Queen's Economics Department Working Paper No. 1070

Bureaucratic Advice and Political Governance

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5-2006

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by

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ABSTRACT

Politicians typically do not know what policies are best for achieving their broad objectives, so rely on bureaucrats for advice. Bureaucrats are better informed, so can manipulate outcomes by proposing policies that suit their interests. We capture this conflict of interests using a model of political decision-making that focuses on the interaction between politicians and the bureaucracies that advise them. In the basic model, a representative bureaucrat, knowing the characteristics of a given project, recommends to a representative politician whether to adopt it. If the politician chooses to adopt the project, its characteristics are revealed ex post. On the basis of the revealed outcome, the politician decides whether to discipline the bureaucrat. The bureaucrat anticipates imperfectly the chances of discipline when making an ex ante recommendation. When project characteristics are multi-dimensional, the politician can choose whether to seek advice from one bureaucrat or more than one. We compare outcomes in these centralized and decentralized regimes.

Acknowledgments: We thank Jorn Rattso and two referees for many useful comments on an earlier version. Financial support is gratefully acknowledged by Boadway from the Social Sciences and Humanities Research Council of Canada and by Sato from the Center of Excellence Project of the Ministry of Education of Japan and from the Japan Society for the Promotion of Science, Grant-in-Aid for Scientific Research.

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1 Introduction

This paper deals with a classical theme of the political economy literature: the conflict of interest between bureaucrats and politicians, with bureaucrats able to use their superior information to manipulate political outcomes. Politicians responsible for enacting legislation will typically not know which policies are best suited for achieving their broad objectives. They will not be able to predict the consequences of alternative policies, and they will not know their costs. To inform themselves, they rely on experts in the bureaucracy. However, politicians face different incentives than bureaucrats. They are ultimately responsible to their electorates, and will be judged based on outcomes achieved from the policies chosen. Bureaucrats, on the other hand, are employees of the government and are ultimately responsible to the politicians. They do not face the discipline of the political marketplace, but are constrained more by the possibilities of dismissal or lack of promotion, or by the sizes of their budgets. Because bureaucrats are better informed than politicians, they have the potential to manipulate this to their advantage by proposing policies that suit their own interests. Given this, politicians may find it useful to decentralize the bureaucracy so that policy advice comes from more than one source. That is the main focus of this paper.

Our approach is to construct a simple analytical framework of bureaucratic advice that can be used to compare the efficacy of centralized versus decentralized modes of governance. We focus on the decisions that politicians make on the basis of advice from bureaucrats. In our basic model, a representative bureaucrat, knowing the relevant characteristics of a given project, recommends to a representative politician whether to adopt the project. If the politician decides to adopt the project, its characteristics are revealed ex post and the politician can choose to discipline the bureaucrat. The discipline will be based on the extent to which the outcome deviates from the politician's preferences. The bureaucrat, in deciding on an ex ante recommendation, anticipates the possibility of dismissal, though with some uncertainty about the politician's preferences or tolerance for adverse outcomes.

Using this basic framework, we then extend the model to allow for the fact that there may be more than one dimension to project or policy choice. Two particular cases are considered. In the first, the politician must choose among different sizes of a given project, rather than focusing on an indivisible project as in the basic model. In the other, more than one project can be undertaken. In each of these cases, bureaucratic advice is multi-dimensional, thereby providing more scope for the bureaucracy to manipulate political outcomes, reminiscent of the Romer and Rosenthal (1978) agenda-control model. This allows us to compare two regimes, a centralized one in which a single bureaucrat provides advice on all dimensions of project choice, and a decentralized one in which separate bureaucrats advise on different dimensions.

The model is developed at a level of generality that allows for various types of differences between the bureaucrat's preferences and those of the politician. Thus, they could differ over preferences for the size of the public sector or over the efficiency-equity trade-off. Moreover, either the politician or the bureaucrat could be viewed as being more closely aligned with the consensus views of the voters. Depending on the interpretation used, there may be different implications for the choice of institutional or constitutional rules that should govern public sector decision-making, such as whether the senior bureaucracy should be permanent employees or appointed by the politician currently in power. For concreteness, we assume that bureaucrats have a stronger preference for projects being undertaken than do politicians, perhaps because of Leviathan-like tendencies. Politicians, of course, recognize this when weighing the advice they receive.

Our model of governance takes the form of an principal-agent problem in which bureaucrats serve as agents to politicians. Such problems have been widely examined in the literature, typically using the standard optimal contract framework as sumarized in Laffont and Tirole (1994). With complete contracts, the politician can elicit at a cost the information possessed by the bureaucrat. We rely instead on an incomplete contract setting where the politician has limited ability to reward as well as to penalize the agent because the bureaucrat's performance is difficult to assess and/or verify. Our paper is related to Crawford and Sobel (1982) and Milgrom (1981), who discuss strategic information transmission in general contexts. Li, Rosen and Suen (2001) examine the case where committee members, each of whom has private information, fail to pool such information since they have an incentive to manipulate information transmission in their favor. Dewatripont and Tirole (1999) address the possibility that competition among advocates of specific interests can lead to better information production as a whole, even though each of them is motivated to defend a certain cause. An example is a court in which a defense attorney defends a client, while the prosecutor is tough with the defendant. A related recent paper by Prendergast (2003) considers the bureaucracy as a second-best institution for dealing with the inefficiency of market transactions. Our model also considers the role of informed parties in enhancing the information available to decision-makers, in our case political decision-makers. We study how the structure of governance in the bureaucracy can enhance the information available to uninformed politicians.

As mentioned, our approach is also related to the agenda-setter model of Romer and Rosenthal (1978) where the bureaucrat has control over the size of a project being proposed to replace the status quo. Various papers have extended this to an explicit asymmetric information setting. Romer and Rosenthal (1979) explore the effect of uncertainty about voter preferences on the ability of the bureaucrat to set the agenda. Banks (1990) assumes that the bureaucrat is better informed about the status quo than voters, and shows that the true status quo state is never revealed to voters. Banks (1993) extends the analysis to two-sided uncertainty, where voters do not know the status quo while the bureaucrat does not know voters' true preferences. The status quo is revealed in this case, but the bureaucrat's proposal is biased downward relative to when voters already know the status quo, implying that an informational advantage lowers the bureaucrat's ability to manipulate outcomes. In these agenda-setter models, the bureaucrat offers a take-it-or-leave-it proposal to the principal, while in ours the bureaucrat's agenda-setting power is advisory in nature. The politician uses the advice of the bureaucrat to update his beliefs about the quality of the project and can choose to accept or ignore the bureaucrat's advice. For moderate differences between the politician's and the bureaucrat's evaluation of the project, the politician will rely on the bureaucrat's message so the latter is effectively an agenda-setter. The politician may be able to moderate the influence of the bureaucracy by choosing between a centralized and decentralized bureaucracy.

The paper by Li and Suen (2004) is similar in approach to ours. They study the case for a principal employing one or more experts who are better informed about a single project, but whose preferences are biased. Unlike in our model where bureaucrats provide advice while the politician retains decision-making power, theirs is a model of delegation of authority. They focus on delegating decision-making on a given project and show how it can always be beneficial. We focus on decentralizing bureaucratic advice when projects are multi-dimensional, and show that it may or may not be beneficial. Alesina and Tabellini (2003) are also concerned with the delegation of tasks from politicians to bureaucrats. They examine from a positive standpoint which type of tasks the politician would prefer to retain and which they would delegate to bureaucrats, and relate this to an efficient amount of delegation.

We present in Section 2 the basic model involving one representative politician, one representative bureaucrat, and one project to be decided on. The next two sections allow for the fact that projects are multi-dimensional, with the possibility that advice can be sought from more than one bureaucrat with independent advisory responsibilities. We investigate the advantages and disadvantages of decentralizing the bureaucracy in the context of projects of variable size in Section 3 and multiple projects in Section 4. A final section considers some extensions.

2 The Basic Setting

We begin with a simple model involving a single political decision designed to illustrate the mechanics of our approach. The focus is on the interaction between a representative politician, denoted P, who must decide whether to undertake a project, and a representative bureaucrat, denoted B, who advises P and is better informed. The project under consideration is independent of any other projects that might be undertaken so issues of decentralized versus centralized governance do not arise in this section. The project yields given benefits to P and B, and varies along a single dimension, which we take to be its cost. While the benefits of the project to P and B are common knowledge, B is better informed than P about its costs.

The relationship between P and B is hierarchical with B providing advice to P, recommending either that the project be undertaken or rejected. The recommendation is based both on the benefit of the project to B relative to its costs and on the expectation of being disciplined, which depends on the net benefit realized by P and some uncertainty about P's tolerance for bad outcomes. Discipline can be thought of as dismissal of B from his current job. P decides whether to accept B's advice based on expectations about the project's costs and how they affect B's recommendation. These expectations are formed knowing B's evaluation of the project and the distribution of possible project costs, and in equilibrium are correct. B's advice will generally be biased with respect to P's preferences, with the direction of bias depending on the relative valuation of the project by P and B.

The only role of B is to advise P whether to undertake the project. Other administrative roles are suppressed, as well as other modes of behavior, such as effort, rent-seeking, etc. This serves to focus our attention on the role of B as a well-informed policy advocate. We need not be explicit about the source of the difference in relative values of the project to P and B. Either one may be more benevolent than the other from a social welfare point of view. Thus, B can be either a public servant in the normative sense or can have Leviathan tendencies. Similarly, P's values might be based on various combinations of ideology, vote maximization, self-interest, or debts to special interests. For concreteness, we shall evaluate outcomes from the perspective of P's preferences in what follows.

To be more precise, B's recommendation is given by a message $m \in \{0,1\}$, where $m = 1$ means B recommends that the project be undertaken, while $m = 0$ means B recommends rejection. The decision by P to accept or reject a project is denoted by $x \in \{0,1\}$, where $x = 1$ if the project is undertaken and $x = 0$ if it is not. P's choice of x is influenced by B's advice m, but P may accept or reject the project regardless of m.

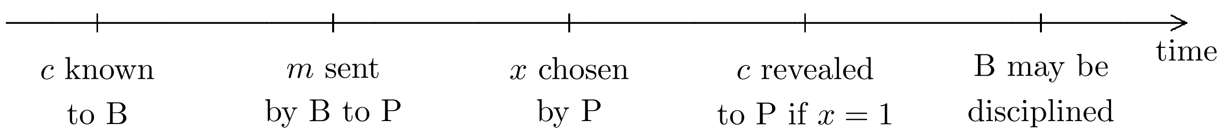
The cost of the project under consideration is c. It is drawn from a distribution $\Phi(c)$ over $c \in [0, \overline{c}]$, which is assumed for simplicity to be uniform, so:

$$\Phi(c) = \frac{c}{\overline{c}}\,, \qquad \text{with density} \quad \Phi'(c) = \frac{1}{\overline{c}} \tag{1}$$

B knows the cost of the project with certainty at the time the message m is sent, although adding some uncertainty would not alter the essence of the argument as long as B is better informed than P. On the other hand, when x is chosen, P knows only the distribution $\Phi(c)$ from which the project is drawn, along with B's recommendation. If the project is undertaken ($x = 1$), the cost c becomes known to P and can be used to discipline B ex post. If the project is not undertaken, no costs (or benefits) are incurred, and P does not learn the project cost. In this case, B is not disciplined.[1]

An important assumption is that P cannot offer B a contract based on the value of c that is revealed ex post if the project is undertaken. This might be because c is non-verifiable. It might include not only monetary expenses but also political costs. It could also include any welfare costs due to policy distortions, external costs from environmental externalities, or imputed costs of the redistributive effects of the project. In that sense, the contract between P and B is incomplete. As is well-known from the literature on complete contracts (Laffont and Tirole, 1994), if the project cost c is verifiable ex post, and if the payment to B can be made contingent on c, an incentive scheme can be designed so that B's interest is aligned with that of P. The inability to enforce complete contracts—which seems to be a realistic assumption in the context of bureaucratic advice—is a key element of our approach and allows B to manipulate outcomes in his favor.

The information structure is summarized by the following timeline of events:



Our focus is on the choice of m by B followed by the choice of x by P. We characterize equilibrium outcomes by analyzing these choices in reverse order.

2.1 The Payoff to the Politician

Let b_P be the benefit obtained by P if the project is undertaken. We assume that b_P is also known to B, although some uncertainty could be added without changing the nature of the results. The ex post payoff to P once c is revealed, denoted v_P, is given by:

$$v_P = (b_P - c)x \qquad \text{for} \qquad x \in \{0, 1\}$$

Note that if $x = 0$, $v_P = 0$: no benefits or costs are incurred if the project is not undertaken.

[1] The reader might wonder why B's message is simply a recommendation whether to undertake the project rather than the cost itself. The reason is that in our context, a message space consisting of project cost would be no more informative to P than a recommendation about whether to proceed since the choice of the politician is a binary one. This will continue to be the case in the following sections as well. This might be contrasted with Crawford and Sobel (1982) whose message space is the cost of the project. In their case, actions of the principal are continuous.

The ex ante expected payoff to P at the time x is chosen, given m, is:

$$E[v_P|m] = (b_P - E[c|m])\,x \qquad \text{for} \qquad x \in \{0,1\}$$

Denote P's choice of x given B's message m by x_m. The following lemma is apparent:

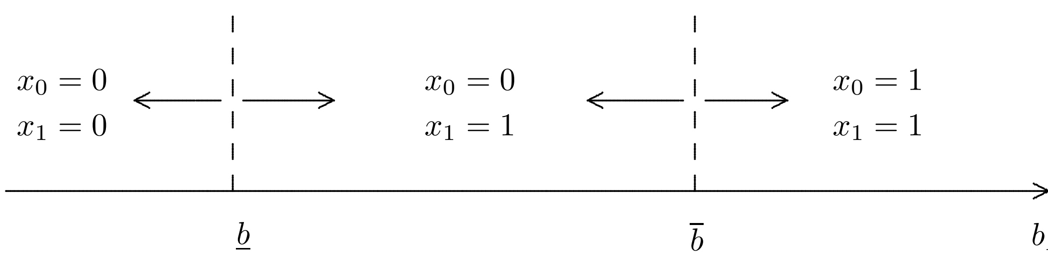
Lemma 1: $x_m = 1$ *iff* $b_P \geqslant E[c|m]$.

The expected value of the project cost c given B's message m, $E[c|m]$, depends on P's beliefs about B's choice of m. P knows that B will recommend undertaking the policy only if project costs c are low enough. Let $\hat{c}$ be P's belief about the cutoff level of c below which B will advocate undertaking the project: P believes that $m = 1$ if $c \leqslant \hat{c}$, and $m = 0$ otherwise. These beliefs will be correct in equilibrium, as discussed below. Given the uniform distribution $\Phi(c)$, P's beliefs can be summarized as follows:

$$E[c|m=1] = \frac{\int_0^{\hat{c}} d\Phi(c)}{\Phi(\hat{c})} = \frac{\hat{c}}{2} \equiv \underline{b}, \quad E[c|m=0] = \frac{\int_{\hat{c}}^{\overline{c}} d\Phi(c)}{1-\Phi(\hat{c})} = \frac{\hat{c}+\overline{c}}{2} \equiv \overline{b} \tag{2}$$

where $\overline{b} > \underline{b}$. By Lemma 1, $x_1 = 1$ iff $b_P > \underline{b}$, and $x_0 = 1$ iff $b_P > \overline{b}$. Thus, $\overline{b}$ and $\underline{b}$ are the cutoff levels for P's choice of x, given B's two possible recommendations $m \in \{0,1\}$.

The following figure summarizes how P's choice of x is affected by the value of the project b_P, B's message m, and P's beliefs about the cutoff level $\hat{c}$ as reflected in $\underline{b}$ and $\overline{b}$.



It is clear that B can influence P's choice, albeit imperfectly. B's advice will always be heeded when P's evaluation of the project is in the range $\overline{b} > b_P > \underline{b}$. However, for $b_P > \overline{b}$, P will undertake the project regardless of B's advice, and vice versa for $b_P < \underline{b}$. When beliefs are correct, B can perfectly anticipate P's choice of x given the recommendation m.

2.2 The Payoff to the Bureaucrat

B faces the possibility of being disciplined if the ex post payoff to P, v_P, is unsatisfactory. Assume that P disciplines B if v_P falls below some reservation level whose value is uncertain to B. Let B's perception of the reservation payoff to P be $v_0 - \varepsilon$, where ε is a random variable distributed according to $G(\varepsilon)$ with $G'(\varepsilon) > 0$. It may reflect B's uncertainty about the ideology or tolerance of the politician.[2] Then, if the project is undertaken ($x = 1$), P will dismiss B if $v_P = b_P - c \leqslant v_0 - \varepsilon$, or $\varepsilon \leqslant v_0 - v_P = v_0 + c - b_P$. B's perception of the probability of dismissal, given $G(\varepsilon)$, is:

$$\text{Prob}[\text{dismissal}|x = 1] = \text{Prob}[\varepsilon \leqslant v_0 + c - b_P] = G(v_0 + c - b_P)$$

Throughout the paper, we assume that that $G(\varepsilon)$ has the following properties:

i) $G(v_0 + c - b_P) = 0$ if $v_0 \leqslant b_P - c$

ii) $G(v_0 + c - b_P) > 0$ and $G'(v_0 + c - b_P) > 0$ if $v_0 > b_P - c$

Thus, B will not be dismissed if the project payoff is at least as great as P's reservation payoff, but otherwise there is a positive and increasing probability of dismissal. We also assume that if the project is not undertaken, P does not learn c and B is not dismissed. In the following two sections, an important property will be the sign of $G''(\varepsilon)$, that is, whether the probability of dismissal rises more or less rapidly with ε. Whether it is positive or negative will affect the consequences of decentralizing the bureaucracy.

Assume that if the project goes ahead, its payoff to B is $b_B - c$, which will generally differ from P's payoff since the benefits b_P and b_B may differ. Let the cost of dismissal to B be normalized to unity. Then the expected payoff to B, given P's choice of x, is $E[v_B] = (b_B - c - G(v_0 + c - b_P))x$, so $v_B = 0$ if the project does not go ahead ($x = 0$). B can influence $E[v_B]$ only by his choice of message m, which affects P's decision x. In fact, B's influence over P's choice of x is somewhat restricted given the binary nature of both m and x. Let $\Delta x \equiv x_1 - x_0$. Then, as indicated above, $\Delta x = 1$ for $\underline{b} < b_P < \overline{b}$, and zero otherwise. B's message will have a decisive impact on the project outcome only if P's evaluation b_P is in this middle range.

[2] An alternative, perhaps more realistic, assumption would be that P can only observe the cost c ex post with some error. (Indeed, this will contribute to incomplete contracting.) The qualitative effects of this would be the same as assuming the uncertainty lies with P's tolerance for unfavorable outcomes, and we adopt the latter for simplicity. Yet another alternative would be to introduce some ex ante uncertainty about project cost c. For example, c could include random factor so that $\tilde{c} = c + \varepsilon$ with $E[\varepsilon] = 0$, and the bureaucrat can only observe c which is ex ante unknown to the politician. The chance of replacing the bureaucrat would then be related to ε. This would complicate the analysis even further without yielding any additional insights.

In choosing m, B compares his expected payoffs for $m = 0$ and $m = 1$, given c:

$$E[v_B|m=1] - E[v_B|m=0] = \begin{cases} b_B - c - G(v_0 + c - b_P) & \text{if} \quad \underline{b} < b_P < \overline{b} \\ 0 & \phantom{\text{if}} \quad b_P < \underline{b},\ b_P > \overline{b} \end{cases} \tag{3}$$

Clearly, B sends a message of $m = 1$ if and only if $b_B \geqslant c + G(v_0 + c - b_P)$. Since $G' > 0$, the righthand side is increasing in c, so there will be a value of $c = c_B$ such that:

$$b_B = c_B + G(v_0 + c_B - b_P) \tag{4}$$

The implication is that for $\underline{b} < b_P < \overline{b}$, B prefers $m = 1$ as long as $c \leqslant c_B$, and $m = 0$ otherwise. When $b_P < \underline{b}$ or $b_P > \overline{b}$, B is indifferent between $m = 0$ and $m = 1$ since the message does not influence P's decision ($\Delta x = 0$). Without loss of generality, we can assume that in these latter cases, B follows the same rule as when $\underline{b} < b_P < \overline{b}$, so B's decision can be characterized in the following lemma:

Lemma 2: $m = 1$ *iff* $c \leqslant c_B$, *where* c_B *satisfies* (4).

2.3 Equilibrium

In equilibrium, P's belief $\hat{c}$ must be consistent with B's cutoff cost c_B, or, using (4):

$$b_B = \hat{c} + G(v_0 + \hat{c} - b_P) \tag{5}$$

This yields $\hat{c}(b_B, v_0, b_P)$, where $\partial\hat{c}/\partial b_B > 0$ and $0 < \partial\hat{c}/\partial b_P = -\partial\hat{c}/\partial v_0 < 1$. Since B correctly anticipates P's beliefs, he knows x_m precisely. From this, we can see that P's policy preference b_P influences $\hat{c}$, which in turn influences his beliefs $(\underline{b}, \overline{b})$ by (2), and thus both his decision by Lemma 1 and B's decision by Lemma 2. Using (5) and (2), cutoff values for $\underline{b}$ and $\overline{b}$ satisfy the following:

$$b_B = 2\underline{b} + G(v_0 + \underline{b}), \quad b_B = (2\overline{b} - \overline{c}) + G(v_0 + \overline{b} - \overline{c}) \tag{6}$$

Thus, $\underline{b}$ equates b_P with $E[c|m = 1]$ and for $b_P > \underline{b}$, we have $b_P > E[c|m = 1]$. The analogous interpretation can be given to $\overline{b}$ so that for $b_P > \overline{b}$, $b_P > E[c \mid m = 0]$. Given these expressions determining $\underline{b}$ and $\overline{b}$, equilibrium can be summarized in the following proposition, where superscript e denotes equilibrium values:

Proposition 1: *Equilibrium choices* $\{m^e, x^e\}$ *are characterized by:*

$$m^e = \begin{cases} 1 & \text{if} \quad c \leqslant \hat{c} \\ 0 & \phantom{\text{if}} \quad c > \hat{c} \end{cases} \qquad \text{and}$$

$$\begin{cases} x_0^e = x_1^e = 0 & & b_P < \underline{b} \\ x_0^e = 0, x_1^e = 1 & \text{if} & b_P \in [\underline{b}, \overline{b}] \\ x_0^e = x_1^e = 1 & & b_P > \overline{b} \end{cases}$$

where $\hat{c}$ *satisfies* (5)*, and* $\underline{b}$ *and* $\overline{b}$ *satisfy* (6)*.*

Clearly, the equilibrium outcome for any given project depends not only on its cost c, but also on the benefits b_P and b_B obtained by P and B respectively. To illustrate possible equilibria, we proceed by considering how various relative evaluations of a project by B affect outcomes from P's point of view. To focus on interesting outcomes, it is useful to restrict parameters values such that $\overline{b} > \underline{b} > 0$ and $\overline{c} > \underline{b}$. If $\underline{b} > \overline{c}$, no projects would ever be undertaken, while if $\overline{b} < 0$, all projects would be. Using (6) and the fact that its right-hand sides increase in $\underline{b}$ and $\overline{b}$, the range of values of b_B is $G(v_0 + \overline{c}) + 2\overline{c} > b_B > G(v_0)$. We can then classify possible values of b_B into two ranges, given P's reservation payoff v_0:

High values: $\quad G(v_0) + \overline{c} < b_B < G(v_0 + \overline{c}) + 2\overline{c} \iff 0 \leqslant \underline{b} < \overline{c} < \overline{b}$

Low values: $\quad G(v_0) \leqslant b_B \leqslant G(v_0) + \overline{c} \iff 0 \leqslant \underline{b} < \overline{b} \leqslant \overline{c}$

Figures 1(a) and 1(b) indicate equilibrium outcomes for these two ranges of values of b_B. The shaded areas in each figure indicate projects that will be undertaken. The lines labeled $\hat{c}$ depict the solutions of (5) for $\hat{c}$ in terms of b_P for each of the two cases. For all points to the left of these lines, B recommends undertaking the project ($m = 1$), and vice versa. These recommendations are decisive unless b_P falls outside the range $\underline{b} < b_P < \overline{b}$. These figures can be used to compare the full-information outcomes with those in which only B is fully informed. All projects to the left of the diagonal line ($c = b_P$) would be chosen by P under full information. In each case, some projects should be undertaken but are not—Type I errors—and some projects should not be undertaken but are—Type II errors. Areas of Type I and Type II errors are labeled **I** and **II**.

Figure 1(a) depicts the case in which B attaches a relatively high value to the project. Here, only relatively high-cost projects are not recommended. For $b_P > \underline{b}$, all projects to the left of the $\hat{c}$ line are recommended by B and undertaken by P. For $b_P < \underline{b}$, some projects are not undertaken despite being recommended by B. Type I errors are shown as $\boldsymbol{oab}$ and Type II errors are $\boldsymbol{bcde}$. The range of both Type I and Type II errors will increase the greater is the deviation between b_B and $G(v_0) + \overline{c}$.

The low-value case is depicted in Figure 1(b). In this case, the line $\hat{c}$ representing B's indifference locus intersects the diagonal line above $\underline{b}$.[3] Outside the range $\underline{b} < b_P < \overline{b}$, there are some projects undertaken by P that are not recommended, and some projects not undertaken that are recommended. B's message is biased downward for high values of c and upward for low values of c. There are alternating areas of Type I errors ($\boldsymbol{oab}$, $\boldsymbol{fde}$) and Type II errors ($\boldsymbol{bcf}$, $\boldsymbol{egh}$). Their sizes depend on the slope of the $\hat{c}$ curve. From (5), we infer that $\partial b_P / \partial \hat{c} = (1 + G')/G' > 1$. Increases in P's evaluation b_P will tend to increase Type I errors and reduce Type II errors in the middle ranges of b_P with $\underline{b} < b_P < \overline{b}$.[4]

This completes our description of the basic model of bureaucratic advice. In what follows, we extend the basic model to cases in which the policy decisions are multi-dimensional so that bureaucratic advice can be decentralized. Our focus is on how the governance structure in the bureaucracy can constrain the form of policies undertaken by the politician.This allows us to investigate alternative governance arrangements in the bureaucracy, focusing especially on the comparison between centralized versus decentralized advice. We consider two main cases. The first involves projects that can differ in size as well as costs, so policymakers must decide not only whether to undertake a project, but also how large the project should be. In the other, more than one project can be undertaken. In both cases, there is the possibility of relying on a single bureaucrat to provide advice over both dimensions of project choice, or decentralizing advice to two bureaucrats each of whom advises on a particular dimension of the project. Decentralizing advice does not unambiguously improve information in our context. Depending on the circumstances, it may cause advice

[3] To see this, let b_P^* be at the intersection of the $\hat{c}$ locus with the diagonal. By (5), $b_P^* = \hat{c}$ implies $b_B = G(v_0) + b_P^*$. Then, (6) implies that $b_P^* > \underline{b}$, and $\overline{b} \leqslant \overline{c}$ leads to $b_P^* < \overline{b}$.

[4] In Figure 1(b), Type I errors occur when $b_P < \underline{b}$ with prob$[c < b_P]$=$\Phi(b_P)$, which increases in b_P. Type I errors also occur in the range $\overline{b} > b_P > b_B - G(v_0)$ with prob$[b_P > c] = \Phi(b_P) - \Phi(\hat{c})$, which increases in b_P. Type II errors occur when $b_P > \overline{b}$ with prob$[b_P < c] = 1 - \Phi(b_P)$, which decreases in b_P. Type II errors occur where $\underline{b} < b_P < b_B - G(v_0)$ with prob$[b_P < c] = \Phi(\hat{c}) - \Phi(b_P)$, which decreases in b_P.

to be more expansionary or more conservative than centralization: that is, it may lead to more Type II errors and less Type I errors, or the reverse. In these circumstances, the choice between centralized and decentralized regimes depends upon the weights put on these two types of errors.[5]

3 Choice of Project Size

Suppose now that projects can differ in size as well as cost. It suffices to consider two project sizes, small or large.[6] It is useful to think of project size being determined sequentially, although this is only for analytical convenience. First, a decision is made about whether to undertake a project of basic size. Then, if the basic project is accepted, a decision is made whether to expand it. P can now choose among three mutually exclusive outcomes, $x \in \{0, 1, 2\}$, where $x = 0$ means no project is undertaken, $x = 1$ means the basic project is undertaken, and $x = 2$ means the expanded project is undertaken.

Given that two sequential decisions are made by P, two separate recommendations can be made by the bureaucracy. Thus, the message consists of two elements, $m \equiv (m_1, m_2)$, where $m_j = 1$ means project size j is recommended and $m_j = 0$ means it is not. The bureaucracy can recommend neither size project, only one project size, or both project sizes. Since expansion to the large project size can only occur if the basic project is undertaken, the message can be one of the following: $m \in \{(0, 0), (1, 0), (1, 1)\}$. We distinguish between two governance regimes. In the centralized case, called Regime C, a single bureaucrat B sends both m_1 and m_2. In the decentralized case, Regime D, there are two bureaucrats, B_1 and B_2. B_1 advises on launching the project and sends m_1, while

[5] A comparison between two such regimes is also examined in Dewatripont and Tirole (1999) and Li and Suen (2004), but they focus on a single project (or policy). We instead consider the choice of regime in the context of multi-dimensional policy-making where decentralization involves obtaining separate advice on each dimension of the policy.

[6] A more natural case is that in which size is continuously variable, as in the original Romer and Rosenthal (1978, 1979) analyses. Crawford and Sobel (1982) consider the general case of principal-agent interaction when actions are continuous and an uninformed principal chooses one action based on a message sent by an informed agent. They show that the informed agent does not reveal the true state c but bundles realizations of c into a discrete number of groups and sends a common message for all actions pooled within a group. Our model captures the idea that a discrete number of messages will be sent, while at the same time not complicating the analysis with a continuum of project sizes.

B_2 advises expanding the project and sends m_2.

The structure of costs and information are a simple extension of the basis model. The cost of the basic project and its expansion are identical and are each given by c, where c is again drawn from the uniform distribution $\Phi(c)$ with $c \in [0, \overline{c}]$. If both the basic project and its expansion are undertaken, the total cost is then $2c$. The timing of events is analogous to the basic case: 1) c is known to the bureaucracy; 2) $m = (m_1, m_2)$ is sent by the bureaucracy to P; 3) P chooses $x = \{0, 1, 2\}$; 4) c is revealed to P if $x = 1$ or $x = 2$ (but cost is not publicly verifiable); and, 5) bureaucrats may be disciplined. It makes no difference whether m_1 and m_2 are sent simultaneously or sequentially since the bureaucracy is fully informed so neither message depends on the other.

3.1 The Payoffs to the Politician and the Bureaucrats

The values to P of the two project sizes are b_P^1 and b_P^2, where $\Delta b_P = b_P^2 - b_P^1 < b_P^1$, reflecting an assumed concavity of benefits. The ex post project payoffs to P are then:

$$v_P^1 = b_P^1 - c, \qquad v_P^2 = b_P^2 - 2c, \qquad \Delta v_P = v_P^2 - v_P^1 = \Delta b_P - c$$

all of which are decreasing in c. For $\Delta b_P > c$, the large project will be preferred to the small project, and vice versa. Under full information, the following outcomes, denoted x^f, would be chosen by P:

$$x^f = \begin{cases} 2 & \text{if} \quad \Delta b_P \geqslant c \\ 1 & \text{if} \quad b_P^1 \geqslant c \geqslant \Delta b_P \\ 0 & \text{if} \quad c > b_P^1 \end{cases}$$

If c is known only to the bureaucracy when project decisions are made, P's decision will be contingent on the message m sent by the bureaucracy. It will be given by:

$$x(m) = \begin{cases} 2 & \text{if} \quad \Delta b_P \geqslant E[c|m] \\ 1 & \text{if} \quad b_P^1 \geqslant E[c|m] \geqslant \Delta b_P \\ 0 & \text{if} \quad E[c|m] > b_P^1 \end{cases}$$

The payoffs to the bureaucracy depend on whether Regime C or Regime D is in place. Consider each in turn.

Bureaucrat B's Payoffs in Regime C

Let b_B^1 and b_B^2 be B's benefits from the basic project and its expansion, respectively. Then, proceeding as in the basic model, B's ex post payoffs are:

$$v_B^1 = b_B^1 - c - G(v_0^1 + c - b_P^1), \qquad v_B^2 = b_B^2 - 2c - G(v_0^2 + 2c - b_P^2) \tag{7}$$

where v_0^1 and v_0^2 are the reservation payoffs to P in the two project outcomes, and $G(\varepsilon)$ has the same properties as earlier. Then, defining Δv_B^C and Δb_B in obvious ways and using $\Delta b_P = b_P^2 - b_P^1$, we have:

$$\Delta v_B^C = v_B^2 - v_B^1 = \Delta b_B - c - \left[G(v_0^2 + 2c - b_P^1 - \Delta b_P) - G(v_0^1 + c - b_P^1)\right] \tag{8}$$

Of course, if neither project is pursued ($x = 0$), B's payoff is zero.

Bureaucrats B_1 and B_2's Payoffs in Regime D

In this case, both bureaucrats B_1 and B_2 value the benefits b_B^1 and b_B^2 and assess the costs c and $2c$ if the small and large projects are undertaken. However, B_1 can be disciplined if either the basic project or its expansion are undertaken (since in either case the basic project is undertaken), but B_2 can only be disciplined if the expansion goes forward. Let v_{B1}^1 and v_{B1}^2 be the payoffs to B_1 from $x = 1$ and $x = 2$ respectively, with analogous notation for B_2. Then, the payoffs for the two bureaucrats are as follows:

$$v_{B1}^1 = b_B^1 - c - G(v_0^1 + c - b_P^1), \qquad v_{B1}^2 = b_B^2 - 2c - G(v_0^1 + c - b_P^1) \tag{9}$$

$$v_{B2}^1 = b_B^1 - c, \qquad v_{B2}^2 = b_B^2 - 2c - G(\Delta v_0 + c - \Delta b_P) \tag{10}$$

where $\Delta v_0 = v_0^2 - v_0^1$.

Note that the expansion of the project does not change the risk to B_1 of being disciplined. That depends only on the payoff to P of the basic project, $b_P^1 - c$, and P's reservation payoff, v_0^1. Similarly, B_2 is not penalized when $x = 1$. The probability of B_2 being dismissed depends upon the payoff to P from expansion, $\Delta b_P - c$, and the change in the reservation payoff, Δv_0. Analogous to the case in Regime C, we define Δv_B^D as the change in payoffs to B_2 from an expansion of the project, or:

$$\Delta v_B^D = v_{B2}^2 - v_{B2}^1 = \Delta b_B - c - G(\Delta v_0 + c - \Delta b_P) \tag{11}$$

To facilitate the analysis in this section, it is useful to make the following assumptions (which will also be made in the next section):

Assumptions: i) $\Delta b_B > \Delta b_P$, and ii) $v_0^1 \geqslant b_P^1$.

The first assumption biases the outcome in favor of an expansion of the project relative to the full-information case. The second implies that there is a positive chance of being dismissed if the project is undertaken. These assumptions lead to the following lemma:[7]

Lemma 3: $\Delta v_B^C \gtreqless \Delta v_B^D$ iff $0 \gtreqless G''(\varepsilon)$.

Thus, the bureaucracy will tend to be more 'expansionary' in Regime C than in Regime D if the distribution function $G(\varepsilon)$ is strictly concave and more 'conservative' if $G(\varepsilon)$ is strictly convex. The relevance of the convexity or concavity of the distribution function representing P's tolerance plays a key role here and in the following section. There is no natural assumption to make about the sign of $G''(\varepsilon)$. That is, there is no natural assumption to make about whether the probability of discipline raises more or less rapidly with the deviation of P's payoff from his reservation level. That being the case, we shall proceed by conditioning our results on whether or not $G''(\varepsilon)$ is positive or negative, both in this section and the following one.

Given these payoffs for P and the bureaucrats in the two regimes, we can now analyze equilibrium outcomes. We begin with Regime C and then turn to Regime D.

3.2 Equilibrium Outcomes in Regime C

In this regime, B sends both messages m_1 and m_2. We can identify cutoff values for c that reflect B's ranking of the various options. Let c_1^C and c_2^C be the values of c such that $v_B^1 = 0$ and $v_B^2 = 0$ in (7). These will be uniquely determined since both expressions in (7) are decreasing in c. Similarly, c_{12}^C is the value of c such that $\Delta v_B^C = 0$ in (8), which we also assume is decreasing in c.[8] Specifically, assuming that $v_B^1 = v_B^2 > 0$ at $c = c_{12}^C$ and

[7] The proof follows immediately by using (8), (11) and the fact that $G(0) = 0$ to give $\Delta v_B^D - \Delta v_B^C = G(\Delta v_0 + c - \Delta b_P) + G(v_0^1 + c - b_P^1) - G(v_0^1 + c - b_P^1 + \Delta v_0 + c - \Delta b_P) \gtreqless 0$ as $0 \gtreqless G''(\varepsilon)$, if $c \geqslant \Delta b_P - \Delta v_0$. This condition holds in equilibrium.

[8] Differentiating (8) yields $\partial \Delta v_B^C / \partial c = G'(v_0^1 + c - b_P^1) - 2G'(v_0^1 + \Delta v_0 + 2c - b_P^1 - \Delta b_P)$, which will be negative if $G''(\varepsilon) > 0$. We assume that it remains negative if $G''(\varepsilon) < 0$.

that c_{12}^C is in the interior, we have that $c_1^C > c_2^C > c_{12}^C > \Delta b_P - \Delta v_0$.[9] B's payoffs from the two projects, v_B^1 and v_B^2, as well as c_1^C, c_2^C, c_{12}^C, and Δb_P are depicted in Figure 2.

In what follows, we restrict P's preferences, b_P^1 and b_P^2, to be such that:

$$\frac{c_1^C + c_{12}^C}{2} \leqslant b_P^1 \leqslant \frac{c_1^C + \overline{c}}{2}, \qquad \frac{c_{12}^C}{2} \leqslant \Delta b_P \leqslant \frac{c_1^C + c_{12}^C}{2} \tag{12}$$

This restriction plays the same role as $\underline{b} \leqslant b_P \leqslant \overline{b}$ in the basic model, which is the range of P's preferences where B's advice is decisive. Consider the following two obvious candidate strategies for B's choice of $m = (m_1, m_2)$:

$$m_I = \begin{cases} (1,1) & \text{if} \quad c \leqslant c_{12}^C \\ (1,0) & \text{if} \quad c \in [c_{12}^C, c_1^C] \\ (0,0) & \text{if} \quad c > c_1^C \end{cases}, \qquad m_{II} = \begin{cases} (1,1) & \text{if} \quad c \leqslant c_2^C \\ (1,0) & \text{if} \quad c \in [c_2^C, c_1^C] \\ (0,0) & \text{if} \quad c > c_1^C \end{cases} \tag{13}$$

If P rationally anticipates the strategy that B is following, then, on the basis of B's message, P's updated beliefs using (13) are as follows for the two strategies:

$$E[c|m_I] = \begin{cases} E[c|(1,1)] & = & c_{12}^C/2 \\ E[c|(1,0)] & = & (c_{12}^C + c_1^C)/2 \\ E[c|(0,0)] & = & (c_1^C + \overline{c})/2 \end{cases}, \; E[c|m_{II}] = \begin{cases} E[c|(1,1)] & = & c_2^C/2 \\ E[c|(1,0)] & = & (c_2^C + c_1^C)/2 \\ E[c|(0,0)] & = & (c_1^C + \overline{c})/2 \end{cases}$$

The following proposition, which is proven in the Appendix, indicates that strategies m_I and m_{II} will be equilibrium strategies for different ranges of P's preferences.

Proposition 2: *Assuming $\Delta b_B > \Delta b_P$:*

(i) If $b_P^1 \geqslant c_2^C$, m_I is an equilibrium strategy with outcomes:

$$x^C(m_I) = \begin{cases} x^C(1,1) & = & 2 \\ x^C(1,0) & = & 1 \\ x^C(0,0) & = & 0 \end{cases}$$

(ii) If $b_P^1 \leqslant (c_1^C + c_2^C)/2$, m_{II} is an equilibrium strategy with outcomes:

$$x^C(m_{II}) = \begin{cases} x^C(1,1) & = & 2 \\ x^C(1,0) & = & 0 \\ x^C(0,0) & = & 0 \end{cases}$$

[9] The last inequality follows from the assumption that $\partial \Delta v_B^C / \partial c < 0$. At $c = \Delta b_P - \Delta v_0$, $\Delta v_B^C = \Delta b_B - \Delta b_P + \Delta v_0 - [G(v_0^1 + \Delta b_P - \Delta v_0 - b_P^1) - G(v_0^1 + \Delta b_P - \Delta v_0 - b_P^1)] = \Delta b_B - \Delta b_P + \Delta v_0 > 0$.

Two observations should be made about this proposition. First, B's advice is always decisive when equilibrium stategy m_I is used. This is not the case for strategy m_{II}. P will never choose the small project despite the fact that B sometimes recommends it. Second, the ranges of c for which m_I and m_{II} are equilibrium strategies overlap. For $b_P^1 \in [c_2^C, (c_1^C + c_2^C)/2]$, there will be multiple equilibria.

Figure 2 illustrates equilibrium outcomes in Regime C, denoted x_I^C and x_{II}^C, when B adopts strategies m_I and m_{II}. P's preferences are shown as b_P^1, where $(c_1^C + c_2^C)/2 \geqslant b_P^1 \geqslant c_2^C$ and $\Delta b_P < b_P^1$. (In this case, both stategies can be equilibria.) The full-information outcomes are shown as x^f. If P knew the true costs, the large project would be chosen for $c < \Delta b_P$, and the small project for $c \in [\Delta b_P, b_P^1]$. With strategy m_I, the large project is chosen for $c < c_{12}^C$, the small project is chosen for $c \in [c_{12}^C, c_1^C]$, and no project is chosen for $c > c_1^C$, as advocated by B. From P's point of view, equilibrium outcomes are biased toward projects of excessive size, a form of Type II errors. That is, there will be some large projects undertaken in equilibrium when only small projects would be chosen with full information (for $c \in [\Delta b_P, c_{12}^C]$); and there will be some small projects undertaken that would not have been under full information (for $c \in [b_P^1, c_1^C]$). Under stategy m_{II}, outcomes $x_{II}^C = 2$ extend all the way to $c = c_2^C$. There will be a larger range of costs for which large projects will be undertaken when smaller ones would have been chosen under full information (Type II errors). For $c > c_2^C$, neither project will be undertaken. Under full information, some small projects in this range would have been undertaken, so there are Type I errors.

To facilitate a comparison between Regimes C and D below, we focus below only on equilibrium strategies m_I given by (13). In this case, the bureaucracy's advice is decisive, which is also the case in Regime D as we shall now see.

3.3 Equilibrium Outcomes in Regime D

In this regime, there are two bureaucrats, B_1 and B_2, each of whom will have cutoff levels of c relevant for their own decisions. In the case of B_1, the value of c satisfying $v_{B1}^1 = 0$ in (9) is the same as c_1^C, so $c_1^D = c_1^C$. For B_2, let c_{12}^D be the value of c that satisfies $\Delta v_B^D = 0$

in (11). The relationship between c_{12}^D and c_{12}^C is given by the following lemma:[10]

Lemma 4: $c_{12}^D \gtreqless c_{12}^C$ iff $G''(\varepsilon) \gtreqless 0$.

Thus, while the cutoff cost level for the basic project is the same in the two regimes, that for project expansion differs. The implication will be, as we shall see, that the same advice will be given in Regimes C and D with respect to the basic project, but it will differ for project expansion as long as $G''(\varepsilon) \neq 0$. If $G''(\varepsilon) = 0$, decentralization of the bureaucracy will have no effect.

The obvious strategies for the two bureaucrats in Regime C are then the following:

$$m_1 = \begin{cases} 1 & \text{if} \quad c \leqslant c_1^D \\ 0 & \text{if} \quad c > c_1^D \end{cases}, \qquad m_2 = \begin{cases} 1 & \text{if} \quad c \leqslant c_{12}^D \\ 0 & \text{if} \quad c > c_{12}^D \end{cases}$$

P correctly anticipates these strategies and forms the following beliefs:

$$E[c|m] = \begin{cases} c_{12}^D/2 & \text{if} \quad m = (1,1) \\ (c_{12}^D + c_1^D)/2 & \text{if} \quad m = (1,0) \\ (c_1^D + \overline{c})/2 & \text{if} \quad m = (0,0) \end{cases}$$

To be comparable with Regime C, we adopt the following restrictions on P's benefits:

$$\frac{c_1^D + c_{12}^D}{2} \leqslant b_P^1 < \frac{c_1^D + \overline{c}}{2}, \qquad \frac{c_{12}^D}{2} < \Delta b_P \leqslant \frac{c_1^D + c_{12}^D}{2}$$

This will be consistent with (12) when:

$$\max \left[\frac{c_1^C + c_{12}^C}{2}, \frac{c_1^D + c_{12}^D}{2} \right] \leqslant b_P^1 \leqslant \frac{c_1^D + \overline{c}}{2}, \qquad \text{and}$$

$$\max \left[\frac{c_{12}^C}{2}, \frac{c_{12}^D}{2} \right] \leqslant \Delta b_P \leqslant \min \left[\frac{c_1^C + c_{12}^C}{2}, \frac{c_1^D + c_{12}^D}{2} \right]$$

Then, equilibrium in Regime D is characterized by messages m_1 and m_2 sent by B_1 and B_2, and choices by P of:

$$x^D(m) = \begin{cases} x^D(1,1) & = & 2 \\ x^D(1,0) & = & 1 \\ x^D(0,0) & = & 0 \end{cases}$$

Thus, the bureaucrats' messages are decisive, as in Regime C

[10] Proof: Since we assume that v_B^C is decreasing in c, $c_{12}^C \geqslant \Delta b_P - \Delta v_0$ by (8). By Lemma 3, $\Delta v_B^C \gtreqless \Delta v_B^D$ at $c = c_{12}^C$ iff $0 \gtreqless G''(\varepsilon)$. Since Δv_B^C decreases with c, Lemma 4 follows.

3.4 Comparison between Regime D and Regime C

For both regimes, we can summarize the quality of the outcomes from P's perspective in terms of Type I and II errors. With respect to the basic project, both Regimes yield the same outcomes, and both Type I and Type II errors are possible depending on the size of b_P^1. For low values of b_P^1 ($b_P^1 < c_1^D = c_1^D$), too many projects will be undertaken. The probability of Type II errors in the two regimes will be given by $P_{II}^{C1} = P_{II}^{D1} = \Phi(c_1^D) - \Phi(b_P^1)$. On the other hand, for $b_P^1 > c_1^D = c_1^D$, Type I errors will occur with probability $P_I^{C1} = P_I^{D1} = \Phi(b_P^1) - \Phi(c_1^D)$. These are independent of the concavity/convexity of the distribution function $G(\varepsilon)$.

Outcomes differ, however, for the project expansion choice, and the direction of differences depends upon the sign of $G''(\varepsilon)$. Consider the two cases in turn.

Strictly Convex $G(\varepsilon)$

When $G''(\varepsilon) > 0$, $c_{12}^D > c_{12}^C$ so decentralization tends to be more expansive. The permissible values of Δb_P can be divided into three ranges. For low values ($\Delta b_P < c_{12}^C$), Type II errors occur for both regimes, but the probability is higher for Regime D:

$$\Delta b_P < c_{12}^C : \qquad P_{II}^{D2} = \Phi(c_{12}^D) - \Phi(\Delta b_P) > \Phi(c_{12}^C) - \Phi(\Delta b_P) = P_{II}^{C2}$$

For high values of Δb_P ($\Delta b_P \geqslant c_{12}^D$), Type I errors occur in both regimes, but are higher in Regime C:

$$\Delta b_P > c_{12}^D : \qquad P_I^{C2} = \Phi(\Delta b_P) - \Phi(c_{12}^C) > \Phi(\Delta b_P) - \Phi(c_{12}^D) = P_I^{D2}$$

In the intermediate range ($c_{12}^C < \Delta b_P < c_{12}^D$), project expansion is chosen too often in Regime D, but not often enough in Regime C:

$$c_{12}^C < \Delta b_P < c_{12}^D : \qquad P_{II}^{D2} = \Phi(c_{12}^D) - \Phi(\Delta b_P), \qquad P_I^{C2} = \Phi(\Delta b_P) - \Phi(c_{12}^C)$$

Thus, when the distribution function $G()$ is strictly convex, Regime D tends to be relatively expansionary and Regime C relatively conservative with respect to project size.

Strictly Concave $G(\varepsilon)$

The opposite occurs when $G''(\varepsilon) < 0$, where $c_{12}^C > c_{12}^D$. For low values of Δb_P ($\Delta b_P < c_{12}^D$), Type II errors occur in both regimes, but with higher frequency in Regime D:

$$\Delta b_P < c_{12}^D : \qquad P_{II}^{C2} = \Phi(c_{12}^C) - \Phi(\Delta b_P) > \Phi(c_{12}^D) - \Phi(\Delta b_P) = P_{II}^{D2}$$

When $\Delta b_P > c_{12}^C$, Type I errors occur more frequently in Regime D:

$$\Delta b_P > c_{12}^C : \qquad P_I^{D2} = \Phi(\Delta b_P) - \Phi(c_{12}^D) > \Phi(\Delta b_P) - \Phi(c_{12}^C) = P_I^{C2}$$

In the intermediate range, Type II errors occur in Regime C, and Type I in Regime D:

$$c_{12}^D < \Delta b_P < c_{12}^D : \qquad P_{II}^{C2} = \Phi(c_{12}^C) - \Phi(\Delta b_P), \qquad P_I^{D2} = \Phi(\Delta b_P) - \Phi(c_{12}^D)$$

In this case, now Regime C is relatively more expansive and Regime C relatively more conservative.

These results highlight the role played by the shape of the distribution function $G(\varepsilon)$ in determining the relative performance of the centralized and decentralized regimes. If the probability of being disciplined rises more rapidly than deviations of project payoffs from the politician's reservation payoff, a centralized regime—where a single bureaucrat internalizes all dismissal costs—tends to be more conservative. To the extent that bureaucrats tend to put more value on undertaking the project than politicians, the latter may prefer to keep the bureaucracy centralized in these cases. The opposite occurs in the case where $G(\varepsilon)$ is strictly concave. These same considerations will play a similar role in the next extension.

4 Multiple Projects

In the previous section, we considered different sizes of a given project. In this section, our focus is on different projects of a given size. Suppose there are two projects under consideration, denoted by the subscript $j = 1, 2$. Either one or both of the projects can be carried out. The costs of the two projects, c_1 and c_2, are again assumed to be distributed uniformly and independently over $[0, \overline{c}]$. As in the previous section, there can be two regimes. In Regime C, the single bureaucrat B observes (c_1, c_2) and sends a message concerning both projects, $m = (m_1, m_2)$, where $m_j \in \{0, 1\}$. In Regime D, a separate bureaucrat B_j in charge of each project. B_j observes only c_j, and sends a message $m_j \in \{0, 1\}$ independently of the other bureaucrat. P chooses (x_1, x_2), given the messages (m_1, m_2), and knowing bureaucratic preferences.

The two projects are symmetric to P and each yield the payoff $v_P^j = (b_P - c_j)$ if undertaken. Given the message $m = (m_1, m_2)$, P chooses $x_j = 1$ iff $b_P \geqslant E[c_j|m]$. It is clear that m_i affects the expectation for $c_j,\ j \neq i$, only in Regime C where one bureaucrat sends the joint message. When there are two bureaucrats, each in charge of a project, no information is learned about project j from the message sent by B_i.

B_1 and B_2 also evaluate the two projects symmetrically. They obtain a benefit of b_B per project, and are faced with the prospects of discipline if their project is undertaken and found to be excessively costly to P. In addition, the costs of a given project are shared by the both bureaucrats. A share $\alpha \in [0, 1]$ of the costs of a project is borne from the budget of the bureaucrat in charge, while the other $(1 - \alpha)$ is borne by the other bureaucrat. This is a rough and ready way of reflecting an overall budget constraint facing all projects. Of course, in Regime C, the single bureaucrat bears the full cost of both projects: spillovers are internalized. We consider the two regimes in turn, beginning here with Regime D.

Regime D

We proceed as usual by considering the choice of the bureaucrats, then P's choice, and finally the deviation of outcomes in equilibrium from those preferred by P.

The Bureaucrats' Messages

Each bureaucrat's payoff is affected by whether the other's project is undertaken, but is uninformed about the latter's cost or its prospects. Let $\tilde{c}_i$ and $\tilde{x}_i$ be the random values of c_i and x_i for project i from B_j's perspective $(i \neq j)$. Then, the expected payoff to B_j are:

$$v_B^j = \begin{cases} b_B - \alpha c_j - (1-\alpha)\tilde{c}_i\tilde{x}_i - G(v_0 + c_j - b_P) & \text{if} \quad x_j = 1 \\ -(1-\alpha)\tilde{c}_i\tilde{x}_i & \text{if} \quad x_j = 0 \end{cases}$$

B_j sends message $m_j = 1$ iff $E[v_B^j|m_j = 1] \geqslant E[v_B^j|m_j = 0]$, or $b_B \geqslant \alpha c_j + G(v_0 + c_j - b_P)$. Define $\hat{c}^D$ such that B_j is just indifferent between $m_j = 1$ and $m_j = 0$:

$$b_B = \alpha\hat{c}^D + G(v_0 + \hat{c}^D - b_P) \tag{14}$$

Then, B_j will send $m_j = 1$ iff $c_j \leqslant \hat{c}^D$. From (14), we obtain $\partial\hat{c}^D/\partial\alpha < 0$: as more of the cost of a project is shifted to the other bureaucrat, the more aggressive is a bureaucrat in advocating his own project.

The Politician's Decision

Given the uniform distribution of c_j, the P's expectation of the costs given m_j are $E[c_j|m_j = 1] = \hat{c}^D/2$ and $E[c_j|m_j = 0] = (\hat{c}^D + \overline{c})/2$. Assume that $(\hat{c}^D + \overline{c})/2 \geqslant b_P \geqslant \hat{c}^D/2$ so that P always takes the advice of B_1 and B_2. We can readily illustrate equilibrium outcomes and errors in Figure 3. Project 1 is undertaken whenever $c_1 \leqslant \hat{c}^D$, that is, to the left of the vertical line $\boldsymbol{hm}$. Project 2 is undertaken whevever $c_2 \leqslant \hat{c}^D$, that is, below the horizontal line $\boldsymbol{qk}$. Thus, both projects are undertaken in the area $\boldsymbol{oqsh}$.

Type II Errors in Regime D

If P knew costs c_j ex ante, projects of type 1 to the left of $\boldsymbol{gn}$ and projects of type 2 below $\boldsymbol{fj}$ would be undertaken. Therefore, given that $(\hat{c}^D + \overline{c})/2 \geqslant b_P \geqslant \hat{c}^D/2$, there will be only Type II errors: some projects are undertaken that should not be. Type II errors for the two types of projects are indicated by the following areas in Figure 3:

Project 1: $P_{II}^D = \text{Prob}[b_P < c_1|x_1 = 1] = \boldsymbol{ghmn}$

Project 2: $P_{II}^D = \text{Prob}[b_P < c_2|x_2 = 1] = \boldsymbol{fjkq}$

Note that these areas increase as α decreases.

Regime C

The Bureaucrat's Message

Here, B—the only bureaucrat—bears the full cost of both projects. His ex ante payoff is:

$$v_B = \sum_{j=1}^{2}(b_B - c_j)x_j - G\left(\sum(v_0 + c_j - b_P)x_j\right) \tag{15}$$

B's prospects of being disciplined depend on the sum of the payoffs to P from both projects, where v_0 is the reservation payoff to each project. Using (15), the expected payoffs to B when both or one project are undertaken are given by:

$$v_B^{12} = 2b_B - \sum c_j - G\left(2(v_0 - b_P) + \sum c_j\right) \tag{16}$$

$$v_B^j = b_B - c_j - G(v_0 - b_P + c_j) \qquad j = 1, 2 \tag{17}$$

Let $\hat{c}_1^C = \hat{c}_2^C$ be the critical value of c_j such that $v_B^j = 0$, so by (17),

$$b_B = \hat{c}_j^C + G(v_0 - b_P + \hat{c}_j^C) \qquad j = 1, 2 \tag{18}$$

where $c_j < \hat{c}_j^C$ implies $v_B^j > 0$, and vice versa. Similarly, define $2\hat{c}_{12}^C$ as the critical average value of $c_1 + c_2$ such that $v_B^{12} = 0$. Then, by (16),

$$2b_B = 2\hat{c}_{12}^C + G\left(2(v_0 - b_P) + 2\hat{c}_{12}^C\right)$$

so $(c_1 + c_2)/2 < \hat{c}_{12}^C$ implies $v_B^{12} > 0$, and vice versa. For simplicity, we impose analogous restrictions on preferences to those in the previous section:

Assumption: $v_0 > b_P$.

This implies that undertaking the second project increases the risk of being disciplined, since $\sum_j (v_0 + c_j - b_P) > v_0 + c_i - b_P$. Note that the relative sizes of $\hat{c}_j^C$ and $\hat{c}_{21}^C$ depend on the sign of $G''(\varepsilon)$ as follows:

$$\hat{c}_{21}^C \gtreqless \hat{c}_j^C \quad \text{as} \quad G''(\varepsilon) \gtreqless 0$$

Once again, the concavity or convexity of $G(\varepsilon)$ will be relevant. We consider these alternative cases in characterizing equilibrium outcomes below.

B will choose $m_1 = m_2 = 1$ if $v_B^{12} > 0$ and $v_B^{12} > v_B^j$ $(j = 1, 2)$; $m_j = 1$ and $m_i = 0$ if $v_B^j > 0 > v_B^i$ and $v_B^j > v_B^{12}$; and $m_1 = m_2 = 0$ if $v_B^{12} < 0$ and $v_B^j < 0$ $(j = 1, 2)$. To characterize these cases, we can define the cutoff values of costs which determine whether B will prefer one versus two projects undertaken. Let $\overline{c}_i^C(c_j)$ be the value of c_i given c_j such that $v_B^{12} = v_B^j$ for project $j \neq i$. Equating (16) and (17), $\overline{c}_i^C(c_j)$ is determined by:

$$b_B = \overline{c}_i^C + G(2(v_0 - b_P) + c_j + \overline{c}_i^C) - G(v_0 - b_P + c_j) \qquad j = 1, 2 \tag{19}$$

It is straightforward to show that the solution for $\overline{c}_i^C(c_j)$ will be in the range $\overline{c}_i^C > c_j$, or $v_B^j > v_B^i$, with $v_B^{12} \geqslant 0$. Moreover, the following properties of $\overline{c}_i^C(c_j)$ apply:[11]

$$\overline{c}_i^C(0) \gtreqless \hat{c}_j^C \quad \text{and} \quad \frac{\partial \overline{c}_i^C}{\partial c_j} \gtreqless 0 \quad \text{as} \quad 0 \gtreqless G''(\varepsilon)$$

[11] Proof: By (18) and (19), we have $\overline{c}_i^C(0) + G(2(v_0 - b_P) + \overline{c}_i^C(0)) - G(v_0 - b_P) = \hat{c}_j^C + G(v_0 - b_P + \hat{c}_j^C)$. So, $\hat{c}_j^C < \overline{c}_i^C(0)$ iff $\overline{c}_i^C(0) + G(2(v_0 - b_P) + \overline{c}_i^C(0)) - G(v_0 - b_P) < \overline{c}_i^C(0) + G(v_0 - b_P + \overline{c}_i^C(0))$. Since $G(0) = 0$ and $v_0 > b_P$, this will be satisfied iff $G''(\varepsilon) < 0$. Then, differentiating (19), we obtain $\partial \overline{c}_i^C / \partial c_j > 0$ iff $G'(2(v_0 - b_P) + c_j + \overline{c}_i^C) < G'(v_0 - b_P + c_j)$, or, iff $G''(\varepsilon) < 0$.

Figures 4(a) and 4(b) show B's messages when $G''(\varepsilon) < 0$ and $G''(\varepsilon) > 0$ (assuming an interior solution where $G(\varepsilon) < 1$). Both figures indicate the values of $\hat{c}_1^C, \hat{c}_2^C, \hat{c}_{12}^C, \overline{c}_1^C(0)$ and $\overline{c}_2^C(0)$. Consider the two cases in turn.

Figure 4(a): Strictly Concave $G(\varepsilon)$

The lines $\boldsymbol{ab}$, $\boldsymbol{de}$ and $\boldsymbol{bd}$ indicate the boundaries $v_B^{12} = v_B^1$, $v_B^{12} = v_B^2$, and $v_B^{12} = 0$, respectively. As well, the vertical line through $\boldsymbol{gb}$ is the locus $v_B^1 = 0$, while the horizontal line through $\boldsymbol{fd}$ is the locus $v_b^2 = 0$. Thus, $v_B^1 > v_B^{12}$ above $\boldsymbol{ab}$, $v_B^2 > v_B^{12}$ to the right of $\boldsymbol{ed}$, $v_B^{12} > 0$ to the southwest of $\boldsymbol{bd}$, $v_B^1 > 0$ left of $\boldsymbol{gb}$, and $v_B^2 > 0$ below $\boldsymbol{fd}$. Therefore, B's messages can be summarized as follows:

$m_1^C = m_2^C = 1$ within the area $\boldsymbol{oabde}$

$m_1^C = m_2^C = 0$ northeast of $\boldsymbol{bd}$

$m_1^C = 1, m_2^C = 0$ above $\boldsymbol{ab}$

$m_1^C = 0, m_2^C = 1$ right of $\boldsymbol{de}$

Note that because the density of $G(\varepsilon)$ is falling as its argument increases, there are projects in the area $\boldsymbol{bcd}$ such that B would prefer that both be undertaken, even though the payoff from each of them if undertaken alone would be negative. In that sense, there are gains from undertaking projects jointly in this case.

Figure 4(b): Strictly Convex $G(\varepsilon)$

In this case, these are disadvantages from undertaking projects jointly since the density of $G(\varepsilon)$ is increasing in its argument. Consequently, the range of projects for which B would recommend both be undertaken is much smaller. In this case, the lines $\boldsymbol{ab}$ and $\boldsymbol{be}$ show the boundaries $v_B^{12} = v_B^1$ and $v_B^{12} = v_B^2$, respectively. Along the line $\boldsymbol{rs}$, $v_B^{12} = 0$. As before, the lines through $\boldsymbol{gc}$ and $\boldsymbol{fc}$ satisfy $v_B^1 = 0$ and $v_B^2 = 0$. B's messages are are determined as follows:

$m_1^C = m_2^C = 1$ within the area $\boldsymbol{oabe}$

$m_1^C = m_2^C = 0$ northeast of point $\boldsymbol{c}$

$m_1^C = 1, m_2^C = 0$ above $\boldsymbol{abc}$

$m_1^C = 0, m_2^C = 1$ right of $\boldsymbol{cbe}$

Note that in the intermedate case where $G''(\varepsilon) = 0$, the area $\boldsymbol{abe}$ coincides with $\boldsymbol{fcg}$. In this case, for all points to the left of $\boldsymbol{gc}$ ($v_B^1 = 0$), project 1 would be undertaken, while all those below $\boldsymbol{fc}$ ($v_B^2 = 0$), project 2 would be undertaken. Therefore, in the area $\boldsymbol{fcg}$, both would be undertaken.

The Politician's Decision

P fully understands the ranges governing the messages sent by B, and must choose x^C accordingly. This will obviously depend on the value of the project to P. As usual, assume that P's preferences are such that B's advice is always accepted. This will be the case if the following conditions are satisfied:[12]

Assumption: $\quad E[c_i|m_i = m_j = 1] \leqslant b_P = \hat{c}_j^C \leqslant \overline{c}/2$

Given this assumption about P's preferences, P's decisions $x_j = \{0, 1\}$, $j = 1, 2$ follow directly from B's messages outlined above with reference to Figures 4(a) and 4(b).

Type I and Type II Errors in Regime C

Given the assumption that $b_P = \hat{c}_j^C$, we can characterize P's preferred outcomes in Figures 4(a) and 4(b). Under full information, P would choose $x_1 = 1$ for all points to the left of the line through $\boldsymbol{gc}$ and $x_2 = 1$ for all points below the line through $\boldsymbol{fc}$. Using that as a benchmark, we can see the errors involved for the two cases $G''(\varepsilon) < 0$ and $G''(\varepsilon) > 0$.

As Figure 4(a) indicates, if $G''(\varepsilon) < 0$, there will be only Type II errors. Type II errors for the two types of projects are enclosed by the following areas:

Project 1: $\quad P_{II}^C = \text{Prob}[b_P < c_1|x_1 = 1] = \boldsymbol{gbde}$

Project 2: $\quad P_{II}^C = \text{Prob}[b_P < c_2|x_2 = 1] = \boldsymbol{abdf}$

Note that these areas are smaller, the smaller is the value of $|G''(\varepsilon)|$. When $G''(\varepsilon) = 0$, Type II errors disappear, and the preferences of B and P are aligned.

On the other hand, if $G''(\varepsilon) > 0$, there will be only Type I errors. These are given for the two types of projects by the following areas in Figure 4(b):

Project 1: $\quad P_I^C = \text{Prob}[b_P > c_1|x_1 = 1] = \boldsymbol{bcge}$

[12] The first inequality implies that $x_1 = x_2 = 1$ if $m_1 = m_2 = 1$. From the remainder of the conditions, we have $E[c_j|m_j = 1, m_i = 0] < \hat{c}_j^C = b_P \leqslant \overline{c}/2 < E[c_i|m_1 = m_2 = 0]$ which implies $x_j = 1, x_i = 0$ if $m_j = 1, m_i = 0$ and $x_1 = x_2 = 0$ if $m_1 = m_2 = 0$, as required. Note that the assumption adopted in Regime D that $E[c_j|m_j = 1] \leqslant b_P \leqslant E[c_j|m_j = 0]$ does not contradict the assumption used here.

Project 2: $\qquad P_I^C = \text{Prob}[b_P > c_2 | x_2 = 0] = \boldsymbol{abcf}$

These areas also decrease as $G''(\varepsilon)$ decreases.

Comparison between Regimes C and D

Figures 3 and 4 allow us to compare the relative magnitudes of Type I and Type II errors in the two regimes under various circumstances. As a benchmark, continue to assume for Regime C that $b_P = \hat{c}_j^C$. As we have just seen, there will be Type II errors if $G(\varepsilon)$ is strictly concave, Type I errors if it is strictly convex, and no errors if it is linear. For Regime D, assume that $(\hat{c}^D + \overline{c})/2 \geqslant b_P \geqslant \hat{c}^D/2$ so that P always takes the advice of the bureaucrats. From (17) and (21), if $\alpha = 1$ (so each bureaucrat bears the full cost of his own project), $\hat{c}^D = \hat{c}_j^C = b_P$. In this case, there will be no errors in Regime D.

If $\alpha < 1$, then $\hat{c}^D > \hat{c}_j^C = b_P$ since $\partial \hat{c}^D / \partial \alpha < 0$ by (18).[13] As Figure 3 indicates, there will be Type II errors in Regime D, and the errors will be higher the smaller is α, so the greater are costs borne by the second bureaucrat. Suppose $G''(\varepsilon) < 0$, so there will be Type II errors as shown in Figure 4(a). Imagine superimposing Figure 3 on Figure 4(a). If α is such that $\hat{c}^D \leqslant \overline{c}_i^C(0)$, the area ***oqsh*** from Figure 3 will lie everywhere inside ***oadbe*** from Figure 4(a), so Type II errors will be unambiguously higher in Regime C. As α falls, the area ***oqsh*** increases. At the point where, $\hat{c}^D \geqslant \overline{c}_i^C(\hat{c}_j^C)$, Type II errors will be unambiguously higher in Regime D. By the same token, if $G''(\varepsilon) > 0$, there will be Type I errors in Regime C and Type II errors in Regime D. Thus, Regime D can be thought of as more aggressive and Regime C more conservative relative to P's preferred outcomes. These results can be summarized as follows:

Proposition 3: *Assume B_j's advice is decisive and $b_P = \hat{c}_j^C$. Then,*

(i) There are neither Type I nor II errors in Regimes C and D if $\alpha = 1$ and $G''(\varepsilon) = 0$.

(ii) There are only Type II errors in Regime D if $\alpha < 1$ regardless of the sign of $G''(\varepsilon)$.

iii) There are only Type I errors in Regime C if $G''(\varepsilon) > 0$.

iv) There are Type II errors in both Regimes if $\alpha < 1$ and $G''(\varepsilon) < 0$. If α is high enough, Type II errors are greater in Regime C than in Regime D, and vice versa.

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[13] We assume that $b_P \geqslant \hat{c}^D/2$ continues to apply when α is decreased. If not, P may choose not to undertake any project regardless of the advice received.

Of course, as P's benefit b_P becomes smaller, there will be more Type II errors and less Type I errors, but the above pattern of biases between the two Regimes will persist.

7 Conclusions

This paper has explored ways in which well-informed bureaucrats may be able to manipulate the outcomes of public policy to suit themselves rather that the politicians to whom they are directly accountable. The bureaucrat is limited by the possibility of facing discipline if outcomes deviate excessively from those preferred by the politician. Depending on the relative preferences of the politician and the bureaucrat, there may be a preponderance of Type I or Type II errors in which the politician turns down projects that would have been preferred under full information, and accepts projects that would not be undertaken under perfect information. The basic model with a representative bureaucrat and a representative politician deciding on a given project is sufficient to illustrate these points. These results are purely positive in the sense that no presumption is made about whether the preferences of the bureaucrat or the politician better represent that of society.

The basic model was extended to settings where projects are multi-dimensional and advice may be decentralized to more than one bureaucrat. As long as relative preferences are such that bureaucratic advice is decisive, both Type I and Type II errors can occur in both centralized and decentyralized regimes. However, the relative chances of the two types of errors occuring depends upon whether the distribution function determining if bureaucrats are disciplined is strictly concave or strictly convex. If $G(\varepsilon)$ is strictly convex, the decentralized regime temds to be more expansionary than the centralized regime, and vice versa if $G(\varepsilon)$ is strictly concave. There appears to be no a priori reason to assume one or the other case. Which regime the politician may prefer given the form of $G(\varepsilon)$ will depend upon the relative weights put on Type I and Type II errors.

The analysis and its interpretation could be extended in a number of directions. In our model, the cost of the project becomes known to the politician ex post if the project is undertaken. It would be straightforward to assume that the politician only observes an imperfect signal of the cost. Then, the probability of discipline could readily take that into account. If we were to allow to politician to observe costs ex post no matter what, the bureaucrat could also be disciplined if the project did not go ahead. One could also allow the bureaucrat to have an unobservable level of ability or competence, which affects the value of the outcome of the project. In a career concern version of the model, the bureaucrat could be disciplined if his ability is found to be below a certain level, rather than because the project recommended does not conform with the politician's preferences. In our analysis, we have assumed that the bureaucrat is fully informed about the politician's preferences. It would be possible to take an asymmetric information approach with respect to that. In all these cases, the methodological approach we have taken could be readily adopted to deal with the complications involved.

Alternative informational assumptions could also be considered. The politician could be allowed to hire external advisors to supplement the advice given by the bureaucrat. This turns out to be beneficial to the politician as long as the advisors preferences are sufficiently close to those of the politician. Alternatively, the bureaucrat might not be perfectly informed, and may be able to improve his information at some cost.

Finally, other dimensions of decision-making could be studied. For example, projects may have more than one cost dimension that may be evaluated differently by politicians and bureaucrats. Thus, costs might include both direct costs and indirect costs, like environmental degradation.

Appendix

Proof of Proposition 2

i. For $b_P^1 \geqslant (c_1^C + c_{12}^C)/2$, we have (12):

$$\frac{c_{12}^C}{2} \leqslant \Delta b_P \leqslant \frac{c_1^C + c_{12}^C}{2} \leqslant b_P^1 \leqslant \frac{c_1^C + \overline{c}}{2}$$

Therefore, using P's updated beliefs, P's choice of projects given B's message m_I is:

$$x(m_I) = \begin{cases} x(1,1) &= 2 \\ x(1,0) &= 1 \\ x(0,0) &= 0 \end{cases}$$

Given this choice of projects, which B will anticipate perfectly, B has no incentive to deviate from strategy m_I given by (13). Therefore, it will be an equilibrium.

On the other hand, if $b_P^1 < (c_1^C + c_{12}^C)/2$, we have:

$$\frac{c_{12}^C}{2} \leqslant \Delta b_P \leqslant b_P^1 \leqslant \frac{c_1^C + c_{12}^C}{2} \leqslant \frac{c_1^C + \overline{c}}{2}$$

In this case, assuming that B follows strategy m_I in (13), P's decision is given by:

$$x(m_I) = \begin{cases} x(1,1) &= 2 \\ x(1,0) &= 0 \\ x(0,0) &= 0 \end{cases}$$

Anticipating this, B will have an incentive to deviate from strategy m_I. For $c \in [c_{12}^C, c_2^C]$ (where $v_B^2 > 0$), B will want to send $m = (1,1)$ in order to get P to choose $x = 2$. Sending $m_I = (1,0)$ will induce P to choose $x = 0$, which B values less than $x = 2$. Therefore, m_I is not a sustainable equilibrium in this case.

ii. If $b_P^1 \leqslant (c_1^C + c_2^C)/2$, we have:

$$\frac{c_2^C}{2} \leqslant \Delta b_P \leqslant b_P^1 \leqslant \frac{c_1^C + c_2^C}{2} \leqslant \frac{c_1^C + \overline{c}}{2}$$

which implies P's choice of projects is given by:

$$x(m_{II}) = \begin{cases} x(1,1) &= 2 \\ x(1,0) &= 0 \\ x(0,0) &= 0 \end{cases}$$

Given this, B will have no incentive to deviate from strategy m_{II}.

But, if $b_P^1 > (c_1^C + c_2^C)/2$, P's choice $x(m_{II})$ will be identical to $x(m_I)$ given above. In this case, B will have an incentive to deviate if $c \in [c_{12}^C, c_2^C]$. Since $v_B^1 > v_B^2$ in this range, B would prefer to send $m = (1,0)$ to obtain $x = 1$ rather than $m_{II} = (1,1)$. Thus, m_{II} is not sustainable in this range.

References

Alesina, A.F. and G. Tabellini (2003), 'Bureaucrats or Politicians', NBER Working Paper No. W10241, January 2003.

Banks, J. (1990), 'Monopoly Agenda Control with Asymmetric Information', *Quarterly Journal of Economics* 105, 445–64.

Banks, J. (1993), 'Two Sided Uncertainty in the Monopoly Agenda Setter Model', *Journal of Public Economics* 50(3), 429–44.

Crawford, V.P. and J. Sobel (1982), 'Strategic Information Transmission', *Econometrica* 50(6), 1431–51.

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

Laffont, J.-J. and J. Tirole (1994), *A Theory of Incentives in Procurement and Regulation* (Cambridge, USA: MIT Press).

Li, H., S. Rosen and W. Suen (2001), 'Conflicts and Common Interests in Committees', *American Economics Review* 91, 1478–97.

Li, H. and W. Suen (2004), 'Delegating Decisions to Experts', *Journal of Political Economy* 112, S311–35.

Milgrom, P.R. (1981), 'Good News and Bad News: Representation in Theorems and Applications', *Bell Journal of Economics* 12(2), 380–91.

Prendergast, C. (2003), 'The Limits of Bureaucratic Efficiency', *Journal of Political Economy* 111(5), 929–58.

Romer, T. and H. Rosenthal (1978), 'Political Resource Allocation, Controlled Agendas, and the Status Quo', *Public Choice* 33, 27–43.

Romer, T. and H. Rosenthal (1979), 'Bureaucrats vs. Voters: On the Political Economy of Resource Allocation by Direct Democracy', *Quarterly Journal of Economics* 93, 563–88.

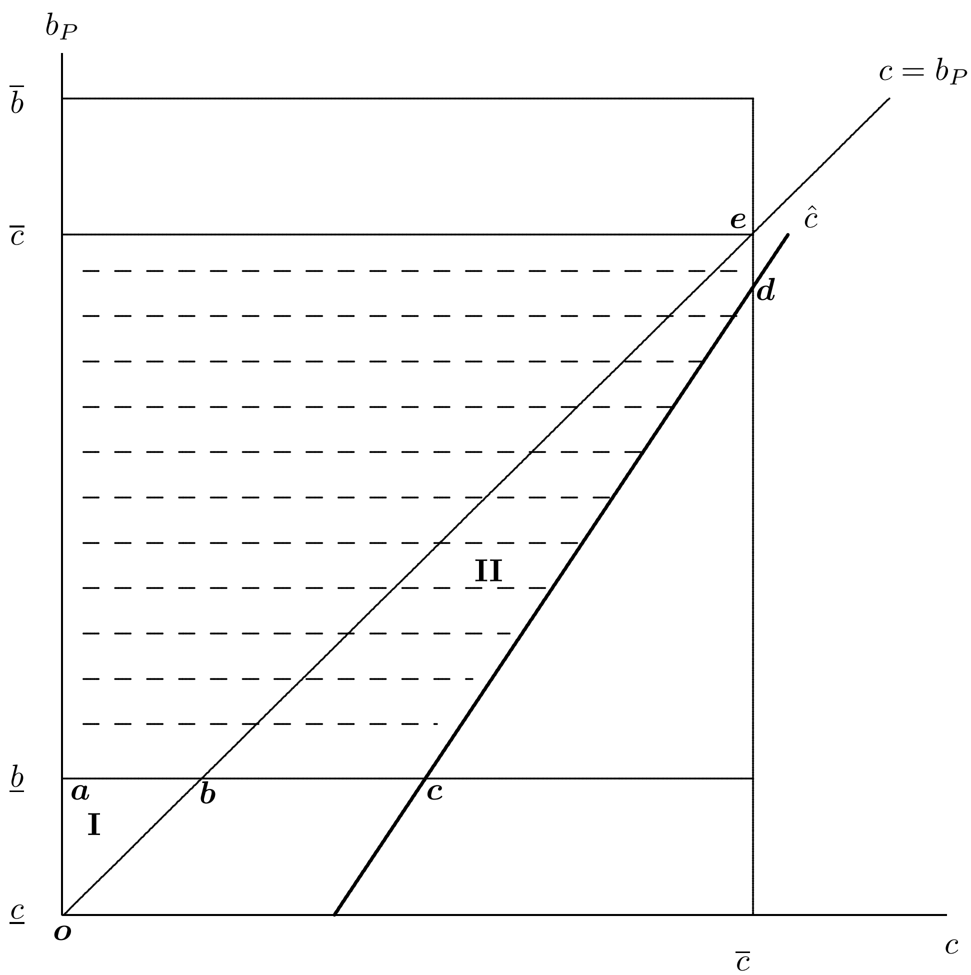

Figure 1(a). Equilibrium Outcomes with $b_B > G(v_0) + \overline{c}$

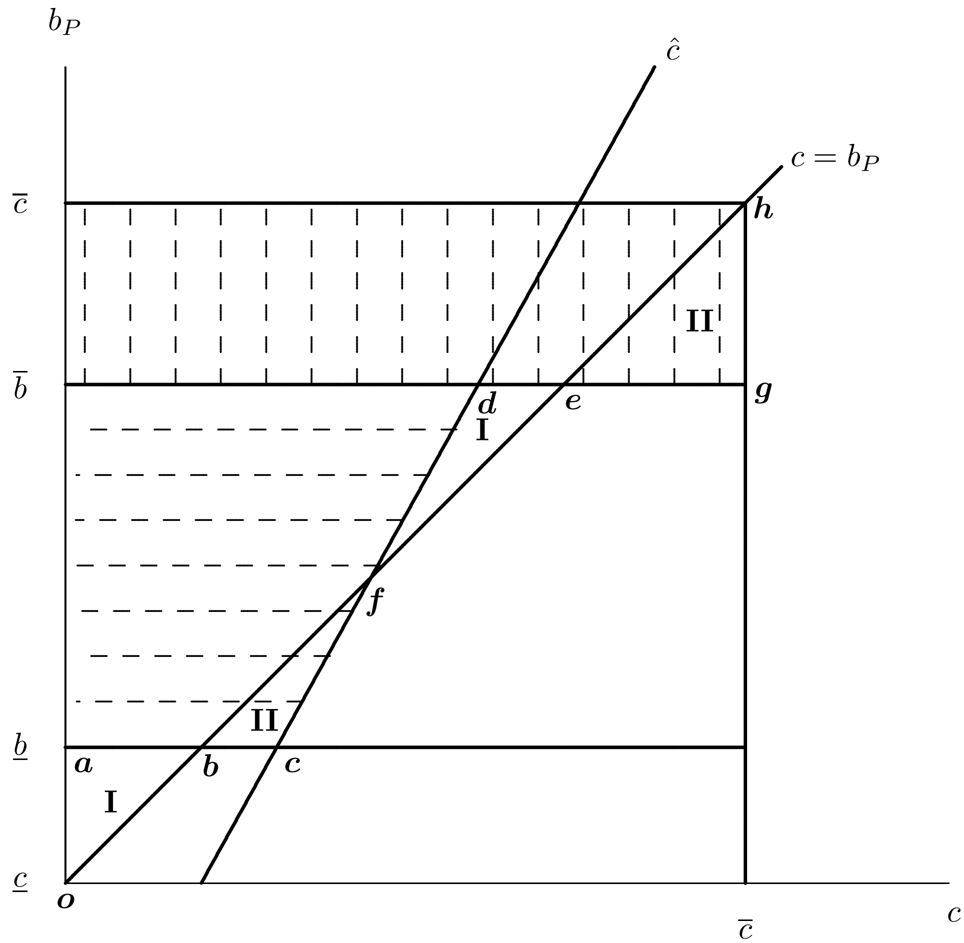

Figure 1(b). Equilibrium Outcomes with $G(v_0) \leqslant b_B \leqslant G(v_0) + \overline{c}$

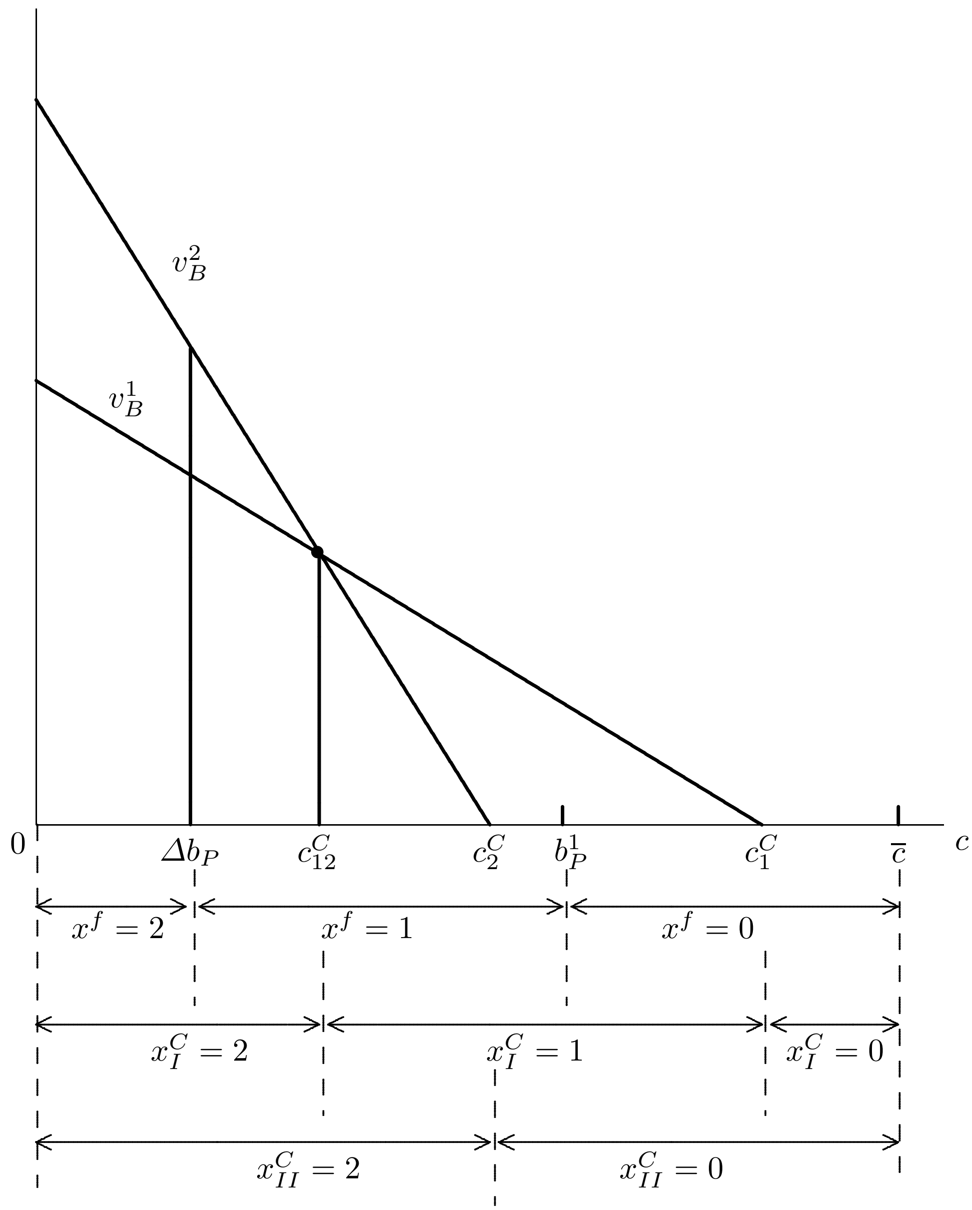

Figure 2. Choice of Project Size

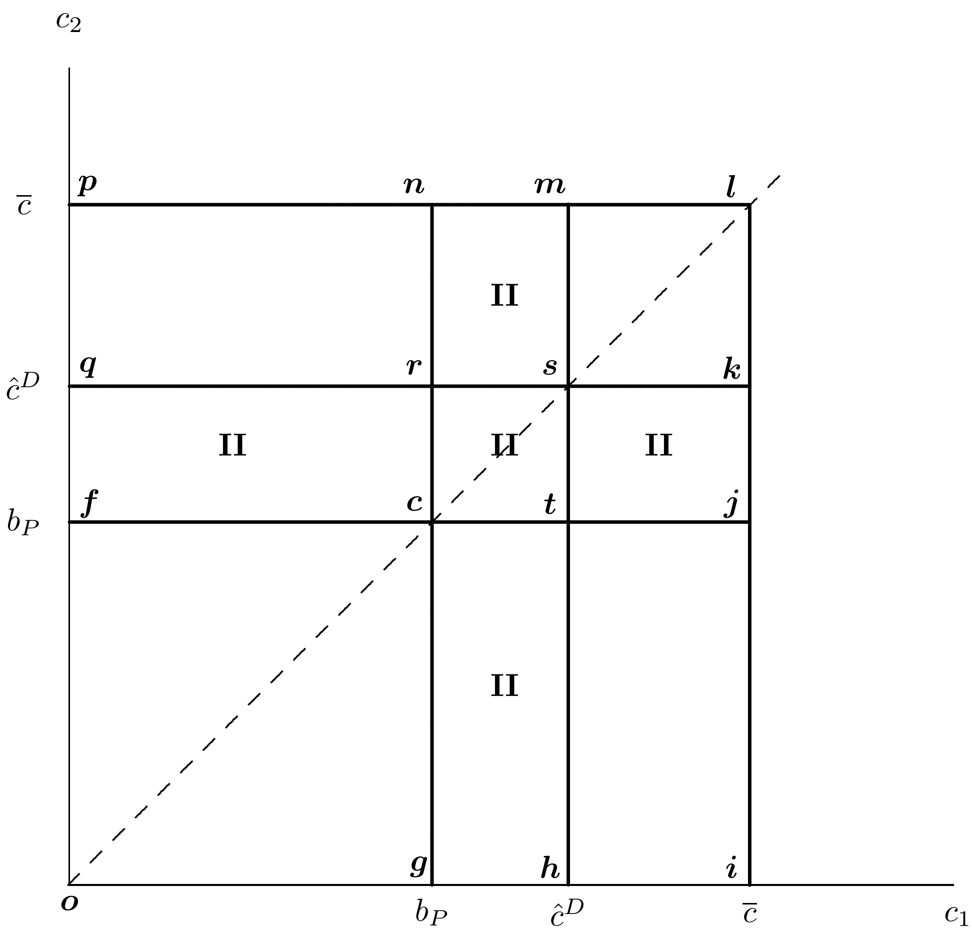

Figure 3. Decentralized Regime with Two Projects

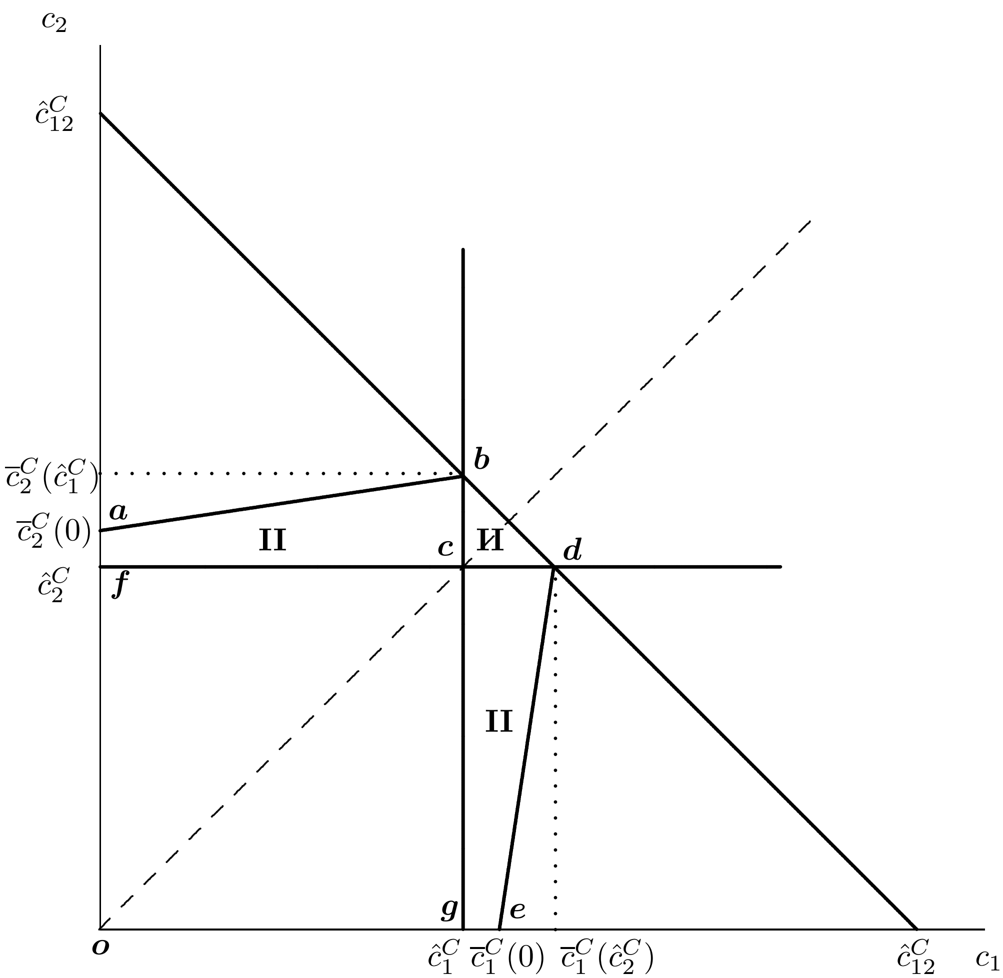

Figure 4(a). Centralized Regime with Two Projects: $G''(\varepsilon) < 0$

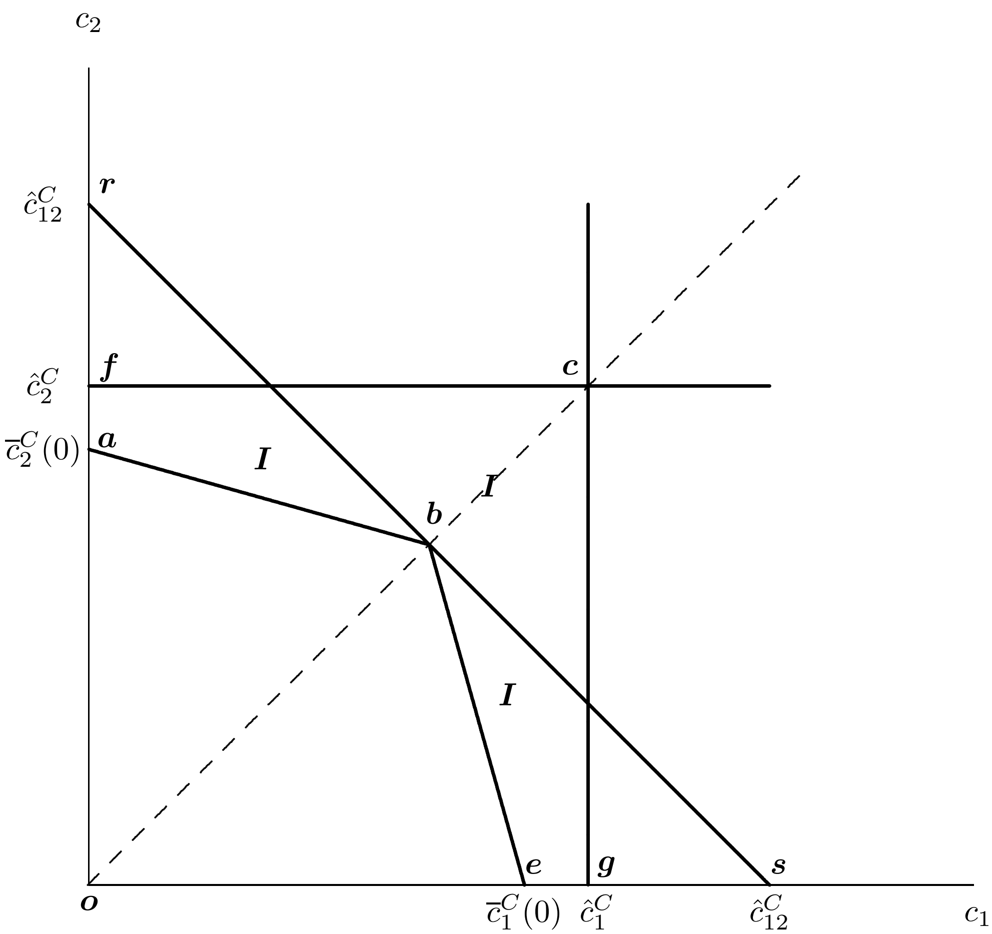

Figure 4(b). Centralized Regime with Two Projects: $G''(\varepsilon) > 0$