Informational Lobbying and Access When Talk Isn't Cheap

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Abstract

I develop a model in which interest groups (IGs) have private, verifiable information in support of their preferred policy positions that in aggregate determine the set of policies that maximizes citizen welfare. An uninformed policy maker (PM) is concerned with both implementing a set of policies that maximize citizen welfare, and collecting contributions from IGs. I model the interaction between the PM and the IGs as an all-pay auction where IGs provide contributions to the PM, and the PM grants access to the groups that gave the largest contributions. The IGs with access can present their information to the policy maker before he chooses a policy set. In equilibrium, because contributions are chosen endogenously, the PM learns about the information quality of all IGs, even when he grants access to only a subset of the groups. When there is no limit to the size of contributions, the welfare maximizing policy set is implemented in equilibrium. Limiting the size of contributions strictly reduces expected citizen welfare.

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1 Introduction

"...[T]he only way in which a human can make some approach to knowing the whole of a subject is by hearing what can be said about it by persons of every variety of opinion, and studying all modes in which it can be looked at by every character of mind."

—John Stuart Mill, *On Liberty*

Decision makers can make informed judgements regarding an issue only when they fully understand the perspectives of all parties involved with the issue. In government, policy makers (PMs) are charged with making decisions regarding a vast range of issues which they may not fully understand. To improve their understanding of an issue before implementing a policy, a PM can invite interest groups (IGs) or other parties to present information in support of their favored policy positions.

I develop a game in which a single PM must implement a policy for each of multiple issues. There are two IGs concerned with each of the issues; one representing each of the extreme policy positions on the issue's single dimensional policy space. All IGs have information in support of their preferred policy positions. The quality of their information is drawn from a random distribution at the start of the game and can be directly revealed to the PM if they present him with their information. The PM can determine with certainty the policy that maximizes the welfare of the representative citizen only if he learns the information quality of both IGs concerned with an issue; therefore, he can maximize citizen welfare only if he knows the information quality of all IGs.[1]

[1]The quality of an IG's information is defined by the impact the information has on a PM's perception of the optimal policy. Therefore, knowledge of a piece of information's quality has an equivalent impact on the PM's beliefs as knowing the information itself. This is true so long as each piece of information may only be presented by a single IG, which is the case when a single IG represents each policy position (which is assumed in this paper), or if multiple IGs represent each position, but they have non-overlapping areas of concern or expertise. For example, one IG might have information regarding how a policy hurts consumers, while another IG might have information regarding how the same policy hurts the environment. In such a situation, the conclusions of the paper continue to hold.

In a situation in which information quality is not equivalent to the information itself, the access mechanism in this model may result in a second-best citizen welfare outcome rather than the first-best outcome that is achieved when information and information quality are equivalent.

The PM—who is concerned about citizen welfare and collecting political contributions—learns the information quality of all IGs if he grants all IGs access.[2] However, granting access to all IGs might not be feasible due to time or other constraints. Furthermore, it might not be optimal for the PM if limiting access allows him to collect contributions from the IGs. I consider PM and IG behavior when the PM provides access to the IGs that provide him with the highest political contributions. The formal model takes the form of an all-pay auction with incomplete information in which each IG submits a contribution (bid) to the PM, and the highest contributors win access (prizes). In such a framework, I show that IGs with higher quality information are willing to bid more for access than other groups. This allows the PM to learn about an IG's information quality from its contributions and remain fully informed about all issues even when he chooses to grant access to only some of the IGs.

When contributions are unconstrained, the model results in the implementation of the policy set that maximize the welfare of the representative citizen. However, this result requires that there is no limit on the amount that IGs are allowed to contribute. If limits are placed on IG contributions, the PM can no longer distinguish between the information qualities of the IGs that provided the maximum allowed contribution. This means that the PM is less than fully informed when he chooses a policy, which results in strictly lower expected welfare for the representative citizen.[3]

This paper develops a reasonable alternative to existing models of informational lobbying, providing different (often more optimistic) explanation for the role of IGs, political contributions, and lobbying expenditures in the political process. In my model, contributions are used by IGs to buy access from politicians rather than to buy policy favors. IGs that receive access are able to communicate their private information to a PM who uses the information to more fully understand an issue for which he must implement a policy. This

[2] As I show in the analysis, an IG who is offered access always accepts.

[3] If IGs communicate arguments in support of their policy positions rather than communicate verifiable information, or if the PM is biased in his interpretation of the information, we need to be cautious when interpreting the results of the model in terms of citizen welfare. In such situations, the idea of welfare as used in the paper should be interpreted as the PM's expectations regarding citizen welfare rather than actual realized citizen welfare.

framework differs from most of the lobbying literature in that it assumes that information is verifiable, and that the PM must grant an IG access in order for the IG to communicate its information. Although a few papers incorporate one of these two assumptions, I am aware of no other paper that develops an access model for situations where information is verifiable. Furthermore, this paper represents a novel application of the all-pay auction in the literature.

Most papers concerned with informational lobbying assume that information is completely unverifiable (see Grossman and Helpman 2002 for an extensive overview). In these models, the presentation of information takes the form of cheap talk, and the PM can only make some inferences about the quality of the information if he believes that the IG's preferences are in line with his own, or that it is more costly for an IG to lie compared to presenting truthful information (e.g. Austen-Smith 1993; Krishna and Morgan 2001). The unverifiable information models most closely related to this paper consider the role of IG contributions on a PM's decision to provide access to an IG. In Austen-Smith (1995), contributions allow the PM to identify and grant access to the interest groups that have policy preferences most closely in line with his own. In Lohmann (1995), IGs always present information in favor of their ideal policy position; however IGs that received information in favor of their preferred policy have a higher expected payoff if the PM implements their ideal policy than similar IGs that did not receive a signal. The IGs that receive a signal have a higher willingness to pay for the PM to incorporate their information into his decision; therefore the PM can identify the IGs that report their signals truthfully from their contributions. In both of these models, contributions inform the PM about the likelihood of an IG presenting truthful information, and generally do not result in the PM becoming fully informed.

Although the majority of research has focused on the case where information is completely unverifiable, this paper is not the first to consider the alternative case in which IG information is verifiable.[4] In their influential paper, Milgrom and Roberts (1986) consider the decisions of

[4] This paper treats information as completely verifiable. However the true state of information is probably somewhere in between completely verifiable and completely unverifiable information (Dewatripont and Tirole

IGs to reveal their private verifiable information, and consider the conditions under which the PM becomes fully informed. Only recently have other papers started to incorporate verifiable information into lobbying models. In Bennedsen and Feldmann (2002), IGs can provide verifiable information to members of a legislature, who then collectively implement a policy. Bennedsen and Feldmann (2006) and Dahm and Perteiro (2005a, 2005b) develop models in which IGs can influence a PM's policy decision through both the provision of verifiable information, and the provision of contributions contingent upon the implementation of their preferred policy. None of the papers that incorporate verifiable information model the PM's decision to provide access to an IG; any IG that wants to present information to the PM has the ability to do so. When contributions are included in these models, they are used to buy policy favors, not access.

In this paper, the PM allocates access to the highest contributors through an all-pay auction.[5] This paper represents the first application of an all-pay auction to an informational lobbying game. However, all-pay auctions have been used in the more general lobbying literature to model the competition between IGs for a policy favor (Hillman and Riley 1989; Baye et al 1993, 1994, 1996). In these other applications of the all pay auction, IGs who are all concerned with the same issue provide a PM contributions, then the PM chooses to implement the policy that is preferred by IG that gave the largest contribution.[6] In this paper, IGs compete for access rather than a policy favor. The all pay auction framework incorporated into this paper is most similar to the models of Holt (1979) and Holt and

2005). An interpretation of this paper's model in line with this more realistic perspective assumes that IGs present the PM with arguments (a combination of verifiable and unverifiable information, or points of view) in favor of their policy position, and the quality of an IG's information defines the impact its argument has on the PM's beliefs about the policy that maximizes citizen welfare. This is analytically equivalent to the assumption of verifiable information except that the results cannot be interpreted in terms of the true socially optimal policy. Instead, the results can be interpreted in terms of the PM's perceived socially optimal policy.

[5] The PM may always provide access to certain IGs. Allowing this does not change any results, so long as the PM still allocates some access through the all-pay auction. Providing access to the one IG that provides the largest contributions is sufficient.

[6] Alternative models for the allocation of policy favors include frameworks in which the IGs provide contributions contingent upon receiving the favor (e.g., Besley and Coate 2001), or in which the favor is allocated through a lottery, in which the probability of an IG receiving the favor depends on the relative size of the IG's contribution (e.g., Tullock 1980). Fang (2002) and Taylor, et al (2003) compare all-pay auctions and lotteries.

Sherman (1982) that allow for private valuations and the allocation of multiple prizes. The application of the all-pay auction in this model differs from previous applications in that bidders are competing for an opportunity to share their information with the PM; however, in this framework, their information quality is revealed through their bids. This results in an interesting decision problem for the bidders that is not present in previous applications of all-pay auctions.

The following section of the paper describes the model. The third section solves for the equilibrium of the general model, when contributions are not limited. The fourth section imposes contribution limits and considers how they impact the outcome of the game. The fifth section concludes by discussing the analysis, its implications, and extensions for future research.

2 Model

Interest Group Information:

There are N policy issues. For each of the N issues, a policy can be chosen from a single dimensional policy space along the interval $[-1, 1]$. There are a total of $2N$ IGs, with two IGs concerned with each issues. For each issue, one IG prefers policy -1, and one IG prefers policy 1. An IG is denoted by the issue it is concerned with and its preferred policy platform; therefore IG (n, j) refers to the IG concerned with issue $n \in \{1, ..., N\}$ and policy platform $j \in \{-1, 1\}$. Where it is clear which issue I am discussing, I may refer to an IG simply as IG j. The fundamental results in this paper do not change if I allow multiple IGs to represent each side of an issue.

At the beginning of the game, each IG draw information in support of its preferred policy. The quality of IG (n, j)'s information is denoted by I_n^j and is i.i.d. on the continuum $[0, 1]$. A higher I_n^j can be thought of as IG (n, j) having stronger evidence in support of its preferred policy. The realized value of I_n^j is known only to IG (n, j); although the distribution is common knowledge. Let $F(I)$ denote the distribution of a randomly drawn IG's information; $f(I)$ defines the density of $F(I)$.[7]

Socially Optimal Policy:

The information quality of both groups concerned with an issue determines the policy choice that is best for the representative citizen. Let p_n^o define the *socially optimal policy* for issue n, and the vector $p^o = \{p_1^o, ..., p_n^o\}$ defines the set of socially optimal policies across all issue. For any issue n, $p_n^o(I_n^{-1}, I_n^1)$ is a continuous function that is strictly decreasing in I_n^{-1}, that is strictly increasing in I_n^1, and where $p_n^o(1,0) = -1$ and $p_n^o(0,1) = 1$. For most of the analysis I assume p_n^o takes the form

$$p_n^o = I_n^1 - I_n^{-1} \tag{1}$$

I use this simple function because it allows for a very clean analysis. It is straightforward to extend the analysis to allow a more complicated socially optimal policy function, and reasonable changes to the function do not change the general results.[8]

Communicating Information:

After the IGs learn their information quality, some IGs may have an opportunity to present their information to the PM. The PM can grant access to at most $\bar{K}$ IGs. Let $K \in \{0, 1, ..., \bar{K}\}$ denote the number of IGs that the PM actually grants access to. When an IG is granted access, it decides whether to accept access and present its information to the PM, or to decline access. This decision is denoted by the binary variable $a_n^j \in \{0,1\}$, such

[7] This notation assumes that $F(I)$ is the same for all IGs. This does not have to be the case. Alternatively, $F_n^j(I)$ could define the distribution of IG (n,j)'s information. Allowing the distribution of information to differ across IGs does not change the results of the analysis, but does make the notation more complicated.

[8] An alternative socially optimal policy function may allow for the optimal policy to favor one of the IGs when both IGs have the same information quality. For example, let $p_n^o = \alpha_n + (1-\alpha_n) I_n^1 - (1+\alpha_n) I_n^{-1}$, where $\alpha_n \in (-1,1)$ is the socially optimal policy when both of the issue's interest groups have $I = 0$. Although using such a function complicates notation and some of the equilibrium equations, it does not alter the conclusions of the analysis.

Additionally, the function p_n^o does not have to be linear in information quality. So long as the function is additively separable in terms of I^{-1} and I^1, the asymmetries between the impact of the two groups' information on the optimal policy may be accounted for through a transformation of their information distribution functions $F_n^j(I)$. As stated previously, allowing for asymmetric distribution functions does not change the results of the analysis.

that $a_n^j = 1$ iff IG (n, j) accepts access when granted. It is costless for the PM to provide access to $K \leq \bar{K}$ interest groups, and costless for an IG to present its information if granted access.

When an IG presents its information to a PM, the PM becomes informed of the IG's information quality. Therefore, when IG (n, j) accepts access, the PM learns I_n^j for sure.

When the PM chooses $K < 2N$, he provides access to fewer than the total number of IGs. Instead of randomly granting access to K of the IGs, he essentially trades access in exchange for political contributions. After the IGs learn their information quality, and before the PM announces which IGs receive access to present their information, the IGs each provide the PM with a political contribution. b_n^j denotes the contribution provided by IG (n, j). The PM observes the set of contributions and grants access to the K IGs that provided the largest contributions. If the Kth and $(K + 1)$th highest contributions are equal, then the PM randomly chooses which of the IGs that provided this same contribution receive access.

Because the PM is not allowed to outright sell access, all contributions must be provided before access is granted. Contributions are non-refundable, and cannot be provided contingent upon being granted access. Therefore, the exchange of access for political contributions functions as an *all-pay auction*: all bidders (IGs) commit their bids (contributions) before the prizes (access) are allocated, and the highest bidders receive prizes.

The PM is said to be *fully informed* if he is certain about the information quality of all IGs. Otherwise, he is considered *less than perfectly informed*.

Payoffs

The function $W(p^*)$ defines the welfare of the representative citizen given the set of implemented policies, such that

$$W(p^*) = \sum_{n=1}^{N} w(d_n^o) = \sum_{n=1}^{N} w(|p_n^* - p_n^o|) \tag{2}$$

$p_n^* \in [-1, 1]$ denotes the policy choice of the PM in regards to issue n, and $p^* = \{p_1^*, ..., p_N^*\}$

denotes the set implemented policies. $d_n^o = |p_n^* - p_n^o|$ is the distance between the socially optimal policy and the actual policy implemented by the PM. The function $w(d_n^o)$ is symmetric across all issues, where $w'(d) < 0$, $w''(d) \leq 0$, and $w(0) = 0$.[9]

The PM chooses how many total IGs to grant access to, K, and for each issue n he chooses the policy to implement, p_n^*. The PM is concerned with the representative citizen's welfare as well as generating revenue through political contributions. PM utility is given by:

$$U^{PM}(p, b) = W(p^*) + \rho \sum_{n=1}^{N} \left(b_n^1 + b_n^{-1}\right) \tag{3}$$

$\rho \geq 0$ represents how much the PM cares about revenue generation relative to citizen welfare. The PM is non corrupt, and does not sell policy favors; contributions determine whether an IG receives access, but does not have a direct influence over the policy choice of the PM.

Each IG (n, j), understanding the PM's problem, chooses the size of its political contribution b_n^j and whether to present its information if granted access, a_n^j. IGs want to minimize the difference between their own policy preferences and the actual policy implemented by the PM. Let $V(d_n^j)$ denote IG (n, j)'s policy utility where d_n^j is the difference between the IG's preferred policy p_n^j and the PM's implemented policy p_n^*. Therefore, $d_n^j = |p_n^* - p_n^j|$. Let $V'(d) < 0$, $V(0) = 0$, and the functional form of $V(\cdot)$ be independent of any b and p.[10] IG (n, j)'s overall utility is given by:

$$U_n^j\left(p_n^*, b_n^j\right) = V\left(d_n^j\right) - b_n^j = V\left(\left|p_n^* - p_n^j\right|\right) - b_n^j \tag{4}$$

Summary of Game and Description of Equilibrium:

The game takes place as follows:

1. Each IG (n, j) observes its own private information I_n^j and chooses a political contri-

[9] The results are not changed if the certain issues are of more importance to the representative citizen than other issues, so long as these differences are common knowledge.

[10] All IGs are assumed to have the same policy utility function. The results do not change if the IG utility functions differ, so long as they are common knowledge.

bution b_n^j to provide to the PM.

2. The PM observes contributions and chooses how many IGs to provide access to. Let $K \in \{0, 1, ...\bar{K}\}$ denote the number of groups that are offered access. Access is provided to the K IGs that provided the largest contributions. Therefore, access is determined through an all-pay auction, where payments (contributions) are committed before the prizes (access) are allocated.

3. Each IG that has been granted access chooses whether to present its information. Let the binomial $a_n^j \in \{0, 1\}$ describe an IG's acceptance decision, with $a_n^j = 1$ iff IG (n, j) accepts access when granted. If a group presents its information, the PM directly learns the quality of its information.

4. The PM updates his beliefs regarding each IG's information quality and implements a policy concerning each of the N issue. Let p_n^* denote the policy implemented by the politician regarding issue n, and let $p^* = \{p_1^*, ..., p_N^*\}$ denote the set of implemented policies for all issues.

A final solution to this game should describe a complete strategy for each IG composed of two actions b and a, as well as a complete strategy for the PM composed of the choice of K and a function $p^* : b, \{I_n^j\}_{(n,j)|a_n^j=1} \to p$ that maps IG contributions and revealed information into policy choices. Below, I show that a_n^j is exogenous of the model and can therefore be excluded from descriptions of an equilibrium. I consider symmetric equilibrium in which all IG contribution decisions correspond to the same bid function $B(I)$. Following the all-pay auction literature, $B(I)$ is assumed to be either a constant, or continuous and strictly monotone in I (and therefore invertible), which makes the analysis tractable. Complete strategy descriptions may be described by the contribution function $B(I)$, the PM access decision K, and the policy function $p^*(\cdot)$.

Definition 1 *The set of IG strategies $\{a_n^j, B(I_n^j)\}_{\forall(n,j)}$ and the PM strategy $\{K, p^*\}$ constitute a **contribution equilibrium** if ex ante:*

1. *There does not exist an IG* $\{m,i\}$ *such that given the strategies* $\{a_n^j, B(I_n^j)\}_{\forall(n,j)\neq(m,i)}$ *and* $\{K,p^*\}$, *for some* $\left\{\tilde{a},\tilde{b}\right\} \neq \{a_m^i, B(I_m^i)\}$ *where* $\tilde{a}\in\{0,1\}$ *and* $\tilde{b}>0$, $U_m^i\left(\tilde{a},\tilde{b}\right) > U_m^i\left(a_m^i, B\left(I_m^i\right)\right)$.

2. *There does not exist an strategy* $\left\{\tilde{K},\tilde{p}^*\right\} \neq \{K,p^*\}$ *such that given strategies* $\{a_n^j, B(I_n^j)\}_{\forall(n,j)}$, $U^{PM}\left(\tilde{K},\tilde{p}^*\right) > U^{PM}(K,p^*)$.

This definition says that a contribution equilibrium is a Nash equilibrium of the game in which no player acting alone has an incentive to deviate from its chosen strategy.

3 General Analysis

3.1 Solving the Standard Model

The analysis first considers the policy choice of the PM at the conclusion of the game, and the decision of the IGs of whether to accept access if offered. Given these actions, I then consider the all pay auction in which IGs choose the size of their contributions, and the PM chooses how many IGs to offer access to. I find the sub game perfect equilibrium of the game. Although backwards induction would imply that I analyze the PM's access decision before, I consider the IGs' contribution decision, the analysis is greatly simplified if I first determine the contribution function. Therefore, the IG contribution decision is discussed before the PM's access decision in the analysis below.

PM Policy Choice

The PM benefits from both higher total contributions and higher representative citizen welfare. By the time the PM chooses a policy, the IGs have already provided their contributions and presented their information. This means that the PM's policy choice cannot impact his revenue utility. Therefore his policy choice maximizes the expected welfare of the representative citizen. The following lemma defines the policy function $p^*(\cdot)$.

Lemma 2 $p_n^* = E(p_n^o)$ *for all* $n \in \{1,...,N\}$.

This implies that the PM, when choosing policy at the conclusion of the game, always acts in the citizen's best interest. This does not imply that he acts in the citizen's best interest through the whole of the game. The policy he believes is best for the representative citizen depends on how informed he is regarding the IGs' information quality.[11] The accuracy of his information is determined from actions in earlier stages of the game. When the PM is certain regarding all IGs' information quality, then $E\left(I_n^j\right) = I_n^j$ for all (n, j) and $p^* = p^o$. When the PM is uncertain regarding an IG's information quality, the PM acts as a Bayesian, updating his beliefs given what he does know.

IG Acceptance of Access

Prior to the PM's choice of policy, the IGs that were offered access must decide whether to make a presentation to the PM. As the following lemma states, IGs always accept access if offered. This is because if an IG does not accept access, the PM updates his beliefs assuming that the IG's information is of lower quality than he expected. This results in a downward spiral of beliefs, such that the PM concludes that the IG has valueless information ($I = 0$).

Lemma 3 $a_n^j = 1$ *for all* (n, j).

IG Contribution Decision

In equilibrium, all IGs contribute according to the contribution function $B(I)$. I first consider the case where $K \in \{1, ..., 2N-1\}$, and solve for the function $B(I)$ that I show is strictly increasing in I. Then I consider the IG contribution decision when the PM provides access to no IGs, or all of the IGs ($K = 0$ or $K = 2N$).

The approach used to solve for $B(I)$ when $K \in \{1, ..., 2N-1\}$ is similar to the approach developed by Holt (1979) and Holt and Sherman (1982). They solve an all pay auction in which bidder valuations are private knowledge, and there are multiple prizes allocated by the auction. I initially assume the existence of a strictly monotone contribution (bid) function, then establish that solve for such a function, thereby proving that one exists.

[11] As I will show, when there are contribution limits, the PM may prefer to commit to access decisions that increase his total contributions at the expense of learning about the information from a greater number of IGs. This results in lower expected welfare for the citizen than the PM could have obtained.

Given that $B(I)$ is strictly monotone in information, it follows that the contribution function is strictly invertible, where $I(b) = B^{-1}(I)$. When the game is in equilibrium, it immediately follows that a rational agent can determine an IG's information quality if he observes its contribution. This has very interesting implications for the model. Suppose instead that the PM cannot learn an IG's information except by providing the IG access. Then IG's with high quality information benefit from receiving access and informing the IG that their information is higher quality than expected. This means that groups with higher quality information are willing to pay more to secure access, and therefore contribute more to the PM than IGs with lower quality information. However, when the PM can learn an IG's information quality by observing their contributions, the benefit from actually gaining access disappears, and the incentives to provide contributions change.

Whenever an IG provides a contribution on the range of the equilibrium contribution function, the IG recognizes there is a positive probability that it provided one of the K highest contributions, and will therefore be offered access.[12] Groups also realize that they will accept any access offer; therefore, if the PM offers them access, the PM will become fully informed as to their information quality. The IG incorporates these considerations into their contribution decision.

In equilibrium, no IG has an incentive to provide a contribution different from $B(I)$. The analysis precedes by analyzing the contribution decision of a single IG given that all other IGs act according to the equilibrium contribution function.

IG (n, j) maximizes the following equation with respect to b:

$$\int_0^1 f\left(I_n^{-j}\right)\left(\left(1-\Theta\left(I\left(b\right),K\right)\right)V\left(j-I\left(b\right)+I_n^{-j}\right)+\Theta\left(I\left(b\right),K\right)V\left(j-I_n^j+I_n^{-j}\right)\right)dI_n^{-j}-b \tag{5}$$

$\Theta(I(b), K)$denotes the probability that an IG receives access given contribution b when the PM offers access to the K IGs that provided the largest contributions. The information

[12] This follows from information being i.i.d., and the IGs not knowing the information quality of other interest groups.

quality density function $f\left(I_n^{-j}\right)$ is used to represent the expectation that the IG has over the PM's expectation about the other IG's information at the time the PM implements his policy choice. It is sufficient to use $f\left(I_n^{-j}\right)$ in this problem since, as I show below, the equilibrium solution for this problem results in the PM being fully informed about the other IG's true information quality.

First order conditions for the IG's problem are given by:

$$\int_0^1 f\left(I_n^{-j}\right)\begin{pmatrix} \left(1-\Theta\left(I\left(b\right),K\right)\right)\frac{\partial V}{\partial d}\frac{\partial I}{\partial b}\left(-1\right) \\ -\frac{\partial \Theta}{\partial I}\frac{\partial I}{\partial b}V\left(j-I\left(b\right)+I_n^{-j}\right) \\ +\frac{\partial \Theta}{\partial I}\frac{\partial I}{\partial b}V\left(j-I_n^j+I_n^{-j}\right)\end{pmatrix} dI_n^{-j}-1=0 \tag{6}$$

In equilibrium $I\left(b\right)=I_n^j$. Therefore the problem simplifies to:

$$\frac{\partial B}{\partial I}=\int_0^1 f\left(I_n^{-j}\right)\left(\left(1-\Theta\left(I\left(b\right),K\right)\right)\frac{\partial V}{\partial d}\left(-1\right)\right)dI_n^{-j} \tag{7}$$

Because $f\left(I_n^{-j}\right)>0$, $\left(1-\Theta\left(I\right)\right)\geq 0$ (with strict inequality for some $B\left(I\right)$), and $\frac{\partial V}{\partial d}<0$, it follows that $\frac{\partial B}{\partial I}>0$. This means that information quality is increasing in contribution amount, and the PM can correctly infer that the IGs that provide the largest contributions are also the IGs with the highest quality information. This conclusion holds for all $K\in\{1,...,2N-1\}$; however, $K=2N$ implies that $\Theta\left(I\right)=1$, which means that $\frac{\partial B}{\partial I}=0$.

It is now straightforward to construct the function $\Theta\left(I\right)$:

$$\Theta\left(I,K\right)=\sum_{i=0}^{K-1}\left(\frac{(2N-1)!}{(2N-1-i)!i!}\right)F\left(I\right)^{2N-1-i}\left(1-F\left(I\right)\right)^i \tag{8}$$

The value $\Theta\left(I,K\right)$ equals the probability that fewer than K other IGs have information quality greater than the information quality I held by the IG.[13]

[13] If the distribution of information quality differs between IGs, an the equation for Θ can still be found. Now the probability that fewer than K other IGs have information quality greater than $I\left(b\right)$ is given by:

$$\Theta\left(b\right)=\sum_{S\in\mathbf{S}}\prod_{(n,j)\notin S}F_n^j\left(I\left(b\right)\right)\prod_{(n,j)\in S}\left(1-F_n^j\left(I\left(b\right)\right)\right) \tag{9}$$

From here we can derive the contribution function:

$$B_K\left(I_n^j\right) = \int_0^{I_n^j}\int_0^1 f\left(I_n^{-j}\right)\left(1-\Theta\left(y,K\right)\right)\left(-1\right)\frac{\partial V\left(j-y+I_n^{-j}\right)}{\partial d}dI_n^{-j}dy \tag{10}$$

$B_K\left(I\right)$ defines the equilibrium contribution of an IG with information quality I when the PM grants access to K IGs.

An IG can increase the PM's perception of its information quality by increasing its contribution; however, increasing their contributions also increases the probability that it will actually selected to present its information. In equilibrium, for any information quality I, the benefit an IG receives from bidding more than $B_K\left(I\right)$ in an attempt to convey a higher I than it actually has equals the cost of providing a higher contribution. Given the same contributions, IGs with better information face less of a loss if they are actually offered access than IGs with lower information quality. This results in equilibrium contribution functions in which IGs with the highest information quality still provide the largest contributions.

The above results hold for all $K \in \{1, ..., 2N-1\}$. However, the PM could alternatively choose to offer access to none or all of the IGs ($K = 0$ or $K = 2N$). In either of these alternative cases, $B\left(I\right) = 0$ for all I.

If $K = 0$, then no matter how much an IG contributes, there is no possibility that it will end up presenting its information to the PM. The contributions are seen as cheap talk by the PM, who can no longer infer anything about an IG's information quality from its contribution. The PM therefore ignores any contributions as they are not informative. The IGs recognize that contributions do not provide any benefit to them, and therefore do not spend money on contributions. Thus, $B_0\left(I\right) = 0$ for all I.

If $K = 2N$, then all IGs are offered access no matter the size of their contributions. This means there are no benefits from providing contributions, and the IGs provide no money to the PM. This may also be seen by setting $\Theta\left(I, 2N\right) = 1$ for all I in the function for $B_K\left(I\right)$

where $\mathbf{S}$ denotes the collection of all possible sets of different interest groups with fewer than K members. There are a total of $\sum_{i=1}^{K-1}\left(\frac{(2N-1)!}{(2N-1-i)!i!}\right)$ different sets within $\mathbf{S}$.

above. Thus, $B_{2N}(I) = 0$ for all I.

PM Access Decision

When the PM chooses K, the IGs have already submitted their contributions, and he is aware that any IG that is offered access will accept. In equilibrium, the IGs must all submit contributions according to the same function $B(I)$. Above, I define $2N + 1$ different potential equilibrium bid functions: $\{B_K(I)\}_{K=0,1,...,2N}$. If $\bar{K} < 2N$, then there exists only $\bar{K} + 1$ different potential equilibrium bid functions.

When the IGs submit bids according to one of the functions $B_k(I) \in \{B_1(I), ..., B_{2N-1}(I)\}$, the PM becomes fully informed about the information quality of all IGs no matter his choice of K. Therefore, the PM's choice of K does not affect the amount of information he learns, or the contributions he collects. He is therefore indifferent between any $K \in \{0, 1, ..., \bar{K}\}$. When he is indifferent, I assume he chooses $K = k$ where k is the access decision the IGs based their contribution choice on (the subscript on $B_k(I)$).

When $B_k(I) \in \{B_0(I), B_{2N}(I)\}$ all IGs submit no contribution. Because each group provides the same contribution independent of their information quality, the PM no longer becomes fully informed, and can only learn an IG's information quality by granting it access. Therefore, the PM is no longer indifferent between all $K \in \{0, 1, ..., \bar{K}\}$, and instead prefers to grant access to the greatest number of IGs. When $\bar{K} \geq 2N$, he provides access to all of the IGs, $K = 2N$. When $\bar{K} < 2N$, the provides access to $\bar{K}$ IGs, $K = \bar{K}$. However, only when $K = 2N$ does the PM's access decision correspond to the access decision assumed by the IGs' contribution function. When $K < 2N$, the IGs have an incentive to increase their contributions in an attempt to secure access for sure.

Model Equilibrium

It follows from the above analysis that there exists a set of equilibrium in which the PM chooses $K \in \{1, ..., \min\{2N, \bar{K}\}\}$, and the IGs each contribute according to the contribution function $B_K(I)$. In each of these equilibria, the IGs always accept access when granted, and the PM always becomes fully informed regarding the information quality of all IGs. This means that any equilibrium results in the implementation of the socially optimal policy.

Proposition 4 *For any* $K \in \{1, ..., \min\{2N, \bar{K}\}\}$*, there exists a contribution equilibrium in which:*

1. *For each IG* (n, j)*,* $b_n^j = B_K(I_n^j)$ *and* $a_n^j = 1$ *where*

$$B_K(I_n^j) = \begin{cases} \int_0^{I_n^j} \int_0^1 f(I_n^{-j})(\Theta(y, K) - 1) \frac{\partial V\left(j - y + I_n^{-j}\right)}{\partial d} dI_n^{-j} dy & \text{for } K < 2N \\ 0 & \text{for } K = 2N \end{cases} \quad (11)$$

2. *The PM grants access to* K *IGs; and*

3. *The PM chooses the socially optimal policy for each issue,* $p^* = p^o$*.*

Given the potential number of equilibrium, having all IGs coordinate on one may be difficult. However, the PM may be able to commit to an access decision before the IGs choose their contributions. The equilibrium of a game where the PM can commit to an access decision is called the *PM-Controlled Equilibrium*. In such an equilibrium, the PM commits to the value K that maximizes his payoffs.

Proposition 5 *There exists a unique PM-controlled equilibrium in which* $K = 1$*,* $b_n^j = B_1(I_n^j)$ *and* $a_n^j = 1$ *for all* (n, j)*, and* $p^* = p^o$*.*

The PM-controlled equilibrium involves $K = 1$, the minimum amount of access. It is feasible that the PM could constrain the amount of time he is available to provide access before the IGs choose their contributions. If he is able to assure that he only has time to provide access to one IG, the PM-controlled equilibrium represents the unique solution to the game.

3.2 Alternative Assumptions

In this section, I discuss the implications of some fundamental changes to the above model. In the first consideration, the representative citizen is allows to have preferences more in line with some IGs than others. In the second consideration, the PM must choose between two discrete policies, one at each extreme of the issue.

Biased Policy Preferences

In the above analysis, I assume that $p_n^o = I_n^1 - I_n^{-1}$ for all n. I argue that this simplification does not drive the results of the model, and that more complicated choice of p_n^o can be used. I could alternatively assume that when both IGs concerned with an issue have the same quality of information, the representative citizen prefers a policy closer to one of the IG's platform than the other's; or $p_n^o \neq 0$. This alternative policy definition does not change the fundamental result of the above analysis: in equilibrium, the PM continues to be fully informed as to the information quality of all IGs. But in addition to this result, I also show that the bids of IGs with policy preferences more in line with the representative citizen contribute less to the PM than interest groups with a larger difference in preferences.

Let p_n^o be linear in information such that

$$p_n^o = \alpha_n + (1 - \alpha_n) I_n^1 - (1 + \alpha_n) I_n^{-1} \tag{12}$$

where $\alpha_n \in (-1, 1)$ is the socially optimal issue-n policy when both of the issue's interest groups have $I = 0$. When $\alpha_n = 0$, the problem simplifies to $p_n^o = I_n^1 - I_n^{-1}$.

This alternative form of p^o does not change the IG's acceptance decision, or the PM's access or policy choice. However, it does result in a modified contribution function. The new contribution functions now depend on the bias variable α, such that for $K \in \{1, ..., 2N - 1\}$ the equilibrium contribution functions are given by:

$$B_K\left(I_n^j, \alpha_n\right) = \int_0^{I_n^j} \int_0^1 f\left(I_n^{-j}\right)\left(1 - \Theta\left(y, K\right)\right)\left(j\alpha_n - 1\right) \frac{\partial V\left(d_n^j\left(y, I_n^{-j}, \alpha_n\right)\right)}{\partial d} dI_n^{-j} dy \tag{13}$$

where $d_n^j\left(I^j, I^{-j}, \alpha_n\right) = j - j\alpha_n + \left(j\alpha_n - 1\right) I^j + \left(j\alpha_n + 1\right) I^{-j}$.

It still holds that $B_K\left(I, \alpha\right)$ is strictly increasing in I for $K \in \{1, ..., 2N - 1\}$. There does not exist an equilibrium where $K = 0$. When $K = 2N$, all IGs submit bids $b = 0$, but the PM remains fully informed. Therefore in any equilibrium, the PM can still infer the information quality of all IGs from their contributions and choose the policy set that maximizes expected citizen welfare.

Discrete Policy Choice

Instead of choosing a policy from a continuos policy space, PMs may need to select a policy from a discrete set. I consider an alternative game in which PMs choose policy $p_n^* \in \{-1, 1\}$. Again, this new assumption does not change the IG's acceptance decision, or the PM's access decision or preference to maximize expected representative citizen utility. However, it does change the set of contribution functions.

IG (n, j) now determines its contribution by solving

$$\max_b \int_0^1 f\left(I_n^{-j}\right) \left(\begin{array}{c} (1-\Theta(I(b), K))(1-F(I(b)))V(2) \\ +\Theta(I(b), K)(1-F(I_n^j))V(2) \end{array} \right) dI_n^{-j} - b \tag{14}$$

Which results in contribution function

$$B_K\left(I_n^j\right) = \int_0^{I_n^j} \int_0^1 f\left(I_n^{-j}\right)(1-\Theta(y, K))(-f(y))\, dI_n^{-j} dy \tag{15}$$

where $f(\cdot) = F'(\cdot)$. It can be shown that $B_K(I)$ is strictly increasing in I, and the set of equilibrium can be constructed the same way they were in the original analysis. This means that the IGs and PM act in a similar way as they do with continuous policy set.

4 Contribution Limits

The general model analyzed above assumes that there are no limits to the maximum size of the IG contributions. However, the size of contributions is often limited by legislation or less formal rules. In this section, I consider how the analysis changes if IG contributions are constrained. Let $\bar{b}$ be the maximum allowed size of an IG contribution such that $b \in \left[0, \bar{b}\right]$

for all IGs.

Under contribution constraints, the PM continues to implement the set of policies that he believes is best for the representative citizen at the conclusion of the game, and the IGs continue to always accept access if granted. Therefore, $p^* = E(p^o)$, and $a_n^j = 1$ for all (n, j).

Contribution limits do, however, change the outcome of the all pay auction, including the IG contribution function and the PM's access decision.

Contribution Function

When the maximum contribution is limited, the contribution function behaves much as it did in the previous section for low enough values of I. Then for high enough values of I, groups choose to contribute the maximum amount $\bar{b}$. Also similar to the previous section, there are multiple equilibrium corresponding to different values of K.Let $\hat{B}_K(I)$ denote the revised contribution function in an equilibrium in which the PM provides access to K IGs. $\hat{B}_K(I)$ is a discontinuous function that is defined by a continuous function $\tilde{B}_K(I)$ for $I \in [0, \bar{I}_K)$, and then is equal to $\bar{b}$ for all $I \in \left[\bar{I}_K, 1\right]$. The value $\bar{I}_K$ is defined as the information quality at which an IG is indifferent between contributing according to $\tilde{B}_K(I)$ and contributing amount $\bar{b}$. It follows that $\tilde{B}_K\left(\bar{I}_K\right) < \bar{b}$. Let $M = M\left(\bar{b}, I, K\right)$ denote the number of IGs who provide contribution $\bar{b}$ in equilibrium.

The function $\tilde{B}_K(I)$ is derived in a similar fashion as $B_K(I)$ in the non-constrained problem. IG (n, j) chooses a contribution b to maximize the following equation:

$$\int_0^1 g_K\left(I_n^{-j}\right)\left(\left(1 - \hat{\Theta}(I(b), K)\right) V\left(j - I(b) + I_n^{-j}\right) + \hat{\Theta}(I(b), K) V\left(j - I_n^j + I_n^{-j}\right)\right) dI_n^{-j} - b \tag{16}$$

This differs from the IG's non-constrained maximization problem in that b must now be on the interval $\left[0, \bar{b}\right]$, the density function $f(\cdot)$ from the original problem is now replaced by the function $g_K(\cdot)$, and the probability that an IG is granted access given it's information quality is given by a newly defined function $\hat{\Theta}(\cdot)$ rather than the original $\Theta(\cdot)$. I define the functional forms of $\hat{\Theta}(\cdot)$ and $g_K(\cdot)$ below.

The function $\hat{\Theta}(I(b), K)$ defines the probability that IG (n, j) is granted access given that it contributes b when the PM provides access to K IGs. For values of $I < \bar{I}$, this probability is the same as it was in the non-constrained problem. This is because the probability that an IG with $I < \bar{I}$ receives access continues to equal the probability that it has one of the K highest information qualities. All IGs with $I \geq \bar{I}$ provide the same contribution $\bar{b}$ in equilibrium. When less than K IGs provide $\bar{b}$, each of these IGs is granted access. When more than K IGs provide $\bar{b}$, the PM randomly chooses K of these IGs to grant access to. Therefore, $\hat{\Theta}(I, K)$ is defined as follows:

$$\hat{\Theta}(I, K) = \begin{cases} \sum_{i=1}^{K-1} \left(\frac{(2N-1)!}{(2N-1-i)!i!}\right) F(I(b))^{2N-1-i} (1 - F(I(b)))^{i} & \text{when } I \in [0, \bar{I}_K) \\ \sum_{i=1}^{K-1} \left(\frac{(2N-1)!}{(2N-1-i)!i!}\right) F\left(\bar{I}_K\right)^{2N-1-i} \left(1 - F\left(\bar{I}_K\right)\right)^{i} & \\ \quad + \sum_{i=K}^{2N-1} \left(\frac{(2N-1)!}{(2N-1-i)!i!}\right) F\left(\bar{I}_K\right)^{2N-1-i} \left(1 - F\left(\bar{I}_K\right)\right)^{i} \frac{K}{1+i} & \text{when } I \in \left[\bar{I}_K, 1\right] \end{cases} \tag{17}$$

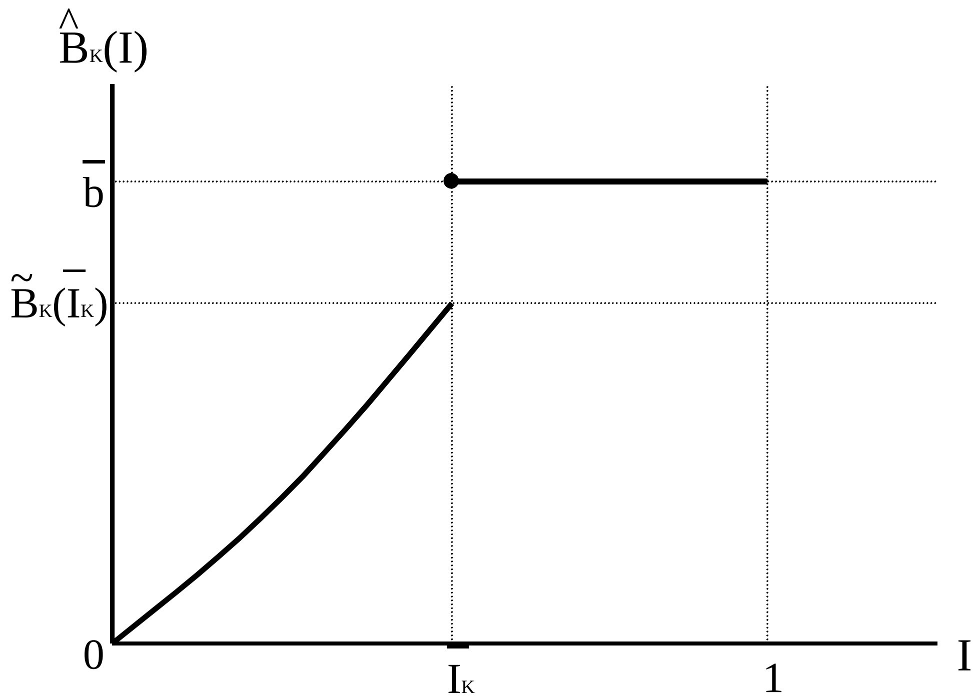
For $I \in \left[\bar{I}_K, 1\right]$ the function $\hat{\Theta}(I, K)$ is independent of I. All IGs with $I \in \left[\bar{I}_K, 1\right]$ have the same probability of being offered access. Denote this probability by $\bar{\Theta}(K)$.

The function $g_K(I)$ denotes the probability that the PM expects a randomly drawn IG to have information quality I. In equilibrium, the PM will know for sure an IG (n, j)'s information when $I_n^j < \bar{I}_K$. However, when $I_n^j \geq \bar{I}_K$ he learns the IG's information quality for sure only if he grants that IG access, which he does with probability $\bar{\Theta}(K)$. If he does not grant the IG access, he know the IG's information quality is on $\left[\bar{I}, 1\right]$, and therefore updates his expectations such that $E(I) = \int_{\bar{I}_K}^{1} f(y)\, y dy$. Therefore,

$$g_K(I) = \begin{cases} f(I) & \text{for } I \in [0, \bar{I}_K) \\ \bar{\Theta}(K) f(I) & \text{for } I \in \left[\bar{I}_K, 1\right] \text{ and } I \neq \int_{\bar{I}_K}^{1} f(y)\, y dy \\ \int_{\bar{I}_K}^{1} \left(1 - \bar{\Theta}(K)\right) f(y)\, dy & \text{for } I = \int_{\bar{I}_K}^{1} f(y)\, y dy \end{cases} \tag{18}$$

The function $\tilde{B}_K(I)$ is derived from solving equation 16, in a similar fashion as the

Figure 1: Example Contribution Function with Spending Limits



function $B_K(I)$ was derived in the non-constrained problem. It follows that:

$$\tilde{B}_K\left(I_n^j\right) = \int_0^{I_n^j}\int_0^1 g_K\left(I_n^{-j}\right)\left(\left(1-\hat{\Theta}\left(y,K\right)\right)\frac{\partial V\left(j-y+I_n^{-j}\right)}{\partial d}\left(-1\right)\right)dI_n^{-j}dy \qquad (19)$$

The new contribution function $\hat{B}_K(I)$ is defined by $\tilde{B}(I)$ for the values $I \in [0,\bar{I})$, and by $\hat{B}(I) = \bar{b}$ for $I \in \left[\bar{I},1\right]$. An example of a contribution function in the constrained game is provided by Figure 1.

A full definition of the contribution function $\hat{B}_K(I)$ requires the definition of the cut off information value $\bar{I}_K$. This is the information quality of the IG that is indifferent between contributing according to the function $\tilde{B}_K(I)$ and contributing the higher contribution $\bar{b}$.

The value $\bar{I}_K$ solves the following equation:

$$\int_0^1 g_K\left(I_n^{-j}\right) V\left(j-\bar{I}_K+I_n^{-j}\right) dI_n^{-j} - \tilde{B}\left(\bar{I}_K\right)$$
$$= \int_0^1 g_K\left(I_n^{-j}\right) \left(\begin{array}{c} \left(1-\bar{\Theta}(K)\right) V\left(j-\int_{\bar{I}_K}^1 f(y)\, y dy + I_n^{-j}\right) \\ +\bar{\Theta}(K) V\left(j-\bar{I}_K+I_n^{-j}\right) \end{array} \right) dI_n^{-j} - \bar{b} \tag{20}$$

For any $\bar{b} < B_K(1) = \tilde{B}_K(1)$, there exists a value $\bar{I}_K < 1$ that solves this equation. When the solution for $\bar{I}_K$ is non positive, then all IGs contribute the amount $\bar{b}$. Here, I do not explicitly solve for $\bar{I}_K$; recognizing the existence of the value is sufficient for the analysis.

PM Access Decision

As in the non-constrained model, the PM"s choice of K does not impact the IG's strategy choice, and therefore cannot impact the total amount of contributions collected by the PM. However, in the constrained model, the choice of K may determine how informed the PM is regarding the issues.

In an equilibrium, there is a one-to-one mapping between an IG's information quality and its contribution iff its information quality is below $\bar{I}$. All IGs with information quality at least as great as $\bar{I}$ submit the maximum contribution $\bar{b}$. Therefore, from the contributions alone, the PM will learn the information quality of the IGs with $I < \bar{I}$. When an IG provides the maximum contribution, the PM only knows that the IG's information quality is on the interval $\left[\bar{I}, 1\right]$. This means that a PM must grant access to at least as many IGs as contributed $\bar{b}$ in order to be fully informed about all issues.

M denotes the number of IGs who contributed $\bar{b}$. Because the information quality of the IGs is i.i.d., any $M \in \{0, 1, ..., 2N\}$ can occur with positive probability so long as $\bar{b} < B_K(1) = \tilde{B}_K(1)$.

When $M \leq \bar{K}$, the PM can choose K such that he becomes fully informed about all issues. Therefore, he is indifferent between any $K \in \left\{M, ..., \bar{K}\right\}$. In this case, he implements the set of socially optimal policies.

Alternatively, when $M > \bar{K}$, it is impossible for the PM to become fully informed about all issues. The best he can do is choose $K = \bar{K}$ which minimizes the amount of information that he does not know. In this case, the set of socially optimal policies is implemented with probability zero.

Constrained Equilibrium

Similar to the previous section, there exists a set of multiple equilibrium in which the PM chooses $K \in \{1, ..., \min\{2N, \bar{K}\}\}$, and the IGs each contribute according to the contribution function $\hat{B}_K(I)$.

Proposition 6 *For $\bar{b} < B(1)$ and any $K \in \{\min\{\bar{K}, \max\{1, M\}\}, ..., \min\{\bar{K}, 2N\}\}$, there exists a contribution equilibrium in which:*

1. *For each IG (n, j), $b_n^j = \hat{B}_K(I_n^j)$ and $a_n^j = 1$ where*

$$\hat{B}_K\left(I_n^j\right) = \begin{cases} \int_0^{I_n^j}\int_0^1 g_K\left(I_n^{-j}\right)\left(\left(1-\hat{\Theta}(y,K)\right)\frac{\partial V\left(j-y+I_n^{-j}\right)}{\partial d}(-1)\right)dI_n^{-j}dy & \text{when } K < 2N \text{ and } I \in [0, \bar{I}_K) \\ \bar{b} & \text{when } K < 2N \text{ and } I \in [0, \bar{I}_K) \\ 0 & \text{when } K = 2N \end{cases} \tag{21}$$

and $\bar{I}_K$ is defined above;

2. *The PM grants access to K IGs; and*

3. *The PM chooses the expected socially optimal policy for each issue, $p^* = E(p^o)$.*

Only when the PM can provide access to all IGs can he be assured of always learning the socially optimal policy. When $\bar{K} < 2N$, there is a positive probability that more IGs will contribute $\bar{b}$ than the PM can provide access to. This means that there is a positive probability that the PM implements a policy that is not socially optimal. I show that when $\bar{K} < 2N$, expected citizen welfare is strictly lower when the contributions are limited than when the contributions are unconstrained. This does not mean that the realized welfare is lower. Rather, realized welfare is never improved, and is reduced by contribution limits with positive probability.

Proposition 7 *When $\bar{K} < 2N$, in any equilibrium the ex ante welfare of the representative citizen is strictly lower when there is a contribution limit $\bar{b} < B(1)$ then when contributions are unconstrained.*

The problem of coordinating on a single equilibrium is greater here than in the non-constrained model because there is uncertainty about how many IGs will contribute $\bar{b}$ before the contributions are submitted. This may drive even greater welfare loss than the inefficiency of equilibrium alone. However, it may be reasonable to assume that coordination takes place at the equilibrium in which $K = \bar{K}$. This is the only equilibrium that exists for sure ex ante. For any other K, there is a positive probability that $M > K$ and that the equilibrium will not exist. However, the $\bar{K}$ equilibrium exists independent of the realization of M. If $\bar{K} \leq M$, then $\bar{K}$ is a strictly dominant action; while if $M < \bar{K}$, then the PM is indifferent between $\bar{K}$ and some other values of K.

5 Discussion

This paper considers an access game in which IGs have private, verifiable information that can enable a PM to make better policy choices, and the PM selects which IGs are allowed to present their information. IGs provide the PM with contributions, and the PM grants access to the groups that provided the largest contributions. Although granting access to all IGs allows the PM to implement the socially optimal policy set, full access will not be possible if the PM is time constrained. Furthermore, even if granting access to all IGs is possible, the PM may prefer to limit access if he is concerned about collecting contributions.

There is a variety of evidence in the empirical literature that is consistent with an access model similar to the one developed here. However, the evidence may also support a model in which IGs provide contributions in exchange for policy favors. For example, Grier and Munger (1991), Romer and Snyder (1994) and Milyo (1997) all show that members of legislative committees collect more political contributions than non-members. Committee members are responsible for making initial recommendations to the legislature regarding whether proposed bills should become law. By communicating an IG's information quality to a committee member, the information may be passed along to other members of a legislature. Therefore, IGs should be more concerned with communicating their information quality to committee members compared to other members of a legislature. Furthermore, Stratmann (1998) shows that IGs tend to provide contributions when a vote on the issue they are concerned with is coming up. When a vote is approaching, the IGs are most interested in communicating their information to the PM. Stratmann (2002) shows that contributions have a larger affect on the voting behavior or junior legislators compared to senior legislators. This is consistent with my model if junior legislators do not initially understand the issues as thoroughly as their senior colleagues, and therefore contributions will reveal more information to them in comparison.

I first solve the model assuming that contributions are not constrained. In any equilibrium the PM becomes fully informed about the information quality of all IGs even when he grants access to only some of the groups. This follows because of the IG's endogenously chosen contributions. In non-constrained equilibrium, the PM always implements set of policies that is best for the representative citizen.

In then solve the model assuming that contributions are not allowed to exceed some maximum limit. When such a limit exists, there is a positive probability that there will not exist an equilibrium in which the PM becomes fully informed about all issues. When this is the case, the PM almost surely implements a policy choice different from the socially optimal policy. Therefore, contribution limits strictly reduce expected citizen welfare.

When IGs are not ex ante symmetric—for example, if they have different levels of wealth—or when the representative citizen cares more about certain issues compared to others, my results continue to hold so long as the heterogenous parameters are common knowledge.

There are some limits to my model. First, I consider a one-time interaction between IGs and a PM. Future research may consider a dynamic model in which the game is repeated multiple times by the same IGs and PM. In such a model, the PM's policy choice may be affected by an IG's ability to provide contributions at multiple points of time. Second, throughout the analysis, I interpret the policy set p^o as the true socially optimal policy set; however it could also represent the PM's biased interpretation of the social optimal, or even the PM's preferred policy set independent of the citizen's welfare. Third, my model relies on the PM allocating access to IGs through an all pay auction. If instead he allocates access randomly, IGs contribute nothing, and the PM does not become fully informed. However, even if the PM always provides access to certain IGs, he can still become fully informed in the non-constrained case if he also provides access to the highest contributor.

Furthermore, my model relies on the assumption that the PM is non-corrupt and does not sell policy favors. If contributions buy policy favors instead of access, contribution constraints may actually benefit citizens. For example, Bennedsen and Feldmann (2006) consider a game in which IGs can influence a PM by both undertaking costly searches for verifiable information, and providing the PM with contributions contingent upon receiving a policy favor. They show that the presence of contribution constraints can keep the IGs from relying on the quid pro quo contributions and instead cause them to focus on collecting information. This allows the PM to make more informed decisions. However, despite the recent media attention given to scandals involving lobbyist Jack Abramoft and ex-US Congressman Randy "Duke" Cunningham, I continue to believe that corrupt politicians who explicitly trade policy favors for gifts are the exception rather than the rule.

Future work should adapt this model for situations in which multiple PMs work together to implement policy, such as in a legislature; and where contributions are made during campaigns when two or more potential PM compete in an election.

This paper's result has implications for the current debate in the US legislature and media about reforming the lobbying system in an effort to reduce corruption and government spending on earmarks and pork projects. There has been a push to limit the size of campaign contributions in an effort to reduce corruption, as is evident from recent legislation such as the McCain-Feingold-Cochran Campaign Reform Bill's ban on soft money, and contribution limits in various states.[14] In my model, such spending limits reduce citizen welfare by decreasing the amount of information available to legislators. If most policy makers do not engage in the quid pro quo exchange of contributions for policy favors, then contribution limits may actually hurt rather than help citizens. This suggests that lobbying reform should be cautious about focussing on contribution limits, and consider alternative means of fighting corruption and high spending.

6 Appendix

Proof (Lemma 2). The PM's utility is composed of two independent parts: the representative citizen's welfare and utility from contributions. Because the contributions of all $2N$ IGs are already collected, the utility from contributions is independent of his policy choice. Therefore, the PM prefers to implement the policy that maximizes the representative citizen's welfare: $p_n^* = E\left(p_n^o\right)$. ■

Proof (Lemma 3). Claim: if IG j refuses to present its information, then the PM expects that I_j equals zero $\left(E\left(I_j\right) = 0\right)$. Suppose not, then $E\left(I_j\right) = Z > 0$. Then, if $I_j > Z$, IG j would be strictly better off if it provided the information. Therefore, if the group does not provide information, the PM infers that $E\left(I_j\right) \in [0, Z]$. The PM updates his expectations of I_j conditional on I_j being on the continuum $[0, Z]$. Therefore, $E\left(I_j\right) < Z$, which is a contradiction. Therefore, $E\left(I_j\right) = 0$ for all j when j refuses access.

Given this, each IG that is granted access provides its information to the PM if $I > 0$. U_n^j

[14] For example, Iowa, North Dakota, Pennsylvania and Texas prohibit labor unions, regulated industries, and associations from contributing to the campaigns of political candidates.

is decreasing in the difference between the IG's preferred policy and the policy implemented by the PM, and this distance is strictly decreasing in the PM's expectation regarding the IG's own information. Therefore, showing that $I > 0$ results in strictly higher utility for the IG compared to letting the PM believe that $I = 0$. If $I = 0$, the IG is indifferent between providing and not providing information. With information distributed along a continuum, the probability that $I = 0$ is zero. Therefore, all IGs that are offered access present their information to the PM. ■

Proof (Proposition 4). As Lemmas 2 and 3 show, in any equilibrium $p_n^* = E(p_n^o)$, and $a_n^j = 1$ for all n and j. The PM can choose $K \in \{0, 1, ..., \min\{2N, \bar{K}\}\}$. I will show there does not exist an equilibrium in which $K = 0$. When $K \in \{1, ..., \min\{2N-1, \bar{K}\}\}$, I will show that the equilibrium involves the strictly increasing function $B_K(I)$, as defined in the analysis. When $K = 2N$, the equilibrium involves the IGs each contributing nothing, such that $B_{2N}(I) = 0$ for all I.

First, suppose $K = 0$. This means that there is no probability of the IGs having to present their information to the PM. Therefore, the IGs all face the same incentives to provide contributions and the PM will not be able to infer any information about the IGs' I values from their contributions. The IGs know this and will each choose $b = 0$ since contributing provides no benefit. However, when all IGs contribute nothing, the PM has an incentive to provide access to a positive number of IGs since providing any access allows him to better maximize expected representative citizen welfare and increase his own utility. Therefore, there does not exist an equilibrium in which $K = 0$ since the PM will always have an incentive to deviate.

For any $k \in \{1, ..., \min\{2N-1, \bar{K}\}\}$, suppose that each IG (j, n) chooses its contribution according to the function $b_n^j = B_k(I_n^j)$. As was shown in the analysis, $\frac{\partial B_k(I)}{\partial I} > 0$ for all I. Since the function is strictly increasing, it is invertible. Therefore, the rational PM can infer I_n^j for any IG after observing b_n^j, and can then determine p^o for sure. This means that the PM's choice of K does not impact his utility, since all choices of K result in the same policy choice and cannot change the total contributions collected. However, only when $K = k$ do the IGs not have an incentive to deviate. Remember that $B_k(I)$ is the derived contribution function when the IGs believe $K = k$. If $K \neq k$, the IGs have an incentive to deviate to bid according to the function $B_K(I)$ rather than $B_k(I)$. This proves proposition 4 for $K \in \{1, ..., \min\{2N-1, \bar{K}\}\}$.

Alternatively, consider the case where $K = 2N$, which exists when $\bar{K} \geq 2N$. Then all IGs receive access. This means that the IGs do not have an incentive to provide a positive contribution. All contributions will result in the same ex post PM belief about their information quality since they all are provided access with probability one. Therefore, the IGs minimize the amount spend on contributions by choosing $b = 0$. When $b = 0$, the PM then maximizes his utility by selecting the maximum possible K since such a choice allows him to become the most informed about the IGs' information qualities. If $\bar{K} < 2N$, then the PM chooses $K = \bar{K}$ which results in an incentive for the IGs to deviate to providing $b = B_{\bar{K}}(I)$. If $K \geq 2N$, then the PM chooses $K = 2N$ which results in no incentive to deviate by the PM or the IGs. This proves proposition 4 for $K = 2N$. ■

Proof (Proposition 5). When the PM can commit ex ante to a choice of K, he will choose the value that maximizes his utility. He can commit to any values $K \in \{0, 1, ..., \min\{2N, \bar{K}\}\}$. I first rule out the possibility that $K = 0$ or $K = 2N$. As described in the proof to Proposition 4, when $K = 0$ or $K = 2N$ the IGs all contribute $b = 0$. Choosing any $K \in \{1, ..., \min\{2N-1, \bar{K}\}\}$ maximizes expected representative citizen welfare because the IGs contribute according to some strictly increasing bid function $B_K(I)$ which I define in the body of the paper, and the PM is able to determine for sure p^o and therefore will choose $p^* = p^o$. Furthermore, the function $B_K(I)$ means that $\sum_{\forall(n,j)} b_n^j > 0$. Therefore, PM utility is strictly higher if he commits to some $K \in \{1, ..., \min\{2N-1, \bar{K}\}\}$ rather than $K = 0$ or $K = 2N$.

Next, consider the case where the PM commits to some $K \in \{1, ..., \min\{2N-1, \bar{K}\}\}$. Commitment to any of these K's results in the PM becoming fully informed regarding the

IGs' information qualities and choosing $p^* = p^o$ at the end of the game. Therefore, the only way that the choice of K from this range can impact the PM's utility is by impacting the total amount of contributions he collects. The PM's utility function is strictly increasing in total contributions. I show that for any $K \in \{1, ..., \min\{2N-1, \bar{K}\}\}$, the corresponding equilibrium contribution function $B_K(I)$ is strictly decreasing in K for all I.

$$B_K(I) = \int_0^I \int_0^1 f\left(I_n^{-j}\right)(1-\Theta(y,K))(-1)\frac{\partial V\left(j-y+I_n^{-j}\right)}{\partial d} dI_n^{-j} dy \tag{22}$$

$$\frac{\partial B_K(I)}{\partial K} = \int_0^I \int_0^1 f\left(I_n^{-j}\right)\left(\frac{\partial \Theta(y,K)}{\partial K}\right)\frac{\partial V\left(j-y+I_n^{-j}\right)}{\partial d} dI_n^{-j} dy \tag{23}$$

$$\frac{\partial B_K(I)}{\partial K} < 0 \tag{24}$$

Notice that $f\left(I_n^{-j}\right) > 0$ for all I_n^{-j}, and $\frac{\partial V(d)}{\partial d} < 0$ for all d. Furthermore, $\frac{\partial \Theta(I,K)}{\partial K} > 0$ for any I and K since the probability of having one of the $k+1$ highest information qualities is strictly higher than the probability of having one of the k highest information qualities. This means that the contributions of the IGs are strictly decreasing in the number of IGs that receive access. Therefore, the PM's utility is maximized when he commits to the lowest value K, which is $K = 1$. As illustrated in Proposition 4, this choice is consistent with the equilibrium in which $K = 1$, $b_n^j = B_1\left(I_n^j\right)$ and $a_n^j = 1$ for all (n, j), and $p^* = p^o$. ■

Proof (Proposition 6). The majority of the proof follows directly from the analysis in the body of the paper, and precedes similar to the proof of Proposition 4. I do not walk through the majority of the proof; however, I do show that if $K < M$ then $K = \bar{K}$ is the only equilibrium. This was not illustrated in the body of the paper or the proof to a previous proposition. Suppose that $K < M$, which means that the PM is less than fully informed about all IGs' information strength. Increasing K is not costly when $K < \bar{K}$, and allows the PM to increase the number of IGs for which he has full knowledge of their information strength. Therefore, the PM will always increase K if $K < M$ and $K < \bar{K}$. If $K < M$ and $K = \bar{K}$, then he cannot increase his choice of K, and he does not have an incentive to deviate. In such an equilibrium $K = \bar{K}$, $b_n^j = B_{\bar{K}}\left(I_n^j\right)$ and $a_n^j = 1$ for all (n, j), and

$p^* = Ep^o$. Because the PM is less than fully informed, $\Pr(p_n^* = p_n^o \ \forall n) = 0$. ■

Proof (Proposition 7). For any $\bar{b} < B(1)$ and $\bar{K} < 2N$, there exists a positive probability that more than $\bar{K}$ IGs draw $I \geq \bar{I}$, where $\bar{I}$ is defined in the body of the paper. All of these IGs bid $\bar{b}$. Denote the number of IGs that bid $\bar{b}$ by M. The unique equilibrium in this case involves $K = \bar{K} < M$ as illustrated by Proposition 6. Because the PM is less than fully informed, $\Pr(p_n^* = p_n^o \ \forall n) = 0$. Therefore, the representative citizen is strictly worse off under contribution limits when $M > \bar{K}$ and no better off when $M \leq \bar{K}$. Contribution limits strictly reduce expected citizen welfare. ■

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