TYPES OF BUREAUCRATIC INTERACTION

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Received September 1984, revised version received October 1985

A taxonomy of relationships between a public bureau and its sponsoring institution is modelled within a simple follower-leader framework. Various assumptions are made with respect to who makes the decision about the bureaucratic activity level and with respect to cost information. The role played by budgetary slack is emphasized. Deviations from the socially optimal bureau are identified, but no general support is found for the view that bureaus tend to become too big.

1. Introduction

Compared to the flow of economists' papers about market interactions the flow of papers about bureaucratic interaction is out of proportion to the relative importance of markets versus bureaucracies in modern economies.

The present paper deals with a small subset of the issue. It studies different types of interaction that can result from the relationship between a bureau and its sponsoring institution. This interaction may differ depending on the dispersion of decision-making power and relevant information between the opposing sides. Attention is focused on the determination of the bureaucratic activity level and the corresponding budget. Hence, the analysis is related to the models of budgets and bureaucrats starting out with Niskanen (1971). [For a brief survey of this literature see Orzechowski (1977).]

In both Niskanen's original analysis and in the modified version by Migué and Bélanger (1974) it follows more or less directly that bureaus become too large according to the sponsor's preferences. This is a consequence of assuming a passive sponsor in the budgetary process. Miller (1977) introduces an active sponsoring institution within a game-theoretic framework. The present analysis takes the same approach. It differs from Miller's in several respects. Miller considers only the case where both sides have all relevant information, and where the budget and the activity level are assumed, without further motivation, to be determined by simultaneous

*I wish to thank Hans Henrik Scheel for his stimulating criticism. I am also grateful to Jens Chr. Andvig, Tor Hersoug, Michael Hoel, Knut Moum and an anonymous referee for helpful comments on an earlier draft.

moves within a prisoner dilemma type of situation. The present paper makes various assumptions with respect to the sequence of decision-making, and with respect to who decides on what under what information. By varying these assumptions one may perhaps come closer to the different procedures that are actually followed in various budgetary processes. In this respect our approach is similar to Miller and Moe (1982) who expand the original Niskanen setup within a follower–leader type of game framework. The paper by Sørensen (1984), who applies game theory in the study of hierarchical organizations, is also relevant.

Depending on the distribution of the decision-making power and of relevant information, different kinds of interaction between sponsors and bureaus may result. Hence, bureaus differ with respect to strategic position and due to particular procedures they have to follow and one cannot expect to capture all types of bureaucratic interaction with the same type of solution. On the contrary, a taxonomy of solutions follows. No attempt has been made, however, to cover all logically possible cases; attention is only given to situations that seem to have some similarity to real-life bureaucratic interaction.

The plan of the rest of the paper is as follows. In section 2 the setup is presented and the optimal response of the bureau to different levels of the appropriated budget is derived. Section 3 discusses different types of sponsor–bureau interaction when the sponsor formally determines both the budget and the activity level. Section 4 focuses on cases where the bureau itself determines its activity level and the sponsor only grants the budget. Finally, section 5 concludes the paper.

2. Preferences

Let $X$ indicate the production or activity level of the bureau. Our setup requires that this indicator is conceptually distinguishable from the budget $B$ of the bureau. Hence, in applied work rather rough indicators of output levels have to be used, at least for some types of bureaucratic activities.

Furthermore, $W(X)$ is the sponsor’s maximum willingness to pay for the activity level $X$. When the sponsor is the legislature we are neglecting possible misrepresentations of social preferences. The paper aims to demonstrate that the outcome of the information and decision-making structure within the state apparatus can be socially inoptimal even when the legislature correctly reflects society’s preferences. Accordingly, in this case $W(X)$ indicates society’s willingness to pay for bureaucratic services. Naturally, $W(O) = 0$, and positive, but diminishing, marginal utilities are assumed, i.e. $W'(X) > 0$ and $W''(X) < 0$. Furthermore, the willingness to pay is bounded in the sense that $W'(\infty) = 0$.

$C(X)$ is the minimum total costs of providing the bureaucratic activity level
These costs are assumed to be increasing in $X$ with non-decreasing marginal costs, i.e. $C'(X) > 0$ and $C''(X) \geq 0$. Furthermore, $\hat{C}(X)$ is the cost function reported by the bureau. Due to a possible information monopoly of bureaucrats, $\hat{C}(X)$ may differ from the true $C(X)$. A budgetary slack may result. This slack, defined as the difference between appropriated budget and true minimum costs,

$$Z = B - C(X),$$  \hfill (1)

cannot be taken out as ordinary income by bureaucrats. Nevertheless, it may be highly valued in the preferences of the bureau.

Following Migué and Bélanger (1974) and others, the bureau is assumed to have positive marginal utility of its size, indicated by the level of $X$, and of the budgetary slack $Z$:

$$U = U(X, Z).$$  \hfill (2)

$U$ is assumed to be strictly quasi-concave and both $X$ and $Z$ are assumed to be normal goods to the bureau. The meaning of the latter is as follows. If $X$ and $Z$ could have been bought at given unit costs subject to a budget constraint, the bureau would have bought more of both $X$ and $Z$ the higher the budget.

The normality assumption just stated implies that $X$ and $Z$ are increasing in $B$ also in the case with convex costs $C(X)$. To see this consider the case where the bureau obtains the budget $B$, and is free to choose $X$ as to maximize $U$, given by (2), subject to $B \geq C(X)$. The optimal level of $X$ is indicated by

$$X = F(B),$$  \hfill (3)

where $F$ is the optimal response function of the bureau. Recall that the slack is the residual $Z = B - C(X)$ or equivalently $B - Z + cX$, where $c = C(X)/X$.

Now consider an increase in $B$. When unit costs of $X$ are constant the normal goods $X$ and $Z$ are, as already defined, increasing with $B$. When $C(X)$ is strictly convex unit costs $c$ will increase with $X$, implying a substitution effect in the direction of more slack and less output. However, since this substitution effect is the result of an increase in $X$ it cannot outweigh the positive income effect on $X$. Hence, both $Z$ and $X$ are increasing in $B$, as illustrated in fig. 1: for any $B_2 > B_1$ the optimal responses are $X_2 > X_1$ and $Z_2 > Z_1$. Furthermore, the utility of the bureau is increasing along the $F(B)$ curve in the figure: the higher the budget the higher the bureaucrats' utility level. Accordingly, no global maximum exists in the $B,X$ space unless additional constraints are introduced.
Fig. 1. $U^1 < U^2 < U^3$. The relationship between the appropriated budget $B$, the slack $Z$ and the bureaucratic activity level $X$.

Next, we turn to the sponsoring institution. It wants to maximize the net utility (or surplus) of bureaucratic services, i.e.

$$S = W(X) - B.$$  \hfill (4)

Let us then turn to how bureaus and sponsors may interact.

3. The sponsor determines both the activity level and the budget

The allocation of formal decision-making power does not necessarily identify the real influence on decisions made. As will be analysed below the
sponsor may have to act on the basis of cost information provided by the bureau. First, however, we derive the bench-mark where the sponsor is all-powerful and informed and where the bureau is passive.

3.1. The bench-mark

Being all-powerful and informed means that the sponsoring institution decides on the level of both \( X \) and \( B \), and that the true cost curve is known to it. Then the sponsor chooses \( X \) and \( B \) to

\[
\max_{x, b} W(x, b) - B
\]

s.t.

\[
B \leq C(x).
\] (5)

The solution is \( X_a, B_a \) determined by the optimality conditions

\[
W'(x_a) = C'(x_a) \quad \text{and} \quad B_a = C(x_a).
\] (6)

Implicitly it is assumed here that this solution yields a non-negative surplus to the sponsor, i.e. \( W(x_a) \geq B_a \), such that it is preferred to no bureaucracy at all.

In the case of public spending (6) yields the socially optimal level of bureaucratic services where marginal social gains equal true marginal costs. No budgetary slack obtains. This case may be considered economists' 'traditional view' of public spending as the outcome of centralized decision-making by the government without bureaucratic discretion. The solution is illustrated by point \( a \) in fig. 2, i.e. by the level of \( X \), where the \( W(X) \) and \( C(X) \) curves have equal slopes and where necessary expenses are just covered. This case will be considered the bench-mark and will for short be referred to as the social optimum.

3.2. Misrepresentation of costs

We now consider the case where the sponsoring institution is formally all-powerful, but where the true cost function is not known to it. The bureau, on the other hand, knows the sponsor's willingness to pay. The sponsor may for example be a decision-making body consisting of elected politicians, say the legislature. In that case the true cost curve can often be kept as a bureaucratic secret because politicians normally lack the special knowledge and experience necessary to provide themselves with accurate estimates of \( C(X) \). The legislature's preferences, on the other hand, may more easily become public information: representatives follow political programs, ex-
change views, talk to the press and try to persuade opponents. These activities imply that the willingness to pay for bureaucratic services may be fairly well known to bureaucrats.

The decision procedure is such that the bureaucrats first provide the 'relevant' information about costs. The bureau knows \( W(X) \) and the fact that the sponsor's decision procedure will yield a similar solution to (6), but now with the reported cost function taking the place of the true one:

\[
W'(X) = \hat{C}(X) \quad \text{and} \quad B = \hat{C}(X). \tag{7}
\]

Therefore the bureau reports the \( \hat{C}(X) \) function that maximizes its own preference scale \( U \) subject to (7) and \( B \geq C(X) \).
Analytically this problem can be solved in two steps. First we find the best feasible levels of $X$ and $B$ in accordance with the preferences of the bureau. Then we construct the reported cost function such that this solution is obtained by the sponsor’s decision procedure.

As long as the sponsor formally makes the budgetary decision the following inequality holds [by definition of $W(X)$ for the chosen pair of $X$ and $B$]:

$$W(X) \geq B.$$  
(8)

Hence, the best level of $B$ that the bureau can obtain for each level of $X$ is $B = W(X)$. The optimal level of feasible $X$, as seen by the bureau, is then given by the solution to

$$\max_{X} U(X, W(X) - C(X))$$

s.t.

$$W(X) \geq C(X),$$

(9)

where we have inserted $B = W(X)$ in the bureau's utility function.

It is straightforward to see that the solution to (9) is a value of $X$ higher than $X_a$ given by (6). $X_a$ maximizes the difference $W(X) - C(X)$ which is also an argument in the bureau's maximand. However, since the bureau, in addition, has positive preferences of $X$, the solution $X_b$ to (9) must obey

$$X_b \geq X_a,$$

(10)

where a strict inequality holds when $W(X_a) > C(X_a)$.

The next step is to construct the $\hat{C}(X)$ function such that $X_b$ and $B_b = W(X_b)$ are chosen by the procedure (7). The reported cost function must satisfy

$$W'(X_b) = \hat{C}'(X_b) \quad \text{and} \quad W(X_b) = \hat{C}(X_b).$$

(11)

Hence, if for example the class of possible cost functions is linear, $C = \alpha X + \beta$, the bureau will report a lower value of variable unit costs $\hat{\alpha}$ and a higher level of fixed costs $\hat{\beta}$ than the true ones. By so doing the sponsor will get the impression that a marginal increase in $X$ is less expensive than it really is. Therefore the sponsor is led to choose $X_b > X_a$. The high value of reported fixed costs leads the sponsor to appropriate a high budget such that the optimal level of feasible slack is obtained by the bureau. With regard to
public spending, the results are that the bureaucratic activity level becomes too high and too expensive as compared to social optimum. The case is illustrated by point \( b \) in fig. 2 which is the point along the \( W(X) \) curve that yields the highest utility of the bureau. In principle the solution is the same as in Migué and Bélanger (1974). When the bureau has an information monopoly about the true cost curve it does not matter for the resulting activity level whether it also has decision-making power over \( X \) (as in the paper by Migué and Bélanger) or not.

Note that the bureau exploits all the consumer surplus since \( W(X_b) - B_b = 0 \). Furthermore, the sponsor is brought to believe that \( X_b \) is the only activity level where the willingness to pay covers the costs, since if the sponsoring institution believed that a strictly positive surplus could have been obtained at another activity level, it would have chosen it. Hence, the reported cost function cannot intersect the \( W(X) \) curve for \( X \) values other than \( X_b \). [This is also implied by the original solution in Niskanen (1971) as pointed out in the book review by Thompson (1973). See also Spencer (1980).]

If the information monopoly of the bureau were restricted, the outcome would have been different from the one described above. In particular, the sponsor would then more likely obtain a positive net surplus \( W - B \).

3.3. Restrictions on the bureau's information monopoly

To illustrate the effects of limitations on the information monopoly of the bureau we consider a simple but interesting case: \( X \) now indicates a possible expansion of an existing bureau. There is no possibility to misrepresent the fixed costs since they are already invested. The variable costs of the expansion are known to be proportional to \( X \), but the rate of proportionality \( \alpha \) is unknown to the sponsor.

When the reported cost information is received the sponsor chooses the expansion

\[
X = H(\hat{\alpha}) \quad \text{and} \quad B = \hat{\alpha} H(\hat{\alpha}),
\]

(12)

where \( H(\hat{\alpha}) \) is the value of \( X \) determined by

\[
W'(X) = \hat{\alpha},
\]

(13)

implying that \( H' < 0 \). The social optimum is \( X = H(\alpha) \) and \( B = \alpha H(\alpha) \leq W(H(\alpha)) \).

The bureau reports the value of \( \hat{\alpha} \) that maximizes its utility taking (12)
K.O. Moene, Types of bureaucratic interactions

into account, i.e.

$$\max_d U(H(\hat{\alpha}),(\hat{\alpha} - \alpha)H(\hat{\alpha}))$$

s.t.

(i) $\hat{\alpha}H(\hat{\alpha}) \leq W(H(\hat{\alpha}))$, and

(ii) $(\hat{\alpha} - \alpha)H(\hat{\alpha}) \geq 0,$

(14)

where the latter constraint takes care of the fact that the bureau has to cover the costs of its expansion. From (14) it follows immediately that if there is a misrepresentation it will be in the direction of too high marginal costs $\hat{\alpha}$ leading to an underexpansion of the bureau. The reason is the trade-off between slack and expansion: a marginal increase in $\hat{\alpha}$ leads to higher $Z$ but to lower $X$, the rate of transformation being $dZ/dX = [(\hat{\alpha} - \alpha)H' + H]/H'$. Thus, if the marginal utility of a positive slack is sufficiently high, $\hat{\alpha}$ will be higher than $\alpha$ and an underexpansion occurs. An interior solution to (14) obtains when $\hat{\alpha}$ is determined by equating the rate of substitution between slack and expansion with the absolute value of their rate of transformation, i.e. by

$$\frac{U_1}{U_2} = \frac{H + (\hat{\alpha} - \alpha)H'}{-H'},$$

(15)

without violating the constraints in (14). Such an interior solution will yield a positive surplus to the sponsor, i.e. $W(H(\hat{\alpha})) - \hat{\alpha}H(\hat{\alpha}) > 0$.

3.4. The bureau is uncertain about the sponsor's willingness to pay

The bureau may only know the expected willingness to pay prior to the sponsor's decision. There may be some probability of either a lower or a higher realized willingness to pay, i.e. we have $W(X) + \varepsilon$, where $\varepsilon$ is a random variable with zero mean-value. ($\varepsilon$ is assumed to be distributed over a certain interval $I$ with a positive density for all $\varepsilon$ in $I$.) Since the bureau reports its costs before the true willingness to pay is revealed there is a chance of obtaining insufficient support for the budget. This possibility should lead the bureau to report more conservative costs than otherwise, implying that the sponsor can obtain a positive surplus from the interaction.

To illustrate that the introduction of uncertainty may have rather surprising effects let us reconsider the simple case discussed above where the bureau cannot misrepresent the fixed cost.

The situation is then as follows. If the realized willingness to pay is high enough relative to reported costs, the sponsor chooses an optimal expansion
According to the reported costs, i.e. $X = H(\hat{a})$, and grants the 'necessary' budget. If, on the other hand, the willingness to pay is too low, the sponsor chooses not to expand and grants nothing. Formally:

$$X = H(\hat{a}) \text{ and } B = \hat{a}H(\hat{a}), \quad \text{if } W(H(\hat{a}))+\varepsilon \geq \hat{a}H(\hat{a}),$$

$$X = 0 \text{ and } B = 0, \quad \text{if } W(H(\hat{a}))+\varepsilon < \hat{a}H(\hat{a}).$$

Under these circumstances the bureau should report the value of $\hat{a}$ which maximizes its expected utility, taking (16) into account. Let the $U$ function be normalized such that $U(0,0)=0$ and let us use the short-hand

$$Pr(\varepsilon \geq \hat{a}H(\hat{a}) - W(H(\hat{a}))) = G(\hat{a}),$$

where $G' < 0$. The expected utility of the bureau, based on (16), is then

$$EU = G(\hat{a})U(H(\hat{a}), (\hat{a} - a)H(\hat{a})).$$

The optimal value of $\hat{a}$ can now be found from the following first-order condition:

$$\frac{U_1}{U_2} = \frac{\frac{H + (\hat{a} - a)H'}{-H'} - g}{g = UG'/GH'} > 0.$$

Hence, the absolute value of the marginal rate of transformation exceeds the value of the marginal rate of substitution. By comparing (19) with (15) (taking the second-order conditions into account) we find that the reported marginal costs which obtain from (19) are the lower. However, even when $\hat{a}$ is chosen in accordance with (19) there may still be a positive probability of the case that the legislature vote for no expansion at all. The conclusion is therefore as follows: whenever the expansion takes place it will be larger than in the certainty case. Due to the veil of uncertainty about the preferences of the sponsor the bureau reports a lower value of $\hat{a}$ to increase the probability of obtaining the expansion. Whether the sponsoring institution is better off in this situation than in the one analyzed in section 3.3 is difficult to tell since its preferences are not necessarily identical in the two cases. However, if $\varepsilon$ represents 'political noise' and $W(X)$ actually is the true preferences in both situations, the uncertainty case produces the highest surplus to the sponsor.

4. The sponsor grants the budget and the bureau determines its activity level

The situation analysed in this section differs from the one analyzed in
section 3 by the allocation of decision-making power over \( X \). Now the bureau itself is assumed to choose its own activity level. The existence of such discretionary power is sometimes a consequence of the nature of the specific bureaucratic activities under consideration: the more special skills that are required for the provision of bureaucratic services the more discretionary power over \( X \) the bureau is likely to obtain.

4.1. The sponsor moves first

We now consider the case where the sponsor knows the optimal response of the bureau, i.e. \( X = F(B) \). The sponsor may, for example, be fully informed, considering the bureau to be a rational decision-making unit that tries to make the best out of the situation according to its own preferences. This is a reasonable assumption when the sponsor is the top level of a bureaucratic hierarchy where the leaders have held lower positions and know \( C \) and \( U \) by own experience or due to special training.

However, the sponsor does not need to be fully informed: within a lasting sponsor–bureau relationship with repeated budgetary processes the sponsor easily learns how the bureau reacts to different budgets. The sponsor may nevertheless be out of position to learn about the true cost function from the repeated relationship.

In both cases the optimal \( B \) to the sponsor is determined by

\[
\max_B W(X) - B
\]

s.t.

\[
X = f(B),
\]

which gives us the first-order condition

\[
W' = 1/F'.
\]

Let us call the resulting budget \( B_c \) and the corresponding activity level it induces \( X_c = F(B_c) \). The solution is illustrated by point \( c \) in fig. 2. This is the point along the bureau’s response function that gives the sponsor the highest utility level. As seen from fig. 2, \( X_c \) is below \( X_a \), the social optimum. This is not a coincidence, but a general result of the model: since \( Z = B - C(F(B)) \) is increasing in \( B \), i.e. \( dZ/dB = 1 - C'F' > 0 \), we have

\[
C' < 1/F'.
\]

From (7), (21) and (22) we obtain \( W'(X_c) > W'(X_a) \), implying that \( X_c < X_a \). Note that we cannot tell whether \( B_c \geq B_a \), the latter being the budget at social
optimum. What we do know, however, is that a positive slack obtains such that we can conclude as follows: the bureaucratic activity is too low as compared to social optimum and the bureau is cost-inefficient.

4.2. The bureau moves first

In this case both sides are fully informed. $X$ may be thought of as a minor part of a bureau's total activities. For practical reasons the bureau may have been given discretionary power over $X$ and the possibility to pass the bill to the sponsor ex post. The true cost of providing $X$ is assumed to be public information. The bureau is therefore unable to cheat on the true costs. $X$ may, for example, be something that the bureau has to buy in the market, such as equipment, business-travelling and other special items or services. Since the sponsor easily can check the market values of these types of activities, the costs are known. Accordingly, the sponsor will of course pay nothing more than the true costs, and the bureau cannot obtain any budgetary slack. This leads to a situation where the derived utilities of the bureau become $U = U(X, 0)$, and where the bureau consequently wishes to make $X$ as high as possible. In practice, however, the sponsor will not passively pay out whatever amount demanded for these activities. Probably, explicit or implicit punishment exists when the bureau goes beyond 'reasonable limits'. One way to make such limits precise in the context of the model is by assuming that the case $C(X) > W(X)$ is not tolerated, i.e. by assuming that punishment is strong enough to preclude costs from exceeding the willingness to pay. The bureau will then choose $X = X_d$ as the highest level of $X$ which satisfies

$$W(X_d) = C(X_d).$$

(23)

The corresponding budget is $B_d = C(X_d)$. This case is illustrated by the point $d$ in fig. 2 which indicates the maximum level of feasible $X$ that will be supported by the sponsor.

The result of this special case is identical to the budget maximization solution suggested by Niskanen (1971), but now as the outcome of a different decision procedure.

5. Concluding remark

Within our taxonomy of bureau–sponsor interaction there is no general support for the hypothesis that bureaus tend to be too big. However, underproduction of bureaucratic services can be harmful as well.
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