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BRIBING VOTERS

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Abstract

We show how an outside party offering incentives to a committee can manipulate at no cost collective decisions made through voting, and induce inefficient outcomes. This contrasts with previous contributions—which ignore the possibility of outside influence—highlighting the advantages of using committees making decisions through voting. We develop a model and analyze different incentive schemes, credibility situations, and payoff and information structures. We assess when voting should be made secret, and how the committee’s corruptibility can be reduced by granting it the authority to change its own decision rules. We discuss implications for lobbying, voting in legislatures and central banks, and the efficiency of democracy.

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1 Introduction

One might think that corrupting a group of people deciding on a common issue will take more bribes than corrupting a single individual deciding on it. If so, collective decision making bodies where members vote on issues would make good anticorruption devices. Two important questions in Economics and Politics are whether the previous statements are true, and how to design institutions to insulate collective decisions from outside influence. Studying this problem is highly relevant: voting inside collective bodies is used throughout society to reach important decisions. Supreme courts and juries—where members vote on verdicts—provide examples of this. Another group of examples includes legislators voting on bills and central banks run by boards voting on interest rates or money supply. If the executive found it easy to influence voting decisions, the republican separation of powers and the independence of central banks could be seriously curtailed.¹

In principle, setting up a collective body where decisions will be made through voting has its advantages. Condorcet held that collective decisions could outperform individual ones because they bring about more information. He stated this in the context of sincere voters subject to judgement failures. His “jury theorem” has triggered significant research on information aggregation through voting.² On a more applied note, Blinder (1998) has informally argued that decisions made by groups could be better for central banks than those made by individuals: group decisions will tend to avoid extremes, and with them very bad mistakes. More formally, Waller (2000) shows that a central bank board (as opposed to an individual) will reduce the policy volatility generated by changing electoral outcomes.

There is one advantage that committees do not have, however: running against direct intuition, perhaps, they will not necessarily be more expensive to bribe than a single individual. The reason is connected to the fact that collective decision making involves several people, none of whom holds all decision rights individually. Thus, when that collective decision affects all decision makers, the welfare of each one of them depends on the actions of the others. Therefore, voting procedures leading to a collective decision generate externalities among de-

¹Further examples of situations where collective decisions are made through voting include trade union members meeting to decide whether or not to go on strike; zoning boards granting building permits; shareholders gathering in assemblies to vote on matters of corporate control; and academic committees deciding on the admission of students and colleagues.

²See inter alia Grofman, Owen and Feld (1983), Austen-Smith and Banks (1996), Young (1988), Feddersen and Pesendorfer (1997) and Myerson (1998). See Persico (2000) and Cai (2001) for committees where information is costly. For an experimental study of group decisions, see Blinder and Morgan (2000).

cision makers. How an outside party can best exploit these voting externalities in order to manipulate collective decisions has not been investigated. The contribution of this paper is twofold. First, it shows how (and to what extent) voting externalities may be exploited by an outside party, rendering the collective decision inefficient and easily manipulable. This result will be independent from the number of voters and the degree of homogeneity in their preferences. Second, we study changes in the influence ability of this outside party under a variety of treatments. This helps to design institutions that will protect collective decisions from outside pressure.

We consider a group of people—to be called a “committee”, the “voters”, or the “agents”—that has to make a binary decision by majority voting. These voters are potentially under the influence of an outside party—to be called the “principal”.³ We establish assumptions isolating a benchmark case in which the principal gets “absolute influence”. Under these conditions, two results emerge. First, (Proposition 1) the principal can induce the committee to opt for either of the two alternatives *while making no payments in equilibrium*. Second, and under more general circumstances, we have our Proposition 2: under outside influence, collective decisions through voting can be inefficient, in the sense that they do not maximize the sum of utilities of the principal and the agents. This can happen when agents would have chosen an efficient allocation in the absence of external influence. Neither of these results holds when all decision rights are held by a single agent reflecting the committee’s preferences.

We then relax the initial assumptions and offer a variety of treatments altering the credibility of offers, the flexibility of contracts, the information and payoff structures, and the set of actions allowed to the voters. Proposition 3 shows that limits to the credibility of the offers the principal can make out of equilibrium might affect her influence power. Also, the principal might save on bribes if the committee suspects her to have a deep wallet or a higher stake than is actually the case. Propositions 4 and 5 show that limiting the complexity of the contracts allowed to the principal might also damage her influence power. We precisely quantify the benefits to the principal of different degrees of contract flexibility.

³Considering a set-up with only one principal is interesting since it captures many real life situations in which there is only one party in a position to exert influence over the agents. Other interested parties may be disperse or too badly informed (about, for instance, the fact that one other party has approached the committee). A regulated firm, for instance, is more likely to be able to lobby the regulator than the consumers. The executive, at times, may be in a far better position to lobby the congress than normal citizens or interest groups. There are numerous contributions profitably exploiting single-principal lobbying set-ups. See for instance Bennedsen and Feldmann (2002) on informational lobbying.

We analyze the options open to the principal when uninformed about how much voters dislike her project and study the costs of influence when committee members face a cost from voting for the principal’s project regardless of the committee decision. In perhaps the most radical variation of the basic model, we allow voters to collude against the principal. The ability of voters to coordinate their play through non-binding agreements does not alter the principal’s influence power. We show that stronger forms of collusion, i.e. through binding agreements, do mitigate the principal’s influence power. A way in which committee members can behave “as if” contracting, and thus improve their position vis-à-vis the principal is by agreeing to change the majority rule to be used. This accounts for the legislative discretion to alter the path of different projects within Congress, so that a different number of veto powers apply, and with them, a different effective majority rule. In Section 10 we build upon previous treatments to analyze whether voting should be made secret. We show why keeping legislative voting public is likely to be beneficial, while votes in a general election should always be secret. We also use the model to interpret contrasting transparency practices across central banks.

An implication of our first two results is that the presence of a principal who offers payments to voters may undo all the potential advantages of collective decision making mentioned before. When Proposition 1 holds, committees make decisions just as if the principal were the decision maker. Thus, the aggregation feature of committees breaks down completely. This is also relevant to the literature on regulatory and political capture (see for instance Stigler, 1971, Peltzman, 1976, Becker, 1983, Bernheim and Whinston, 1986, and Chapter 11 in Laffont and Tirole, 1993). These contributions provide a picture where the capture or corruption of the regulatory or political agent can only be partial: the extent of capture is limited by the preferences of the agent. For instance, if a left-wing politician has to choose policy from a set of options, a right-wing lobby will need to pay a high bribe to see a right-wing policy adopted. As the lobby values money, it will typically choose not to push the policy too much towards the right. This “friction” disappears with a committee. Suppose the latter is to choose policy by voting over all possible pairs of options. Proposition 1 implies that the lobby may costlessly rig every voting round and induce an extreme right policy. Thus, with committees, there is scope for *total* capture of the policymaking process. This shows that the policy-smoothing feature of committees in Blinder (1998) and Waller (2000)⁴ might disappear under influence. Proposition 1 also tells us that adding agents will

⁴If the principal is the leader of the executive, then she can impose her most preferred policy by bribing the central bank board. Thus, the volatility of policies arising from the rotation of political leaders is restored.

not necessarily make corruption more difficult—quite the contrary. This has implications for the role of wages as an anticorruption device. When corruption is a gamble, a higher wage to an individual agent should raise the expected cost of wrongdoing (see, for instance, Becker and Stigler, 1974), thus making capture more expensive and less frequent. Proposition 1 implies that efficiency wages might not reduce capture with committees.

Proposition 2 contributes to the debate on whether democracies will tend to display efficient results. Wittman (1989) holds that the market for policies operates as well as the markets for goods do, and then democracies will generate efficient results. In our view, the market for policies involves collective decision problems under external influence to a larger degree than the markets for goods do. We show that collective decisions under influence can be inefficient when individual decisions (or collective decisions under no influence) would not be. Therefore the market for policies—i.e. democracy—may fail more often than the market for goods.

Our work is related to the literature on vote trading. This practice was seen in a good light by authors like Coleman (1966) and Buchanan and Tullock, (1962, Chapter 10), as it allowed the expression of intensity of preferences. They assumed that the externalities generated by voting (already identified by Downs, 1957, p. 191-192), would not be significant. Riker and Brams (1973) showed that due to such externalities, vote trading among voters with different preferences could have a negative net effect indeed.⁵ Our analysis of vote trading with an outside party does not require heterogeneity in voters' preferences and reveals a degree of vulnerability of collective decisions that has gone unnoticed. It also has implications for the literature on voting patterns in legislatures. Riker (1962) predicted the formation of minimum winning coalitions. Groseclose and Snyder (1996) explain the formation of supermajorities as a result of sequential strategic bribing. Weingast (1979) and Niou and Ordeshook (1985) provide explanations for why legislatures would display relatively unanimous voting patterns instead. We will show that outcomes very close to minimum winning coalitions, supermajorities, and universalist (unanimous) outcomes are all equilibria when a committee is under influence. Proposition 1 also contributes an explanation regarding the puzzle of cheap bribes. The puzzle is that politicians often sell official favors at very low prices in comparison to the (usually very large) value those favors have for the recipients. See Ramseyer and Rasmusen (1992) and Helpman and Persson (1998) for different explanations.

Snyder (1991) provides an early contribution on the buying of legislators. Groseclose and

⁵See Philipson and Snyder (1996) for a less grim picture on the consequences of vote trading.

Snyder (1996) offer a model where legislators are bribed sequentially by two principals.⁶ Prat and Rustichini (1999) study the provision of incentives—by competing principals—to agents playing a variety of games, voting included. These papers constrain payments to the agents to be made contingent on individual actions—i.e. offers are of the form “I will pay you an amount X if you vote in favor of this project”.⁷ As we will see, this is not the kind of offers an optimizing principal will want to use, if more general contracts are available. Moreover, their focus is different. Prat and Rustichini, for instance, devote their paper to proving very general propositions regarding a wide variety of interactions. This is also true for a third related paper, by Segal (1999). He studies the general case of a principal exploiting externalities among agents when contracting with them. Our model, tightly tailored to the voting case, is consistent with his more abstract approach. By being simpler, however, our model can easily offer a wider range of treatments, including that when voters can alter the game after hearing the principal’s offers. This more focussed framework enables us to say more about how to design committee structures. Both in this paper and in Segal (1999), the principal can use a “divide and rule” mechanism whereby the payoff of one agent is made contingent on the behavior of others. This idea goes back at least to Crémer and McLean (1985), and is also present in the literature on exclusionary contracts (see Section III in Aghion and Bolton, 1987).⁸ Neeman (1999) and Segal and Whinston (2000) consider simpler contracts without this feature, whose terms are only contingent on each individual’s action. The former makes the interesting point that the freedom to contract should sometimes be limited. The latter show that profitable and inefficient entry prevention can occur. Ferejohn (1986) analyzes the case where electors promise to support an incumbent in exchange for favors, and their Bertrand competition for the latter pushes the price of their support to zero. In our model voters do not compete directly nor have necessarily any commitment power (so any quoted prices are not binding). Under these conditions, when the moment comes the electors in Ferejohn’s model would deviate and not support the incumbent. Our model will elucidate what the principal needs to do in order to secure support for no favours.

The plan for the paper is as follows. Section 2 presents an example that clarifies intuitions behind the initial results. Section 3 presents our model of influence over a committee. Section 4 presents three assumptions on information, credibility of offers, and contract flexibility,

⁶Using this model, Myerson and Diermeier (1999) look at the relationship between lobbying and institutions in the internal organization of legislatures.

⁷Grossman and Helpman (2001)—building on Snyder (1991)—also use these offers in Chapter 9 of their recent book.

⁸See also Spiegler (2000).

and establishes the first two propositions. Section 5 considers limitations to the credibility of offers. Section 6 studies limitations to the complexity of the contracts the principal can use. Section 7 looks at the principal's options when facing incomplete information about the committee members' preferences. In Section 8 we allow for voters who care about how they vote per se, as well as about the collective decision. In Section 9 we analyze collusion among voters. Section 10 analyzes the question on whether voting in committees should be kept secret. Section 11 concludes. Proofs are contained in the Appendix when no reference is made to them in the main text.

2 An example

Consider a situation in which a real estate developer plans to buy a green area to build houses. This green space is collectively owned by three neighbors gathered in a committee. The developer submits a project to them: she offers to buy the land for a very low price and then build a huge number of houses. All three neighbors realize that selling the green area they enjoy for such a price, only to find the neighborhood overcrowded in the future, would be a terrible deal. They would each suffer a utility loss of size $\theta > 0$. The three neighbors are to vote, simultaneously, for or against the developer's project. The criterion is simple majority: if two or more neighbors vote "yes", the project is accepted. Otherwise, it is rejected. Given the neighbors' preferences, one can expect them to vote against it. Now imagine that, before voting takes place, the developer offers a bribe to every neighbor.

Several interesting questions arise: **1.** Would we expect the developer to have to spend little or much money to get the project accepted? **2.** Will the outcome be efficient, in the sense that the sum of utilities of neighbors and developer is maximized? **3.** How would uncertainty affect the principal's influence power? **4.** Could the developer be helped by the fact that she is known to make huge profits if she succeeds? **5.** Would the neighbors make the decision process less corruptible by, (i) trusting it to just one of them, (ii) keeping their individual votes secret, or (iii) allowing themselves to vote first on changing the decision rule? This paper answers these questions.

Suppose the developer offers contracts telling each voter: "If you vote "yes" together with just one other neighbor, you will receive an amount slightly larger than θ , otherwise you will get nothing". We call these "pivotal contracts" because they compensate each voter for the harm the project imposes on him (the amount θ), if and only if his vote happens to

be pivotal.⁹

Under these contracts every neighbor will then reason this way: “If my vote is not pivotal, say because my two colleagues vote “*no*”, then I will suffer no loss—no matter what I vote—because the project will be rejected. If, on the other hand, my vote is not pivotal because my two neighbors are voting “*yes*”, then my loss is θ regardless of my vote, since I cannot prevent the project from being accepted. Voting “*yes*” or “*no*” is again the same for me. In the cases in which my vote is pivotal and makes the project to be accepted, I will be more than compensated. It follows that in some circumstances I will be indifferent, and in others I will be happier voting “*yes*”. Voting this way is therefore a weakly dominant strategy for me.” Since every neighbor reasons in the same way, they should all vote “*yes*”. Nobody will happen to provide a pivotal vote. Then the developer—honoring her promises—will pay nothing, while still getting her project approved. This example illustrates how collective decisions made through voting can be vulnerable to external influence. We will study the nature and limits of this vulnerability, and try to find ways to reduce it.

3 The model

Three members of a committee are to vote on a given issue.¹⁰ Each committee member casts a vote v_i for or against the proposal. Therefore, the action space for an individual voter is the set $\mathcal{V}=\{yes,no\}$. The letter v denotes the vector of cast votes $[v_1, v_2, v_3] \in \mathcal{V}^3$. This action profile determines the committee’s decision through a decision rule $d(v)$ which we take to be simple majority. The results are not altered by considering other non-unanimous majority rules in committees of any size N . The committee’s decision $d(v)$ belongs to the set $\{Yes, No\}$.¹¹ Hence, if at least two of the three votes are “*yes*” (“*no*”), the committee’s decision is “*Yes*” (“*No*”). For expositional convenience, suppose that $d(v)$ takes the value 1 when the decision is “*Yes*”, and the value 0 when it is “*No*”. We assume to begin with that

⁹With a total of three neighbors, each is providing a pivotal “*yes*” vote whenever he is voting that way together with just one other voter. In these circumstances that voter is decisive—i.e. changing his vote would alter the collective decision.

¹⁰The assumption that the committee size is three is just made to simplify presentation. When stating each result, we will comment on how it extends to the case of a committee of size $N > 3$. The results hold also for $N = 2$ if the requirement to make a decision favoring the principal is only one vote.

¹¹We will always write “*yes*” (“*no*”) with lower case initial when we refer to an individual vote, and with uppercase initial when we refer to the overall committee decision. We will use the expressions “*yes*” and “*y*” interchangeably when referring to individual votes. The same applies to “*no*” and “*n*”. Note however that uppercase “*N*” on its own exclusively denotes the committee size when we want to refer to it generically.

the principal can observe the entire vector v (decision d is obviously observable). We will study different contracts, however, that can be of use when the principal does not observe v .

The principal gets revenue $\pi > 0$ when the committee’s decision is “*Yes*”. Decision “*No*” yields her zero.¹² Therefore the principal will try to induce the committee to choose “*Yes*” by offering its members a set of bribe offers $\{b_i\}_{i=1,2,3}$. An offer b_i is actually a function $b_i(v)$ expressing the bribe that will be paid to voter i depending on the realized voting profile v . We assume the principal cannot tax voters so bribes are always nonnegative. Our default assumption is that bribe offers are only observed by the recipient (as befits possibly illegal offers) but also analyze cases where offers are public (i.e. each voter knows also what others are being offered—as in Sections 5 and 6.3). The principal is assumed to be able to commit to her offers.¹³ It is not necessary, however, to assume any commitment capacity on the voters’ side. The principal’s payoff can then be written as,

$$d(v)\pi - \sum_{i=1}^3 b_i(v).$$

The payoff of voter i can in turn be written as,

$$-d(v)\theta_i + b_i(v).$$

This expression says voters care positively about the bribes they receive, and negatively about the committee’s decision. When it is “*No*”, voters get zero utility, but when it is “*Yes*”, each committee member i suffers a utility loss of size θ_i . This magnitude is the “type” of voter i . Both situations in which these types are respectively public and private information will be analyzed. Every θ_i is independently drawn from a distribution $F(\cdot)$, with associated density $f(\cdot)$. We want to focus on cases where there is a conflict between the committee and the principal. Therefore we assume that $F(\cdot)$ has support in the nonnegative real numbers: all committee members are to some extent *against* the approval of the project desired by the principal. Assuming that some members of the committee are actually in favor of the principal would just make things easier for the latter. All results in this paper

¹²For expositional convenience, we will refer throughout to the principal as a female, and to the voters as males.

¹³Presumably, this is so because a long-lived principal facing a sequence of committees (as a big corporation may do over decades with changing legislatures) wants to develop a reputation for honouring promises. Assuming away the credibility problem is standard in the literature on political influence (see for instance the common agency models as introduced by Bernheim and Whinston, 1986). We follow this convention in order to relate the origin of our results to the specific difference of our environment: the body under influence is a committee rather than an individual.

would be either strengthened or unchanged. Note our formulation implies that voter i cares about his own vote only in so far as it affects the collective decision $d(v)$ and the bribe $b_i(v)$ he will receive.¹⁴

We allow voters to use mix strategies. Voter i chooses independently a distribution $\sigma_i(v_i)$ over the set $\{yes, no\}$ and the profile $[\sigma_1, \sigma_2, \sigma_3]$ induces a distribution $\sigma(v)$ over the set \mathcal{V}^3 . Therefore the principal's expected payoff becomes $\sum_{v \in \mathcal{V}^3} \sigma(v) \{d(v) \cdot \pi - \sum_{i=1}^3 b_i(v)\}$ while the expected payoff of voter i becomes $U_i(\sigma_i, \sigma_{-i}) = \sum_{v \in \mathcal{V}^3} \sigma(v) \{-d_i(v) \cdot \theta_i + b_i(v)\}$. All the results involve pure strategy equilibria, although strategies are not *a priori* restricted to be pure. Actually the results in Section 5 become considerably stronger if we impose this restriction.

All the propositions in this paper survive if we specify risk averse preferences and when using nonseparable utility functions.

Timing

First stage: nature determines types $\theta_1, \theta_2, \theta_3$. Depending on the information setting, either the voters or both principal and voters learn these types. Then the principal offers each voter i a contract specifying payment promises.

Second stage: the voters learn the bribe offers of the principal. Then they cast their votes simultaneously and noncooperatively.

Solution concept

We will be interested in (sub-game perfect) Nash equilibria (SPNE) for the game described. Votes are the committee members' pure strategies. A collection of bribe offers $\{b_i\}_{i=1,2,3}$ is a pure strategy for the principal. In the extension in which voters' types are their private information, they play a Bayesian game in the voting stage. Therefore we will look for Bayesian Nash equilibria (BNE) in the voting stage.

When each bribe offer is only observed by its recipient, we will say that the principal can induce or implement a decision "Yes" by the committee if only if there is a majority for whom voting "yes" is a (weakly or strictly) dominant strategy. Whenever voters have a (weakly or strictly) dominant strategy we will take it that they will use it. When bribe offers are public, we will say that the principal can also implement a decision "Yes" if the

¹⁴If voters face a moral cost of accepting contracts of any sort from the principal, things are altered. The acceptance or not of those contracts must be modeled explicitly as a decision previous to voting. The treatment is then similar to the one we include in Section 8, where voters mind about what their vote is, irrespective of the voting result. One can argue that this is the case when legislators feel they may not be reelected by their constituents after voting for laws against their constituents' interests.

voting game has a unique NE, even if this does not involve dominant strategies by a majority. There are cases when only one player may have an overall dominant strategy, but iterated deletion of dominated strategies may select a unique profile. This requires all bribes being known to all voters so that, knowing all payoffs of the game, voters can work out what the equilibrium is and play it.

4 Complete contracting under full information

The following assumptions will hold throughout this section, and will be relaxed in later ones.

Assumption 1. Both the principal and the voters know all voters' types.

Assumption 2. The principal can make payment promises contingent on the complete action profile: each voter may be offered a payment depending not only on what he does, but also depending on what the others do.

Assumption 3. The principal's promises are credible no matter the level of the payments promised.

One further assumption made only for simplicity of exposition in this section and in Sections 6, 8 and 9, is that all voters' types are the same—i.e., $\theta_i = \theta$ for all i .

Think first about the voting game the committee members are to play when the principal is not active—to be called the *laissez faire* voting game. This game can be represented in normal form by having voter 1 choosing rows, voter 2 choosing columns, and voter 3 choosing boxes. The payoffs in each cell correspond from left to right to players 1, 2 and 3 respectively.

	n		y	
	n	y	n	y
n	0, 0, 0	0, 0, 0	0, 0, 0	$-\theta, -\theta, -\theta$
y	0, 0, 0	$-\theta, -\theta, -\theta$	$-\theta, -\theta, -\theta$	$-\theta, -\theta, -\theta$

There are eight possible voting profiles in this game: $[y, y, y]$, $[y, y, n]$, $[y, n, y]$, $[n, y, y]$, $[y, n, n]$, $[n, y, n]$, $[n, n, y]$, and $[n, n, n]$. Five of these profiles constitute NE: $[y, y, y]$, $[n, n, n]$, $[n, n, y]$, $[n, y, n]$ and $[y, n, n]$. In other words, in none of these profiles there is a player who could improve his payoff by voting differently.

Equilibrium $[y, y, y]$ is surprising: the three members vote for an option they dislike. The reason why it could emerge is simple. If any player i takes it as given that the other two will

vote “yes”, then his own vote cannot affect the collective decision and hence his own payoff. It follows that member i does not care about voting one way or the other. However, one would not expect this equilibrium to actually emerge, since it involves the play of a weakly dominated strategy by the three voters (if any member attached a small probability to the fact that each of the other voters may make a mistake and vote “no” when trying to vote “yes”, then such member would be better off voting “no” himself. Voting “no” keeps voters on the safe side). And we assumed that whenever dominant strategies exist, we will take voters to use them. This argument also rules out equilibria involving mixed strategies. We then have,

Claim 1 *The voting profile $[n, n, n]$ is the most robust prediction for the laissez faire voting game, since it is a NE in weakly dominant strategies by all players.*

Now we meet the principal. If she thinks that profile $[n, n, n]$ is the most likely outcome of the *laissez faire* voting game, she will try to affect the way this game is played. Imagine that the principal offers the pivotal bribes of our example in Section 2. These promise every voter a payment $\theta + \varepsilon$ in exchange for a pivotal “yes” vote and nothing otherwise. The amount ε can be assumed to be arbitrarily small throughout. The voting game the committee members play under these offers has the following normal form:

	n			y																	
	<table style="width: 100%; text-align: center;"> <tr> <td></td> <td style="padding: 2px;">n</td> <td style="padding: 2px;">y</td> </tr> <tr> <td style="padding: 2px;">n</td> <td style="padding: 2px;">0, 0, 0</td> <td style="padding: 2px;">0, 0, 0</td> </tr> <tr> <td style="padding: 2px;">y</td> <td style="padding: 2px;">0, 0, 0</td> <td style="padding: 2px;">$\varepsilon, \varepsilon, -\theta$</td> </tr> </table>		n	y	n	0, 0, 0	0, 0, 0	y	0, 0, 0	$\varepsilon, \varepsilon, -\theta$		<table style="width: 100%; text-align: center;"> <tr> <td></td> <td style="padding: 2px;">n</td> <td style="padding: 2px;">y</td> </tr> <tr> <td style="padding: 2px;">n</td> <td style="padding: 2px;">0, 0, 0</td> <td style="padding: 2px;">$-\theta, \varepsilon, \varepsilon$</td> </tr> <tr> <td style="padding: 2px;">y</td> <td style="padding: 2px;">$\varepsilon, -\theta, \varepsilon$</td> <td style="padding: 2px;">$-\theta, -\theta, -\theta$</td> </tr> </table>		n	y	n	0, 0, 0	$-\theta, \varepsilon, \varepsilon$	y	$\varepsilon, -\theta, \varepsilon$	$-\theta, -\theta, -\theta$
	n	y																			
n	0, 0, 0	0, 0, 0																			
y	0, 0, 0	$\varepsilon, \varepsilon, -\theta$																			
	n	y																			
n	0, 0, 0	$-\theta, \varepsilon, \varepsilon$																			
y	$\varepsilon, -\theta, \varepsilon$	$-\theta, -\theta, -\theta$																			

It now follows from inspection of the payoffs that,

Claim 2 *The voting profile $[y, y, y]$ is the most robust prediction for the voting game under pivotal bribes, since it is a NE in weakly dominant strategies by all players.*

The pivotal bribes render the voting game a kind of multilateral prisoners’ dilemma. By playing (weakly) dominant strategies all players end up in an outcome that is undesirable for them relative to some other feasible outcome.¹⁵ Note that the pivotal contracts specify

¹⁵A slight difference here is that voters do not have a strict incentive to deviate from $[n, n, n]$ —which is also a NE—unless the bribe scheme includes a bribe contingent on each member voting “y” on his own.

zero payments if the profile $[y, y, y]$ were realized. Thus, they induce the approval of the principal's project at zero cost. Having ruled out negative bribes, this is as good as things can get for the principal. Hence, offering these contracts must be an equilibrium for her. It follows that we have an equilibrium for the overall game. This implies,

Proposition 1 *In equilibrium, the principal will induce the committee to decide “Yes” at no cost.*

Several remarks follow. Some of them clarify the nature of the equilibrium and deal with efficiency concerns. Others extend the validity of the results.

Extension to committees of size N In the case $N = 2$ (and the decision rule being $d(v_1, v_2) = Yes$ if and only if at least one vote is “yes”), offering each player a large enough bribe contingent on him voting “yes” on his own transforms the voting game into a prisoner's dilemma. In equilibrium, the two voters vote “yes” and get zero payments. When $N > 3$, we see immediately that the pivotal contracts scheme can be adapted directly.

Multiplicity of equilibria The reader can check that slightly different schemes also allow the principal to induce decision “Yes” at no cost. It is interesting to consider some variations of the pivotal contracts and a committee of size $N > 3$.¹⁶ Offering bribes contingent on the provision of a pivotal “yes” vote to all N voters will induce the casting of N votes for “yes” and zero votes for “no”, if every voter uses his weakly dominant strategy. However, the principal would do as well by offering such contracts to any number k of members, where k is strictly larger than $\frac{N+1}{2}$ and smaller than or equal to N , while offering no contracts to the remaining $N - k$ voters. If, in each case, all voters play weakly dominant strategies, we will have a corresponding voting equilibrium with k votes for “yes” and $N - k$ votes for “no”. As k is greater than $\frac{N+1}{2}$, no voter is ever pivotal, and all these equilibria will yield decision “Yes” at no cost for the principal. The next corollary tells us that the same legislature and lobbying situation can generate very different legislative voting outcomes.

Corollary 1 *An outcome very close to a minimum winning coalition (that is, a minimum winning coalition plus one vote), supermajorities of any size, and unanimous outcomes, are all equilibria of the voting game under influence—and part of equilibria in the whole game. The first outcome emerges when the principal offers bribes contingent on the provision of a pivotal “yes” vote to $\frac{N+1}{2} + 1$ members. The second, when these bribes are offered to a number*

¹⁶I take N to be odd in the following calculations, but the results apply to even sizes as well.

of members between $\frac{N+1}{2} + 1$ and N members. The third outcome happens when bribes are offered to all N members.

Different decision rules The results hold for any other majority requirement less demanding than unanimity. They break down with the latter, because every voter becomes pivotal to the decision “Yes”.

Coalition proofness The equilibrium selected in Claim 2 is not coalition proof because voters would have higher payoffs with, say, profile $[n, n, y]$, also a NE. This may not be a problem in the sense that coordinating such a move requires that two people agree to play weakly dominant strategies, which may not be self-enforcing when there is the possibility of mistakes. In case such deviations worry the principal, the latter can easily prevent them by offering bribes of value ε contingent on non-pivotal “yes” votes. This makes $[y, y, y]$ the unique NE of the game (involving strictly dominant strategies).

Efficiency Since, as shown before, the principal can attain decision “Yes” at no cost, any other equilibria of the overall game will involve a set of bribes which achieve that same outcome—otherwise they will not be equilibria. Let’s define efficiency as a feature of equilibria where the committee’s decision maximizes the sum of utilities of all four ($N + 1$ if the committee has size N) players in the game. We then have,

Proposition 2 *If $\pi < 3\theta$ ($\pi < N\theta$, for committees of size N), the equilibria of the voting game under influence are inefficient.*

Proof: The equilibria of the voting game under influence will always involve decision “Yes”, no matter how small the principal’s gain π is, and no matter how large the committee members’ utility loss 3θ is ($N\theta$ when the committee size is N). Whenever the former is smaller than the latter, the collective decision does not maximize the sum of all players’ utilities. ■

The reader may think “Of course, a committee where members do not trade among themselves and where preferences are heterogeneous may well choose an allocation that yields tiny gains to the majority and imposes enormous costs on the minority. Thus, voting procedures may fail to maximize the sum of utilities even when no principal is rigging them”. Note however that Proposition 2 points at something else: when a single person would choose an allocation that maximizes the sum of utilities of both principal and agent, a committee will probably not. And this is so even when the committee holds unanimous preferences and

therefore would indeed—in the absence of the principal—choose an allocation that maximizes the sum of the voters’ utilities.

The rationale for the results in this section is connected to the fact that each committee member has limited control over the committee’s final decisions and therefore over his own payoff. The control loss of decision makers within a committee is due to the fact that, under a non-unanimous decision rule, no player is a priori pivotal to the collective decision. Any decision can be made without the agreement of any one player. This allows the outside party to make a committee do things for a price that each one of its members individually would never accept, because, “after all, if I don’t do it then someone else will”. One interesting consequence is that very natural collusion proof contracts to, say, a regulatory agent, might discourage capture when the agent is an individual, but not when it is a committee. Suppose the President appoints a single regulator to control a firm. The President could tell the regulator: “If you approve bad projects I will fire you and you will lose your wage θ ”. If the regulator’s best alternative wage is zero, this scheme would set the price of capture by the regulated firm to θ . Capture would then happen only when $\pi > \theta$. The same contract imposed on members of a regulatory committee, on the contrary, would do nothing to prevent capture.

These results are perhaps surprising. The reader may think, however, that the principal was allowed far too many advantages. The remainder of the paper is devoted to removing them.

5 Constrained promises

In this section we ask: what happens if the principal cannot make very high offers while keeping them credible? We may think that, in case offers are public, it cannot be credible for the principal to offer contracts jointly granting more than π , conditional on the realization of a profile that yields “Yes”. After all, why would the principal promise to pay a sum larger than what she stands to gain from the favorable decision? This section will deal with a relaxation of Assumption 3. We assume that offers jointly granting less than π are believed, but offers jointly granting more than π are ignored. We also assume that all players know all offers (which is consistent with the problem being present in the first place). We will allow the types of voters to differ, while remaining common knowledge.

Proposition 3 *If π is greater than the sum of at least one pair of voters’ types, the principal can implement the decision “Yes” at an arbitrarily small cost, by making $[y, y, y]$ the unique*

Nash equilibrium of the voting game.

Proof: See Appendix.

One implication of this proposition is that a constraint on the principal's promises off the equilibrium $[y, y, y]$ can indeed prevent her from inducing decision "Yes" in the three voter case. If the voters ignore the principal's valuation for the committee's decision, but know the principal's wealth, perhaps the credibility of offers will depend on this wealth, rather than on the stake π . In any case, the basic message of this proposition is that the voters' perception of the principal's wealth, her stake, or whatever affects the size of the offers she can credibly pledge, might be relevant to the price of the committee's decision. A high enough perceived wealth or stake will save the principal bribes (a paradoxical outcome: in normal trading situations the buyer wants to play down her valuation). Note that in the case of three voters, the credibility constraint has to be quite tight to damage the principal's ability to get her project approved for no money. The principal's stake may be insufficient to promise full compensation to two of the three possible majorities, but she will still be able to induce the decision "Yes" at a negligible cost. One may think that this is not surprising as in any case it should only be necessary to compensate only one majority to purchase a decision. But what this result tells us is that being able to afford one majority is enough to be able to avoid paying them.

The basic message of this section is that the inefficiency put forward by Proposition 2 does not rely on Assumption 3. And also, that offers being public—i.e. all voters knowing all offers—may create a credibility problem for the principal in the sense that the total sum of bribes cannot exceed π for any voting profile. But offers being public also allows the principal more latitude in using bribe schemes. In this result we use bribe schemes that are not symmetric nor make all voters have dominant strategies, but they make the voting game have a unique NE yielding decision "Yes". And because all voters know all bribes they should be able to work out what the unique equilibrium is and play it.

6 Limiting the conditioning ability

6.1 Payments contingent on individual actions

In this section we relax Assumption 2. In real life it may not always be possible to communicate intricate payment schemes like the pivotal contracts in a quick and safe way. These

may trigger more negotiation and argument than simpler offers. Assume then that offers to member i are constrained to be of the form: “I will pay you a bribe b_i if you vote “*yes*”, and zero otherwise”. Assume also that, for simplicity, in this section voters’ types are again all equal to θ . We are now concerned with finding the minimal cost at which the principal can induce a favorable decision from the committee.

Proposition 4 *If the principal wants to induce the collective decision “Yes” by offering each voter a payment contingent on the individual’s vote, she must spend at least 2θ .*

Proof: See Appendix.

The last proposition tells us that limiting the principal’s conditioning ability can substantially affect the cost of influencing the committee’s decision. With vote contingent contracts, the principal must fully compensate two of the three members in the committee to be confident that the collective decision will be favorable to her.¹⁷ Clearly, outcomes will still be inefficient whenever $\pi \in [2\theta, 3\theta)$. The result in the last proposition extends naturally to the case of committees of size $N > 3$. Reasoning along the lines of its proof, it can be shown that the principal must spend at least $\frac{N+1}{2}\theta$ to guarantee a “Yes” decision (N odd).

6.2 Payments contingent on the collective decision

When the principal cannot observe the realized voting profile—say because votes are secret—she cannot condition payments on the way committee members vote. However, the principal can condition payments on the committee’s decision. In this subsection we consider how well can the principal do when the only contracts she can offer to any player i are of the form: “I will pay you an amount b_i if the committee chooses “*Yes*”, and zero otherwise”.

Proposition 5 *If the principal wants to induce decision “Yes”, by offering payments contingent on the collective decision, she must spend an amount that is arbitrarily close to (but larger than) 2θ .*

Proof: See Appendix.

The proof of this claim shows that, by spending a sum which is larger than 2θ by an arbitrarily small amount, the principal can make sure that two of the three players have

¹⁷Note that, when offering bribes contingent on individual actions, the principal commits to pay non-trivial amounts for profiles that yield decision “No”. So these offers are only possible when the principal has enough wealth prior to the obtention of any committee favours.

“yes” as their weakly dominant strategy, and this cannot be attained by spending exactly 2θ or less. The main implication is that making all information about the voting stage secret prevents costless capture but not inefficiency (more on this in Section 10). Note that the outcome will be inefficient whenever $\pi \in (2\theta, 3\theta)$. This proposition can also be extended to the case of committees of size $N > 3$ reasoning along the lines used in the proof for the case where $N = 3$. Thus, it can be shown that the principal needs to spend an amount (slightly) larger than $\frac{N+1}{2}\theta$ in order to guarantee a “Yes” decision from the committee. It is also worth noting that only a principal using relatively sophisticated bribes, such as the pivotal ones, is hurt by making votes secret. A principal that uses the observability of votes to offer vote-contingent bribes does not gain anything over what she can obtain by conditioning on the final outcome, which does not require observing who votes what (the costs of capture are virtually the same).

6.3 Payments contingent on the vote share

Sometimes the principal may not be able to observe who votes what, but may be able to observe something more than just the final decision, such as the share of voters voting in a particular way. Conditioning payments on the vote share is more flexible than conditioning on the final outcome, so capture at cost 2θ is obviously possible. It is quite immediate that spending less than this will fail to implement an equilibrium yielding “Yes” in dominant strategies. In this subsection we ask whether the principal can attain costless capture when being able to observe (and condition payment on) the vote share, and when being able to use public bribe schemes, that do not need to rely on dominance.

Proposition 6 *For $N=3$, the principal cannot obtain costless capture by offering bribes contingent on the voting share.*

Proof: See Appendix.

The proof of this proposition shows how, in a committee of size three, there is no way of making the committee approve the project without incurring costs. We also analyze the case of larger committees. Denote with $[\#y = N]$ a voting profile containing N votes for “yes”.

Claim 3 *For $N>3$ and a public bribe scheme, the principal can make $[\#y = N]$ the unique pure strategy NE of the voting game at an arbitrarily small cost.*

Proof: See Appendix.

The proof shows by example that a complicated bribe scheme where payments are contingent on how many people vote in a particular way can destroy all voting equilibria yielding “No”. These schemes, however, are almost surely vulnerable to mixing (the pure strategy NE is not the unique NE), and would need to be public to be effective, as no dominant strategies exist. All voters would need to know all bribes in order to work out what the pure strategy equilibrium is. This is problematic in the case of a general election (which is one situation in which these bribe schemes could expect to be applied, as after a general election not only the winner, but also the voting shares, are known). The reason why it would be problematic is that, for the whole electorate to know all bribes, the bribe scheme should be advertised in the mass media—clearly a shortcoming. Moreover, these schemes rely on very strong assumptions on voter rationality. After all payments are offered to voters in a myriad of profiles in which they vote “no”. A very careful examination of the game is required on their part in order to work out that they should vote “yes” instead.

7 Imperfect information

In this section we relax Assumption 1. Except where indicated otherwise, Assumptions 2 and 3 continue to hold.

7.1 Voters’ types are unknown to the principal

When Assumption 3 holds, the principal can credibly offer any payments she wants. Therefore she can offer arbitrarily large bribes in exchange for pivotal votes. This in turn means that, with a probability arbitrarily close to one, voting “yes” is a weakly dominant strategy for every committee member. Hence, we could conjecture that the principal can get the decision “Yes” at no cost with a probability which is arbitrarily close to one. One problem with this reasoning is that we cannot predict a finite bribe level for the principal to offer in equilibrium. With infinite support for θ , and given any bribe level b , raising it to $b + \varepsilon$ will make the probability of success a bit higher. However, one could argue that there is no reason to assume that voter types can be infinite. Thus,

Claim 4 *If there is an upper bound to the voters’ types which is known to the principal, the latter can induce decision “Yes” with probability one, at no cost.*

Proof: See Appendix.

This shows that introducing imperfect information on the principal's side does not necessarily prevent costless capture. It might, though, if we simultaneously relax Assumption 3. Limiting the principal's offers to be credible only at low enough levels can make cheap capture not certain. One can show that there are bribe strategies that induce decision "Yes" at no cost with positive probability. However, finding the optimal strategy for the principal when no restrictions are placed on the distribution of voters' types is a difficult task indeed. We leave this task to future efforts.

7.2 Voter i 's type is voter i 's private information

Just before stating Claim 4, we argued that, with infinite support, it is not possible to predict a bribe level that the principal would like best. That is when the principal is the *only* one under imperfect information. Extending uncertainty to voters themselves helps to obtain a pure strategy equilibrium with certain cheap capture. Now θ_i is known to member i only, and he votes under certain beliefs about the way the others will vote. Using a different model, Neeman (1999) proved that when voters get vote contingent offers and are uncertain about each other's vote, the equilibrium in which they all vote "yes" is the most likely if the committee is large enough. The reason is that a positive vote contingent offer, even when small, implies a sure revenue for the voter. On the contrary, the cost of voting "yes" is incurred only when being pivotal, something that can be made arbitrarily unlikely by enlarging the committee. We now offer a model where voters make their choices under uncertainty and bribes are not restricted to be contingent on the single action of each voter but also on the actions of others, and as a result costless capture may hold even for small committees.

Call the eight possible voting profiles in a committee of size three as follows: $v^i = [n, n, n]$, $v^{ii} = [n, n, y]$, $v^{iii} = [n, y, n]$, $v^{iv} = [y, n, n]$, $v^v = [n, y, y]$, $v^{vi} = [y, n, y]$, $v^{vii} = [y, y, n]$, $v^{viii} = [y, y, y]$. Call b_i^j the bribe the principal offers to voter i conditional on the realization of profile j . When making a decision on what vote to cast, each voter is uncertain about the votes of others. The reason is that, even when the contracts offered by the principal are public, each voter ignores the types of the other voters. Thus, the only element on which voter i may condition his actions is his own type, while he takes as given the behaviour of others (i.e. the probability that they vote one way or the other). In this Bayesian voting game, a strategy for voter i is a function $\sigma_i(\theta_i)$ that tells the probability that member i votes

“yes”, depending on this member’s type.

Assume the principal offers the following bribe matrix,

	v^i	v^{ii}	v^{iii}	v^{iv}	v^v	v^{vi}	v^{vii}	v^{viii}
for voter 1	0	0	0	α	0	β	β	γ
for voter 2	0	0	α	0	β	0	β	γ
for voter 3	0	α	0	0	β	β	0	γ

where α , β , and γ are nonnegative. This structure says to every voter: “if you vote “yes” alone, then you will get α , if you vote “yes” and are pivotal, you will get β , and if you vote “yes” together with all the others, you will get γ ”.

Define p_i to represent the probability that voter i votes “y” in equilibrium. Member i should vote “yes” whenever the expected gain from so doing is greater than the expected loss. For, say, player 1, the expected bribe revenue when voting “yes” is,

$$(1 - p_2)(1 - p_3)\alpha + [p_2(1 - p_3) + p_3(1 - p_2)]\beta + p_2p_3\gamma,$$

while the expected cost is the loss incurred when providing a pivotal “yes” vote, times the probability this will happen,

$$\theta_1[p_2(1 - p_3) + p_3(1 - p_2)].$$

Member 1 will therefore vote “yes” whenever the first expression is larger than the second, or whenever,

$$\theta_1 < \frac{(1 - p_2)(1 - p_3)\alpha + [p_2(1 - p_3) + p_3(1 - p_2)]\beta + p_2p_3\gamma}{p_2(1 - p_3) + p_3(1 - p_2)} = \hat{\theta}_1.$$

The cutoff value $\hat{\theta}_1$ determines the probability that member 1 votes “yes”. Note that if θ_1 is smaller than this cutoff value, then member 1 is better off voting “yes” than voting “no”. It follows that $\sigma_i(\theta_i)$ should equal 1 when $\theta_i < \hat{\theta}_i$. If θ_1 is greater than $\hat{\theta}_1$, then member 1 will want to vote “no” with probability 1. In this case, $\sigma_i(\theta_i)$ should equal 0. As the type θ_1 is drawn from the distribution $F(\theta)$, the probability that member 1 will vote “yes” is given by,

$$\begin{aligned} p_1 &= P(\theta_1 \leq \hat{\theta}_1) = F(\hat{\theta}_1) = \\ &= F \left\{ \frac{(1 - p_2)(1 - p_3)\alpha + [p_2(1 - p_3) + p_3(1 - p_2)]\beta + p_2p_3\gamma}{p_2(1 - p_3) + p_3(1 - p_2)} \right\}. \end{aligned} \tag{1}$$

The strategies and cutoff values of the other players are characterized analogously. We then obtain the system,

$$\begin{aligned} p_1 &= F \left\{ \frac{(1-p_2)(1-p_3)\alpha + [p_2(1-p_3) + p_3(1-p_2)]\beta + p_2 p_3 \gamma}{p_2(1-p_3) + p_3(1-p_2)} \right\} \\ p_2 &= F \left\{ \frac{(1-p_1)(1-p_3)\alpha + [p_1(1-p_3) + p_3(1-p_1)]\beta + p_1 p_3 \gamma}{p_1(1-p_3) + p_3(1-p_1)} \right\} \\ p_3 &= F \left\{ \frac{(1-p_2)(1-p_1)\alpha + [p_2(1-p_1) + p_1(1-p_2)]\beta + p_2 p_1 \gamma}{p_2(1-p_1) + p_1(1-p_2)} \right\} \end{aligned} \quad (2)$$

In a Bayesian equilibrium, every player chooses an optimal strategy while taking as given the strategies of the others. An equilibrium of this game can be expressed as a triplet of strategies $[\sigma_1^*(\theta_1), \sigma_2^*(\theta_2), \sigma_3^*(\theta_3)]$ such that every strategy is a best response to the others. Clearly, every player i wants to decide his vote by taking as given the right probabilities p_j and p_k . So we can look at equilibria where the best responses $[\sigma_1^*(\theta_1), \sigma_2^*(\theta_2), \sigma_3^*(\theta_3)]$ are associated to a profile of probabilities $[p_1^*, p_2^*, p_3^*]$ satisfying the system in (2). For such a profile, the probabilities each player takes as given are equal to the actual probabilities.

An obvious solution for the system above is the vector $[1,1,1]$. This can be reached for instance with bribes $\alpha = \beta = \gamma > 0$ (i.e. positive vote-contingent offers). If every player expects the others to vote “yes” with probability one, then every player expects a chance of being pivotal equal to zero. Therefore, all players are ready to set a cutoff value of infinity, which implies being ready to accept a bribe of zero in exchange for voting “yes”. In this case, the bribes induce all players to vote “yes” with probability one. Therefore, every player would do the right thing by expecting the others to vote “yes” with probability one in the first place.

Is this the only equilibrium? It is not, when the principal offers a uniform bribe ($\alpha = \beta = \gamma$) which is small enough. It can be proved that to avoid equilibria that yield “No” with some positive probability, the principal needs to raise the uniform bribe to some minimum level.¹⁸ But this means that in equilibrium she will be paying a non trivial amount to the voters. However,

Proposition 7 *If: the principal can choose α , β and γ freely and separately, and the function $F(\theta)$ is such that $f(\theta)$ approaches zero at a speed faster than quadratic when θ approaches infinity (this is satisfied by any exponential distribution),*

Then: the principal can make $(1,1,1)$ the unique symmetric Bayesian-Nash equilibrium of the voting game, while the payments γ made in equilibrium are arbitrarily small.

¹⁸Neeman (1999) avoids this by making the number of voters so high that every member faces a small enough chance of being pivotal.

Proof: See Appendix.

This result implies that an uninformed principal can get her way for no money even when every θ_i can be arbitrarily large and the committee is small. Differently from Neeman (1999), the probability each voter attaches to being pivotal does not go to zero because the committee goes large, but because he correctly anticipates that all others will vote “yes” with chances approaching one. An important caveat is that there may be asymmetric equilibria yielding capture with probability lower than one.

8 Individual accountability: vote-related costs and position-taking

In this section we relax Assumption 2. We assume now that voters care about how they vote *per se* besides caring about bribes and the final decision. Assume that, on top of losing θ if the project is approved, every committee member suffers a loss η when voting “yes”. This value η may reflect moral concerns or the fact that committee members act under some form of external monitoring. For example, a legislator voting for a project damaging his constituency may face a cost in terms of lower chances of reelection. The payoff of voter i is, now,

$$-d(v)\theta - I(v_i)\eta + b_i(v),$$

where $I(v_i)$ is an indicator function taking the value 1 when $v_i = \text{“yes”}$ and the value 0 otherwise.

The reader can easily check that the *laissez faire* voting game with vote-related costs has a unique NE (in strictly dominant strategies): $[n, n, n]$. This means that the principal must intervene if she wants the collective decision to favour her. With full conditioning abilities, we have,

Proposition 8 *If the principal wants to induce decision “Yes”, then she needs to spend at least $\min\{2(\eta + \theta), 3\eta\}$.*

Proof: Decision “Yes” can be implemented by making Nash a profile comprising either

two or three “*y*” votes. The normal form game is,

$$\begin{array}{c}
 \begin{array}{c}
 \begin{array}{cc}
 & n & y \\
 \hline
 n & 0, 0, 0 & 0, -\eta, 0 \\
 y & -\eta, 0, 0 & -\theta-\eta, -\theta-\eta, -\theta
 \end{array}
 \end{array}
 \quad
 \begin{array}{c}
 \begin{array}{cc}
 & n & y \\
 \hline
 n & 0, 0, -\eta & -\theta, -\theta-\eta, -\theta-\eta \\
 y & -\theta-\eta, -\theta, -\theta-\eta & -\theta-\eta, -\theta-\eta, -\theta-\eta
 \end{array}
 \end{array}
 \end{array}
 \tag{3}$$

Making $[y, y, y]$ the equilibrium in dominant strategies costs (almost) 3η : the principal’s best strategy is to offer a payment of $\eta + \varepsilon$ for a non-pivotal “*y*” vote, and an extra payment θ if that vote is pivotal. Making a profile comprising two “*y*” votes to be a dominant strategy NE, in turn, works by compensating two voters with $\eta + \theta$ (plus ε) for a “*yes*” vote. Otherwise these two voters would deviate. Hence the second approach costs close to $2(\theta + \eta)$. The principal will choose the cheapest approach.■

When accountability costs are relatively high (i.e. when $3\eta > 2(\theta + \eta)$), the principal will choose the second approach. It follows that whenever $\pi \in (2(\eta + \theta), 2(\eta + \theta) + \theta)$ capture is costly but possible (at price $2(\eta + \theta)$), and the final decision inefficient (as the voters’ total losses amount to $2(\eta + \theta) + \theta$). Inefficient capture is precluded only if the interval $(2(\eta + \theta), 2(\eta + \theta) + \theta)$ collapses into a single point of the real line, so that π has no chance of being inside of it. Note now that, for any vote-related costs η , this only happens when the voting externality θ (that the two voters voting “*y*” exert on a third voter voting “*n*”) goes to zero, i.e. when voters do not care about the final decision. If, on the other hand, $3\eta < 2(\theta + \eta)$, the principal will choose to make $[y, y, y]$ the equilibrium in dominant strategies. The condition for affordable but inefficient capture is now $\pi \in (3\eta, 3(\eta + \theta))$. The potential for inefficient capture is again seen to disappear only when θ goes to zero.

What is suggestive in this variation of the basic model is that when voters care about how they vote per se, as well as about policy, capturing the committee is more expensive. Costs η can be expected to arise when voting in legislatures is public (as with roll call votes), and each legislator faces a threat of non reelection when displaying a bad individual voting record. Given such reelection strategy from constituents, one would expect legislators to engage in position-taking activities. This is, to spend considerable time choosing how to vote, and in particular, making sure they are *seen* to be voting in tune with the desires of their constituents, even if their particular vote will not affect the policy outcome.¹⁹ These activities

¹⁹An implication is that—when able to observe legislative votes—the electorate does indeed have incentives to condition the reelection of legislators on their individual voting record rather than on the performance of

may be seen as wasteful when they will not affect policy, but they must be understood as part of a game where individual accountability is raising the costs of capture.

9 Collusion among voters

As said before, offering the pivotal bribes plus small bribes contingent on non pivotal “yes” votes makes $[y, y, y]$ the unique NE of the game (in strictly dominant strategies). This means that a weak form of collusion among voters such as coordinating their play through nonbinding agreements will not prevent costless capture. Can committees prevent costless, inefficient capture when voters are allowed to engage in actions that bind them to play a different game?

9.1 Full contracting capabilities

If voters can cooperatively agree to any scheme of transfers among themselves contingent on different voting profiles before the principal makes offers, then they can alter the payoffs of the game in any way they like. For instance they can agree on schemes that reward those voting “no” and punish those voting “yes” by making the latter have to pay sums of money to the former. And this implies that the costs of capture can be raised arbitrarily by raising the transfers involved in the reward/punishment scheme. For instance, the costs of capture can be raised exactly to π , so that voters can extract the principal’s surplus. An example of such schemes is one stating that “Every voter voting “no” will receive an amount $\frac{t}{2}$ from each of his colleagues”, which all voters commit to honor before the principal communicates bribes. The normal form game then looks like,

	n		y	
	n	y	n	y
n	$0, 0, 0$	$\frac{t}{2}, -t, \frac{t}{2}$	$\frac{t}{2}, \frac{t}{2}, -t$	$-\theta+t, -\theta-\frac{t}{2}, -\theta-\frac{t}{2}$
y	$-t, \frac{t}{2}, \frac{t}{2}$	$-\theta-\frac{t}{2}, -\theta-\frac{t}{2}, -\theta+t$	$-\theta-\frac{t}{2}, -\theta+t, -\theta-\frac{t}{2}$	$-\theta, -\theta, -\theta$

where it is clear that voting “no” is a strictly dominant strategy for every voter. This scheme provides every voter with a profitable deviation from those profiles where he is voting “yes”. If the principal wants to induce decision “Yes” for sure, she will necessarily have to do one of

the whole legislature (as assumed). Snyder and Ting (2002) combine our analysis with the model in Snyder (1991), and obtain such behavior as the optimal retrospective reelection rule for the electorate.

two things. One is making a profile with two “*yes*” votes a NE in dominant strategies, and the other is making $[y, y, y]$ a NE in dominant strategies. The first thing will cost an amount $2(\theta + t)$. The second will cost $3t$. The principal will always go for the cheapest. Voters can then choose t to extract the principal’s valuation π .

Schemes of this type require that voters have deep enough wallets and perfect enforcement capabilities—something committee members may lack. This suggests that voters such as legislators may have an interest in developing organizations like political parties, understood as technologies to render contracting possible. The observation that parties are organizations that make contracting among politicians possible, so that they can realize Pareto-improving trades, goes back at least to Alesina and Spear (1988) and Wittman (1989). In the former paper, contracting among politicians is used to avoid the well known last-period problem. Our model isolates a different instance where contracting among politicians would be useful: when committees are under pressure. In our set-up, if parties can discipline their members through internal rewards and punishments, membership to parties would help committee members make credible offers among themselves. This would in turn allow those members to resist capture (or choose the terms of trade).

Still, this source of enforcement may not be perfect, and in many committees members may not engage in the practice of making payments among themselves at all. So we turn our attention to complementary institutional remedies that may, to an extent, function “as if” voters did so.

9.2 Choosing decision rules

In this subsection we study what amounts to a restricted form of collusive contracting. This does not require voters possessing any resources nor enforcement capabilities. We look at whether a simple provision in the committee’s “constitution” can eliminate cheap and inefficient capture. Up until this point, the constitution of the committee states one thing: the function $d(v)$ embodying the decision rule. Assume now that the constitution includes a provision regarding the possible *reform of $d(v)$* , saying: “The committee may at any point decide to change *to unanimity* the decision rule if and only if there are at least $M \geq 1$ votes in its favor.” We then add a stage to the basic game. In the first stage the principal announces bribes. In the second (the “reform”) stage, an imaginary third party puts forward the proposal of procedural reform and committee members vote secretly on it

under the majority requirement M .²⁰ In the third (the “project”) stage, voters vote publicly on the principal’s project according to the decision rule emerging from the second stage.

The complete action profile of voters in the game with a procedural reform stage is now denoted with $\{v^r, v^p\} = \{[v_1^r, v_2^r, v_3^r], [v_1^p, v_2^p, v_3^p]\}$, where as before the subscript denotes the voter. The superscripts ‘ r ’ and ‘ p ’ stand for ‘reform’ and ‘project’ respectively, to indicate what members are voting on (e.g. a vote $v_i^r = y^r$ (n^r) is a vote favorable (unfavorable) to making unanimity the new decision rule). The principal’s bribes can be made contingent on v^p , but not on v^r , because voting on the decision rule is secret. We will now look at SPNE of this expanded game and see whether costless capture and inefficiencies are still possible.

Proposition 9 *a) When a procedure reform stage exists (and regardless of the value of M), costless capture does not happen.*

b) When reform must be passed by unanimity ($M=N$), the cost of capture is raised to that of fully compensating a single voter: θ .

c) Inefficient capture might still happen in the game with a procedure reform stage, unless the constitution gives every voter the right to reform procedures unilaterally ($M=1$).

Proof: See Appendix.

The proof to part a) shows that if the principal made offers that attempt costless capture (like the pivotal ones), then voters are better off by changing the voting rule and resisting capture. Before voting over the principal’s project, voters pass reform and make themselves all pivotal to the “Yes” decision. This makes any offers attempting costless capture to fail at inducing the “Yes” decision. And it is part of a SPNE in (weakly) dominant strategies for committee members to vote unanimously for reform in the reform round, as otherwise costless capture follows in the “project” subgame and voters end up with lower payoffs. Note however that the cost of capture is not raised much. If unanimity is required to pass reform, the proof to part b) shows that there are ways of conditioning payments on v^p that give one voter incentives to block reform at the cost of fully compensating just that voter.

²⁰Adding the reform stage and making it public would serve no purpose. The principal could rig it just as she can rig the voting over her project. The project stage, though, is kept public. It may be thought that if voting in the project stage is public, it must be so in order to hold committee members accountable for their individual voting behavior, thus giving rise to vote-related costs. The results of this section are not substantially altered by considering such costs, but notation is heavier. We therefore stick with the basic payoff function: voters care only about the final decision and money.

This explains why inefficient capture is still possible. The cost of inducing failure of reform and subsequent approval of the project is very low (just $\theta + \varepsilon$) if the requirement for reform is as strong as unanimity. If the constitution stated that reform can be approved by simple majority, the principal could boycott reform and get her project approved at a higher cost. For a committee of size 3, the cost is 2θ , which makes inefficiency not impossible, but less likely. The only way to make the failure of reform so expensive that inefficient capture never happens is to give every voter full rights to pass reform unilaterally (i.e. to set $M = 1$). Thus, boycotting reform requires that the principal compensates every voter. This raises the cost of stopping reform and getting a project approved to at least 3θ , eliminating the potential for inefficiency.

Clearly, setting $M = 1$ would be optimal in our set-up since all voters have the same preferences. In any realistic situation with heterogeneous preferences, however, making reform so easy would be problematic. Every member could dictate that a project he does not like should be dealt with under unanimity rule, and then go on to vote against it himself. Hence, setting $M = 1$ amounts to giving every member a veto and renders any real life committee quite ineffective. There is presumably an optimal degree of flexibility in terms of what majority rule should apply to approve a change of the decision rule. This should balance the benefits of preventing inefficient capture more often with the costs of making the committee less prone to approve projects that are beneficial but do not command a complete consensus. Pursuing this line of enquiry is beyond the scope of this paper.

In real life we do not observe committees changing their majority rules all the time explicitly, but we do see them changing them implicitly. For example, in the US Congress the Speaker of the House has ample discretion to choose whether a project will have to go through, say, one committee or two. This alters the effective majority rule applying to the project. When a project is dealt with under simple majority in the floor, but has to survive the threat of veto in a number of committees, the project is effectively facing a supermajority rule.²¹ If in our model we allowed for a fraction $f < \frac{1}{2}$ of committee members that are incorruptible (i.e. who will not accept bribes), then the committee would not need to change the majority rule to unanimity in order to prevent costless capture. It would be enough to change it to a supermajority of $1 - f$. The extension we just offered can thus

²¹Tullock (1998) remarked that the effective majority rule applying to projects that would alter the status quo in the American Congress is around 60%, given the presidential veto power and the bicameralist structure. Raising the majority rule in our model has an analogous effect to that of adding veto powers in Myerson and Diermeier (1999).

account for the legislative practice of changing implicit majority rules as a way to reduce the risk of capture, or to set its price higher.

10 When should votes be kept secret?

In this section we use our model to obtain general lessons on when secret votes will be convenient. We then analyze a striking contrast: while ballots are secret in general elections, votes are public in legislatures.

Consider for simplicity a committee with three members, each corruptible—or rational—with probability p . With probability $1 - p$ members are non-corruptible and always vote the right way. Each committee member loses θ if a bad project is passed, and he attaches value η to retaining office. Reappointment depends on constituents being happy with the behavior of the representative or the body (depending on what constituents can observe).²² Suppose now that a bad project is under consideration at the committee. *Under secret voting*, if constituents see that the project is approved, they will know that at least a majority took bribes, but they will not know who in particular did so. Hence constituents will update their priors on the moral type of all members. It is immediate that, for any prior p , the posterior on *all* members will be greater than p after a bad project is passed. Because any common citizen has a lower chance of being corrupt (just p), let us accept that after a bad project goes through constituents replace all committee members with randomly sampled citizens. Thus, the game facing corrupt members before bribes are pledged displays a payoff structure analogous to the baseline game in Section 4; the only difference is that when a bad project passes, committee members suffer a disutility η from losing office on top of the outcome-related disutility θ . From Section 6.2 we know that under secret voting the cost of capture would be $2(\theta + \eta)$, as the principal can only condition payments on the collective decision.

We now analyze the case of *public votes*. Upon seeing a committee member voting for the bad project, constituents update their prior p *only* on that particular representative to a posterior of 1. Thus, it is only that member who is not reappointed for sure when memberships are reconsidered (in the case of legislators, when they run for reelection). Before bribes are offered, the voting game for three corrupt members then looks exactly like

²²A positive cost η implies that constituents can tell that the bad project is bad. A cost $\eta = 0$ would mean that they are uninformed and cannot tell a bad project from a good one. A cost $\eta < 0$ would mean they are misinformed, and they think that a bad project is good.

the game in (3): costs η accrue to a member whenever he votes for the bad project, and costs θ accrue whenever the project is approved. From Section 8 we know that the cost of capture in that game is given by the expression $\min\{2(\eta + \theta), 3\eta\}$.

From the comparison of the costs of capture with secret and public votes, we see that,

Proposition 10 *When the measure θ of concerns for the final outcome is large relative to the accountability measure η (i.e. when $2(\eta + \theta) > 3\eta$), public votes will allow for cheaper capture—so secrecy would be best. When, on the contrary, the costs from being held accountable are relatively strong (i.e. when $2(\eta + \theta) < 3\eta$), secrecy is not necessary to protect committees.*

The intuition behind this proposition is simple. When the final outcome is what matters most to voters, pivotal bribes—as made possible by public voting—allow the principal to avoid compensating voters for the (relatively large) costs θ . This saves the principal more money than she has to pay from public votes making voters individually accountable. Things change when the vote-related costs stemming from individual accountability are relatively large (i.e. when $2(\eta + \theta) < 3\eta$). In this situation the costs of capture are equal to $2(\eta + \theta)$ with either secret or public votes.

Given these general considerations we can now analyze the cases of voting in general elections and legislatures. The voter in a general election can be thought to care about who wins (i.e. $\theta > 0$), but he does not represent anyone else but himself (accountability is absent, so $\eta = 0$). From the analysis above, the costs of capture with public and secret votes are respectively zero and 2θ , so secrecy yields a strictly higher cost of rigging elections.²³²⁴

Now let us consider legislatures. We said above that when the force of accountability is strong, capture with public votes costs the same as with secret votes. This would seem to suggest that public voting in legislatures can never strictly dominate secret voting.²⁵ However, under the collective accountability implied by secret voting, the legislature would always tend to have a proportion p of corrupt members. Under individual accountability, only

²³See Section 6.3 for why, when votes are secret, conditioning payments on the vote share is not likely to attain costless capture.

²⁴The rigging of elections is an old concern (as made clear in the work of authors like Bentham and Mill) and there are historical accounts remarking that the secret ballot helped protect elections. A (cautious) opinion in that direction was expressed in 1881 by Charles Dodgson (a XIX century voting theorist better known as Lewis Carroll): *“forms of bribery were rampant in the days of open elections. The introduction of vote by ballot has, we may hope, largely diminished both...”*.

²⁵Of course if the principal could observe individual votes through a spy under secret voting, making votes public would be strictly better as it would “level” the field between principal and constituents.

corrupt members supporting bad projects fail to be reelected, while honest representatives can be kept in. So with public voting the legislature should converge to having only honest legislators. This yields a rationale for roll calls in legislatures: when accountability is strong (η is large) public votes do not allow for cheaper capture and do allow for the dynamic purification of the legislature.

Before concluding too enthusiastically that legislative votes being public is always a good thing, we must present two caveats. First, we have assumed throughout the section that constituents are in a good position to judge what is a “good” vote (see Maskin and Tirole 2001, for an analysis of officials that cater to badly informed constituents). When accountability is weak (i.e. η is close to zero) we saw that secrecy will be best. The same applies when constituents are badly informed and they would punish representatives that vote against bad projects (i.e. $\eta < 0$). In other words, the rule emerging from our model is “Stick with secrecy unless the pressure stemming from individual accountability is strong *and* well advised.” In the case of monetary policy, it has been indicated that the partiality induced through control by territorial constituencies is undesirable (Issing, 1999). Our model would then predict that if this type of control overrides that by other desirable sources (the professional community, say), then voting should be kept secret in central banks where board members represent areas or countries, as it is the case with the Bundesbank and the European Central Bank (where secrecy holds indeed). On the other hand, votes could be made public in central banks where territorial attachment of board members is absent, as in the Bank of England or the Federal Reserve of the United States (where secrecy is not in place).

A second caveat is that sometimes the principal may attain costless capture by promising transfers in the pivotal form *to constituents*, not to representatives. Admittedly, bribing entire constituencies may be difficult to do for a standard lobby. But it may not be so for the executive, who can transfer funds for public projects that affect the utility of whole constituencies (see Lizzeri and Persico, 2001, for a model where politicians use public programs to target redistributive transfers to certain segments of society). Now legislators face no electoral cost from voting for the principal’s project, as constituents understand that such voting behavior is the price of bringing them, say, pork barrel projects. Hence, the relevant model is not that of Section 8 (with vote-related costs) but that of Section 4. Thus, legislative votes being public could at times help, rather than hinder, an undesirable influence.

11 Conclusion

We began by selecting assumptions that isolate an extreme benchmark case: that of “absolute influence”. This is when the principal can manipulate at will the committee’s decisions while paying no bribes in equilibrium. Thus, collective decisionmaking is not necessarily a good safeguard against the influence of special interests, and may stop aggregating preferences and smoothing decisions. Also, the extent of political influence could become more extreme. An important literature in political science (mentioned already in the Introduction) has worried about the possible adverse effects of vote trading among voters. This paper exposes the dangers of trade between the committee members and an outside party.

A variety of treatments were offered, spawned by the relaxation of the assumptions producing the initial benchmark case. This pursued two aims. One was to show that those assumptions, though sufficient, were not always necessary to generate the initial results. In some cases marginal relaxations would leave the results unchanged. For example, only significant limitations on the credibility of bribes off equilibrium would raise the cost of capturing the committee away from zero. When the limitation would bind, an interesting implication followed: being suspected to be very wealthy—or to have a higher stake than is actually the case—might save the principal substantial bribes. In other cases, relaxing assumptions did change the cost of capture, but did not remove the potential for inefficiency. For instance, limiting the complexity of the offers made by the principal does make capture costly, but inefficiencies remain possible. Another aim of these treatments was to quantify the impact of relaxing the initial assumptions on the principal’s influence power. For example, offering bribes contingent only on individual votes (which requires the principal to observe who votes what) and offering bribes contingent on the final decision (which does not) allow capture at virtually the same costs. Thus, losing the ability to observe individual voting behavior only hurts the principal when she can use bribe schemes that are more sophisticated than just offering money in exchange for a vote. An example are the bribes promising compensation for pivotal votes only. These bribes can fully exploit the voting externalities that committee members generate on each other. By studying the case of voters that do not care about the committee’s decision, these externalities were easily isolated as the origin of inefficiencies.

This paper was concerned with studying protective measures for committees. We allowed voters something more than just voting. We showed that allowing them to coordinate their play through non-binding communication does not help them to avoid costless, inefficient

capture. This means that voters realizing a project is bad will not mitigate absolute influence, if the only weapon they have is talking about it and promising to each other to vote against the bad project. When the moment comes, they will all support this project if the principal was clever enough. We then allowed voters full contracting capabilities to show how they could use the principal's intention to capture the committee to their favour. We discuss how political parties could emerge to allow voters such abilities. We then allowed voters to change their voting procedures to make the voting rule more stringent. This was shown to allow committees to affect the price of capture and mitigate the potential for inefficiency. Finally we analyzed the reasons why it may be optimal to keep ballots secret in general elections while voting is kept public in legislatures.

12 Appendix

Proof of Proposition 3. Suppose w.n.l.o.g. that $\pi > \theta_1 + \theta_2$. The principal then offers bribes as follows. To 1 and 2: "I will pay ε for a non-pivotal "yes" vote, and $\theta_i + \varepsilon$ for a pivotal "yes" vote; nothing otherwise". To voter 3: "I will pay ε for a "yes" vote; nothing otherwise". By writing down the normal form, the reader can check $[y, y, y]$ is the unique NE of the game (it is uniquely selected by IDSDS).²⁶ Equilibrium bribes are arbitrarily small: 3ε . ■

Proof of Proposition 4. We prove first that a) the principal can induce decision "Yes" by spending 2θ . Then we prove that b) the principal cannot be certain to induce decision "Yes" by spending less than 2θ .

a) Suppose (w.n.l.o.g. as the game is symmetric) that players 1 and 2 are offered each a payment θ in exchange for a "yes" vote, and zero for a "no" vote. Member 3 gets no offers. The game in normal form looks like,

		n				y	
		n	y		n	y	
n		0, 0, 0	0, θ , 0	n		0, 0, 0	$-\theta$, 0, $-\theta$
y		θ , 0, 0	0, 0, $-\theta$	y		0, $-\theta$, $-\theta$	0, 0, $-\theta$

where $[y, n, n]$, $[n, y, n]$, $[y, y, n]$, $[n, n, y]$, and $[y, y, y]$ are NE. Of these, $[y, y, n]$ involves the play of weakly dominant strategies. Because we take the view that players play weakly

²⁶The assumption that all committee members know all offers is relevant here. For 3 to know that 1 and 2 will vote "yes", he needs to know what the principal is offering them.

dominant strategies when they have any, we regard $[y, y, n]$ as the prediction for the game, supporting a “Yes” decision.

b) The principal can offer bribes adding up to less than 2θ in many ways. It is immediate that no such way will afford making “yes” a dominant strategy for two voters, which is required to predict that the decision will favour the principal. ■

Proof of Proposition 5. We first prove a) that the principal can, by spending above 2θ , induce a voting game where the NE in weakly dominant strategies yields “Yes”. Then we prove b) that this is not feasible spending exactly 2θ (spending less cannot help).

a) Suppose the principal offers bribes $b = \theta + \varepsilon$ to players 1 and 2, conditional on the committee choosing “Yes”. Player 3 gets no offers. The normal form game is,

	n		y	
	n	y		
n	0, 0, 0	0, 0, 0		
y	0, 0, 0	$\varepsilon, \varepsilon, -\theta$		

	n		y	
	n	y		
n	0, 0, 0	$\varepsilon, \varepsilon, -\theta$		
y	$\varepsilon, \varepsilon, -\theta$	$\varepsilon, \varepsilon, -\theta$		

where $[n, n, n]$, $[y, y, n]$, and $[y, y, y]$ are NE. The profile $[y, y, n]$ involves weakly dominant strategies by all voters, and is therefore our prediction for the game, supporting a “Yes” decision at a cost arbitrarily close to 2θ .

b) Now suppose the principal spends exactly 2θ offering members 1 and 2 bribes $b = \theta$ conditional on the decision being “Yes”. Then there are four pure strategy NE and none of them involve the play of a dominant nor dominated strategy by any player: $[n, n, n]$, $[y, n, n]$, $[n, y, n]$ and $[y, y, n]$. Of these four equilibria, three yield a “No” decision, and therefore the principal cannot be confident to see a “Yes” outcome. It is straightforward to check that if 2θ is spent in other ways, things do not improve for the principal. ■

Proof of Proposition 6. The way to attempt costless capture is to make $[y, y, y]$ either the unique NE, or at least a NE in weakly dominant strategies. No scheme conditioning on the vote share can make “yes” a dominant strategy given that it is weakly dominated to begin with, and any such scheme would promise money to voters also conditional on profiles where they are voting “no”. (If a scheme tells a voter i that he will get a payment X if one person votes “yes”, that means voter i gets paid even if he votes “no” but exactly one other person votes “yes”.) So the only hope for the principal is to use a complicated scheme that does not rely on dominance. This means the scheme must be public if voters are to know what the equilibrium is. Any such scheme must work by destroying all equilibria apart from $[y, y, y]$. The following figure represents the eight profiles of the voting game.

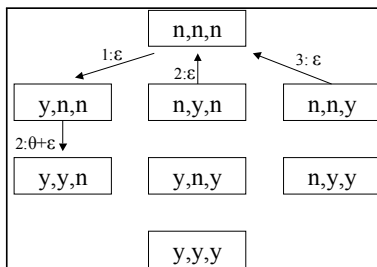


Figure 1: Destroying all NE yielding “No”

The meaning of the arrows is as follows: the arrow labeled, for instance, “1: ε ” and pointing to $[y, n, n]$ means that player 1 is being offered a bribe of ε conditional of profile $[y, n, n]$ being realized, which means he has an incentive to deviate from $[n, n, n]$ to $[y, n, n]$. Notice that offering a profitable deviation from the second to the third row requires bribes of at least $\theta + \varepsilon$. The first two rows represent profiles yielding decision “No”. Destroying them as NE (which they all are) requires providing at least one voter with a profitable deviation from each of those profiles—as shown in the figure. And costless capture requires that they be destroyed by providing deviations that do not involve payments in profiles in the third row (i.e. profiles where two voters vote “yes”). The reason is that if some voter i will get paid at least $\theta + \varepsilon$ if two votes for “yes” take place, then he will have incentives to deviate from the profile $[y, y, y]$ which in turn needs to be kept a NE. And the latter can only be kept as a NE if payments larger than $\theta + \varepsilon$ are offered conditional on its realization to voter i . So to conclude the proof we need to show it is impossible to break all “No” equilibria without offering money contingent on a profile comprising two “yes” votes to at least one voter.²⁷ Destroying all equilibria in the second row without giving a profitable deviation to any voter to a profile in the third row requires offering deviations to all three voters to move from profiles in the second row to the profile $[n, n, n]$. Doing this however would reinforce the latter profile (which yields “No”) as a NE. So at least one voter must be given incentives to deviate from it, as exemplified in the figure with the arrow labeled “1: ε ”. But if voter 1 is being given incentives to deviate from $[n, n, n]$ to $[y, n, n]$, then the latter profile is a NE, as voters 2 and 3 do not have incentives to further add a “y” vote themselves. So the only way of destroying $[y, n, n]$ as an equilibrium is providing voters 2 (as shown in the figure) or 3 with a profitable deviation to a profile containing two “y” votes. ■

²⁷If this cannot be done using a totally flexible bribe scheme, one that conditions on the vote share will not attain it either. So now we restrict attention to totally flexible schemes.

Proof of Claim 3. Suppose a committee of size 5 operating under simple majority rule. Now assume the bribe scheme detailed in the following table is offered:

	1	2	3	4	5
0 “yes” votes		ε			
1 “yes” votes	ε		ε	ε	ε
2 “yes” votes		ε			

This table shows the amount promised to each of the five voters (who are labeled 1 to 5 and situated in columns) depending on how many people vote “yes”. Any profile with two or less “yes” votes triggers decision “No”, and this bribe scheme breaks them all as NE. To see this, ask: Can a profile with two “yes” votes be a NE? No, because of those two voters, at least one is different from voter 2. And that voter would prefer deviating to voting “n” as in a profile with only one “y” vote he gets ε instead of nothing. Can a profile with one “y” vote be a NE? No, because: *i.* if that voter is 1, 3, 4 or 5, then voter 2 would want to deviate to vote “y” as well, as in a profile with two “y” votes he gets paid ε instead of nothing; *ii.* if that voter is 2, then he would prefer to vote “n” with the others, as when everybody votes “n” he gets paid ε rather than nothing. Lastly, can a profile comprising zero votes for “y” be a NE? No again, because any player apart from 2 would want to deviate, as in a profile with one “y” they get paid ε rather than nothing. So this scheme can destroy all NE yielding “No” and then the only remaining pure strategy NE yield “Yes” and cost nothing (i.e. the profiles where four and all five people vote “y”). Making sure the unique PSNE is the one where everybody votes “y” requires offering bribes of ε to all voters contingent on it. The cost of this is arbitrarily close to zero. It is easy to generalize this scheme to any other committee size $N > 5$.■

Proof of Claim 4. Suppose that the set of voters’ types is bounded above. Now assume that the principal faces no constraint on payment promises or that π is large relative to the upper bound on types. Then the principal can offer every member a bribe—contingent on the provision of a pivotal “yes” vote—infinitesimally larger than the member’s maximum possible type. This makes “y” the weakly dominant strategy for each player with probability one. The voting game then has $[y, y, y]$ as the NE in weakly dominant strategies, and the principal gets decision “Yes” with certainty and at no cost.■

Proof of Proposition 7. Our focus is on symmetric equilibria (i.e. where $p_1 = p_2 = p_3$). Now let us analyze p_1 as a function of p_2 and p_3 (first function in system (2)). As in

equilibrium $p_2 = p_3$,

$$p_1[p_2] = F \left\{ \frac{(1 - p_2)^2 \alpha + p_2^2 \gamma}{2p_2(1 - p_2)} + \beta \right\}$$

This function has domain in the interval $[0,1]$ and image in the same interval. It is continuous in such interval also. Therefore, it must have at least one intersection with the 45 degree line. That intersection constitutes a fix point, i.e. $p_1 = p_2$ and, as $p_3 = p_2$, it constitutes a symmetric solution to system (2). But we know already that there is at least one fix point at $(1,1)$: when p_2 is equal to both zero and one, p_1 equals one. Now, does $p_1(p_2)$ cross the 45 degree line at any other point apart from $(1,1)$? If we knew that the slope of $p_1(p_2)$ at $(1,1)$ is larger than one, then we would know that, close to $(1,1)$, the function $p_1(p_2)$ lies below the 45 degree line, and that there must be at least one other fix point, for some $p_2 \in (0,1)$ —the function $p_1(p_2)$ would look similar to that in the following figure,

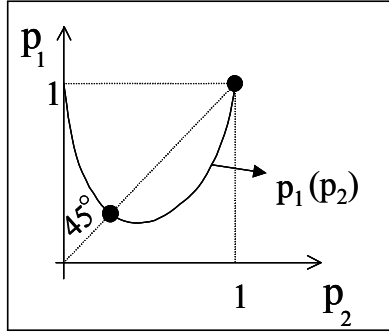


Figure 2: Possible symmetric equilibria

We turn then to study the slope of $p_1(p_2)$ near the point $(1,1)$.

Let $g(p_2) = \frac{(1-p_2)^2 \alpha + p_2^2 \gamma}{2p_2(1-p_2)} + \beta$, so that $p_1(p_2)$ can be written as $p_1(g) = F(g)$. Let also $k(p_2) = \frac{1}{2p_2(1-p_2)}$. The slope of $p_1(p_2)$ is, then,

$$\begin{aligned} \frac{\partial p_1}{\partial p_2} &= F'(g) \frac{\partial g}{\partial p_2} = F'(g) \frac{4[-\alpha(1-p_2) + \gamma p_2] p_2(1-p_2) + 2[\alpha(1-p_2)^2 + \gamma p_2^2](2p_2-1)}{[2p_2(1-p_2)]^2} = \\ &= F' \{ [\alpha(1-p_2)^2 + \gamma p_2^2] k + \beta \} 2k^2 \{ 2[-\alpha(1-p_2) + \gamma p_2] p_2(1-p_2) + [\alpha(1-p_2)^2 + \gamma p_2^2](2p_2-1) \}. \end{aligned}$$

Note that the long expression between curly brackets reduces to γ when $p_2 \rightarrow 1$. Thus, it must be that,

$$\lim_{p_2 \rightarrow 1} \frac{\partial p_1}{\partial p_2} = \lim_{p_2 \rightarrow 1} 2\gamma k^2 F' \{ \gamma k + \beta \}.$$

When p_2 tends to zero or to one, the function k tends to infinity. When this happens, the function k^2 goes to infinity with quadratic speed. Also, $F'(\gamma k + \beta)$ tends to zero when k tends to infinity. Therefore,

- i*) if $F'(k) \rightarrow 0$ at speed faster than quadratic, $\frac{\partial p_1}{\partial p_2}$ has zero limit.
- ii*) if $F'(k) \rightarrow 0$ at quadratic speed, $\frac{\partial p_1}{\partial p_2}$ has finite limit.
- iii*) if $F'(k) \rightarrow 0$ at speed lower than quadratic, $\frac{\partial p_1}{\partial p_2}$ has infinite limit.

The exponential distribution, for example, falls into *i*). Assume that $F(\theta)$ is one such distribution. Then—at least in a small neighborhood of the point (1,1)—the function $p_1(p_2)$ lies above the 45 degree line. Whether it crosses that line at some smaller level of p_2 or not depends on how high the minimum of the function $p_1(p_2)$ is. The function $g(p_2)$ attains its minimum value for some level $p'_2 \in [0, 1]$. Note that the level of the function g at its minimum depends on the payment β . As the distribution $F(g)$ is monotonically increasing, $F(g)$ attains its minimum also at p'_2 . The next figure illustrates how, if $g(p'_2)$ is high enough, then $F[g(p'_2)]$ —and $F[g(p_2)]$ for any p_2 —will always lie above the 45 degree line.

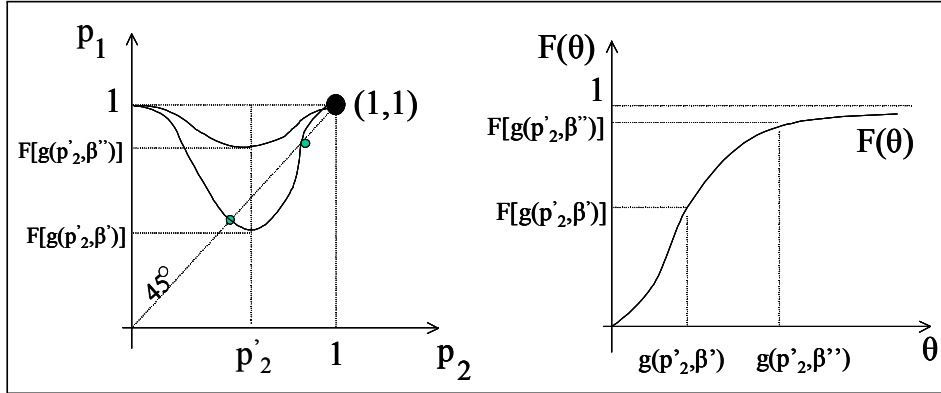


Figure 3: A high enough β yields a unique symmetric BNE

For some—relatively low—level β' , $F[g(p'_2)]$ lies below the 45 degree line and we have more than one fix point. But for some high enough level β'' , $F[g(p'_2)]$ is so high that all points in the function $F[g(p_2)]$ lie above the 45 degree line. Thus, by raising β as much as needed, the principal can make sure that (1,1,1) is the only symmetric equilibrium of the Bayesian game played by voters. ■

Proof of Proposition 9. a) Denote with $[\#y^r \geq M]$ a voting profile on reform containing at least M “ y^r ” votes. We see costless capture is impossible suppose the opposite holds: the principal offers a bribe scheme $b^{cc}(v^p)$ that attains costless capture with players using (at least weakly) dominant strategies in both stages. If $b^{cc}(v^p)$ attains costless capture, it must

have induced the failure of reform in the reform stage;²⁸ i.e. v^r must have been some profile $[\#y^r < M]$ that kept the decision rule as simple majority, then leading to costless capture in the project stage, yielding payoffs $-\theta$ for all voters. But failure of reform is incompatible with voters having used dominant strategies in the reform stage, yielding a contradiction.²⁹

Proving b) requires first proving i) that if $M = N$, spending above θ is sufficient to block reform and subsequently get the project approved, and then ii) that if $M = N$, spending less than θ cannot achieve this. Proving c) requires proving iii) that if $M = 1$, then inefficient capture is ruled out, and iv) that if $M > 1$, then inefficient capture can take place.

We prove points i) and iv) together. Suppose $\pi \in (M\theta, N\theta)$ and that passing reform requires at least $M > 1$ votes. Now suppose that $M - 1$ voters get offers: “ ε if you vote “ y^p ” and more or less than $\frac{N-1}{2}$ others vote that way, and $\theta + \varepsilon$ if you vote “ y^p ” with $\frac{N-1}{2}$ others *and* the project goes through”, while the other $N - (M - 1)$ voters get offers like that plus a payment θ contingent on $[\#y^p = N]$. Then each one of the voters in the second group realize blocking reform is a (weakly) dominant strategy: “If I am not pivotal in the reform stage, I do not care what I vote, while if I am pivotal and block reform, the announced bribes will induce $[\#y^p = N]$ as a NE in dominant strategies in the project subgame, yielding a payoff ε to me, as opposed to zero if I support reform, which will make the project be rejected as no dominant strategies will exist in the subgame.” Voters in the first group use a similar logic to find that their (weakly) dominant strategy is to support reform, although they are not enough to make it pass. Hence the profile $\{[\#n^r = N - (M - 1), \#y^r = M - 1], [\#y^p = N]\}$ is the SPNE involving dominant strategies in both stages (weakly in the first, strictly in the second). Reform fails and the project is approved at cost $(N - (M - 1))(\theta + \varepsilon) < N\theta$. From this expression, if $M = N$, the cost of capture is $\theta + \varepsilon$ (hence i) is proved). If $M = 1$ the cost

²⁸The reason is that any profile $[\#y^r \geq M]$ in the reform stage makes the new decision rule for the project stage equal to unanimity. Under unanimity costless capture is impossible because only the profile $[y^p, y^p, y^p]$ yields decision “Yes” and this profile can only be made a NE at cost 3θ .

²⁹The reason why failure of reform is incompatible with players using dominant strategies is as follows. Any voter deciding under any bribe scheme that could lead to costless capture in the event of reform failure will reason thus: “If I am not pivotal in the reform stage, I do not care what I vote regarding reform. If I am pivotal, then one of two things can happen. If I make reform go through, in the following ‘project subgame’ costless capture is impossible and my payoff is for sure larger than $-\theta$. If I make reform fail, then costless capture happens in the subgame and I get $-\theta$. So my weakly dominant strategy in the reform stage is to support reform”. (Note that bribes can only be conditioned on project votes and on whether the project goes through, but not on reform votes, thus implying that if reform fails, then the equilibrium in the project subgame is the same regardless of how reform failed, and if reform is successful, the equilibrium in the project subgame will be something else, but also invariant to how reform succeeded.)

of capture is $N\theta$, but for any $M > 1$, the cost of capture is lower than $N\theta$, hence inefficiency is possible, proving iv).

Now we prove ii): The principal cannot condition payments on v^r and subsequent play only depends on the offers made contingent on v^p and on whether the project is approved or not. Thus, payoffs are to be the same for any $v^r \neq [y^r, y^r, y^r]$. Therefore, any bribe scheme that does not offer some player a positive payoff for deviating from $[y^r, y^r, y^r]$ —thus blocking reform and leading to the approval of the project—makes $[y^r, y^r, y^r]$ the NE in (weakly) dominant strategies of the reform game.

To finish with, we prove iii): For inefficiencies to be possible in principle, we need $\pi < N\theta$. So assume this. If reform is passed ($v^r \neq [\#n^r = N]$), the cost of getting the project approved is at least $N\theta$ (as, under unanimity, all N voters must be compensated) which the principal cannot afford, hence voters' payoffs are at least zero. For $v^r = [\#n^r = N]$ reform fails, but no bribe scheme will fully compensate all voters in the event of the project being approved (as $\pi < N\theta$), so at least one voter must get negative utility. But this voter can guarantee himself a nonnegative payoff by deviating from $[\#n^r = N]$ to pass reform (making unanimity the new decision rule) and then block the project by voting against it ($[\#y^p = N]$ is not a NE under unanimity). Hence, if every voter can pass reform, all voters must be fully compensated for the project to go through, ruling out inefficiency. ■

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