani (2003) have written on communication in committees. Communication is also analyzed in the second part of our paper. The value added of our analysis with respect to those papers lies in the study of external influence on committee members.

Mukhopadhaya (2003) and Persico (2000) have also derived counterexamples to the Condorcet jury theorem. These counterexamples focus on the role of incentives for information acquisition while our model focuses on external interest group influence.

Gersbach and Hahn (2003) have studied the issue of open versus closed voting in a setup where the committee members' preferences are not known to the political principal(s). The principal's reappointment decision is based on whether he may expect to find a better agent elsewhere.

The paper is also related to the huge literature on the role of special interest politics. In particular it is related to the paper by Grossman and Helpman (1996) who have analyzed the bidding behavior of interest groups who try to influence the choice of electorate platforms by political parties. Our paper instead analyzes a binary decision when the political decision makers have less than perfect information. Another difference is that the decision makers decide directly on the adopted policy while - in Grossman and Helpman - the electorate chooses among two competing platforms.

The paper is organized as follows. In section 2 we outline our model. Section 3 has the equilibrium for a given transfer scheme. In section 4 we derive optimal transfers and section 5 has the main result on the comparison of both voting rules. In Section 6 the role of communication among committee members before voting is analyzed. In section 7 we study the role of the size of a committee under the two voting rules. Section 8 studies the robustness of our results in the common agency case with two opposing interest groups. Section 9 concludes.

2 The Model

2.1 Agents

A homogenous population delegates a binary decision to a committee. For simplicity it is assumed that the committee has three members, $i = 1..3$. Each of these members obtains a private signal about the true state of the world s, which can be either 1 or 0. Each of the two states is realized with probability 1/2. The signal of individual i is denoted s_i. Each signal is correct with probability p. A policy x, which is 1 or 0, is chosen according to majority voting. We denote the individual votes by $x_i \in \{0, 1\}$.

2.2 Preferences

Each member i derives the utility:

$$u_i = y + t_i \tag{1}$$

where t_i is the payment made to agent i and

$$y = \begin{cases} 1 & \text{if} \quad x = s \\ 0 & \text{if} \quad x \neq s \end{cases} . \tag{2}$$

The public´s payoff is given by $n \cdot y$ where n is population size. In the absence of transfers each committee member therefore wants to choose according to the general public´s interest.

The interest group has the following utility function:

$$u = \theta x - \sum_{i=1}^{3} t_i \tag{3}$$

with θ being the valuation for the policy $x = 1$ and $\theta > 0$. This specification implies that the interest group always prefers the policy $y = 1$ independent of the true state of the world. It is further assumed that θ is known to the committee members as well.

2.3 Timing

The timing is such that first the interest group chooses a transfer scheme $(t_1(\cdot), t_2(\cdot), t_3(\cdot))$. These transfers will be conditioned either (i) upon the observable individual votes, x_i, or (ii) upon the chosen policy x. For simplicity we assume that the transfer scheme is known to all three committee members. Along the lines of Grossman and Helpman (1996), we assume that these transfers are credible. Next nature draws a state s. Each of the two states is realized with probability $1/2$. Each committee member privately observes the signal s_i which is correct with probability p. Finally, committee members choose a policy according to majority voting and transfers are paid in the pre-specified way. Society and committee members observe ex post whether the decision was appropriate. However, we assume that this is not verifiable. Hence committee members can not be directly remunerated for correct decisions.

2.4 Surplus

We assume that the interest group is small in the sense that its gain θ does not outweight society's loss (n) from an incorrect decision. Therefore the surplus increases if the probability of inappropriate decisions decreases.

3 Equilibrium for given transfers

3.1 Equilibrium with open voting

In this section it is analyzed how committee members react to a given vector of transfers under open and secret voting schemes. We require an equilibrium of this final stage to fulfill the conditions of (i) a Bayesian Nash equilibrium, and (ii) a trembling hand perfect equilibrium. We abbreviate this equilibrium criterion as THPB. Each player has four pure strategies: truthful voting, always voting for one of the two alternatives and inverse voting. We call players who vote truthfully sincere voters. We concentrate on pure strategies equilibria. The first proposition characterizes the pure strategies equilibria under open majority voting.

Proposition 1 *Consider a committee with three members and open majority voting. Consider the case that the interest group makes payments contingent on the individual voting behavior.*

(i) A THPB equilibrium where one member always votes in favor of alternative 1 *while two others vote truthfully exists if and only if* $t_i \geq (2p - 2p^2)(2p - 1)$, *and* $t_{-i} \in [0, \bar{t}]$, *where* $\bar{t} = \frac{2p-1}{2p^2+1-2p}$ *and where* $-i$ *refers to the other two committee members.*

(ii) A THPB equilibrium where two members always vote in favor of alternative 1 *while one votes truthfully exists if and only if the two receive transfers* $t_j \geq 2p - 1$, *while the third agent receives a transfer which is not too large.*

(iii) A THPB equilibrium where all three members always vote for alternative 1 *exists for all* $t > 0$.

(iv) A THPB equilibrium where all members vote truthfully exists for all $t < (2p - 2p^2)(2p - 1)$.

(v) There is no other trembling hand perfect pure strategies equilibrium with transfers conditioned on individual voting behavior.

Proof: see Appendix.

It is noteworthy that - for all strictly positive transfer vectors - there always exists a trembling hand perfect equilibrium where all voters always vote in favor of the interest group's preferred alternative (part (iii) of Proposition 1). This is due to the fact that - with trembles vanishing the cost of voting insincerely approaches zero. Paying transfers to all three agents therefore seems costless. However, for small transfers, another equilibrium exists that is preferable from the committee members' point of view.

Remark 1 *The THPB equilibrium (iv) is considered as focal compared to (iii) if* $t < (2p - 2p^2)(2p - 1)$*, because in this case all committee members derive a higher utility in equilibrium (iv) than in (iii). Otherwise equilibrium (iii) is considered as focal by the same reasoning.*

A consequence of this remark and of Proposition 1 is that buying all three votes is cheapest if $t_1 = t_2 = \varepsilon > 0$ and $t_3 = (2p - 2p^2)(2p - 1)$.

3.2 Equilibrium with secret voting

Under secret majority voting all transfers can only be made contingent on the outcome of the vote. Hence, costs and benefits of voting insincerely only occur in the event of being pivotal. This is different from the case of open voting where transfers could be made contingent on individual votes.

Proposition 2 *Consider a committee with three members and secret majority voting. Consider the case that the interest group makes payments contingent on the policy chosen by the committee.*

(i) A THPB equilibrium where member i always votes in favor of alternative 1 *while two others vote truthfully exists if and only if $t_i \geq 2p-1$ and t_{-i} not too large.*

(ii) A THPB equilibrium where two members always vote in favor of alternative 1 *while one votes truthfully exists if and only if the two receive transfers $t_j \geq \frac{2p-1}{1-2p+2p^2}$ and $t_{-j} < 2p-1$.*

(iii) A THPB equilibrium where all members always vote for 1 *exists for all $t \geq 2p-1$.*

(iv) For all $t < 2p-1$ a THPB equilibrium exists where all committee members vote truthfully.

(v) There is no other trembling hand perfect pure strategies equilibrium.

PROOF: see Appendix.

One immediately sees that paying transfers to all three committee members is more costly under closed than under open majority voting.

Corollary 1 *The equilibria in Proposition 2 are also equilibria in a setting with open majority voting, given that the interest group makes payments contingent on the policy chosen by the committee.*

PROOF Obvious. Q.E.D.

4 Optimal transfers

In this section we determine the optimal choice of the vector of transfers for the two regimes. We begin with the optimal choice of transfers that are made conditional on individual votes ($t_i(x_i)$) in the case of open voting.

Proposition 3 *Consider the case with open majority voting and transfers made contingent on the individual voting behavior. The interest group´s optimal strategy is to* *pay $(2p-2p^2)(2p-1)$ to one agent and to pay the other two agents an arbitrarily small positive amount iff $\theta \geq 2 \cdot (2p-2p^2)(2p-1)$. Otherwise it is optimal not to promise any transfers.*

Proof Paying transfers to one or two agents is more expensive than paying transfers to three agents. Paying transfers to three agents costs $(2p-2p^2)(2p-1)$. Not paying transfers to any agent yields the decision $x=0$ with probability $1/2$. Hence, paying transfers to three agents is optimal if

$$\frac{\theta}{2} \geq (2p-2p^2)(2p-1). \tag{4}$$

Q.E.D.

Under secret voting the interest group's optimal policy turns out to be somewhat more complex.

Proposition 4 *Consider the case with secret majority voting and transfers made contingent on the policy chosen by the committee. The interest group´s optimal transfer strategy depending on the (θ, p) combination is given in Figure 1 with:*

(i) $p = \frac{1}{2} + \frac{1}{6}\sqrt{3}$ *(3 agents versus 2 agents)*

(ii) $\theta = \frac{12p-5-6p^2+4p^3}{1-2p+2p^2}$ *(3 agents versus 1 agent)*

(iii) $\theta = \frac{6p-3-4p^2+16p^3-20p^4+8p^5}{(1-2p+2p^2)^2}$ *(2 agents versus 1 agent)*

(iv) $\theta = 4.0\frac{2.0p-1.0}{1.0-2.0p+2.0p^2}$ *(2 agents versus no agent)*

(v) $\theta = .5\frac{-6.0p^2+4.0p^3+1.0}{p(-1.0+p)}$ *(1 agent versus no agent)*

Proof The benefit for the interest group in each of the interesting equilibria derived in Proposition 2 is maximized if the weak inequalities are replaced by equalities. The expected benefit from paying a transfer to one member is then given by:

$$B^1 = (p - p^2 + \frac{1}{2})(\theta - 2p + 1). \tag{5}$$

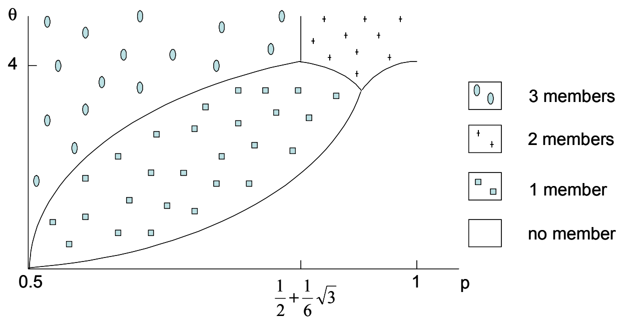

Figure 1: The interest group´s optimal strategy under closed voting.

The expected benefit from paying transfers to two members for the interest group is given by:

$$B^2 = \theta - 2(\frac{2p-1}{1-2p+2p^2}). \tag{6}$$

The expected benefit from paying transfers to all members for the interest group is given by:

$$B^3 = \theta - 3(2p-1). \tag{7}$$

The expected benefit from not offering transfers is given by:

$$B^0 = \frac{1}{2}\theta. \tag{8}$$

Comparing these benefits yields Figure 1 and (i) - (v). Q.E.D.

According to figure 1, for all probabilities p there is a valuation θ above which the interest group starts to distort the committees decision. This critical valuation rises with the quality of the three decision makers. Hence, the decision maker's quality has an indirect effect on the quality of the overall decision by raising the cost of an insincere vote.

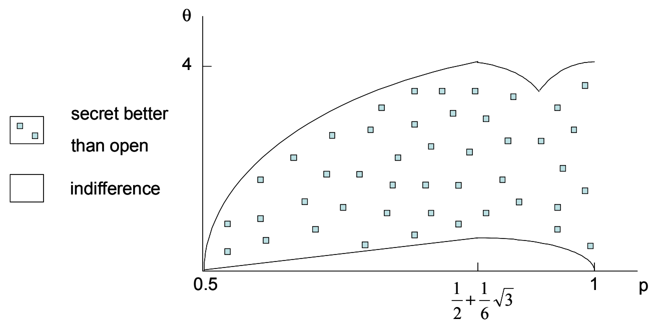

Figure 2: Comparison of the two voting rules.

5 Comparison of the two voting rules

The previous results enable us to make a welfare comparison of both voting systems. If the highest possible realization of the interest group's valuation of policy 1 is large enough then we have a strict ranking of both alternatives.

Proposition 5 *The secret voting scheme is strictly preferred from a social point of view.*

PROOF As a direct consequence of the comparison of the benefits for the interest group derived in the proofs of Proposition 3 and 4 it turns out that for some (θ, p) combinations the two schemes are equivalent[4] and for others the public strictly prefers the secret voting scheme, as depicted in Figure 2. Since the public only knows the distribution function $F(\theta)$ it is obvious that the expected benefit is strictly greater under the secret voting scheme. Q.E.D.

[4]The case where two agents vote insincerely is considered to be equivalent to the one with three agents, since in both cases the probability of $x = 1$ approaches unity, given that the ε trembles go to zero.

6 Communication

In reality committee members very often have the opportunity to talk with each other before voting occurs. The communication might influence the voting behavior and the transfer strategy of the interest group. Therefore, in this section, an extended setting is analyzed, where a message stage is introduced before voting occurs. In this stage the members simultaneously announce their signals and these announcements become common knowledge among the committee members. The interest group however does not know these announcements.

Lemma 1 *All equilibrium strategies derived in the settings without communication augmented by uninformative messages in the message stage, constitute equilibria under the respective voting scheme with communication.*

Proof Obvious. Q.E.D.

There is a multitude of other equilibria in this extended setting and only some economically interesting ones are derived in this paper.

Proposition 6 *Consider a situation where a minority is promised transfers under open voting with N committee members. There is an equilibrium where all members announce their signal truthfully in the message stage, the majority votes for the best policy and the minority votes insincerely for any transfers greater than zero. For any transfers greater than zero, this is the focal equilibrium, if a minority is offered transfers.*

Proof Consider the situation where a minority I is offered transfers. Consider the potential equilibrium strategy where all members $i \in I$ of the minority tell the truth in the message stage and vote for 1 in the voting stage. The potential equilibrium strategy for a member $j \in J$ of the set of all members who are not offered a transfer is to reveal the truth in the message stage and to vote:

- against his own signal if either $\{s_j = 0$ and $\sum_{n=1}^{N} \widehat{s}_n \geq \frac{N}{2}\}$ or $\{s_j = 1$ and $\sum_{n=1}^{N} \widehat{s}_n < \frac{N}{2}\}$.

- sincere otherwise.

The strategies of the sincere voters guarantee, that the policy is chosen, which would also be chosen without any transfers. The strategies of the insincere voters are optimal, since they maximize the probability that the correct policy is chosen. Consider an insincere voter i. Due to the strategies of the sincere voters, agent i is never pivotal in the voting stage. However, he will always obtain the transfers if he votes for policy 1. Therefore it is optimal for him to do so in the voting stage. Furthermore by telling the truth in the message stage he maximizes the likelihood that the correct policy is chosen, which also maximizes his utility. Therefore his strategy constitutes an equilibrium strategy.

As soon as the interest group offers transfers to a minority of committee members, truthful communication in the message stage is focal, since there is no way to obtain a higher utility for the insincere committee members, which is equal to the transfer plus the value of the best possible decision. Therefore the considered equilibrium is focal for transfers to a minority under open voting. Q.E.D.

Corollary 2 *Under open voting with communication the interest group never promises transfers to a minority contingent on the individual voting behavior.*

Proof Otherwise the interest group pays something without influencing the probability that the favored policy is chosen, which is worse than to do nothing. Q.E.D.

As soon as there is communication, transfers to a minority lead to windfall gains for the insincere committee members without any repercussions on the likelihood of the policy chosen. Of course, this result depends on the assumption that the committee members have in principle the same interests regarding the policy decision. Otherwise it is to be expected that truthtelling is in general not optimal in the message stage.

From an empirical point of view the following Proposition is very interesting.

Proposition 7 *Consider a committee with three members and open majority voting, with prior communication.*

(i) There is no equilibrium where all agents communicate truthfully and where they always vote for the best alternative (i. e. the one with most signals), given that $t > 0$ *for all agents.*

(ii) There is an equilibrium where all agents communicate truthfully and where they always vote for 1*, given that* $t > 0$ *for all agents.*

(iii) There is an equilibrium where all agents communicate truthfully and where they always vote for the best alternative, given that $t = 0$ *for all agents.*

PROOF (i) Assume that $s_i = 0$ for all i and suppose two agents vote truthfully. The third agent wants to vote for $y = 1$, since he gets positive transfers and is not pivotal.

(ii) Obvious.

(iii) Obvious. Q.E.D.

As noted above there are many equilibria in the setting with communication. Fortunately it is not necessary to derive the optimal transfer strategies in order to find the optimal voting scheme from a social point of view.

Proposition 8 *From a social point of view secret voting is weakly preferred to open voting in the presence of communication among committee members.*

PROOF Under open voting, the interest group has the basic choice either to give transfers to a certain number of agents contingent on the individual voting behavior or contingent on the policy chosen by the committee. The interest group will choose the alternative which yields the highest utility. Under secret voting in contrast, the interest group can only make the transfers contingent on the policy chosen by the committee.

(1) Assume that under open voting the interest group prefers to make transfers contingent on the individual voting behavior to making them contingent on the policy chosen (or a mixture of both). Necessarily this implies that secret voting is to be preferred to open voting from a social point of view, since transfers are being paid less often[5].

(2) Assume that under open voting the interest group prefers to make transfers contingent on the policy chosen to making them contingent on the individual voting behavior. In this case open voting and secret voting are equivalent from a social point of view. Q.E.D.

7 Enlarging the committee

The argument that speaks in favor of closed voting is that transfers received from outsiders are only motivating the agent in case that his vote is pivotal in the committee. Under open voting the transfer is always important while the cost only arises when an individual vote is pivotal. Moreover, we know that the probability to cast the pivotal vote declines in the size of a committee. This is why one should expect that a larger committee is more vulnerable to external pressure if it is organized as an open committee. Indeed one can easily proof the following statements:

Proposition 9 *Consider a committee with n members under closed voting.*

(i) A THPB equilibrium where all members vote in favor of alternative 1 exists iff $t_i \geq 2p - 1$.

[5] θ is not known by the general public.

(ii) A THPB equilibrium where no member votes in favor of alternative 1 exists iff $t_i \leq 2p - 1$.

(iii) The cost of paying transfers to all committee members increases linearly.

PROOF (i) and (ii) Like in the case with three members. (iii) follows from (i). Q.E.D.

Under closed voting the individual transfers needed are independent of the size of a committee. Therefore the total sum of transfers needed in order to buy the entire committee are increasing in committee size. This is different under open voting.

Proposition 10 *Consider a committee with n members under open voting.*

(i) A THPB equilibrium where all members vote in favor of alternative 1 exists iff $t_i > 0$.

(ii) A THPB equilibrium where no member votes in favor of alternative 1 exists iff $t_i \leq \binom{n}{\frac{n}{2}} p^{\frac{n}{2}} (1-p)^{\frac{n}{2}} \cdot (2p-1)$.

(iii) The amount of money needed in order to ensure that at least one committee member always votes in favor of alternative 1 is declining in n.

PROOF Like in the case with three members. Q.E.D.

These results indicate that it may be more difficult to ensure that the benefits from increasing the size of a committee can fully be reaped. This becomes clear when we consider the comparison of a single decision maker and a committee with three members under open voting.

Proposition 11 *It is less expensive to buy all votes of an open committee with three members than to buy the decision of a single decision maker.*

PROOF We know that buying an open committee with three members costs $(2p - 2p^2)(2p-1)$. Buying the decision of a single decision maker costs $2p-1$. Q.E.D.

Note that this result is at contrast to Condorcet's first jury theorem. This theorem states that more decision makers yield better results. Under interest group influence this need not be the case when committees meet openly. As the number of voters increases, the cost of voting insincerely declines because the probability of being pivotal declines. This is why a larger open committees may make individual voters more vulnerable with respect to external pressure.

8 Common agency

This section analyzes whether the main results of the previous sections are robust when two interest groups try to influence the committee´s decision. We are particularly interested in the case, where the two groups are socially irrelevant and drop out of any welfare considerations.[6] In such a setup one interest group favors alternative 0 while the other always is in favor of alternative 1.

We provide theoretical reasons, why the lobbying of opposing interest groups, which are socially irrelevant, may lead to undesirable distortions on the policy chosen by a committee. We show that a mixed strategies equilibrium of the corresponding (discontinuous payoff) game exists. Such an equilibrium has the property that the interest group's efforts do not always cancel out. It may rather be the case that the difference between transfers induces some agents to vote insincerely. Conditions are derived, which guarantee that secret voting is strictly preferred to open voting from a social point of view.

[6]Note that in the one interest group case, it has to be argued that the interest group is small, in order to neglect it in the welfare analysis.

8.1 A modified first price sealed bid auction

The previous section´s assumptions with respect to the timing, the committee members' information structure and the true state of the world are maintained. A committee member´s utility is given by $u_i = y + t_{i0} + t_{i1}$, with t_{i0} and t_{i1} being the transfers paid by the interest groups 0 and 1 respectively to member i.

Interest group 1´s utility is given by $u_1 = \theta x - \sum_{i=1}^{3} t_{i1}$ and group 0´s utility is given by $u_0 = \theta(1-x) - \sum_{i=1}^{3} t_{i0}$. The parameter θ is common knowledge and mirrors both interest groups' benefit from the policy chosen. Therefore interest group 0 prefers policy $x = 0$ and group 1 prefers policy $x = 1$ and both groups have an identical valuation for the respective preferred policy. As a consequence the interest groups' preferences should drop out of any welfare considerations. Maximizing social welfare requires that

$$x = \begin{cases} 0 & \text{if } \sum_{i=1}^{3} s_i < \frac{1}{2} \\ 1 & \text{otherwise} \end{cases}.$$

The game is a modified first price sealed bid auction. Both interest groups make simultaneous announcements about their transfers and based on these offers, which become common knowledge among the committee members (but not to the opposing interest group), each committee member casts a vote. The main difference with respect to the first-price sealed bid auction is that the difference between the offers has to be above a certain threshold in order to ensure that the vote changes.

8.2 Secret voting scheme

Under secret voting the transfers can only be made contingent on the policy chosen by the committee as a whole, i. e. the offers t_{ij} are made contingent on x (and per definition can not be made contingent on the individual vote y_i).

The committee member i´s optimal vote x_i:

$$x_i = \begin{cases} s_i \text{ if } t_{i,j\neq s_i} - t_{i,-j=s_i} \leq Eu(x_i = s_i, t_j, t_{-j}) - Eu(x_i = j, t_j, t_{-j}) \equiv \triangle_{i,t_j,t_{-j},s_i} \\ j \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad \text{otherwise} \end{cases}.$$

i.e. i votes sincerely if the difference in the transfers $t_{i,j\neq s_i} - t_{i,-j=s_i}$ (the first term being the transfers from the group, which does not coincide with *ís* signal s_i)[7] is smaller than the cost from voting insincerely.

The following Propositions will refer to Figure 3.

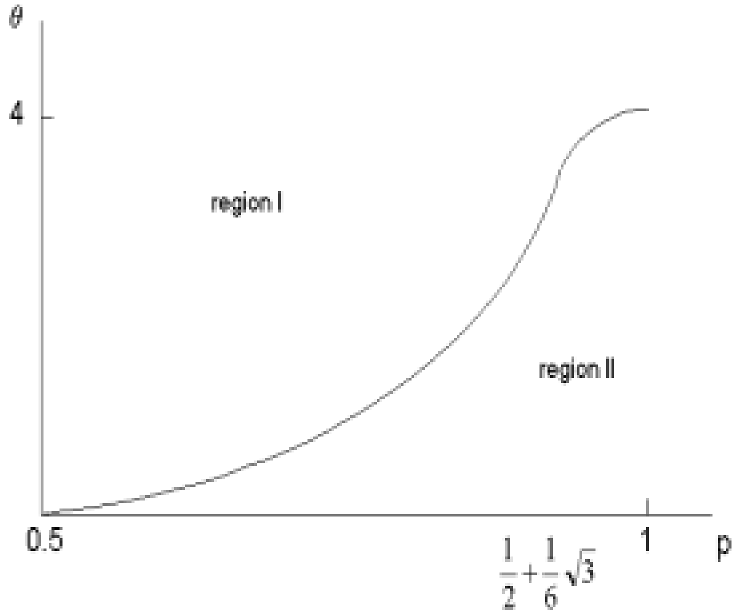

Figure 3

Proposition 12 *(i) For all (θ, p) combinations in region II in Figure 3, there exists only one equilibrium. In this equilibrium the transfers satisfy $t_{ij} = 0$ $\forall i, j$. This equilibrium maximizes the social surplus.*

(ii) For all (θ, p) combinations in region I in Figure 3, there is no equilibrium guaranteeing that the socially best policy is chosen.

[7]For example, if $s_i = 0$ (and therefore member i in principal prefers to vote for policy / group 0) then $t_{i,j\neq s_i} - t_{i,-j=s_i} = t_{i1} - t_{i0}$ is the net benefit obtained from the transfers, given that i accepts the transfer.

(iii) For all (θ, p) combinations in region I in Figure 3, an equilibrium not guaranteeing the socially best policy exists.

Proof (i) In order to proof part (i) consider the potential equilibrium where both interest groups do not offer positive transfers. Given that group $-j$ does not pay transfers, what is the best response of group j. Group j now is in the same situation as in a setting with only one interest group. The best responses for different (θ, p) combinations are given in Proposition 4. As can be seen, for all combinations in region II in Figure 3 it is optimal for group j not to pay positive transfers. Given that j does not pay transfers, the same argument holds for $-j$, which establishes the equilibrium. Since no committee member votes insincerely, this equilibrium maximizes social welfare.

(ii) The proof of (ii) proceeds in two steps. In step (a) it is shown that any equilibrium in pure strategies does not maximize social welfare and in (b) it is shown that any equilibrium in mixed strategies can not yield the socially best policy (which is not trivial per se), as well.

(a) Assume that there is an equilibrium in pure strategies yielding the socially best policy. In this case $t_{ij \neq s_i} - t_{i-j} \leq \triangle_{i,t_j,t_{-j},s_i}$ $\forall i, s_i$. Furthermore, if an equilibrium is welfare maximizing, then each interest group has a probability of $\frac{1}{2}$ of being chosen. Given that the probability of being chosen is $\frac{1}{2}$ and $t_{ij \neq s_i} - t_{i-j} \leq \triangle_{i,t_j,t_{-j},s_i}$ $\forall i, s_i$ the "best response" satisfying these conditions for group j is $\max(0, t_{i-j} - \triangle_{i,t_j,t_{-j},s_i})$. The "best response" for group $-j$ is defined analogously. Obviously they do not have a fixed point except at $t_{i-j} = t_{ij} = 0$. This however can not be an equilibrium. (From part (i) and Proposition 4 we know that except in region II in Figure 3 it is optimal for an interest group to pay transfers to a number of members, given that the other group does not make any payments.) Therefore there can not be an equilibrium in pure strategies which always yields the socially best outcome.

(b) For social welfare to be maximized ex ante, the transfers have to be with certainty within the intervals $(\underline{t_{ij}}, \overline{t_{i-j}})$ defined by the welfare maximization condition. Furthermore, if welfare is maximized, then each interest group has a probability of $\frac{1}{2}$ of being chosen. Since the expected utility is then $Eu_j = \frac{1}{2}(\theta - t_j)$, an agent can improve by choosing $\underline{t_{ij}}$ with certainty (for any other transfer within the interval with $\sigma_{ij}(t_{ij}) > 0$ his utility decreases, whereas the probability that the favored policy is chosen remains $\frac{1}{2}$). Therefore there is no equilibrium in mixed strategies, which also yields the socially best policy.

(iii) The proof can be found in the Appendix.

8.3 Open voting scheme

Under open voting the transfers can be made contingent on the policy chosen by the committee as a whole or on the individual voting behavior. In the latter case the offers t_{ij} are made contingent on x_i and possibly on other member´s votes.

Proposition 13 *(i) For some (θ, p) combinations in region II in Figure 3, there exists only one equilibrium. In this equilibrium the transfers satisfy $t_{ij} = 0\ \forall i, j$. This equilibrium maximizes social welfare.*

(ii) For all (θ, p) combinations in region I in Figure 3, there is no equilibrium guaranteeing that the socially best policy is chosen. An equilibrium not guaranteeing the socially best policy exists.

(iii) For some (θ, p) combinations in region II in Figure 3, there exists an equilibrium, which can not guarantee that the socially best policy is chosen.

Proof In order to proof part (i) it suffices to give examples of these equilibria. Consider the potential equilibrium, given the combination $(\theta = 0, p)$, where both interest groups do not pay any transfers. Given that group $-j$ does not pay transfers, what is the best response of group j. Since j does not derive a utility from the policy chosen, it prefers not to pay transfers.

The proof of (ii) proceeds in two steps. In step (a) it is shown that an equilibrium exists and in (b) it is shown that any existing equilibrium can not yield a welfare maximizing policy.

(a) Analogous to Proof of Proposition 12 (iii).

(b) Analogous to Proof of Proposition 12 (ii).

In order to proof part (iii) it is easiest to depart from equilibrium (i). As soon as (θ, p) is such that a deviation of one interest group from the strategies in (i) is profitable, then (i) does not apply anymore and by the same reasoning as in (ii) we can establish that an equilibrium exists, which in general is not welfare maximizing. Now, consider (θ, p) combinations in region II in Figure 3, and assume that interest group $-j$ does not pay any transfers. Interest group j now is in the same situation as in a setting with only one interest group. From Proposition 3 it is known, that there are (θ, p) combinations in region II, where making transfers t_{ij} contingent on x_i only, is better for group j than not to pay any transfers. Hence a deviation from the "no transfers equilibrium" is profitable and by the same reasoning as in (ii) there exists an equilibrium for these (θ, p) combinations, which is in general not welfare maximizing. Q.E.D.

8.4 Comparison of closed and open voting

Propositions 12 and 13 enable us to make a partial welfare ranking of the two alternative voting schemes. According to both propositions, there are (θ, p) combinations where closed voting is better for society than open voting. In those cases open voting generates a policy bias while closed voting always yields the appropriate decision. For another set of (θ, p) combinations, both open and closed voting yield the appropriate decision. Finally, there are situations where both institutional setups yield a policy bias. Without any additional information on the type of equilibrium we are not able to provide a welfare ranking in those cases.

Proposition 14 *Either θ and p are such that*

(i) closed voting always guarantees that the best policy from a social point of view is chosen, whereas under open voting the best policy is in general not chosen, or

(ii) closed voting and open voting yield the best policy from a social point of view, or

(iii) open and closed voting lead to a policy bias.

Proof (i) From Proposition 12 (i) it is known that for all (θ, p) combinations in region II in Figure 3 no committee member votes insincerely under secret voting and therefore this equilibrium is welfare maximizing. From Proposition 13 (iii) it is known that for some (θ, p) combinations in region II in Figure 3 committee members vote insincerely under open voting and that whatever the equilibrium strategies are, this equilibrium is in general not welfare maximizing.

(ii) Follows from Proposition 12 (i) and Proposition 13 (i).

(iii) Obvious. Q.E.D.

9 Conclusion

This paper has provided a simple argument in favor of the protection of committees from external influence. According to our argument, the decision quality is higher in a closed committee because incentives to give in to external pressure do not decline with the probability of being pivotal. Moreover, we have shown that under open voting, a larger number of decision makers may make lower quality decisions.

This leads to the question whether and when there are good reasons to make committee meetings public instead. One argument may be that a true representation of the delegating population requires that constituencies see what their particular representative has done. A more complete analysis than the present one would take such agency problems into account. Such an analysis would focus on the trade-off between the accountability to (heterogeneous) constituencies and the influence of special interest groups. It might require a different verifiability structure where - ex post - the appropriateness of the decision is at least partially verifiable.[8] In such an analysis one could endogenize both the incentives provided by the general population and those of the interest groups that attempt to affect the policy choice.

10 Appendix 1: Proof of Proposition 1 and 2

Proof of Proposition 1 (i) Consider a potential equilibrium where one member i always votes in favor of alternative 1 and the other agents j and $-j$ vote sincerely. Consider trembles that make the sincere voters vote insincerely with probability $\varepsilon > 0$. They vote according to their signal with probability $1 - \varepsilon$. The remaining decision maker i knows that his decision is only important if he is pivotal. As ε goes to zero, the probability to be pivotal goes to:

$$\lim_{\varepsilon \to 0} p^{piv} = 2p\left(1-p\right). \tag{9}$$

The expected utility from voting truthfully, given that member i obtained signal 0 and is pivotal is:

[8] Besley (2003) considers a model where the public may vary a politician's salary in order to increase the quality of decisions. Incentives are provided when reelection is linked to the policymaker's past performance. Gersbach (2003) studies the impact of additional incentive schemes provided by the public or by the politician himself.

$$Eu_i^{truth}|_{(s_i=0),p^{piv}} = p^{(s_j=0,s_{-j}=1,s=0|s_i=0)} + p^{(s_j=1,s_{-j}=0,s=0|s_i=0)} \tag{10}$$
$$= p^2(1-p) + p^2(1-p)$$
$$= -2p^3 + 2p^2.$$

The expected utility from voting insincerely, given that the third member obtained signal 0 and is pivotal is:

$$Eu_i^{lying}|_{(s_i=0),p^{piv}} = p^{(s_j=0,s_{-j}=1,s=1|s_i=0)} + p^{(s_j=1,s_{-j}=0,s=1|s_i=0)} + t_i \tag{11}$$
$$= (1-p)^2p + (1-p)^2p + t_i$$
$$= 2(1-p)^2p + t_i.$$

The committee member votes insincerely if transfers t_i solve:

$$0 \geq Eu_i^{truth}|_{(s_i=0),p^{piv}} - Eu_i^{lying}|_{(s_i=0),p^{piv}} \tag{12}$$
$$= -4p^3 + 6p^2 - 2p + t_i$$
$$t_i \geq (2p - 2p^2)(2p-1).$$

Next consider a sincere voter. Suppose first that his signal is 0. He is pivotal if the other sincere voter votes 0. Hence the probability that the true state of the world is zero is $\frac{p^2}{p^2+(1-p)^2}$. The expected damage from voting insincerely is

$$\frac{p^2}{p^2+(1-p)^2} - \left(1 - \frac{p^2}{p^2+(1-p)^2}\right) \tag{13}$$
$$= \frac{2p-1}{2p^2+1-2p}.$$

Next consider the case where the signal of a sincere voter is 1. He is pivotal if the other sincere voter votes 0[9]. Hence the two states of the world are equally likely if he is pivotal. Voting truthfully is one best reply in this situation.

[9]or if epsilon trembles make him pivotal. We can ignore this case for obvious reasons.

Therefore truthful voting is a best reply if the transfers for these players are not larger than

$$\bar{t} = \frac{2p-1}{2p^2+1-2p}. \tag{14}$$

(ii) Consider a potential equilibrium where members 1 and 2 always vote in favor of alternative 1 and the third agent votes sincerely. Consider trembles that make one insincere voter $-j$ vote for 0 with probability ε and that make the sincere voter i vote insincerely with probability ε. From the proof of (i) it is known that the other insincere voter j occurs an expected loss

$$\begin{aligned}
& Eu_j^{truth}|_{(s_j=0)} - Eu_i^{lying}|_{(s_j=0)} \qquad (15)\\
= \ & (1-\varepsilon)^2[(p^{(s_i=0,s_{-j}=0,s=0|\widehat{s}_i=0,\widehat{s}_{-j}=1,s_j=0)} + p^{(s_i=0,s_{-j}=1,s=0|\widehat{s}_i=0,\widehat{s}_{-j}=1,s_j=0)}) \\
& -(p^{(s_i=0,s_{-j}=0,s=1|\widehat{s}_i=0,\widehat{s}_{-j}=1,s_j=0)} + p^{(s_i=0,s_{-j}=1,s=1|\widehat{s}_i=0,\widehat{s}_{-j}=1,s_j=0)} + t_j)] \\
& +2(1-\varepsilon)\varepsilon[.] + \varepsilon^2[.] \\
= \ & (1-\varepsilon)^2[(p)-(1-p)] + 2(1-\varepsilon)\varepsilon[.] + \varepsilon^2[.]
\end{aligned}$$

if he is pivotal and votes insincerely when his signal is $s_j = 0$. This loss has to be compensated by transfers:

$$t_j \geq (1-\varepsilon)^2[(p)-(1-p)] + 2(1-\varepsilon)\varepsilon[.] + \varepsilon^2[.] \tag{16}$$

which approaches $t_j \geq 2p-1$ as ε goes to zero.

Consider the member who votes sincerely. Truthful voting only matters if this agent is pivotal. The agent does not learn anything by being pivotal and therefore his loss from lying in this case is equal to $2p-1$. Therefore he will vote truthfully if the transfer is not too large.

(iii) Consider a potential equilibrium where all members always vote in favor of alternative 1. Consider trembles that make two players vote in favor of alternative

0 with probability $\varepsilon > 0$. They all vote in favor of alternative 1 with probability $1-\varepsilon$. The remaining decision maker i knows that his decision is only important if he is pivotal. He does not learn anything from the fact that he is pivotal because the voting behavior of the others is independent of their signal. Hence, conditional on being pivotal, the loss from not reporting the own information is $2p-1$. He always votes for policy 1 only if

$$t_i > p^{piv}(2p-1). \tag{17}$$

The left hand side represents the transfers received for voting insincerely - provided that the signal is 0. The right hand side represents the expected cost of lying - again provided that the signal is 0. Note that the cost only obtains if the voter is pivotal, i.e. with probability p^{piv}. While the benefit from lying is realized independently of this.

As ε goes to zero, the probability to be pivotal goes to zero as well. Hence, for all transfers t_i there is an ε' so that for all $\varepsilon < \varepsilon'$ voting for alternative 1 is a symmetric ε-constrained equilibrium.

(iv) Consider a potential equilibrium where all members vote truthfully. Consider trembles that make 2 players vote in favor of alternative 0(1) with probability $\varepsilon > 0$ if their signal is 1(0). The remaining decision maker knows that his decision is only important if he is pivotal. As ε goes to zero the probability to be pivotal is the same as for the insincere voter in (i): $\lim\limits_{\varepsilon\to 0} p^{piv} = 2p(1-p)$. The expected utility from voting truthfully, given that the decision maker i obtained signal 0 and is pivotal is:

$$\begin{aligned} Eu_i^{truth}|_{(s_i=0),p^{piv}} &= p^{(s_j=0,s_{-j}=1,s=0|s_i=0)} + p^{(s_j=1,s_{-j}=0,s=0|s_i=0)} \\ &= p^2(1-p)+p^2(1-p) \\ &= -2p^3+2p^2 \end{aligned} \tag{18}$$

The expected utility from voting insincerely, given that the decision maker i obtained signal 0 and is pivotal is:

$$
\begin{aligned}
Eu_i^{lying}|_{(s_i=0),p^{piv}} &= p^{(s_j=0,s_{-j}=1,s=1|s_i=0)} + p^{(s_j=1,s_{-j}=0,s=1|s_i=0)} \\
&= (1-p)^2 p + (1-p)^2 p \\
&= 2(1-p)^2 p + t_i
\end{aligned}
\tag{19}
$$

The decision maker votes sincerely if

$$
\begin{aligned}
0 &< Eu_i^{truth}|_{(s_i=0),p^{piv}} - Eu_i^{lying}|_{(s_i=0),p^{piv}} \\
&= -4p^3 + 6p^2 - 2p - t \Leftrightarrow \\
t &< -4p^3 + 6p^2 - 2p.
\end{aligned}
\tag{20}
$$

Hence, for all transfers t that satisfy

$$
t < (2p - 2p^2)(2p - 1). \tag{21}
$$

voting sincerely is a symmetric ε-constrained equilibrium.

(v) Consider an equilibrium where member 1 always votes in favor of alternative 1, member 2 always votes in favor of alternative 0 and member 3 votes thruthfully. Member three either learns nothing from being pivotal. Hence he behaves like a single decision maker. Truthful voting is a best reply if his transfer satisfies $t \leq 2p - 1$.

Player 1 learns from being pivotal that either (i) player 3's signal is 1 or (ii) that trembles have made player 3 and player 2 vote for 1 and 0 respectively. If his signal is 0 then both alternatives are equally likely in the case without trembles. With trembles alternative 0 is superior. Voting for 1 does therefore require a small transfer.

Player 2 learns from being pivotal that (i) player 3 has signal 0 ii) that trembles have made player 3 and player 1 accidentally vote for 0 and 1 respectively. If his own signal is 1 then alternative 1 is more likely. Therefore his transfer would have to be negative in order to ensure trembling hand perfection. If his signal is 0 then 0 is more likely.

The other possible equilibria can be excluded easily with a similar argument. Q.E.D.

Proof of Proposition 2 (i) Consider a potential equilibrium where one member i always votes in favor of alternative 1 and the other agents j and $-j$ vote according to their signal. Consider trembles that make j and $-j$ vote against their signal with probability $\varepsilon > 0$. They vote according to their signal with probability $1-\varepsilon$. As ε goes to zero, the difference in expected utilities between lying and truthtelling for the insincere voter i goes to:

$$\begin{aligned} & Eu_i^{truth}|_{(s_i=0)} - Eu_i^{lying}|_{(s_i=0)} \qquad (22) \\ = \;& p^{(s_j=0,s_{-j}=1,s=0|s_i=0)} + p^{(s_j=1,s_{-j}=0,s=0|s_i=0)} + p^{(y=1|truth,s_i=0)}t_i \\ & -(p^{(s_j=0,s_{-j}=1,s=1|s_i=0)} + p^{(s_j=1,s_{-j}=0,s=1|s_i=0)} + p^{(y=1|lying,s_i=0)}t_i) \\ = \;& p^2(1-p) + p^2(1-p) + p^{(y=1|truth,s_i=0)}t_i \\ & -((1-p)^2 p + (1-p)^2 p + p^{(y=1|lying,s_i=0)}t_i) \qquad (23) \end{aligned}$$

with

$$\begin{aligned} p^{(y=1|truth,s_i=0)} &= p^{(s_j=1,s_{-j}=1,s=0|truth,s_i=0)} + p^{(s_j=1,s_{-j}=1,s=1|truth,s_i=0)} \qquad (24) \\ &= p(1-p)^2 + (1-p)p^2 = p - p^2 \end{aligned}$$

and

$$\begin{aligned} p^{(y=1|lying,s_i=0)} &= p^{(s_j=0,s_{-j}=1,s=0|lying,s_i=0)} + p^{(s_j=1,s_{-j}=0,s=0|lying,s_i=0)} \qquad (25) \\ & +p^{(s_j=0,s_{-j}=1,s=1|lying,s_i=0)} \qquad (26) \end{aligned}$$

$$
\begin{aligned}
&+p^{(s_j=1,s_{-j}=0,s=1|lying,s_i=0)}+p^{(s_j=1,s_{-j}=1,s=0|lying,s_i=0)} \\
&+p^{(s_j=1,s_{-j}=1,s=1|lying,s_i=0)} \qquad (27)\\
=\;& p^2(1-p)+p^2(1-p)+p(1-p)^2 \\
&+p(1-p)^2+p(1-p)^2+p^2(1-p) \qquad (28)\\
=\;& -3p^2+3p.
\end{aligned}
$$

Voting insincerely pays if

$$
t_i \geq 2p-1. \qquad (29)
$$

Consider the sincere voter j. Truthful voting matters only if this agent j is pivotal and his signal is 0. Given that he is pivotal he looses

$$
\begin{aligned}
&\lim_{\varepsilon\to 0}(1-\varepsilon)^2[(p^{(s_{-j}=0,s_i=0,s=0|\widehat{s_i}=1,s_j=0)}+p^{(s_{-j}=0,s_i=1,s=0|\widehat{s_i}=1,s_j=0)}) \qquad (30)\\
&-(p^{(s_{-j}=0,s_i=0,s=1|\widehat{s_i}=1,s_j=0)}+p^{(s_{-j}=0,s_i=1,s=1|\widehat{s_i}=1,s_j=0)})] \\
&+2(1-\varepsilon)\varepsilon[.]+\varepsilon^2[.] \\
=\;&((p^{(s_{-j}=0,s_i=0,s=0|\widehat{s_i}=1,s_j=0)}+p^{(s_{-j}=0,s_i=1,s=0|\widehat{s_i}=1,s_j=0)}) \\
&-(p^{(s_{-j}=0,s_i=0,s=1|\widehat{s_i}=1,s_j=0)}+p^{(s_{-j}=0,s_i=1,s=1|\widehat{s_i}=1,s_j=0)}) \\
>\;& 0
\end{aligned}
$$

as soon as he lies, where agent $-j$ votes truthfully and the insincere voter votes for policy 1. Therefore he will vote truthfully.

(ii) Consider a potential equilibrium where two members j and $-j$ always vote in favor of alternative 1 and the other agent votes sincerely. Consider trembles that make one insincere voter $-j$ vote for 0 and that makes the sincere voter i vote insincerely with probability ε, respectively. As ε goes to zero, the difference in expected utilities between lying and truthtelling for voter j goes to:

$$
\begin{aligned}
& Eu_j^{truth}|_{(s_j=0)} - Eu_j^{lying}|_{(s_j=0)} \qquad (31) \\
= \;& p^{(s_i=0,s_{-j}=1,s=0|s_j=0)} + p^{(s_i=0,s_{-j}=0,s=0|s_j=0)} + p^{(y=1|truth,s_j=0)}t_j \\
& -(p^{(s_i=0,s_{-j}=1,s=1|s_j=0)} + p^{(s_i=0,s_{-j}=0,s=1|s_j=0)} + p^{(y=1|lying,s_j=0)}t_j) \\
= \;& p^2(1-p) + p^3 + p^{(y=1|truth,s_j=0)}t_j - ((1-p)^2 p + (1-p)^3 + p^{(y=1|lying,s_j=0)}t_j)
\end{aligned}
$$

with

$$
\begin{aligned}
p^{(y=1|truth,s_j=0)} &= p^{(s_i=1,s_{-j}=1,s=0|truth,s_j=0)} + p^{(s_i=1,s_{-j}=0,s=0|truth,s_j=0)} \qquad (32) \\
& + p^{(s_i=1,s_{-j}=0,s=1|truth,s_j=0)} + p^{(s_i=1,s_{-j}=1,s=1|truth,s_j=0)} \\
&= p(1-p)^2 + p^2(1-p) + (1-p)^2 p + (1-p)p^2 = 2p - 2p^2,
\end{aligned}
$$

and $p^{(y=1|lying,s_j=0)} = 1$.

The strategy of voter j is optimal if the expected transfers at least compensate the difference, i. e.

$$
t_j \geq \frac{2p-1}{-2p+2p^2+1}. \qquad (33)
$$

Consider the sincere voter. Truthful voting only matters if this agent is pivotal. This agent does not learn anything by being pivotal and therefore his loss from lying in this case is equal to $2p-1$. Therefore he will vote truthfully.

(iii) Consider a potential equilibrium where all members always vote in favor of alternative 1. Consider trembles that make 2 players vote in favor of alternative 0 with probability $\varepsilon > 0$. They all vote in favor of alternative 1 with probability $1-\varepsilon$. The remaining decision maker knows that his decision is only important if he is pivotal. He does not learn anything from the fact that he is pivotal because the voting behavior of the others is independent of their signal. Hence, conditional on being pivotal, the loss from not reporting the own information is $2p-1$. In that case he votes insincerely only if

$$
\begin{aligned}
p^{piv} \cdot t_i &> p^{piv} \cdot (2p-1) \qquad (34) \\
&\Leftrightarrow \; t_i > (2p-1)\,.
\end{aligned}
$$

The left hand side represents the expected transfers received for voting insincerely - provided that the signal is 0. The right hand side represents the expected cost of lying - again provided that the signal is 0. Note that the cost and benefit only obtain if the voter is pivotal, i.e. with probability p^{piv}.

(iv) Consider a potential equilibrium where all members vote truthfully. Consider trembles that make 2 players vote in favor of alternative 0(1) with probability $\varepsilon > 0$ if their signal is 1(0). As ε goes to zero, the difference in expected utilities between lying and truthtelling for the insincere voter i goes to:

$$
\begin{aligned}
& Eu_i^{truth}|_{(s_i=0)} - Eu_i^{lying}|_{(s_i=0)} \qquad (35) \\
= \; & p^{(s_j=0,s_{-j}=1,s=0|s_i=0)} + p^{(s_j=1,s_{-j}=0,s=0|s_i=0)} + p^{(y=1|truth,s_i=0)} t_i \\
& -(p^{(s_j=0,s_{-j}=1,s=1|s_i=0)} + p^{(s_j=1,s_{-j}=0,s=1|s_i=0)} + p^{(y=1|lying,s_i=0)} t_i) \\
= \; & p^2(1-p) + p^2(1-p) + p^{(y=1|truth,s_i=0)} t_i \\
& -((1-p)^2 p + (1-p)^2 p + p^{(y=1|lying,s_i=0)} t_i), \qquad (36)
\end{aligned}
$$

with

$$
\begin{aligned}
p^{(y=1|truth,s_i=0)} &= p^{(s_j=1,s_{-j}=1,s=0|truth,s_i=0)} + p^{(s_j=1,s_{-j}=1,s=1|truth,s_i=0)} \qquad (37) \\
&= p(1-p)^2 + (1-p)p^2 = p - p^2.
\end{aligned}
$$

and

$$
\begin{aligned}
p^{(y=1|lying,s_i=0)} &= p^{(s_j=0,s_{-j}=1,s=0|lying,s_i=0)} + p^{(s_j=1,s_{-j}=0,s=0|lying,s_i=0)} && (38)\\
&\quad + p^{(s_j=0,s_{-j}=1,s=1|lying,s_i=0)} && (39)\\
&\quad + p^{(s_j=1,s_{-j}=0,s=1|lying,s_i=0)} + p^{(s_j=1,s_{-j}=1,s=0|lying,s_i=0)} \\
&\quad + p^{(s_j=1,s_{-j}=1,s=1|lying,s_i=0)} && (40)\\
&= p^2(1-p) + p^2(1-p) + p(1-p)^2 \\
&\quad + p(1-p)^2 + p(1-p)^2 + p^2(1-p) && (41)\\
&= -3p^2 + 3p.
\end{aligned}
$$

The member under consideration does not accept the transfer given that the expected transfer does not compensate the difference, i. e.

$$t_i < 2p - 1. \tag{42}$$

Part (iv) of the Proposition follows immediately.

(v) See Proof of Proposition 1(v).

Q.E.D.

11 Appendix 2: Proof of Proposition 12 (iii)

Notice that the discontinuities in group j's payoff function are confined to the set

$$A^*(j) = \{(t_0, t_1) | t_{i1} = t_{i0} + \triangle_{i,t_{-i1},t_{-i0},s_i=0} \text{ or } t_{i1} = t_{i0} - \triangle_{i,t_{-i1},t_{-i0},s_i=1} \qquad \text{for } \forall i$$

with $t_j = (t_{1j}, t_{2j}, t_{3j})$ and $\triangle_{i,t_{-ij},t_{-i-j},s_i=j}$ being the expected loss from voting insincerely for member i, given that the member obtains signal $s_i = j$. These costs depend on the transfers to the other committee members $-i$, because these transfers may induce other voters to vote insincerely, influencing $i\acute{}s$ voting behavior.

Before proceeding to the proof of Proposition 12 (iii) it is useful to state Lemma 2.

Lemma 2 *In our setting there exists a function $\overline{u}_1(t_1, t_0)$ with $(t_1, t_0) \in A^*(j)$ such that:*

$$\lim_{\theta_1 \to 0} \inf \; u_1(t_1 + \theta_1 e^+, t_0) > \overline{u}_1(t_1, t_0) > u_1(t_1, t_0) \tag{43}$$

with $e^+ \in B^{3+}$ and

$$\overline{u}_1(t_1, t_0) + \overline{u}_0(t_1, t_0) \geq \lim_{\theta_1 \to 0} \lim_{\theta_2 \to 0} \sup_{(e_1, e_2) \in B^3 \times B^3} (u_1(t_1 + \theta_1 e_1, t_0 + \theta_0 e_0) + u_0(t_1 + \theta_1 e_1, t_0 + \theta_0 e_0)). \tag{44}$$

Proof of Lemma 2 Notice that (43) is well defined in our setting, since $u_1(t_1 + \theta_1 e^+, t_0) > u_1(t_1, t_0)$ as $\theta_1 e^+$ gives a little bit more transfers to any committee member than at the point of discontinuity, as θ_1 goes to zero. The members for whom t_1 is critical will therefore vote in favor of group 1 instead of being indifferent between the two groups, which raises group 1´s utility.

The next step is to verify that (43) and (44) are consistent in our setting. Notice that at a point of discontinuity, the utility u_j of group j goes up if the transfers are approached from above (e. g. $t_j + \theta_j e_j^+$ with $\theta_j \to 0$) and in this case (for given t_{-j}) the utility of group $-j$ necessarily goes down.[10] This holds, because more members will vote for group j. Now the definition of (44) implies that for whatever sequences approaching the point of discontinuity, we either have the situation that one utility rises and the other falls, as just described, or both utilities are in the limit

[10] To see this, consider an interest group´s expected utility $Eu = p'(\theta - t)$, with p' being the probability that the favored policy is chosen. In the relevant cases $\theta - t \geq 0$. Therfore if p' goes down, so does the expected utility.

equal to the respective utilities at points of discontinuity. In the first case, choosing an appropriate $\overline{u}_j \in (\lim_{\theta_j \to 0} \inf u_j(t_j+\theta_j e^+, t_{-j}), u_j(t_j, t_{-j}))$ makes (43) and (44) consistent in this application.[11] In the latter case, since $\overline{u}_j(t_1, t_0) > u_j(t_1, t_0)\ \forall j$ (see (43)), it follows that there exist $\overline{u}_j(t_1, t_0)$ such that (43) and (44) are consistent. Q.E.D.

Proof of Proposition 12 (iii) The proof proceeds as follows. In Dasgupta and Maskin (1986) Theorem 5* (D-M Theorem 5*) the existence of an equilibrium in games with continuous action sets and discontinuous payoff functions is derived, given that the payoff functions are weakly lower semi-continuous and the sum of the utilities is upper semi-continuous. Unfortunately this is not the case in our setting, since the sum of the payoff functions is not upper semi-continuous. But, based on our utility functions, we will define a game satisfying the conditions of D-M Theorem 5* where an equilibrium exists. In the next step it is shown that the equilibrium for the modified game is also an equilibrium for the original game, which establishes existence.[12] The definitions used in the proof are largely taken from D-M, but can also be found in "Appendix: general definitions".

The modified game:

Define for each $t \in T$: (analogously for $\widehat{u}_0(t_1, t_0)$)

$$\widehat{u}_1(t_1, t_0) = \left[\begin{array}{ll} \overline{u}_1(t_1, t_0) & \text{if } (t_1, t_0) \in A^*(1) \\ u_1(t_1, t_0) & \text{otherwise} \end{array} \right. \tag{45}$$

with an arbitrary $\overline{u}_1(t_1, t_0)$ satisfying Lemma 2.

Existence:

- Existence with the modified utilities:

[11] Notice as well that in this application $\lim_{\theta_j \to 0} \inf u_j(t_j + \theta_j e^+, t_{-j}) = \lim_{\theta_j \to 0} \sup u_j(t_j + \theta_j e^+, t_{-j})$.

[12] The idea of this proof is analogous to D-M Theorem 5 a.

An equilibrium exists due to D-M Theorem 5* if $\widehat{u}_1(t_1,t_0)+\widehat{u}_0(t_1,t_0)$ is upper semi-continuous and $\widehat{u}_j(t_1,t_0)$ is weakly lower semi-continuous.

Upper semi-continuity of $\widehat{u}_1(t_1,t_0)+\widehat{u}_0(t_1,t_0)$:

If $(t_1,t_0)\notin A^*(j)$, then $u_j(.)$ is continuous and therefore also is the sum $\widehat{u}_1(t_1,t_0)+\widehat{u}_0(t_1,t_0)$. If $(t_1,t_0)\in A^*(j)$ then the sum is upper semi-continuous by construction (i.e. by (44) and (45)).

Weak lower semi-continuity of $\widehat{u}_j(t_1,t_0)$:

If $(t_1,t_0)\notin A^*(j)$, then $u_j(.)$ is continuous and therefore also is $\widehat{u}_j(t_1,t_0)$. Now if $(t_1,t_0)\in A^*(j)$:

Equation X (from the definition of weak lower semi-continuity) reformulated yields X'

$$\int_{B^{3-}}[\lim_{\theta_0\to 0}\inf \widehat{u}_j(t_j+\theta_0 e,t_{-j})dv(e)]+\int_{B^{3+}}[\lim_{\theta_0\to 0}\inf \widehat{u}_j(t_j+\theta_0 e,t_{-j})dv(e)]\geq \widehat{u}_j(t_j,t_{-j})$$

By (43) and (45) $\lim\limits_{\theta_1\to 0}\inf \widehat{u}_1(t_1+\theta_1 e^+,t_0)>\overline{u}_1(t_1,t_0)=\widehat{u}_1(t_1,t_0)$ for any $(t_1,t_0)\in A^*(1)$ (analogous for $j=0$) and therefore there exists a continuous measure $v(e)$ such that $\int_{B^{3+}}[\lim\limits_{\theta_0\to 0}\inf \widehat{u}_j(t_j+\theta_0 e,t_{-j})dv(e)]>\widehat{u}_j(t_j,t_{-j})$. Since $\widehat{u}_j(.)$ is bounded and arbitrary little mass can be put on any $e\in B^{3-}$, there exists a continuous measure $v(e)$ such that X' holds and therefore $\widehat{u}_j(.)$ is weakly lower semi-continuous.

Since $\widehat{u}_1(t_1,t_0)+\widehat{u}_0(t_1,t_0)$ is upper semi-continuous and $\widehat{u}_j(t_1,t_0)$ is weakly lower semi-continuous, the game $[(T_j,\widehat{u}_j);j=1,0]$ has a mixed strategy equilibrium $(\widehat{\sigma}_1,\widehat{\sigma}_0)$ due to Theorem 5* D-M.

- Existence in the original game:

Now it will be shown that $(\widehat{\sigma}_1,\widehat{\sigma}_0)$ is an equilibrium for the original game.

Choose $\widehat{t}_1$ with $\widehat{\sigma}_1(\widehat{t}_1)>0$. Then

$$\int \widehat{u}_1(\widehat{t}_1,t_0)d\widehat{\sigma}_0\geq \int \widehat{u}_1(t_1,t_0)d\widehat{\sigma}_0 \text{ for all } t_1\in T_1. \tag{46}$$

If $\sigma_0(\widehat{t}_0) > 0$ and if u_1 is discontinuous at $(\widehat{t}_1, \widehat{t}_0)$, then from (43), there exists t_1' close to $\widehat{t}_1$ such that $\int \widehat{u}_1(t_1', t_0)d\widehat{\sigma}_0 > \int \widehat{u}_1(t_1, t_0)d\widehat{\sigma}_0$, a contradiction of (46). Hence

$$\int \widehat{u}_1(\widehat{t}_1, t_0)d\widehat{\sigma}_0 = \int u_1(\widehat{t}_1, t_0)d\widehat{\sigma}_0. \tag{47}$$

But from (43) and (45), $\widehat{u}_1(t_1, t_0) \geq u_1(t_1, t_0)$ for all t. Therefore,

$$\int \widehat{u}_1(t_1, t_0)d\widehat{\sigma}_0 \geq \int u_1(t_1, t_0)d\widehat{\sigma}_0. \tag{48}$$

But (47) and (45) imply that

$$\int u_1(\widehat{t}_1, t_0)d\widehat{\sigma}_0 \geq \int u_1(t_1, t_0)d\widehat{\sigma}_0,$$

i.e. $\widehat{\sigma}_1$ is a best response to $\widehat{\sigma}_0$ in the original game. Analogously for $\widehat{\sigma}_0$.

¿From (ii) it follows that any existing equilibrium does not maximize the social surplus.

Q.E.D.

12 Appendix 3: general definitions

Definition 1 B^3 : *Surface of the unit-sphere in* R^3*, with the origin as its centre.*

Definition 2 B^{3-} : *At least one component of an element* $e = (e_1, e_2, e_3)$ *of* B^{3-} *is negative or zero.*

Definition 3 B^{3+} : $B^{3+} = B^3 \backslash B^{3-}$.

Definition 4 *Upper semi-continuity:*

A function $u_j : T \to R^1$ *is upper semi-continuous if for any sequence* $\{t^n\} \subseteq T$ *such that* $t^n \to t$, $\lim_{n\to\infty} \sup u_j(t^n) \leq u_j(t)$.

Definition 5 *Weakly lower semi-continuity:*

Let $e \in B^3$, and let $\theta_0 \in R^+$. Then $u_i(t_i, t_{-i})$ is weakly lower semi-continuous in t_j if for all $t_j \in A_j^*(j)$ there exists an absolutely continuous measure v on B^3 such that for all $t_{-j} \in A_{-j}^*(t_j)$ (equation X)

$$\int_{B^3} [\lim_{\theta_0 \to 0} \inf u_j(t_j + \theta_0 e, t_{-j}) dv(e)] \geq u_j(t_j, t_{-j}).$$

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