Committee preferences and information acquisition

BY Malin Arve and Claudine Desrieux

DISCUSSION PAPER

Institutt for foretaksøkonomi
Department of Business and Management Science

FOR 14/2023

ISSN: 2387-3000
September 2023

Committee preferences and information acquisition

Malin Arve* and Claudine Desrieux†

June 26, 2023

Abstract

We study committees whose task is to make a binary decision where the correct decision depends on the state of the world that is imperfectly known. Committee members can exert effort to learn about the true state of the world and their efforts are linked in a team production function. This allows to explore the externalities between the committee members' efforts in the search for the truth and the different interactions between them. We compare committees made up of neutral members (neutral committees) to committees including biased members (polarized committees). We show that polarized committees may be more efficient than neutral committees when members' efforts to acquire information are strategic substitutes, but not when efforts are strategic complements. Qualitatively, our results still hold when biased members have mixed preferences i.e., they have a bias for one decision outcome but also care about matching the decision to the true state of the world. Our results have implications for instance for the rules governing committees in international arbitration and allow us to better understand how the committee composition affects the committee's efficiency.

Keywords: Incentives, decision-making, committees, arbitration.
JEL Classification: D82, K41

*NHH Norwegian School of Economics, Helleveien 30, 5045 Bergen, Norway. E-mail: malin.arve@nhh.no. ORCID number: 0000-0002-7399-8284 (corresponding author). The author has no competiting interests related to this manuscript.

†Université Paris-Panthéon-Assas, CRED, F-75005 Paris, France. E-mail: claudine.desrieux@u-paris2.fr. ORCID number:0000-0003-1272-0841. The author has no competiting interests related to this manuscript.

1 Introduction

Many important decisions are taken by committees. An example is international arbitration, an often-used method of dispute resolution for commercial or investor-state conflicts. Arbitral tribunals generally consist of three members forming a committee to solve a dispute. An important characteristic of arbitration committees is the way arbitrators are selected. Most of the time, each party appoints one arbitrator, and a third member, who serves as President, is decided by mutual agreement or by the appointed co-arbitrators (Bjorklund et al., 2019). Although arbitrators should be neutral, with such an appointment rule, arbitrators are sometimes suspected of being biased towards the party who appoints them (Martinez, 2013). Motivated by this example, our goal is to determine whether the presence of pro-appointer or biased committee members impacts the efficiency of the decision-making process and, if so, in what way. To address this issue, we compare the efficiency of three-member committees when they include pro-appointer members to committes with only neutral members.

Statistics from the International Court of Arbitration of the International Chamber of Commerce (ICC), one of the most popular arbitral institutions, show that 930 arbitrators among the 1,301 arbitrators appointed in ICC arbitrations were selected by the parties (Brekoulakis, 2013).[1] The right of the parties to participate in the constitution of arbitral tribunals is considered by many legal scholars as "the very essence of arbitration" (Rau, 1997). Arbitrators are generally required to be independent and impartial (Gelinas, 2011).[2] Yet, as one practitioner puts it: "*in selecting his party appointed ar-*

[1]Only if parties fail to agree on the composition of the arbitral committee, the institution administering the arbitration procedure may take this right away and appoints the arbitrators. Blackaby (2015) (p.142) states that the arbitrators' appointment by institutions is "a sensible solution to the problem of constituting an arbitral tribunal (...) However, there may be difficulties when it comes to obtaining recognition and enforcement of an award made by a tribunal that has been established for the parties, rather than by the parties. The New York Convention, in Article V(1) (d), states that recognition and enforcement of an award may be refused on proof that the composition of the arbitral authority or the arbitral procedure was not in accordance with the agreement of the parties, or, failing such agreement, was not in accordance with the law of the country where the arbitration took place. Similarly, in France, an arbitration clause that would provide that 'if a dispute arises, one party will appoint all members of the tribunal' would most likely be an invalid arbitration clause. In its decision dated of 7 January 1991 (*Dutco v. BKMI and Siemens*), the French *Cour de Cassation* relies on the principle of equality of the parties in the appointment of arbitrators [which] is a matter of public policy."

[2]As an illustration, the previous IMF Chief Christine Lagarde was accused of negligence in overseeing an arbitration case with an impartial arbitrator, when she was Minister of Finance in France. Another case is the decision of the U.K. High Court to remove an arbitrator from a construction dispute in April 2016 (*Cofely Ltd v Bingham and Knowles Ltd*), because he may have been biased towards one of the parties involved. More broadly, arbitrators should have no significant financial or personal interest in one of the parties, or the outcome of the case. See the *IBA (International Bar Association) Guidelines on*

bitrator, [the counsel's] choice will be guided not primarily by an interest in finding a strictly impartial or neutral individual, but by the hope of employing one with qualities which tend to give him and his client the greatest assurance that their viewpoint will be understood, appreciated and, ultimately will prevail (...) strictly neutral panels are not what the disputants seek".[3] The question of arbitrators' neutrality is regularly debated. On the one hand, arbitrators are a close-knit community. Professional barriers to entry, notably the requirement of legal experience, and institutional codes of ethics regulate the conduct of individual arbitrators. Extreme decisions could also damage the reputation of an arbitrator.[4] On the other hand, because arbitrators compete for re-appointment, pro-appointer bias may develop in the hope of future nominations (Iossa, 2007; Martinez, 2013). Some arbitrators may also have the mistaken belief that they have an obligation to the party that appointed them (Martinez (2013)). Last, the temptation is high for any party to look for a supporter of one's situation rather than a neutral arbitrator. To avoid - or at least limit - the risk of pro-appointer bias, some legal scholars even suggest that an external authority could be in charge of arbitrators' appointment instead of the parties (Martinez, 2013; Brekoulakis, 2013). Our paper explores this question by investigating how incentives to search for truth are influenced by the appointment of neutral or pro-appointer arbitrators.

We consider committees whose goal is to make a binary decision. Our focus is on effort in the information gathering process and the precision of the associated outcome. To be more precise, in our environement each committee member can make a costly effort to learn about the truth, and these efforts are linked in a production function. This setting allows us to examine the different interactions between the committee members' efforts, namely complementarity or substituability. With such a framework, we compare two types of committees, polarized and neutral committees. For a three-member committee, a polarized committee means that each party to the conflict appoints a member defending its own interest.[5] The third member of the committee is neutral and prefers the *fair*

Conflicts of Interest in International Arbitration (October 2014) for lists of specific situations indicating whether they warrant disclosure or disqualification of an arbitrator.

[3] "Effective Selection of International Arbitrators in International Arbitration", James Wangelin, Mealey's International Arbitration Report, November 1999.

[4] In addition, arbitral institutions impose neutrality crieria. The article 14(1) of the International Centre for Investment Dispute (ICSID) Convention stipulates that all arbitrators must be "persons of high moral character and recognized competence in the fields of law, commerce, industry, finance, who may be relied upon to exercise independent judgment".

[5] In an extension to our basic model (section 4), we relax this assumption to consider committee members with *mixed preferences*, i.e. caring for both their viewpoint and the truth.

decision, i.e., wants to match the decision with the realized state of the world. In reality, this implies that he represents the pivotal member of the committee that in practice takes the final decision. On the other hand, a neutral committee is made up of three members looking for a fair decision. We explore the behavior of each member regarding the effort to learn about the true state of the world, taking into account that the effort of different committee members can be either strategic complements or substitutes. Note that our focus is on the committee members' efforts to learn about the true state of the world. Naturally, a final decision depends on many other parameters (as the advocates' arguments and own efforts, the quality of the proof,..), but our goal here is to isolate the impact of the jury's composition on the efforts to search for the truth. In our leading example, illustrations of such efforts are the determination of the appropriate legal rule (or case-law) to solve the case, efforts to determine each party's responsability, or to disover "the spirit" of an initial agreement between the parties.

Our results show that all members exert effort in neutral committees. In polarized committees, only one member (the neutral one) exerts effort and the two biased members do not exert any effort.[6] When efforts are strategic complements, neutral committees perform better in terms of matching the decision with the true state of the world. There is a positive externality between the members' efforts which enhances the incentives to efforts in neutral committees. This effect does not appear in a polarized committee since only one member exerts effort. In fact, when efforts are strategic substitutes, there is a negative externality (caused by free-riding) between the members' efforts. Polarized committees may then perform better when the degree of strategic substituability is high because they do not suffer from a free-riding effect as in neutral committees. In the example of arbitration committees, this result is an important contribution to current discussions on the procedures governing arbitrators' appointment. Some people recommend that arbitrators should be selected by a neutral body to be more credible and efficient (Paulsson, 2010), some others defend the right of the parties to appoint the arbitrators (Brower, 2013). Focusing on the efforts of the committee members to look for the truth, we show that the right for the parties to choose their arbitrators does not always lead to lower incentives to find the truth, even in the worst scenario (i.e. when this right leads to the choice of biased arbitrators).

In our model, we assume that members of polarized committees exhibit a bias towards one decision outcome. In our example of arbiration committees, in addition to the

[6]In the extension with mixed preferences, this result still holds qualitatively: Biased members exert less effort than neutral committee members.

already mentionned debates on arbitrators' appointment principles supporting this argument, some evidence can be empirically detected. Bloom and Cavanagh (1986) show that parties seem to have a preference for arbitrators that have previously favored their side. Posner and de Figueiredo (2005) as well as Donaubauer et al. (2018) give evidence that judges may favor whomever appointed them. Using survey experiments with arbitration experts around the world, Puig and Strezhnev (2017) show that professional arbitrators indeed suffer from affiliation effects, a cognitive predisposition to favor the appointing party. More generally, several empirical papers show evidence of arbitrators' bias in different fields, such as securities brokerage dispute arbitration (Choi, 2010) employment arbitration (Sherwyn et al., 2005), internet domain name dispute resolution (Geist, 2002) and international investment (Waibel and Wu, 2017).

This paper is related to several strands of the economics literature. First, while the theoretical literature on collective decision-making is large, no paper has compared information acquisition by polarized and neutral committees under a majority voting rule, when efforts can be either complements or substitutes. By choosing a team production function to link the efforts of the committee members, our model allows to explore externalities in information acquisition in a setting where several members exert effort that influences a public signal. The paper thus contributes to a deeper examination of the role of the individual in collective decision-making by focusing on how the collective decision-making process is influenced by biased member. We are different from Ben-Yashar et al. (2012) who study specialization of committee member's expertize. However, the insights from their paper might justify why efforts are complements or substitutes.

The seminal paper of Condorcet (1785) shows that when voters are more likely than not to know the true state of the world, large electorates will choose the right decision under majority voting. Following this article, many papers have investigated collective decision-making, focusing on different topics such as voting rules, communication strategies or jury sizes (Li, 2001; Levy, 2007; Feddersen and Pesendorfer, 1996, 1997, 1998; Mukhopadhaya, 2003; Persico, 2004; Gerardi and Yariv, 2007, 2008; Schulte, 2012). Most of these papers consider jury members with homogenous preferences. Gruner and Kiel (2004) broadens the scope of the literature by introducing individuals whose desired outcomes are correlated but not identical. However this part of the literature does not allow for polarized committees with members having opposing preferences. Heterogeneous preferences of committee members have been progressively introduced in the theoretical literature. Schulte (2010) uses this assumption to investigate information aggregation in committees. Cai (2009) develops a model of committee size based on costly participation

and heterogeneous preferences. We differ from these papers by focusing on how heterogeneous preferences influence the intensity of the efforts to look for the truth.[7] Oliveros (2013) considers voters with asymmetric information and preferences (that vary both in terms of ideology and intensity). His focus is on how more information leads to more abstention. Chan et al. (2018) propose a dynamic model of sequential information acquisition by a heterogeneous committee. However, they mainly discuss the impacts of various voting rules in such a setting: their results show that more diverse preferences, more patient members, or more unanimous decision voting rules lead to lengthier deliberation and more accurate decisions. A closely related paper to ours is Zhao (2018). He investigates how the composition and voting rule of a decision-making committee affect the incentives for its members to acquire information (and thus the quality of its collective decision), and characterize the optimal committee design when the designer can choose both the members and the voting rule. Zhao finds that for a given voting rule, a more polarized committee acquires more information in equilibrium. This comes from the fact that the difference in preferences is related to how large the utility loss from false positives and negatives are, and someone who suffers a lot from false positives incurs relatively low losses from false negatives, and vice versa, but they all obtain the same utility from a "correct" decision. Our focus is not on polarization with regards to what is worse between a false negative and a false positive, but polarization in terms of disagreement as to what the best decision is and how this affects incentives to acquire information. Finally, our paper focuses on the composition of committees not the optimal decision-making procedure. We therefore take majority voting, currently in use in arbitration, as given and do not explore what a hypothetical optimal voting mechanism would look like. In that sense, our contribution is more positive than normative.

Our paper is organized as follows. Our model is described in Section 2 and our main results can be found in Section 3. It establishes the committee members' incentives to exert effort under polarized committees and neutral committees and compares these outcomes. Section 4 explores the performance of polarized and neutral committees when biased members in polarized committees having mixed preferences, valuing both their appointer's viewpoint and the truth. Section 5 concludes.

[7] We could also include here the seminal contribution of Dewatripont and Tirole (1999). They look at competition in information creation and establish the conditions under which advocacy is superior to non-partisanship. This article has strong consequences for the comparison between adversarial and inquisitorial systems, but does not fit to arbitral committees, mainly made up of three members for each decision.

2 The model

A committee has to make a decision in favor of one of two parties. In our arbitration example, this implies that a conflict between two parties arises and the parties have chosen to resolve the issue using arbitration. Thus, a collective decision $x \in \{a, b\}$ has to be made by majority voting without abstension in a committee consisting of three members. A decision $x = a$ represents a decision in favor of party A and $x = b$ in favor of party B.[8] There are two possible states of nature, $\omega \in \{A, B\}$. In state $\omega = A$, party A is correct and in state $\omega = B$, party B is correct. There is uncertainty about the realization of the state of the world. Ex ante both states are equally likely[9].

Timing. The timing of the game is as follows:

1. Nature chooses the state of the world.
2. Each committee member i decides how much effort e_i to exert on obtaining more information about the state of the world.
3. The committee gets a signal which is correlated with the efforts exerted by the members. This signal is observed by all members.
4. Committee members vote for their preferred decision. The majority rule is applied to determine the final decision and payoffs are realized.

Information technology. We assume that using the information technology is costly. The information technology is such that each committee member can exert costly effort $e_i \geq 0$ to learn about the state of the world. The cost of effort for committee member i is $c(e_i) = \frac{e_i^2}{2}$, i.e. this cost is increasing and convex ($c'(e_i) \geq 0$ and $c''(e_i) > 0$).

Following the committee members' efforts, the committee receives a signal $\sigma \in \{\alpha, \beta\}$, which is correlated with the true state of the world:

$$prob\{\sigma = \alpha | \omega = A\} = prob\{\sigma = \beta | \omega = B\} = q(e_1, e_2, e_3), \frac{1}{2} \leq q(e_1, e_2, e_3) < 1.$$

This means that the quality of the signal σ depends on the efforts made by the committee members, but the signal is always imperfectly informative about the state of the world.

[8] For instance, the conflict could be about which disputant will pay for accidental damages or it could involve the allocation of a valuable resource in a commercial dispute.

[9] A generalization to an ex ante probability of state A equal to $\frac{1}{2} + \Delta$, where $\Delta \in (-\frac{1}{2}, -\frac{1}{2})$, yields qualitiatively the same results and can be resolved in the same way as our extension in Section 4.

We assume that more effort implies a better signal in the sense that there is a higher correlation between the true state of the world and the signal: $\frac{\partial q(e_i,e_j,e_k)}{\partial e_i} > 0$ where $e \equiv (e_1, e_2, e_3)$. Furthermore, we assume that this effect is decreasing as own effort increases and that each member's role in the committee is symmetric: $\frac{\partial^2 q(e_i,e_j,e_k)}{\partial e_i^2} \leq 0$ where $e \equiv (e_1, e_2, e_3)$ and $q(e_i, e_j, e_k) = q(e_j, e_i, e_k) = q(e_k, e_i, e_j) = q(e_k, e_j, e_i)$. For instance, in our leading example the signal could be the relevant piece of evidence that allows to determine the true state of the world. Efforts can be time spent to learn about the case, or to look for past judicial decisions. Because they are expert in different fields or because the information to check is very important, all efforts contribute to the precision of the signal.

We have chosen to work with a general function $q(.)$ as it allows us to study effort both in environments with strategic complementarity and strategic substitutability (Bulow et al., 1985). In fact, the function can be split into two regions:

- $\frac{\partial^2 q(e_i,e_j,e_k)}{\partial e_i \partial e_j} > 0$: efforts are strategic complements, meaning that other members' effort reinforces the effect of the effort of member i;
- $\frac{\partial^2 q(e_i,e_j,e_k)}{\partial e_i \partial e_j} < 0$: efforts are strategic substitutes, meaning that other members' effort reduces the effect of the effort of member i.

In arbitration, these two types of efforts can be indeed considered. For instance, some conflicts call for multi-dimensional investigations. As an illustration, in conflicts about contracts involving engineers, firms and funders, several types of investigations need to be undertaken to have a complete view of the problem (investigations about the appropriate regulation to apply, the technical problem, the contractual design, the financial vehicle,...). For these conflicts, the individual efforts to search for the truth are likely to be strategic complements. Each committee member may focus on one dimension of the problem, and a better understanding of the technical part thanks to the effort of one committee member allows a better understanding of the chosen financial vehicle by another member. Efforts may then exhibit positive externalities. On the other hand, other conflicts call for general investigation in a precise field of law. For instance, a conflict on labor law needs deep investigation in this field of law. Efforts exerted by committee members are likely to be strategic substitutes. Only one committee member needs to investigate a precise regulation to get the right decision, and this is likely to create free-riding among neutral committee members, i.e. a negative externality.

Notice that we focus on the cooperative nature of the work within the committee and not on the effort of advocates for each side to exert effort to argue their case in front of

a committee or jury. Our analysis takes the latter as given and studies the incentives of the former to search for and/or evaluate available information.

Preferences and committee types. Throughout the analysis we assume a certain degree of homogeneity in preferences, which ensures that the desirability of decision $x = a$ weakly increases in the probability that the state is $\omega = A$ for each committee member. This is formally stated in the following assumption, identical to Assumption 1 in Schulte (2010).

Assumption 1. $u_i(a, A) + u_i(b, B) - u_i(a, B) - u_i(b, A) \geq 0, \forall i \in \{1, 2, 3\}$.

We consider two types of committee members; neutral and polarized. A neutral committee member would prefer to match the decision to the true state of the world whereas a polarized committee member prefers a given decision x regardless of the state w. In its most simple form this implies that a neutral committee member i's preferences are defined as follows:

$$u_i(a, A) = u_i(b, B) = 1,\ u_i(a, B) = u_i(b, A) = 0.$$

A polarized committee member i's preferences depend on the direction of his bias. If he prefers decision $x = A$, his preferences can be written as:

$$u_i(a, A) = u_i(a, B) = 1,\ u_i(b, A) = u_i(b, B) = 0.$$

Symmetrically, if he prefers $x = b$ then the preferences are described as follows:

$$u_i(b, A) = u_i(b, B) = 1,\ u_i(a, A) = u_i(a, B) = 0.$$

We define a neutral committee as one with only neutral members. Similarily a polarized committee is one in which committee member 1 prefers to match the state w and the decision x, i.e., he prefers the "correct" decision and is neutral. However, committee member 2 always prefers $x = a$ regardless of the probability that A is the true state. Likewise, committee member 3 always prefers $x = b$. Preferences are common knowledge and we do not allow for transfer schemes.

In this model, it is only the difference between the utility from the two possible decisions in state w that matters and normalizing preferences to $\{0, 1\}$ is without loss of

generality for neutral committee members. However, one could of course argue that biased arbitrators also, to some degree, value the truth. In Section 4, we extend our model to allow for such *mixed* preferences where the utility of biased members is not zero when the "correct" decision (defined as the one where the decision matches the state of the world) is made and show that our result still holds.

Equilibrium. Our equilibrium concept is (undominated) subgame-perfect Nash equilibrium and we focus the analysis on pure strategies.

In the next section we analyze the outcome of the decision-making stage given a signal outcome. Then we determine the incentives of each committee member to exert efforts in the two types of committees and we finally deduce the signal's quality (i.e. the value of $q(e_1, e_2, e_3)$) to compare the efficiency of each type of committee.

3 Main result

3.1 Decision stage

Let p denote the probability that the committee assigns to the state of the world $\omega = A$ given the information available to them. A committee member i prefers the implementation of a rather than b if and only if

$$p > \frac{u_i(b,B) - u_i(a,B)}{u_i(a,A) + u_i(b,B) - u_i(a,B) - u_i(b,A)}.$$

Notice that even though the committee members have access to the same information and have the same beliefs about the state of the world, their threshold for preferring action $x = a$ varies across their preferences. This threshold above which committee member i prefers decision $x = a$ is called the *threshold of doubt* in the literature (Feddersen and Pesendorfer, 1998; Schulte, 2010).

Given Assumption 1, a threshold below 0 means that $u_i(b,B) - u_i(a,B) < 0$. In other words, the committee member i always prefers decision a regardless of whether the true state of the world is A or B. Symmetrically, a threshold above 1 means that committee member i always prefers decision b regardless of the true state of world. It is only when the threshold is between 0 and 1 that agent i is willing to make his decision (a or b) conditional on the probability that the true state of the world is A.

In a neutral committee, all members have the same threshold of doubt and the committee always agrees on what the best decision is. Following a signal $\sigma = \alpha$ decision $x = a$ is made unanimously and following $\sigma = \beta$ decision $x = b$ is chosen. This follows straightforwardly from the literature and is summarized in the following lemma.

Lemma 1. *Following a signal $\sigma \in \{\alpha, \beta\}$, a neutral committee unanimously votes for $x = a$ when $\sigma = \alpha$ and $x = b$ when $\sigma = \beta$.*

In a polarized committee, member 2 has a threshold of doubt below 0 and will always vote for decision $x = a$. Symmetrically, member 3 has a threshold of doubt above 1 and will always vote for decision $x = b$. Therefore, in a polarized committee's vote for what decision to choose, committee member 1 is always pivotal and determines the final outcome x after having observed the signal σ and updated his beliefs about the state of the world. If $\sigma = \alpha$, the decision will be $x = a$ as we are above member 1's threshold of doubt and $x = b$ will be voted if $\sigma = \beta$.

Lemma 2. *In a polarized committee, member 2 (resp. 3) votes for $x = a$ (resp. $x = b$) regardless of the signal realization σ. The neutral member 1 is always pivotal and votes for $x = a$ when $\sigma = \alpha$ and $x = b$ when $\sigma = \beta$.*

3.2 Information acquisition under neutral committees

In a neutral committee, each committee member chooses effort to maximize his expected utility:

$$\begin{aligned} &\max_{e_i} \frac{1}{2}\left[q(e)u_i(a,A) + (1-q(e))u_i(b,A) + (1-q(e))u_i(a,B) + q(e)u_i(b,B)\right] - c(e_i) \\ \Leftrightarrow &\max_{e_i} q(e) - c(e_i). \end{aligned}$$

The first-order condition can be written as:

$$\frac{\partial q(e_i, e_j, e_k)}{\partial e_i} = e_i \tag{1}$$

Let us note that $e_i \geq 0$ as $\frac{\partial q(e_i,e_j,e_k)}{\partial e_i} > 0$. Because arbitrators are symmetric in terms of the value of their effort in the production function (and thus first-order condition), they exert effort $e_1 = e_2 = e_3 = e^N$ such that

$$\frac{\partial q(e^N, e^N, e^N)}{\partial e} = e^N. \tag{2}$$

These results are summarized in the following lemma.[10]

Lemma 3. *In a neutral committee, all committee members exert the same level of effort. This effort level is given by (2) which implies that the probability of obtaining a correct signal is* $q^N \equiv q(e^N, e^N, e^N)$.

3.3 Information acquisition under polarized committees

As described in Lemma 2, committee members 2 and 3 vote for the same candidate decision regardless of the outcome of the signal. It is therefore straightforward to conclude that they have no incentive to put effort into improving the signal (since $q(.)$ does not influence their expected utility). Formally, this is because for $i = 2, 3$, their choice solves

$$\max_{e_i} \frac{1}{2} - c(e_i).$$

We therefore have $e_2 = e_3 = 0$. This holds regardless of what level of effort is chosen by the other committee members.[11]

Committee member 1 makes his choice in order to maximize his own expected utility from the decision taking into account $e_2 = e_3 = 0$. Formally,

$$\max_{e_i} q(e) - c(e_i).$$

Taking the first-order condition implies that, in a polarized committee, committee member 1 chooses an effort level e_1^P that equalizes his marginal benefit from an improved signal

[10] As $\frac{\partial^2 q(e_i,e_j,e_k)}{\partial e_i^2} < 0$ by assumption, the existence of this equilibrium is ensured, and along with the assumption $\frac{\partial^2 q(e_i,e_j,e_k)}{\partial e_i^2} < 1 - |\frac{\partial^2 q(e_i,e_j,e_k)}{\partial e_i \partial e_j}|$, it also ensures diagonally strict concavity of the payoff function which gives uniqueness of equilibrium (Rosen (1965)).
In the case of multiple equilibria, because of our symmetric production function, we conjecture that if the committee were to coordinate on an asymmetric equilibrium that is the most effective, this would be the same outcome as under a polarized committee where one member only exerts effort. However, this implies that one member accepts to pay the cost of effort while the others don't have to pay anything and coordination in this setting would be complicated in practice.

[11] Recall that we consider here positive efforts $e_i \geq 0$. A more general setting would allow for negative efforts that could be here strategies to reduce the quality of the signal. Such a generalization would not change our result. Since the two states of the world are both equally likely ex ante, the expected utility from effort of a biased member ($\frac{1}{2}$) is independent of the level of effort e_i. The biased members have then no incentive to make any type of effort.

and the marginal cost of effort.[12] This first-order condition writes:

$$\frac{\partial q(e_1, e_2, e_3)}{\partial e_1} = e_1 \tag{3}$$

Replacing e_1, e_2 and e_3 by their values, the probability to get the correct signal under a polarized committee when the neutral committee member exerts effort is then:

$$q^P = q(e_1^P, 0, 0) \tag{4}$$

These results are summarized in the following lemma.

Lemma 4. *In a polarized committee, only the neutral member 1 exerts effort. His effort level is given by (3) which implies that the probability of obtaining a correct signal is given by (4).*

3.4 Comparison

Let us first compare the individual effort made by a neutral member in each type of committee and study how e_i is influenced by the others' efforts. Differentiation the first-order condition of neutral arbitrator with respect to e_j yields:

$$\frac{\partial e_i}{\partial e_j} = \left[1 - \frac{\partial^2 q(e_i, e_j, e_k)}{\partial e_i^2}\right]^{-1} \frac{\partial^2 q(e_i, e_j, e_k)}{\partial e_i \partial e_j}. \tag{5}$$

Since q is concave in e_i, the first bracket is always positive and we can thus distinguish two cases; the case when efforts are strategic complements and the case when efforts are strategic subsitutes. This is summarized in the following lemma.

Lemma 5. *Effort of a neutral member is higher in a neutral committee if and only if efforts are strategic complements.*

In the case when efforts are strategic complements, if one introduces more nonzero input factors, these will reinforce each other in the signal-generating process. This increases

[12]Note that a polarized committee is not generally comparable to a single.member committee. Because the two other biased members are involved in the committee, the effort of the neutral member is only one of three inputs in the final effort production function, as equation (3) illustrates. It is as if the presence of biased members (who refuse to exert efforts) would limit the collective action leading to the collective effort. Instead, in a single-member committee, there is no longer a collective dimension to reach the final effort (i.e. the single agent's effort would be the only input into the effort production function).

the individual incentives to exert effort. The neutral committee member (member 1) exerts more effort when his peers also exert effort. There is then a *positive externality* from having active members in the committe (i.e., members making strictly positive efforts). With only one input factor (the polarized members never provide any effort), this positive effect disappears. In terms of individual effort of neutral members, it is therefore preferable to be in the case with three *active* committee members (i.e., the neutral committee) when efforts are strategic complements. However, if efforts of the committee members are strategic substitutes, then one member's effort reduces the incentives of the other members. There is then a *negative externality* from having active members in the committee as this generates *free-riding* and lower incentives to exert efforts. In this case, it is therefore better to have only one member exerting a non-zero effort: polarized committees perform better than neutral ones in terms of individual effort of neutral members.

Notice that our result is driven by the externality between committee members for a fixed size of the committee. The result is thus different, but complementary, to the literature that studies the effect of jury size (see for instance, Mukhopadhaya (2003)).

To sum up, the number of committee members exerting a non-zero level of effort varies across the two types of committees, and the result on individual effort has fundamental implication on signal precision (as measured by the probability of obtaining a correct signal). This is formalized in the next Proposition.

Proposition 1. *If efforts are strategic complements, neutral committees always outperform polarized committes in terms of signal precision:* $q^N > q^P$.
If efforts are strategic subsitutes, polarized committees outperform neutral committees if and only if the degree of strategic substitutability is sufficiently strong, i.e.

$$\int_0^{e^N}\int_0^{e^N}\frac{\partial^2 q(x,y,e^N)}{\partial e_1 \partial e_2}dxdy + \int_{e^P}^{e^N}\frac{\partial q(e^N,x,0)}{\partial e_2}dx + \int_0^{e^N}\frac{\partial q(e^N,x,0)}{\partial e_2}dx + \int_0^{e^N}\frac{\partial q(e^P,x,0)}{\partial e_2}dx \quad < 0. \tag{6}$$

The proof of Proposition 1 can be found in Appendix A.

A more detailed value of equation (6) is provided for two examples at the end of the section. However, a brief clarification of equation (6) in the general case is in order before we interpret the results in Proposition 1. The first-term measures the degree of strategic subsitutability/complementarity. It is negative if efforts are strategic substitutes and positive if efforts are strategic complements. The second term measures the difference in

impact of effort by an additional member in a neutral committee and a biased committee. If efforts are strategic complements, the effort exerted by an individual member is higher in the neutral committee and this term is negative. However, if efforts are strategic substitutes, this term is negative as $e^P > e^N$. The two last terms measure the impact of effort by an additional member. These two terms are always positive, as more effort always gives a more precise signal.

When efforts are strategic complements, Proposition 1 states that a neutral committee is always more efficient than a polarized one. This follows almost directly from the insights on individual level effort. A neutral member of a committee exerts higher effort in a neutral committee than in a polarized committee since $\frac{\partial^2 q(e_i,e_j,e_k)}{\partial e_i \partial e_j} > 0$: the others' effort reinforces the individual effort. It is thus immediate that when efforts are strategic complements, $q^N > q^P$. Technically, this can also be seen from equation (6), which holds for both strategic complements and substitutes. For strategic complements all the terms are positive and the condition is therefore never verified.

On the other hand, when efforts are strategic substitutes, free-riding among active members leads to lower individual effort in neutral committees. If efforts are sufficiently strong strategic substitutes (so that (6) holds), then the reverse (but symmetric) reasoning compared to strategic complements applies. Even if three members exert effort in a neutral committee, they suffer from free-riding and in terms of increased signal precision having only one active member exerting effort, i.e., a polarized committee, would be preferable. However, when efforts are only weak strategic substitutes, then having three active members who suffer from free-riding and reduce their effort is still better than having only one active committee member even if that member exerts more effort.

Technically, this can be seen from equation (6) which states when $q^N < q^P$. This is true whenever the cross-derivative is sufficiently negative so that the two first terms in absolute value are greater than the two last terms. It is thus not enough for efforts to be strategic substitutes. This is because, for low degrees of strategic substitutability, the impact that an additional, albeit lower, effort by an active (neutral) member would still have a sufficiently important overall impact on the signal precision $q()$ for neutral committees to outperform polarized ones.

To illustrate our results and the role of the degree of substitutability/complementarity, we propose two examples illustrating that polarized committees outperform neutral ones when efforts are *sufficiently* strategic substitutes.

Example 1: Suppose that $q(e_1, e_2, e_3) = \frac{1}{2} + \frac{1}{10}(e_1 + e_2 + e_3) + s(e_1e_2 + e_1e_3 + e_2e_3)$,

with $-1 < s < 2/5$. Then $e^N = \frac{1}{10(1-2s)}$ and $e^P = \frac{1}{10}$. Using equation (6), we get that $q^N < q^P$ iff $s < \hat{s} = \frac{1-\sqrt{33}}{8}$.

Example 2: Suppose that $q(e_1, e_2, e_3) = \frac{1}{2} + \frac{1}{3}(e_1 + e_2 + e_3) + se_1e_2e_3$, with $s < 1/4$. Then e^N solves $\frac{1}{3} + s(e^N)^2 = 1$ and $e^P = \frac{1}{3}$. For $s < 0$, $e^N = \frac{1-\sqrt{1-\frac{4}{3}s}}{2s}$ and using equation (6) we get that $q^N < q^P$ iff $s < \hat{s} = -3(2 + \sqrt{2})$.

In both of these examples, s captures the degree of substitutability/complementarity. A positive s implies that efforts are strategic complements. If one committee member exerts more effort then that reinforces the impact of the other committee members' effort, and the more so the higher the value of s. A negative s implies that efforts are strategic substitutes and that one committee member's effort reduces the value of the other members' effort.[13]

Going back to Proposition 1, one could easily argue that our model is oversimplified. However, this is done in order to convey the result in its most simple form. In practice, a too strong member bias could undercut his/her credibility in the long run, so that committee members could balance both their viewpoint and their wish to contribute to the truth. In the next section we show that our result is robust to the introduction of such *mixed preferences*.

4 Committee members with mixed preferences

In Section 3, we used simplified utility functions: the committee members are either entirely satisfied or dissatisfied with a decision in a given state of the world, i.e., their utility is either 0 or 1. However, in polarized committees, committee members may have *mixed preferences*, i.e. value both (i) the appropriate decision in the corresponding state of the world (*truth*) even if it is not their personal or political viewpoint, and (ii) their viewpoint even if it is not the appropriate decision (*bias*). In other words, they may want their viewpoint to prevail but still get some satisfaction from the other party's victory if it corresponds to the correct state of the world. In this subsection, we extend the results from the basic model to an environment where biased members have these mixed preferences.

[13] In the examples a also need to be small enough so that $q < 1$, but this is a technical assumption required for q to have the properties of a probability function and is unrelated to the question of strategic substitutes/complements.

Utilities. We denote $\gamma_B \in (0,1)$ (where B stands for *biased*) the committee member's utility when the decision made by the committee is that of his personal/political point of view in the "wrong" state of the world, and $\gamma_T \in (0,1)$ (where T stands for *truth*) the committee member's utility level when the correct decision is made by the committee. The utilities of the committee members are then as follows:

$$\begin{aligned}
&u_1(a,A) = u_1(b,B) = 1,\ u_1(a,B) = u_1(b,A) = 0,\\
&u_2(a,A) = 1, u_2(a,B) = \gamma_B,\ u_2(b,A) = 0, u_2(b,B) = \gamma_T,\\
&u_3(b,A) = \gamma_B, u_3(b,B) = 1,\ u_3(a,A) = \gamma_T, u_3(a,B) = 0.
\end{aligned}$$

where $u_1(.)$ is the utility of a neutral committee member, $u_2(.)$ is the utility of the committee member with a private preference for A, and $u_3(.)$ is the utility of the committee member prefering B.

Since neutral committee members keep the same utility functions as in Section 2, the analysis and results in this case are the same as the ones in Subsection 3.2.

For the polarized committee, the changes in the utility functions imply that we need to check whether the biased committee members have an incentive to exert effort or not. Recall that a committee member only exerts effort if the threshold of doubt is between zero and one. Applying the mixed preferences, the threshold of doubt for:

- a biased committee member in favor of decision $x = a$ becomes $\frac{\gamma_T - \gamma_B}{1+\gamma_T-\gamma_B}$,
- a biased committee member in favor of decision $x = b$ becomes $\frac{1}{1+\gamma_T-\gamma_B}$.

For the biased member in favor of $x = a$, whenever $\gamma_T \leq \gamma_B$, his threshold becomes negative: the biased committee members exert no effort, so that his optimal effort is equal to zero. His preference for the truth (γ_T) is too weak relative to his bias in favor of his appointer (γ_B), so that supporting the cost of effort is not profitable for him. The cost of exerting effort is worth being paid only if $\gamma_T > \gamma_B$. In this case, the threshold of doubt of a biased committee member is between zero and one. His final decision then depends both on his bias (γ_B), his preference for truth (γ_T) and the precision of the signal (given by the probability q^P).

Similarly, for the biased member in favor of $x = b$, whenever $\gamma_T \leq \gamma_B$, his threshold becomes superior to one so that he does not exert any effort, as his taste for the truth is too weak. Efforts are exerted only when $\gamma_T > \gamma_B$.

In what follows, we distinguish between these two cases that we call weak and strong

preferences for the truth.

Definitions. We say that committee members have *weak preferences for the truth* when $\gamma_T \leq \gamma_B$. Committee members have *strong preferences for the truth* when $\gamma_T > \gamma_B$.

Equilibrium under weak preferences for the truth. In this case, the threshold of doubt as defined in Section 3.1 is still such that biased comittee members have no incentive to exert effort. Therefore, since only the neutral committee member exerts a nonzero effort, the probability to obtain a correct signal is the same as the one found in Subsection 3.3 (equation (4)).

Equilibrium under strong preferences for the truth. In this case, all thresholds of doubts are between 0 and 1, and all committee members maximize their non-trivial utility functions.

To keep the model tractable we focus on the probability function for obtaining the correct signal presented in example 1 above;

$$q(e_1, e_2, e_3) = \frac{1}{2} + a(e_1 + e_2 + e_3) + s(e_1e_2 + e_1e_3 + e_2e_3).$$

The neutral committee member (member 1) then maximizes:

$$\max_{e_1} q(e_1, e_2, e_3) - c(e_1).$$

The first-order condition becomes $\frac{\partial q(e_1,e_2,e_3)}{\partial e_1} = e_1$.
Each polarized committee member $j \in \{2, 3\}$ maximizes:

$$\max_{e_j} \frac{[1 - \gamma_B + \gamma_T]}{2} q(e_1, e_j, e_k) - c(e_j).$$

The first-order condition of a polarized committee member is then $\frac{[1-\gamma_B+\gamma_T]}{2} \frac{\partial q(e_1,e_j,e_k)}{\partial e_j} = e_j$.
Solving for the equilibrium levels of effort we obtain

$$e_1^P = \frac{a(1 + \Gamma s)}{1 - \Gamma s(1 + 2s)} \text{ and } e_j^P = \frac{\Gamma a(1 + \Gamma s)}{1 - \Gamma s(1 + 2s)} \tag{7}$$

where $\Gamma = \frac{1-\gamma_B+\gamma_T}{2} \in (0, 1)$. Notice that the effort exerted by a biased committee member

is then lower than the effort made by the neutral member in a polarized committee. It is due to the fact that the arbitrator has a trade-off between increasing his effort to get utility from the truth and decreasing it because of his bias.

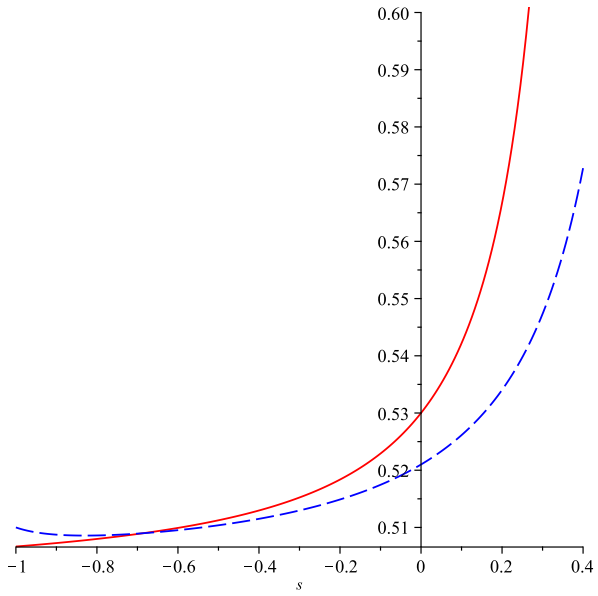

Figure 1: Signal precision in a neutral committee (solid red) vs polarized committee (dashed blue), for Γ=0.55.

Figure 1 illustrates that Proposition 1 remains true also for strong preferences for the truth, but with a lower threshold[14], when there are strong preferences for the truth.

With strategic substitutes and mixed preferences of biased members, a polarized committee outperforms a neutral one when efforts are strongly substitutes. The result is also stronger compared to the case where biased members have full polarized preferences (described in Section 4) in that output precision is higher with mixed preferences. Both the polarized and the neutral committees suffer from the negative externality caused by the others' effort, but the impact of this externality is stronger on the neutral committee because efforts are higher: efforts are driven by full preferences for truth. When efforts are strongly substitutes, this sharply reduces the global performance of neutral committees while polarized committees are affected to a lower extent because the individual efforts of biased members are lower.

Proposition 2. *In the specific model with mixed preferences of biased members:*

- *With weak preferences for the truth ($\gamma_T \leq \gamma_B$), polarized committees outperform neutral ones ($q^P > q^N$) if and only if efforts are strategic substitutes and the degree of strategic substitutability is sufficiently strong, i.e. $s < \tilde{s}$ with $\tilde{s}$ such that:*

$$\int_0^{e^N}\int_0^{e^N} \frac{\partial^2 q(x,y,e^N)}{\partial e_1 \partial e_2} dxdy + \int_{e^P}^{e^N} \frac{\partial q(e^N,x,0)}{\partial e_2} dx \\ \int_0^{e^N} \frac{\partial q(e^N,x,0)}{\partial e_2} dx + \int_0^{e^N} \frac{\partial q(e^P,x,0)}{\partial e_2} dx \quad < 0. \tag{8}$$

- *With strong preferences for the truth ($\gamma_T > \gamma_B$), polarized committees outperform neutral ones ($q^P > q^N$) if and only if efforts are strategic substitutes and the degree of strategic substitutability is sufficiently strong. Furthermore the threshold $\hat{s}$ below which polarized committees outperform neutral ones is lower than under with weak preference for the truth, i.e. $\hat{s} < \tilde{s}$.*

5 Conclusion

We investigate the incentives to exert effort within decision-making committees having to solve a conflict. Such committees are common in for instance dispute resolution mechanisms such as international arbitration. Focusing on three-member committees, we have

[14]The threshold reduces from -0.59 to -0.69.

compared the incentives to exert effort to learn the truth of two types of committees, i.e. neutral committees (made up of neutral members) and polarized committees (made up of two biased members and one neutral member). In our leading example, such efforts are for instance the search for the appropriate legal arguments or case-law, the understanding of the context of the dispute, etc. Because committee members' interaction can take many forms, we allow for different types of efforts that can be either strategic substitutes or strategic complements. Our originality is to consider a setup where information acquisition depends on a production function in which all members can contribute through individual efforts. This allows us to explore externalities between the committee members' efforts in the search for the truth and the different interactions that can appear between committee members.

Our results show that neutral committees perform better than polarized committees when efforts are strategic complements. When efforts are strategic substitutes, efforts have a negative impact on the other members' efforts, which leads to free-riding. In neutral committees, all members exert efforts to look for the truth, so that this type of committee strongly suffers from free-riding. On the opposite, in polarized committees, only one member exerts effort, so that there is no free-riding. The performance of this committee is then higher when the degree of strategic substituability is sufficiently strong to damage the performance of neutral committees enough. When we allow for mixed preferences of biased members (who get utility from both their appointer's interests and the truth), they may get some incentives to learn for the truth. However, our result still holds for stronger level of strategic substituability: the active performance of the three active neutral members in neutral committees suffers greatly from free-riding and underperforms compared to a polarized committee.

Our findings have implications for the appointment rules of arbitral committees. These appointment rules are quite debated. As an illustration, in October 2016, Belgium refused to sign a key trade agreement between the EU and Canada, which had been in the pipeline for seven years. One reason of Belgium's opposition was the introduction of arbitration (as an alternative to the court system) for settling disputes between foreign investors and governments. It was feared that the appointment rules of arbitrators could contradict the right to an independent and impartial judiciary, and Belgium got the right to ask the European Court of Justice to determine whether a system of investor-state tribunals were compatible with EU law. In parallel, alternative appointment rules for arbitrators were explored. In the light of this example, our paper provides conditions under which pro-appointer bias may be beneficial. More broadly, our results contribute to the debate

on whether arbitrators should be chosen by an external and neutral institution or by the parties. We show that even if nomminations by the disputants lead to some pro-appointer bias, this does not necessarily lead to a lower performance on the committee's incentives to look for the truth.

Our analysis could be extended along several lines. First, a repeated games framework could show how committee members' efforts impact their probability to be nominated again in the future. Second, different types of efforts could be included. We focus here on committee members' efforts to learn the truth, but we could also assume other types of efforts, such as advocates' efforts to make one's own viewpoint prevail (whether this viewpoint is true or not). All these extensions represent avenues for future research on interaction within committees. Last, additional empirical works would also be useful to test whether the composition of arbitral committee impacts the outcomes of decisions.

Appendix

A Proofs

Proof of Proposition 1. Notice that

$$\int_0^{e^N}\int_0^{e^N}\frac{\partial^2 q(x,y,e^N)}{\partial e_1\partial e_2}dxdy = q(e^N,e^N,e^N) - q(0,e^N,e^N) - q(e^N,0,e^N) + q(0,0,e^N).$$

Using that $q(\cdot)$ is symmetric in its argument this can be rewritten as

$$\int_0^{e^N}\int_0^{e^N}\frac{\partial^2 q(x,y,e^N)}{\partial e_1\partial e_2}dxdy = q(e^N,e^N,e^N) - 2q(e^N,e^N,0) + q(e^N,0,0).$$

Thus we can write $q(e^N,e^N,e^N)$ as

$$q(e^N,e^N,e^N) = \int_0^{e^N}\int_0^{e^N}\frac{\partial^2 q(x,y,e^N)}{\partial e_1\partial e_2}dxdy + 2q(e^N,e^N,0) - q(e^N,0,0).$$

This implies that $q(e^N,e^N,e^N)$ is strictly smaller than $q(e^P,0,0)$ if and only if

$$\int_0^{e^N}\int_0^{e^N}\frac{\partial^2 q(x,y,e^N)}{\partial e_1\partial e_2}dxdy + 2q(e^N,e^N,0) - q(e^N,0,0) - q(e^P,0,0) < 0. \qquad (A.1)$$

Adding and substracting $q(e^N, e^P, 0)$, this can also be rewritten as

$$\int_0^{e^N} \int_0^{e^N} \frac{\partial^2 q(x, y, e^N)}{\partial e_1 \partial e_2} dx dy + \int_{e^P}^{e^N} \frac{\partial q(e^N, x, 0)}{\partial e_2} dx + \int_0^{e^N} \frac{\partial q(e^N, x, 0)}{\partial e_2} dx + \int_0^{e^N} \frac{\partial q(e^P, x, 0)}{\partial e_2} dx < 0. \quad \text{(A.2)}$$

When the cross-derivative is positive, it is immediate that this never holds (since $e^N > e^P$), whereas it holds when the cross-derivative is sufficiently negative. □

References

Ben-Yashar, R., W.T.H. Koh and S. Nitzan (2012), "Is specialization desirable in committee decision making?". *Theory and Decision*, 72: 341-357.

Bjorklund A., Bungenberg M., Chi, M., and Titi C. (2019), "Selection and Appointment of International Adjudicators: Structural Options for ISDS Reform". *Academic Forum on ISDS Concept Paper 2019/11.*

Blackaby N., Partasides C., Redfern A., and Hunter M. (2015), "Chapter 1: An Overview of International Arbitration". *Journal of International Dispute Settlement*, in *Redfern and Hunter on International Arbitration*, 6^{th} Edition, Kluwer Law International, Oxford University Press, 1-70.

Bloom, D.E. and Cavanagh, C.L. (1986), "An Analysis of the Selection of Arbitrators". *American Economic Review*, 76(3), 408-422.

Brekoulakis, S. (2013), "Systemic Bias and the Institution of International Arbitration: A New Approach to Arbitral Decision-Making". *Journal of International Dispute Settlement*, 4(3), 553-585.

Brower, C. (2013), "The (Abbreviated) Case for Party Appointments in International Arbitration ". *American Bar Association, Section of International Law, International Arbitration Committee*, 1(1), 10-14.

Bulow J., J. Geanakoplos, and P. Klemperer (1985), "Multimarket Oligopoly: Strategic Substitutes and Strategic Complements". *Journal of Political Economy*, 93, 488-511.

Cai, H. (2009), "Costly Participation and Heterogeneous Preferences in Informational Committees". *The Rand Journal of Economics*, 40(1), 173-189.

Chan J., et al. (2018), "Deliberating Collective Decisions". *The Review of Economic Studies*, 85(2), 929-963.

Choi S., et al. (2010), "Attorneys as Arbitrators". *Journal of Legal Studies*, 39, 109-57.

de Condorcet, N. (1785), "Essai sur l'Application de l'Analyse à la Probabilité de Décisions Rendues à la Pluralité des Voix". *L'imprimerie royal*, Paris.

Dewatripont, M. and Tirole, J. (1999), "Advocates". *Journal of Political Economy*, 107, 1-39.

Donaubauer, J., Neumayer, E., and Nunnenkamp, P. (2018), "Winning or Losing in Investor-to-State Dispute Resolution: The Role of Arbitrator Bias and Experience". *Review of International Economics*, 26(4), 892-916.

Feddersen, T. and Pesendorfer, W. (1996), "The Swing Voter's Curse". *American Economic Review*, 86, 408-424.

Feddersen, T. and Pesendorfer, W. (1997), "Voting Behavior and Information Aggregation in Elections with Private Information". *Econometrica*, 65, 1029-1058.

Feddersen, T. and Pesendorfer, W. (1998), "Convicting the Innocent: The Inferiority of Unanimous Jury Verdicts under Strategic Voting". *American Political Science Review*, 92(1), 23-35.

Feddersen, T. and Pesendorfer, W. (1999), "Abstention in Elections with Asymmetric Information and Diverse Preferences". *American Political Science Review*, 93, 381-398.

Geist, M. (2002), "Fair.com? An Examination of the Allegation of Sysematic Unfairness in ICANN UDRP". *Brookline Journal of International Law*, 27, 903-38.

Gelinas, F. (2011), "Independence of International Arbitrators and Judges". *New York International Law Review*, 1-5.

Gerardi, D. and Yariv, L. (2007), "Deliberative Voting". *Journal of Economic Theory*, 134, 317-338.

Gerardi, D. and Yariv, L. (2008), "Information Acquisition in Committees". *Games and Economic Behavior*, 62, 436-459.

Gruner, H.P. and Kiel, A. (2004), "Collective Decisions with Interdependent Valuations". *European Economic Review*, 48(5), 1147-1168.

Iossa, E. (2007), "Reputational concerns in arbitration: decision bias and information acquisition". *Mimeo.*

Levy, G. (2007), "Decision Making in Committees: Transparency, Reputation, and Voting Rules". *American Economic Review*, 97(1), 150-168.

Li, H. (2001), "A Theory of Conservatism". *Journal of Political Economy*, 109(3), 617-636.

Martinez, L. (2013), "The ICDR's Arbitrator Appointment Process - The Institutional Role and Available Options". *ABA Section of International Law*, 1(1), 20-24.

Mukhopadhaya K. (2003), "Jury Size and the Free-Rider Problem". *Journal of Law, Economics and Organization*, 19(1), 24-44.

Oliveros, S. (2013), "Abstention, ideology and information acquisition". *Journal of Economic Theory*, 148, 871-902.

Paulsson, J. (2010), "Moral Hazard in International Dispute Resolution". *ICSID Review*, 25(2), 339-352.

Persico, N. (2004), "Committee Design with Endogenous Information". *Review of Economic Studies*, 71(1), 165-191.

Posner, E.A. and de Figueiredo, M.F.P. (2005), "Is the International Court of Justice Biased?". *The Journal of Legal Studies*, 34(2), 599-630.

Puig, S. and Strezhnev, A. (2017), "Affiliation Bias in Arbitration: An Experimental Approach". *The Journal of Legal Studies*, 46(2), 371-398.

Rau, A.S. (1997), "Integrity in Private Judging". 38 *South Texas Law Review*, 485, 514-521.

Rosen, J.B. (1965), "Existence and uniqueness of equilibrium points for concave n-person games". *Econometrica*, 33(3), 520–534.

Sherwyn D., Estreicher S., and M. Heise (2005), "Assessing the Case for Employment Arbitration: A New Path for Empirical Research". *Stanford Law Review*, 57(5), 1557-1591.

Schulte, E. (2010), "Information Aggregation and Preference Heterogeneity in Committees". *Theory and Decision*, 69(1), 97-118.

Schulte, E. (2012), "Communication in Committees: Who Should Listen?". *Public Choice*, 150(1-2), 97-117.

Waibel, M. and Wu, Y. (2017), "Are Arbitrators Political? Evidence from International Investment Arbitration". *Working Paper*.

Zhao X. (2018), "Heterogeneity and Unanimity: Optimal Committees with Information Acquisition". *Working Paper*.

NORGES HANDELSHØYSKOLE
Norwegian School of Economics

Helleveien 30
NO-5045 Bergen
Norway

T +47 55 95 90 00
E nhh.postmottak@nhh.no
W www.nhh.no