Privatization, bureaucracy, and risk aversion

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Abstract:

The role of governmental risk aversion in the decision to privatize the production of goods and services has not been examined closely. Using a model of a risk-averse, single-service Niskanen bureaucrat, we determine the conditions under which a bureaucrat will prefer to privatize rather than produce in-house. If the private-sector firm is risk neutral, the result will be a fixed-fee contract with complete insurance. If the private-sector firm is risk averse, the result will be a cost-plus contract with the degree of cost sharing determined by the bureaucrat's share of total risk aversion. In both cases, the bureaucrat's sponsor may affect the likelihood of privatization by manipulating the rewards and penalties imposed on the bureaucrat.

Article:

1. Introduction

Studies of the privatization of the production of goods or services by government have typically centered on descriptions of existing practices (Savas, 1987). Such contracts are commonly believed to exploit private-sector economies of scale or other production efficiencies while not diminishing the quality of the good or service. The role of risk in these contracts, however, has received little attention (Hirshleifer and Shapiro, 1983). Sappington and Stiglitz (1987) provide one of the few examples of a discussion of this issue. Their focus, however, is normative and primarily concerned with the effect of private-sector risk aversion. Little attention has been focused on the implications of risk aversion on the part of government.[1]

This paper provides a positive analysis of the behavior of a risk-averse, budget-maximizing bureaucrat charged with producing a single service for some sponsor, such as a legislature. Two difficulties arise in fulfilling this obligation. First, the sponsor is unable to monitor the bureaucrat closely and must therefore rely on an indirect measure of performance. Second, the bureaucrat is exposed to uncertain political and production risks which reduce the bureaucrat's ability to produce the service. Hence, the bureaucrat must choose a specific level of effort given indirect monitoring by its sponsor and uncertainty of outcome.

If privatization contracts are not an option, the bureaucrat, of course, must bear all risks. However, if such contracts are allowed, the bureaucrat may prefer to privatize the production process rather than produce the good in-house. The form of privatization contract will depend on whether the private-sector firm is risk neutral or risk averse. If the firm is risk neutral, the contract will be a fixed-fee contract with guaranteed output. If the firm is risk averse, the contract will be of the cost-plus variety with specific terms dependent on the relative degree of risk aversion attributable to the bureaucrat.

The results presented here are important for at least two reasons. First, they suggest that an increased threat from a bureau's sponsor (such as a legislative committee or group of local voters) will affect the production decisions of the bureaucrat. The ability of a sponsor to threaten its bureaucracy has long been noted. Niskanen (1971: 42), for example, argues that a "bureau that consistently promises more than it can deliver will be penalized by the discounting of future promises and lower budgets" whereas "a bureau that consistently

performs better than expected is likely to be rewarded by higher future budgets." Likewise, Weingast (1984) describes various indirect monitoring mechanisms by which a supervising legislature can direct rewards and punishments at bureaucracies, and Joskow (1974) argues that public-utility regulatory agencies modify their policies in order to minimize conflict and criticism. To the extent that threats from sponsors are credible, bureaucrats will be more cognizant of political and production risks and will be more likely to have production performed by the private sector.[2]

Second, our analysis sheds light on the determinants of fixed-fee versus cost-plus contracting. Sappington and Stiglitz (1987) argue that if the private sector is relatively more risk averse, rents can be captured by the government to the extent that it bears the risks of production. Similarly, Stiglitz (1988) argues that government's superior ability to spread risk provides a rationale for the cost-plus contracts so common in defense procurements. We find that cost-plus contracts will be preferred over fixed-fee contracts whenever any degree of private-sector risk aversion is present, though the relative degree of risk aversion between the bureaucrat and the private-sector firm will affect the degree to which the bureaucrat shares in any added costs of production.

This paper is outlined as follows. Section 2 provides an initial examination of the bureaucrat's problem in the absence of privatization contracts. Sections 2 and 4 then re-examine that problem assuming that privatization contracts are possible under the alternative assumptions of a risk-neutral and a risk-averse private-sector firm. Section 5 contains a brief summary and offers some concluding comments.

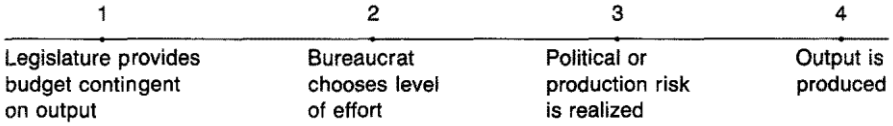

Figure 1. Decision-making time line in the absence of privatization.

2. Production in the absence of privatization

Following Niskanen (1971), consider a budget-maximizing bureaucrat that has received a budget B from a legislature in return for providing a single service. See Figure 1 for a decision time line of this process. Assume, moreover, that the legislature cannot observe the effort of the bureaucrat directly and so must, instead, rely on the observation of the bureaucrat's output γ.[3] As a result, the legislature makes the budget size a function of γ:

$$B = B(\gamma). \quad (1)$$

In determining the structure of the budget function $B(\gamma)$,[4] we assume that the legislature has a preference for a particular quantity of output and is willing to reward further bureaucratic efforts somewhat. However, it also wishes to send strong signals that decreased bureaucrat effort will not be rewarded. Given the inability to view effort directly, then, the legislature structures the budget function such that:[5]

$$dB/d\gamma > 0 \quad (2)$$
$$d^2B/d\gamma^2 < 0. \quad (3)$$

Finally, assume that the legislature requires the bureaucrat to balance its budget, that is, total costs C must be equal to the allocated budget:

$$C = B(\gamma). \quad (4)$$

Given the budget, the bureaucrat begins the production process. Bureaucracies are generally exposed to both production and political risks in producing a service. Production risks have their origins in the physical production process itself and are not directly connected to political forces. Their effect is to reduce the productivity of the bureaucrat and therefore raise the costs of production. Gomez-Ibanez, Meyer, and Luberoff (1990), for example, argue that many communities prefer to have private firms handle solid-waste disposal in order to avoid the risks associated with the use of modern, technologically sophisticated disposal technologies.

Political risks, on the other hand, while also reducing the productivity of the bureaucrat find their origins in the political arena. Thus, for example, Joskow (1974) in his examination of public-utility regulatory agencies, describes the early 1970s as a time characterized by an unanticipated slowdown in the regulation process due to inflation and to the rise of politically active environmentalists.[6]

We assume that the bureaucrat sets in motion the production process by committing to a particular level of effort and that only after that commitment is made will the production or political risks manifest themselves in a particular realization. Thus:

$$\gamma = \gamma(E, \theta) \tag{5}$$

where E represents the level of bureaucratic effort and θ represents the presence of production or political risk. An index variable, θ is assumed to be a random draw from a set of possible states-of-nature Θ and has the known distribution function $f(\theta)$. Let θ take on non-negative values with greater values of θ implying increasingly lower values of γ:

$$\partial\gamma/\partial\theta < 0 \tag{6}$$
$$\partial^2\gamma/\partial\theta^2 \leq 0. \tag{7}$$

For a given level of effort, define the maximum output level to be that level associated with θ equal to zero. Hence, $\theta > 0$ defines a loss L of output:

$$L = L(\theta;E) = \gamma(E, 0) - \gamma(E, \theta). \tag{8}$$

Finally, assume that γ is a positive, strictly concave function of E and that increases in θ reduce the marginal productivity of E:

$$\partial 2\gamma/\partial\theta\partial E < 0. \tag{9}$$

The cost of producing γ is assumed to increase at an increasing rate with the total level of effort expended, that is:

$$C = C(E) \tag{10}$$

such that:

$$dC/dE > 0 \tag{11}$$
$$d^2C/dE^2 > 0. \tag{12}$$

Hence, the bureaucrat's problem is to maximize the expected (e) budget:

$$B^e(E) = \int B(\gamma(E, \theta))\, f(\theta)\, d\theta \tag{13}$$

subject to the constraint that the budget balances in expectation:

$$\int B(\gamma(E, \theta))\, f(\theta)\, d\theta = C(E). \tag{14}$$

Given the assumptions on the production function for γ and the preferences of the legislature as embodied in the budget function B, this problem has an unique solution characterized by the first-order condition:

$$(1 + \lambda)\, dB/d\gamma\, [\int \partial\gamma/\partial E\, f(\theta)\, d\theta] = dC/dE. \tag{15}$$

Equation (15) implicitly defines the optimal level of effort E* and thus the optimal expected budget B*. However, while the budget balances in anticipation, it may not balance after any given realization of θ. We assume that there is sufficient "slack" in the bureau's operations to accommodate last-minute, unanticipated

budgetary deficits or surpluses. Anecdotal evidence in the form of end-of-the-fiscal-year buying sprees and belt-tightening measures suggests bureaucrats are quite skilled at such last minute adjustments.

Note, finally, that although the bureaucrat's preferences are linear in the size of the budget and thus ostensibly risk neutral, the concavity of the budget function offered by the sponsor makes the preferences of the bureaucrat risk averse. There are, of course, other reasons why bureaucrats might be risk averse. Wilson (1989), for example, suggests that the nature of private versus public enterprises might lead to self-selection among individuals such that the more-risk-averse take jobs in government. Interestingly, while many base their analysis on an assumption of bureaucratic risk aversion (Mueller, 1989), there is little empirical evidence to either support or refute the assumption (Wilson, 1989).[7]

3. Privatization with a risk-neutral firm

Because it is risk averse, the bureaucrat has an interest in mitigating the effects of risk through privatization. Define a privatization contract as a promise by the private-sector firm to deliver to the bureaucrat a specified quantity γ_c of the desired good and an insurance payment I (conditional on the loss L associated with the production of γ_c) in return for a payment of G dollars. Assume that the insurance payment I is denominated in units of γ and equal to some quantity no greater than L:

$$0 \leq I(L) \leq L. \qquad (16)$$

Thus, the contract is composed of a production clause which defines γ_c and an insurance clause which defines I. Let F_c be that portion of G which goes for the purchase of γ_c, let P be that portion of G which goes for the purchase of insurance, and note that:

$$G = F_c + P. \qquad (17)$$

Assume that the firm has the same production technology as the bureaucrat. Assume further that the firm is affected in the same way by production risks but to a lesser degree by political risks. Thus, we can define the firm's production function $\hat{\gamma}(E, \theta)$ and note in general that:

$$\hat{\gamma}(E, \theta) \geq \gamma(E, \theta). \qquad (18)$$

The level of effort put forth by the firm is a function of the funds devoted to the production process. In order for the effect of differing input costs not to cloud the analysis, we assume that the firm and the bureaucrat have the same cost equation (equation (10)). Hence, the firm's effort will be a positive, concave function of the funds F devoted to the production process:

$$E = C^{-1}(F). \qquad (19)$$

The contracted level of output γ_c is defined as the level of output generated by an input of F_c funds under the assumption of no risk, that is, $\theta = 0$:

$$\gamma_c = \hat{\gamma}(C^{-1}(F_c), 0). \qquad (20)$$

Assume that the cost to the firm of administering the insurance portion of the contract is fixed and, for expositional convenience, let it equal zero. Assume also that there is a sufficient degree of competition in the private sector so that the profits from the privatization contract are bid to zero. The premium for the insurance portion of the contract will then be actuarially fair and equal to the expected cost of the insurance payment I. The expected cost to the firm of providing the insurance will depend upon how well the firm meets its contractual obligations despite the loss L. In reality, a firm would fulfill a contract by making adjustments throughout the production process. Should it become clear that the contracted quantity γ_c will not be produced under current circumstances, the firm, in an iterative manner, would modify its production process.

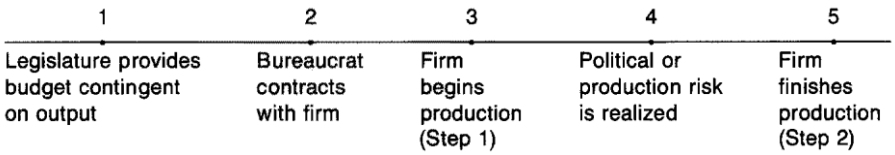

Figure 2. Decision-making time line with privatization.

To incorporate this dynamic adjustment process into our static model, suppose that the contract allows for the production of γ_c to take place in two steps (see Figure 2). The first step has already been described: decisions are made before θ is known, some quantity γ_o is produced, and a loss L equal to $(\gamma_c - \gamma_0) \geq 0$ is realized. If and only if this loss is positive will the second step take place. *Knowing the value of θ from the first step (say θ_0),* assume the firm must *re-perform* the production of γ augmenting the process with additional private funds, F_I so as to produce an additional quantity I. Because θ in this second step is known, the production process is now deterministic. Hence, F_I is implicitly defined by the equation:

$$\gamma_c - L + I = \hat{\gamma}(C^{-1}(F_c + F_I), \theta_0). \qquad (21)$$

Thus, given a particular insurance function I, F_I can be written in general notation as:

$$F_I = F_I(F_c, \theta). \qquad (22)$$

Note that F_I is a positive function of F_c.

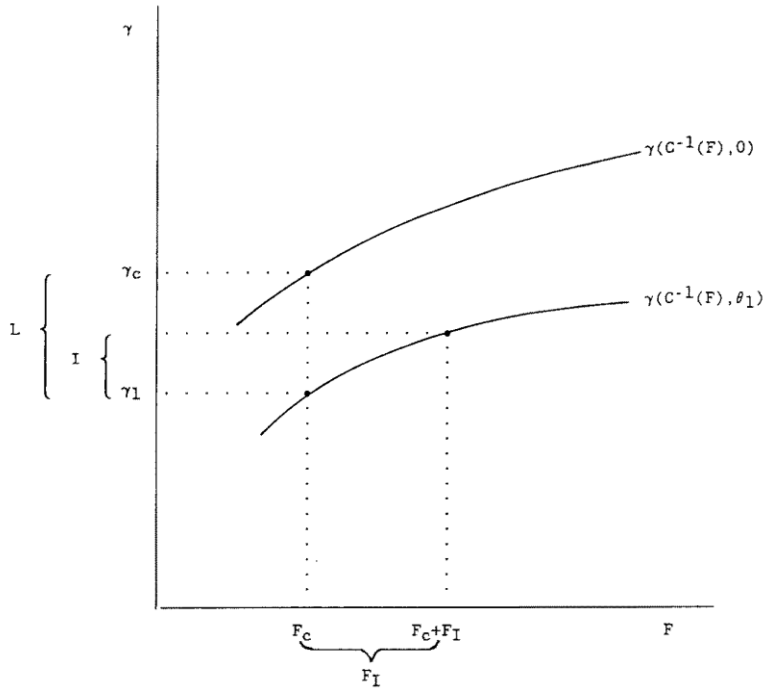

Figure 3. Determining the cost of providing insurance.

This process is illustrated in Figure 3. Let the bureaucrat contribute F_c dollars in exchange for the contracted quantity γ_c. In the first stage of production, the firm realizes a loss $L = \gamma_c - \gamma_1$ as a result of drawing a θ equal to θ_1. Actual total output from stage one is γ_1 which, as drawn, is less than the contracted quantity γ_c. A second stage of production is therefore required. Given that the firm now knows $\theta = \theta_1$ the firm determines that F_1 dollars are required to increase the total output by I, the contracted insurance payment.

F_1 is, of course, the actual cost to the firm of providing the insurance payment, I, to the bureaucrat. The actuarially fair premium, P, is therefore the expected value of F_I:

$$P = F_I^e = \int F_I(F_c, \theta) f(\theta)\, d\theta. \qquad (23)$$

Thus, the premium will be a positive function of the bureaucracy's production costs F_c:

$$P = P(F_c). \quad (24)$$

Finally, note that the expected profits for the firm will be:

$$\Pi^e = G - F_c - F_I^e \quad (25)$$

which by equations (17) and (23) equals zero. By construction, the firm is risk neutra1.[8]

Given equations (17) and (24), the choice of G uniquely determines the contracted quantity γ_c. Thus, we can rewrite γ_c (equation (20)) as:

$$\gamma_c = \gamma_c(G). \quad (26)$$

Note that γ_c is a positive, strictly concave function of G with G the bureaucrat's only decision variable.

The bureaucrat's problem assuming it privatizes the production of γ is to maximize the expected size of its budget through the appropriate specification of the insurance function I(L) and the appropriate choice of G. Given the assumption of a risk-neutral firm and a fixed cost of administering the insurance portion of the contract, the bureaucrat will choose an insurance contract with no deductible and no coinsurance (Raviv, 1979), that is:[9]

$$I = L. \quad (27)$$

Thus, the optimal privatization contract will be a fixed-fee contract with the firm guaranteeing delivery of the quantity γ_c. The bureaucrat's problem therefore becomes the deterministic problem:

$$\max_G B(\gamma_c(G)) \quad (28)$$

subject to the constraint that the budget balances:

$$B(\gamma_c(G)) = G. \quad (29)$$

The solution to this problem is unique and characterized by the first-order condition:

$$(1+\lambda)\, dB/d\gamma_c \; d\gamma_c/dG = 1 \quad (30)$$

which implicitly defines the optimal level of government spending, $\hat{G}$, and thus the optimal budget $\hat{B}$.

Whether, in fact, the bureaucrat prefers to privatize rather than produce the good in-house will depend on the effect of privatization on budget size. If privatization increases the budget size, that is, if $\hat{B} > B^*$, then the bureaucrat will choose to privatize.

To determine whether $\hat{B}$ is greater than B*, note first that there is an output level γ_{CE} which is lower than γ^* (the expected output if the service is produced in-house) and which if produced with certainty would generate a budget equal in size to B*. The budget which will obtain under a privatization contract, $\hat{B}$, will be greater than the expected in-house production budget, B*, if a privatization contract with the level of output set equal to γ_{CE} results in a budgetary surplus, that is, if:

$$B(\gamma_{CE}) > G_{CE} \quad (31)$$

where G_{CE} is the cost to the bureaucrat of a privatization contract for an output of γ_{CE}.

Figure 4 provides an illustration under the assumptions that θ represents production risks, that θ can take only a value of 0 or some $\theta_1 > 0$, and that the probability of $\theta = 0$ and $\theta = \theta_1$ are both 1/2. If the bureaucrat produces the service in-house, the solution to the bureaucrat's problem is to expend an effort which generates costs of F*. At F*, there is a 50% chance that output will be γ_H and a 50°7o chance that output will be γ_L. Hence, the expected budget will be B*. At B* the balanced budget requirement is met (B* equals F*) and the expected level of output is γ^*. Note finally, that γ_{CE} is the level of output which, if produced with certainty, would also generate a budget of B*.

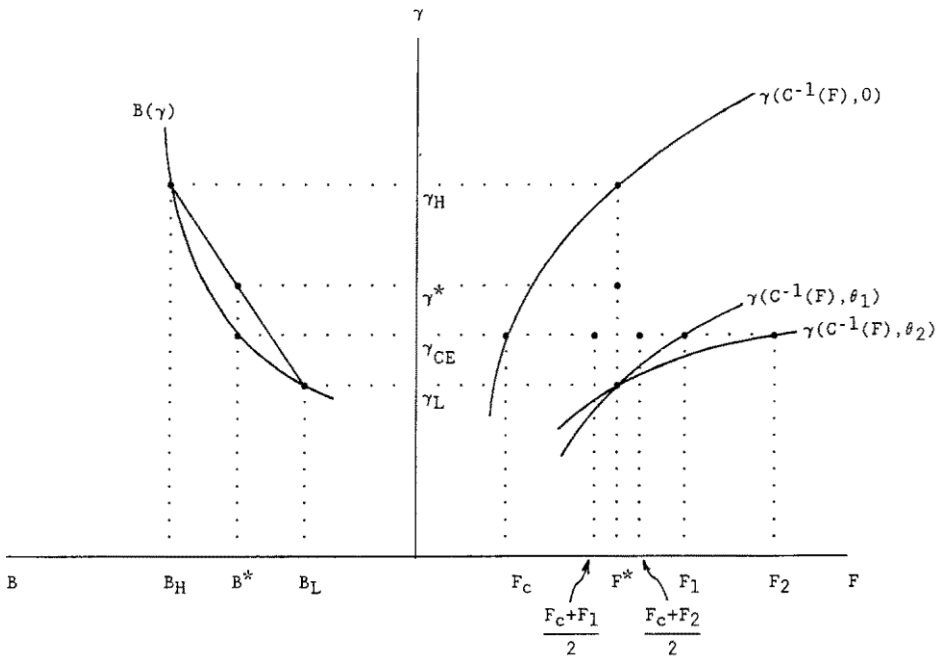

Figure 4. Determining when to privatize

If the bureaucrat contracts with a private firm to produce γ_{CE} with full insurance, the firm's costs will be F_c with probability 1/2 and F_1 with probability 1/2. (For the moment, ignore the curve labeled $\gamma(C^{-1}(F), \theta_2)$.) Hence, the expected cost to the firm of producing γ_{CE} will be $(F_c + F_1)/2$ which is smaller than B*.[10] Hence there is a budgetary surplus, and it pays to privatize. With the optimal privatization contract, output will be somewhat larger than γ_{CE} and therefore $\hat{B}$ will be larger than **B*.** In general, the contracted quantity γ_c may be larger or smaller than the expected in-house quantity γ^*. However, if the private firm can produce the quantity γ^* at a cost less than F*, the level of γ_c will also be greater than γ^*.

It is possible, however, that the bureaucrat will prefer the riskier option of in-house production. Burness, Montgomery, and Quirk (1980), for example, examine the decision making of a regulated firm in a Joskow-type model of regulation and note that under rather general circumstances the firm will actually prefer a risky option over a risk-free alternative. Figure 4 illustrates these circumstances within the context of our model. If θ equals 0 with probability 1/2 and some θ_2 with probability 1/2, and if θ_2 is sufficiently greater than θ_1, we find that while the solution to the bureaucrat's in-house production problem is the same, the expected cost to the firm of producing γ_{CE} will be $(F_c + F_2)/2$ which is larger than B*. Hence a privatization contract for γ_{CE} would result in a budgetary deficit, and only a contract for a lower level of output would balance the budget. However, this would reduce the budget size below what the bureaucrat expects to get through in-house production and will therefore not be preferred. The choice of a riskier alternative, therefore, does not imply a preference for risk per se. Rather, it indicates that the cost of insuring the risk exceeds the willingness to pay for it.

This analysis applies all the more if θ represents political risks. Recall that if the risk is political in nature, the private firm will be affected less by any realization of θ than the bureaucracy would, that is, $\hat{\gamma} > \gamma$. Hence, the likelihood of privatization will be greater because the firm provides an absolute cost advantage in addition to its role as insurer.

Note, finally, that the likelihood of privatization is directly connected to the budget function provided by the sponsor and is therefore subject to manipulation. Changes in the political climate, for example, which lead to a more con-cave budget function $B(\gamma)$ (such as might occur if greater penalties are assessed for production below a target level) will tend to reduce the certainty equivalent budget γ_{CE} and thereby make it more likely that privatization will be chosen.

4. Privatization with a risk-averse firm

The analysis so far has assumed that the private-sector firm is risk neutral. However, as Carlson (1991) reveals, risk aversion is a possibility for many firms, particularly those that are small or for which governmental contracts make up a substantial portion of their business. Following Raviv (1979), we note that if the private-sector firm is risk averse, the optimal insurance contract will now include a coinsurance clause, that is:

$$I = \alpha L \tag{32}$$

where α represents the degree to which the bureaucrat will share the production risks with the private firm and is determined by the relative degree of bureaucratic risk aversion:

$$\alpha = R_G / (R_G + R_F). \tag{33}$$

R_G represents the index of absolute risk aversion for the bureaucrat and R_F represents the same measure for the firm.[11] Hence, if the bureaucrat insists on a particular quantity of output, it must share in any cost overruns, that is, it must engage in a cost-plus contract.

The bureaucrat's problem is thus to maximize the expected value of:

$$B(\gamma_c(G) - (1-\alpha)L) \tag{34}$$

subject to the constraint that the budget balance in expectation:

$$\int B(\gamma_c(G) - (1-\alpha)L)\, f(\theta)\, d\theta = G. \tag{35}$$

The solution to this problem is again unique and characterized by the first-order condition:

$$(1+\lambda)\, dB/d\gamma\, [d\gamma_c/dG - (1-\alpha) \int \partial L/\partial G\, f(\theta)\, d\theta] = 1 \tag{36}$$

The effect of this will depend on the value of α. For values of α close to one, that is, if the firm has relatively little risk aversion, the outcome will be very similar to that described for the case of a risk-neutral-firm. However, as the firm's degree of risk aversion rises, α will fall. Hence, the likelihood that the bureaucrat will find a privatization contract which outperforms what can be achieved by in-house production will fall.

5. Concluding remarks

This paper examined the effect of bureaucratic risk aversion on the decision to privatize production. If the private-sector firm is risk neutral, the bureaucrat will prefer to privatize if it can find a firm willing to produce a quantity of out-put which generates the same budget as the bureaucrat expects to get through in-house production and do so at lower cost. The contract itself will be a fixed-fee contract with full insurance. If the firm is risk averse, the ideal contract will have only partial insurance with the decision to privatize hinging on whether the expected budget is greater under privatization or in-house production. Essentially, this results in a cost-plus type contract for bureaucracies interested in a particular level of output. Because the form of the budget function affects the likelihood of a bureaucracy preferring a privatization contract, sponsors through appropriate manipulation of the reward and penalty structure may be able to induce bureaucracies to privatize more.

Why is privatization a potentially beneficial alternative for the bureaucrat? Clearly, risk aversion on the part of the bureaucrat plays a part, for without it the bureaucrat would have no incentive to seek insurance. However, beyond the preferences of the bureaucrat, it is also necessary that the private firm have some form of superior technology. We do not mean by this that the firm can simply produce the good cheaper using fewer inputs, though that may be the case. What we have in mind is a more subtle superiority connected to the ability to revise decisions in the light of new information. As Gomez-Ibanez, Meyer, and Luberoff (1990) note, the public sector is often less flexible than its private sector counterpart because of cumbersome work rules and a tendency to engage in a slow production process that requires one stage to be completed before moving on to the next. This is the essence of our model of bureaucratic versus private-sector production processes. For the bureaucrat, the production process is essentially static with input levels chosen before the effects of risk are realized. For the firm, however, the process is dynamic. While the firm also targets a level of output and commits to a level

of inputs, it modifies its decisions as the production process progresses. As a result, while the bureaucrat only comes to know the effects of risk ex post, the firm through an iterative process comes to know the effects of risk ex ante.[12]

It needs to be emphasized, however, that the opportunity to privatize does not necessarily mean that it is desirable. Beyond the factors discussed in this paper, there may be other risks such as those associated with public employment considerations which arise only if the bureaucrat chooses to privatize. To the extent such risks exist, they will act as a counterbalance to the forces which induce the bureaucrat to privatize.

Finally, our analysis suggests that popular perceptions of bloated and padded governmental contracts may in fact have some validity. A contract involving a risky production process will contain a risk premium paid by the government to the private-sector firm in compensation for accepting the burden of those risks. These added costs are, however, unavoidable unless the bureaucrat can be persuaded to bear more risk. The greater the risk, the greater premium, and therefore the greater the perceived contract padding. While it is not clear how much the popular perception of padded governmental contracts are due to the necessity of paying an insurance premium, there are examples of fixed-fee contracts with complete insurance. Perhaps the clearest examples are con-tracts which require performance bonds. Performance bonds are devices used to ensure that a production contract is enforced. If the firm reneges on its contract, the government receives a compensating payment. While the amount of the bond is open to negotiation, Savas (1987) argues that such bonds should be set at a level just sufficient to compensate the bureau for having to make alternative arrangements. To not do so, he argues, would only hurt the government because the cost to the firm of the bond is built into the contract price. In essence, then, our analysis suggests that such contracts result in the firm guaranteeing the originally contracted output.

Notes

1. For a critical evaluation of the standard economies-of-scale argument, see Gomez-lbanez, Meyer, and Luberoff (1990). Though not directly concerned with the effect of risk aversion, their two case studies emphasize the importance of risk in governmental decision making.
2. This argument is also consistent with Sava's (1987: 256) view that before privatization can occur there must be "some precipitating event [which] makes it impossible to continue with the status quo." Among the events he considers to be precipitating are pressure from courts, pressure from higher levels of government, or other events that arouse public indignation.
3. Lindsay (1976) argues that a legislature typically monitors a subset of all attributes of the man-dated service. As a result, the bureaucrat only focuses its attention on the monitored subset of attributes. The reader may therefore prefer to think of γ as a vector of monitored attributes.
4. The specific form of the budget function $B(\gamma)$ is determined through a complex principal-agent problem beyond the scope of this paper. For insight, see McCubbins and Page (1987), Sapping-ton (1991), and Weingast (1984). In part, the difficulty with analyzing this problem is tied to the mathematical problem of using optimal control theory with constraints which are typically nonconvex. See Rasmussen (1989).
5. An alternative specification would be to assume that $dB/d\gamma$ is some positive constant for out-put less than the desired quantity and zero thereafter. For still another concave budget function based on a more explicit treatment of penalties for unacceptable bureaucratic behavior see Bendor, Taylor, and Van Gaalen (1985).
6. The resulting change in regulatory policies suggests rent avoidance behavior. See Tullock (1980).
7. Informal evidence abounds. Donahue (1989) discusses a Touche Ross survey of local public managers in which cutting risk was the second most cited reason for privatizing physical facilities. See also Carlson's (1991) description of the U.S. Information Agency's recent experience in producing TV Marti for broadcast to Cuba.
8. We have ignored possible additional motivations for the private-sector firm's involvement. It is possible that such contracts provide additional benefits to the firm by creating economies of scale or scope which result in additional profits in the private sector. Link, Bozeman, and Leyden (1990), for example, examine the role governmental R&D contracts play in expanding the knowledge base of a firm thus creating a basis for expanded profit opportunities in the private sector.

9. Varian (1984) provides a straightforward specification of the demand for insurance for the case of a loss with a fixed probability.
10. The insurance premium P_1 will equal $(F_1 — F_c)/2$. Thus, the expected cost to the firm can also be expressed as $F_c + P_1$.
11. The index of absolute risk aversion is defined to be — U"/U' where U is the objective function of the agent in question. It is sometimes known as the Arrow-Pratt measure of risk aversion (Varian, 1984).
12. The privatization of bureaucratic activities is part of a more general issue concerning the appropriate scope of organizations. For an insightful discussion of this more general issue, see Simon (1991) and Stiglitz (1991).

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