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Bureaucracy, inefficiency, and time

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Abstract. This paper examines the bureaucrat's choice between devoting resources to economic rents (organizational slack) and maximizing the budget of the agency. A new model of bureaucracy is developed using utility rather than a demand function as its foundation. It is shown that increases in income alter the slack-budget constraint to favor organizational slack over budget-maximization. Modern federal bureaucracies in the U.S. are predicted to be slack-maximizing and X-inefficient.

1. Introduction

For at least two decades, analysts have debated the nature of bureaucratic influence. Niskanen (1971) asserted that bureaucrats are budget-maximizers, because everything of value to them (for example, salary, perquisites of office, public reputation, power, and patronage) is directly related to the total budget of the bureau. A later group of writers, led by Breton and Wintrobe (1975) and Migue and Belanger (1974), has argued that this is much too narrow a view. Instead, these authors suggest that the bureaucrat will push to generate excess revenues over and above the cost of production (excess revenues which have been variously called "organizational slack", "the fiscal residuum", or "discretionary profit") to pay for the utility-enhancing expenditures listed above. As will be shown below, given the constraints typically facing bureaucracies, these two approaches lead to radically different conclusions about bureaucratic behavior.

A different but closely related question concerns the nature of bureaucratic inefficiency. Do bureaucrats generate X-inefficiency by paying factors of production too much or by utilizing incorrect input mixes? Williamson (1964), for example, argues that the bureaucrat employs excess staff in order to enhance his own power and prestige. Or is the problem with bureaucracy that it generates allocative inefficiency by producing more of a particular public good than we would like?

Cullis and Jones (1984) and Migue and Belanger (1974) have pioneered a "back door" approach to these questions. Given the ambiguities inherent in trying to answer these questions directly, through surveys or observation of

bureaucratic attitudes and behavior, this approach concentrates on the nature of the constraint facing bureaucrats and its changes over time. These authors pointed out that if it can be shown that the comparative static changes which occur over time favor one kind of inefficiency over another, the nature of inefficiency in modern bureaucracies can be pinpointed without the uncertainties attached to more direct studies of bureaucracy. However, these previous authors reached contradictory conclusions about the long-term nature of bureaucratic inefficiency. In addition, these studies employed crude models which were limited to special cases (such as linear demand curves) and which ignored fundamental aspects of the constraints facing bureaucratic decision-makers.

In this paper I attack the problem of bureaucratic inefficiency using a new and more precise model of bureaucracy. The analysis assumes homothetic preferences over slack and total budget on the part of the bureaucrat, although I argue in the conclusion that this is not an unrealistic assumption. Also, the model is confined to bureaucracies like the US Departments of Defense and Transportation for which easy substitutes are not available. I conclude that for most US federal government expenditures, the passage of time, and its attendant increase in the income of the bureaucrat's legislative sponsor organization, inevitably favors slack-maximization over budget-maximization. As a result, I predict that modern bureaucracies providing these goods are X-inefficient.

The paper is divided into six sections. In Section 2, crucial terms are defined and the two previous attempts to address this question are summarized. Section 3 develops a new model of bureaucracy which uses the sponsor's utility, rather than his demand curve, as its basic concept. This model avoids the pitfalls found in previous work. In Section 4, the model is applied to the question of bureaucratic inefficiency over time. Section 5 extends the model to the case where legislative sponsors have the ability to restrain bureaucratic discretion through monitoring devices. Section 6 draws some conclusions and points out the limitations of the analysis.

2. Previous literature

The model below is built on the premise that bureaucrats have an information advantage over their legislative sponsors in knowing the cost of inputs in the production of public goods and the production function for producing public goods from those inputs (see Niskanen, 1971: 29–30). In the literature on bureaucracy, this information advantage is typically modeled by assuming that the sponsor faces an all or nothing choice: either the budget must be taken as is or the bureaucracy gets nothing and the sponsor does without its services (Niskanen, 1971: 25). The price of public goods to the sponsor may exceed their

cost (the minimum resources required to produce those goods), in which case the bureaucracy creates excess revenues which will be called (following Cyert and March, 1963) *organizational slack*.

Cullis and Jones (1984) assume that the bureaucrat maximizes the size of his budget. As shown by Patinkin (1963), all or none demand curves are *always* price-elastic. Cullis and Jones point out that this implies that the global maximum budget can only be produced by lowering price to the level of costs and maximizing output, thus eliminating X-inefficiency. The only exception to this rule occurs when pricing at cost pushes the legislative sponsor into the negative portion of his demand curve. In this case, since the extra output actually *reduces* the sponsor's willingness to pay for public goods, the budget-maximizing bureaucrat is better off raising price above cost, thus generating X-inefficiency. Cullis and Jones note that, in a world where Baumol's disease (see Baumol, 1967) is continually pushing up the relative cost of public goods, the budget-maximizing bureaucracy is constantly being pushed upward and to the left along the sponsor's demand curve. Any tendency to locate along the negative portion of the demand curve, and to exhibit X-inefficiency, therefore, will be eliminated by the action of Baumol's disease. Modern bureaucracies, they predict, should be X-efficient.

Migue and Belanger (1974) consider the bureaucrat's problem from a more comprehensive perspective. Given an elastic all-or-none demand curve, the bureaucrat must choose between organizational slack and budget maximization, subject to some overall resource constraint generated by the need to keep the sponsor from shutting down the bureaucracy entirely. Migue and Belanger show that, given the increases in demand which occur over time due to increases in income, this constraint will increasingly favor organizational slack over budget-maximization. They predict, therefore, that modern bureaucracy is X-*in*efficient.

3. A utility-based model of the slack-budget function

In addition to their contradictory results, the preceding models of bureaucracy share a common flaw. In an effort to transfer the theory of monopoly to the bureaucratic context, these papers, like much of the literature on bureaucracy, use the sponsor's demand curve as the basic unit of analysis. The problem with this approach is that it is difficult to incorporate the special features of the problem caused by the all or nothing nature of the sponsor's choice. For example, the fact that all or none demand curves are always price elastic cannot be derived from models of this type, so the analyst must simply *add* that information to the results of his models rather than having it incorporated *into* those models. To cite another example, the income elasticity of an all or none de-

mand curve differs from the income elasticity of an ordinary demand curve, but this difference usually goes unrecognized in models of this type. These problems are compounded by the authors' reliance upon linear demand curves, which limits their results to extremely specialized situations. In Migue and Belanger's model, for example, income increases always move the linear demand curves outward in parallel fashion, although in reality this is only one of several possibilities. These models are therefore simultaneously far too specific (in their specification of the functional form of the demand function) and grossly underspecified (in their failure to incorporate the consequences of all or none demand).

To remedy this flaw, this section builds a model of the constraints facing the bureaucrat from a more fundamental perspective, based on the sponsor's utility function. This approach allows us to derive all of the implications of the all or none nature of the sponsor's choice.

The successful bureaucrat faces three fundamental constraints. First, if he presents the sponsor with an all or none choice, he must be certain that the utility of the "none" choice to the sponsor does not exceed the utility of the "all" choice. Otherwise, the sponsor will abandon the bureau entirely. Let u_0 be the level of utility associated with zero output and zero budget for the bureau in question. Then the bureaucrat is constrained by the fact that the utility of the sponsor must never be pushed below u_0:

$$u(w,q) \geq u_0 \tag{1}$$

where w is private goods consumed by the sponsor and q is public services.

Second, the bureaucrat is also constrained by the fact that the sponsor must live within his budget constraint:

$$w + tpq = y \tag{2}$$

where private goods have a price of \$1, t is the tax share of the sponsor, p is the price of the good, and y is the sponsor's income. (t may be less than one because of tax exporting or because political competition forces legislative decisions to conform to the wishes of the median voter, who pays only a fraction of total taxes. In the median voter case, of course, w, q, and y would also represent characteristics of the median voter.) Third and finally, the bureaucrat must also live within *his* means, so that the revenue generated must at least cover his costs:

$$pq \geq cq \tag{3}$$

where c is the per-unit cost of public services (assumed to be constant for simplicity).

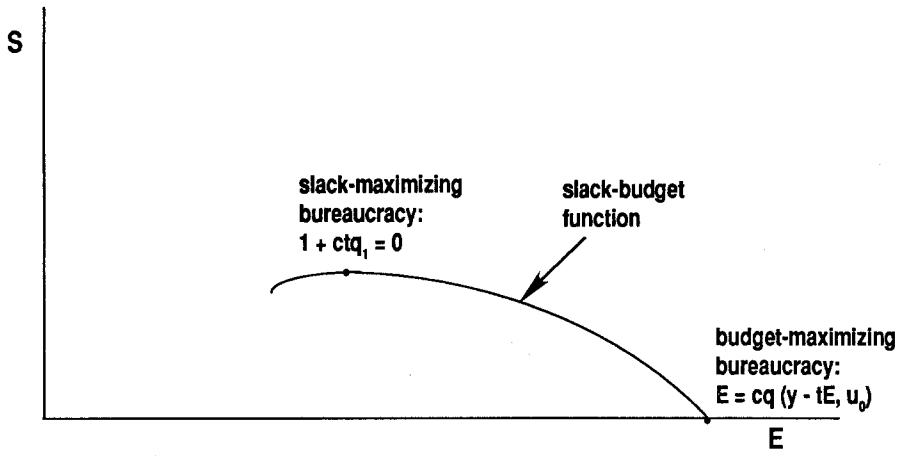

Figure 1. The slack-budget function.

Within these three constraints, the bureaucrat is free to select p and q to maximize his utility. It will be easier to understand the bureaucrat's problem, however, if these constraints can be combined into a single constraint over the items of interest to the bureaucrat: organizational slack and total budget (or total expenditures). It can be shown that the bureaucrat will always push the sponsor's utility down to u_0 so the constraint in equation 1 is always binding.[1] Under these circumstances, we can invert equation 1 to yield:

$$q = q(w, u_0) \tag{4}$$

which is the equation for the indifference curves for q given w and u_0. We also know from the sponsor's budget constraint that $w = y - tpq$. When this result is plugged into equation 4 we have that

$$q = q(y - tE, u_0) \tag{5}$$

where $E = pq$ is the bureaucrat's budget. From the definition of organizational slack, we know that the slack-budget function must have the following form:

$$S = E - cq(y - tE, u_0) \tag{6}$$

where S represents organizational slack. Figure 1 depicts this relationship. Equation 6 makes it clear that, given the number of constraints involved, the bureaucrat's choice of E completely determines his choice of S, and vice versa. (The variables p and q are no longer choice variables, since they are completely determined by E and the exogenous variables y, t, and u_0.) The slope of the slack-budget function is given by:

$$\partial S/\partial E = 1 + ctq_1 \tag{7}$$

where q_1 represents the derivative of q with respect to its first argument. If the sponsor's preferences are well-behaved, q_1 will be negative and decreasing in E. Therefore the slack-budget function must initially have positive slope, reach a maximum where $1 - ctq_1 = 0$, and then decline throughout the rest of its range. As shown in Figure 1, a slack-maximizing bureaucracy will be characterized by

$$1 + ctq_1 = 0 \tag{8}$$

while a budget- and output-maximizing, Niskanen-type bureaucracy is characterized by

$$E = cq(y - tE, u_0) \tag{9}$$

4. Bureaucratic inefficiency over time

In this section we explore the effect of changes in economic conditions on the bureaucratic decision to pursue extra output or organizational slack. Our approach is fairly straigtforward. Equation 6 shows that, since q is a negative function of w, the increases in y which occur over time push the slack-budget function up and out, so that the possibilities for both slack and budget are increased. By contrast, the increases in c over time which occur because of Baumol's disease shift the entire slack-budget function down and in. What really matters for our analysis, however, is the *slope* of the slack-budget function after all these changes have played themselves out. The slope of the slack-budget function, of course, gives the relative price of slack versus budget to the bureaucrat, so unless we have a nonlinear budget "Giffen good", case, in which increases in price increase consumption, we can be sure that the bureaucrat will tend to avoid the good which becomes relatively more expensive. If the function becomes steeper, the bureaucrat will choose a ratio of slack to budget which is higher than before; if the function becomes flatter, the slack/budget ratio will be lower than previously. We show below that the passage of time makes the slack-budget function continually steeper. This result is driven by the effect of income on this function. (Cost increases have an ambiguous effect on the slope of the function.) As income increases, the slack-budget function is pushed out in a nonhomothetic fashion – the changes favor organizational slack over total expenditures. It is easy to show that increases in income increase the *absolute level* of expenditures faster than they increase the *absolute level* of slack, but that is not what matters for purposes of deter-

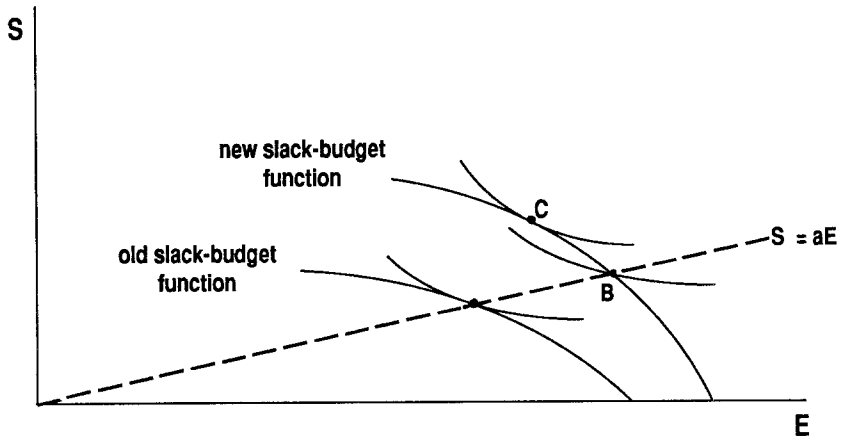

Figure 2. Changes in the slack-budget function.

mining the slope of the function. Since organizational slack is a small part of total expenditures, the *percentage change* in organizational slack far exceeds the *percentage change* in total expenditures, and this results in both a continually increasing slack/budget ratio and a continually steeper slack-budget function. The intuition behind this result is simply that, because slack constitutes a small portion of the total budget, the sponsor can tolerate percentage increases in slack more easily that he can tolerate equal percentage increases in the whole budget. It is much easier to increase the salaries of the Joint Chiefs of Staff by ten percent, for example, than to get an equal percentage increase in the Pentagon budget.

Following Migue and Belanger, we will use the following methodology to demonstrate these changes. Suppose that the original ratio of slack to budget is a. It is possible to show that, as c and y change over time, the new slack-budget function will be steeper than the old along any ray from the origin where S = aE (a any positive number less than one). If the bureaucrat's preferences are homothetic, then, a location on the new slack-budget function where S = aE cannot be optimal. For example, in Figure 2, a location at point B on the new slack-budget function is impossible because the indifference curve and slack-budget function have different slopes at that point. Moreover, because the slack-budget function is steeper than the indifference curve at point B, the new equilibrium must be at a point like C, with more slack and less expenditure than point B. A location downward and to the right of B would lead to lower utility for the bureaucrat than at B. This means that the new location will have a ratio of S to E greater than a.

If continued unchecked, this process will lead to higher and higher levels of S/E. Baumol, Blackman, and Wolf (1985) give evidence that the relative cost

of public goods has been rising for at least four decades, and probably much longer. Per-capita income, of course, has been generally rising since the beginning of national income statistics. It follows that S/E has continually risen, pushing modern bureaucracies very close to the slack-maximizing point.

To prove this point mathematically, we calculate the total differential of the slope of the slack-budget function when we allow y and c to vary and adjust E to keep S = aE. Differentiating 7, we have that:

$$d(\partial S/\partial E) = ctq_{11}dy + tq_1dc - ct^2q_{11}dE \tag{10}$$

where q_{11} is the second derivative of q with respect to its first argument. Now, using the fact that S = aE and differentiating equation 6, we obtain:

$$dE = (cq_1dy + qdc)/(1 - a + ctq_1) \tag{11}$$

When the results for dE are plugged into 10 and rearranged, this yields:

$$d(\partial S/\partial E) = tq_1dc + \frac{tcq_{11}\,(1-a)\,dc}{1 - a + ctq_1}\left[\frac{dy}{dc} - \frac{tq}{1-a}\right] \tag{12}$$

But note that, since S = aE, we can use equation 6 to show that:

$$E = cq/(1-a) \tag{13}$$

Therefore, p = E/q = c/(1 − a). Using this fact, we can rearrange 12 to yield:

$$d(\partial S/\partial E) = tq_1dc + \frac{tyq_{11}\,(1-a)\,dc}{1 - a + ctq_1}\left[\frac{\%\Delta y}{\%\Delta c} - \frac{tpq}{y}\right] \tag{14}$$

Now a must be less than one since S < E (if all expenditures go for slack, the sponsor will have no use for the bureaucracy and will abandon it). So 1 − a must be positive, along with dc, t, y, and q_{11} (as long as preferences are well-behaved). However, q_1 will be negative if the sponsor has well-behaved preferences, and we know that 1 − a + ctq_1 is negative since 1 + ctq_1 is the slope of the slack budget function and the bureaucrat will always locate where this slope is zero or negative. It follows that if the expression in square brackets is positive, the entire differential is negative.

All of the terms in the square brackets are observable. In Baumol's model, the relative price of public output increases by the productivity differential between the public and private sectors. In a recent paper (Baumol, Blackman, and Wolff, 1985), Baumol et al. calculate that the public sector has lagged behind the private sector in productivity by no more than 2.5 percent per year

over the 1947–76 period. This suggests that $\%\Delta c$ is no greater than 2.5%. Over the last forty years, GNP in constant dollars has grown by 3.1%, on average (U.S. Department of Commerce, Bureau of Economic Analysis, 1986 and 1987). It follows that $\%\Delta y/\%\Delta c$ typically exceeds one.

On the other hand, tpq/y is the percentage of the sponsor's income devoted to funding the agency. The largest U.S. bureaucracy is the federal government's Department of Defense. If we consider Congress as this agency's sponsor, t = 1 and y = GNP (Congress cannot shift the burden of taxation to anyone else, and it has the power to tax all of GNP).[2] Over the postwar period, national defense spending has never exceeded 15% of GNP, and it is currently running at 6 to 7% of GNP (U.S. Office of Management and Budget, 1987). It follows that $\%\Delta y/\%\Delta c$ far exceeds tpq/y. Thus, the number in square brackets is always positive and the slack-budget function gets steeper over time. And since we have established this result for the largest bureaucracy, it will hold with greater force for smaller public agencies for whom tpq/y is smaller.

5. Bureaucracy and monitoring over time

The previous analysis has assumed that sponsors are helpless victims whose only alternative to bureaucratic provision is to do without the bureaucracy entirely. In reality, as pointed out by Breton and Wintrobe (1975) and others, sponsors possess monitoring devices which enable them to partially offset the information advantage of the bureaucrat. These include the close examination of proposed budgets, the use of strict budgeting and reporting techniques, the comparison of cost and output data with other bureaucracies, the use of separate "watchdog" agencies (such as the General Accounting Office and the Congressional Budget Office), and the duplication of services by two or more bureaus.

Although it might seem that the presence of such monitoring devices invalidates the previous analysis, this is not the case. Monitoring devices are costly to utilize, requiring time and money from the sponsor. At minimum, they require the time costs of scrutinizing proposed budgets and conducting hearings; at maximum, they necessitate the expense of establishing watchdog agencies. Therefore, as Breton and Wintrobe point out, these devices are only employed up to the point where their marginal costs just equal their marginal benefits. The previous analysis shows that, over time, the incentives for bureaucratic control will continually favor budget monitoring over slack monitoring. As the slack budget function becomes steeper, the sponsor's exchange rate between slack and budget increasingly favors slack. Increases in organizational slack will become less damaging to the sponsor's utility than equal percentage increases in the total budget of the bureau. In Breton and Wintrobe's terms, the

marginal benefit of monitoring excess budget will increase relative to the marginal benefit of monitoring organizational slack. For this reason, we should expect to see an increasing emphasis to be placed on monitoring total output, with similar results to those above: over the long term, public bureaucracies will be characterized by a high degree of organizational slack rather than a budget which is too large.

6. Conclusion

These results suggest that, because of the nature of the changes in the constraint facing bureaucrats, the assumption of slack-maximization is plausible while the assumption of budget-maximization is difficult to justify. Let me point out, however, two possible limitations to this analysis:

1) In proving these results, we assumed that the bureaucrat's preferences over slack and budget are homothetic. This is a simplistic way of assuming away the possibility that the bureaucrat has a strong preference for increased budget as his slack-budget constraint moves outward. Certainly it is possible to construct counterexamples to this theorem using such skewed preferences. However, since slack and total budget are only intermediate goods, which are useful in generating primary goods such as salary, perquisites of office, power over others, etc., it seems doubtful that the bureaucrat would have such a strong preference for budget over slack.
2) We assumed in developing this theorem that u_0 is a constant unrelated to y and c. It's possible to construct plausible cases, however, when this would not be the case. For example, in the local government context, the alternative to bureaucratic provision in one city might be moving to another city. In that circumstance, since he can take the extra income with him when he moves, the sponsor's income certainly affects his u_0 level. Most importantly, no unambiguous results occur when $u_0 = f(y)$.

In other cases, however, notably the federal government's Departments of Defense, Justice, and Transportation, transferring this extra income to the next best alternative is much more difficult. This is because the extra income itself may be impossible without the services provided by the bureaucracy. For example, it is difficult to conceive of sustained increases in national income without a system of justice to enforce the laws, a system of defense to discourage foreign attack, and a system of transportation to move goods to market. The results in this paper are limited to bureaucracies of this type. In any event, the theorem above does not apply to the local good case.

Notes

1. Proof: Suppose not. Then the bureaucrat would hold the sponsor to some higher utility level u_1. In that case, the analysis proceeds as in the text with the slack-budget function being $S = E - cq(y - tE, u_1)$. But since q is increasing in u_1, S declines with increases in u_1 at every level of E. The slack-maximizing bureaucrat, therefore, will want to lower utility as much as possible, so utility will be pushed down to u_0. Alternatively, if the bureaucrat is a budget-maximizer, his situation will now be characterized by $E = cq(y - tE, u_1)$. Taking the total derivative of E with respect to u_1 yields: $\partial E/\partial u_1 = cq_2/(1 + ctq_1)$. $(1 + ctq_1)$ is the slope of the slack-budget function, so it is negative. c and q_2 are positive, so the derivative is negative and increases in u_1 reduce E. Again, the bureaucrat will want to lower u down to u_0.
2. Notice that any reduction in t caused by tax shifting makes tpq/y smaller, reinforcing the argument in this paragraph. If you consider Congress' income to be its budget outlays, rather than GNP, the argument still holds: in the postwar period, national defense expenditures have never exceeded 75% of total outlays (U.S. Office of Management and Budget, 1987), so tpq/y is still less than one. In addition, in this case $\%\Delta y/\%\Delta c$ is even larger, because postwar real federal outlay increases have averaged 4.9% (U.S. Office of Management and Budget, 1987), rather than the 3.1% average rate of increase of real GNP.

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