Contracts Offered by Bureaucrats*

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Fahad Khalil
khalil@uw.edu

Dept of Economics
University of Washington
Seattle, WA

Doyoung Kim
dkim@sogang.ac.kr

Dept of Economics
Sogang University
Seoul, Korea

Jacques Lawarree
lawarree@uw.edu

Dept of Economics
University of Washington
Seattle, WA

Abstract

We examine the power of incentive schemes in bureaucracies by studying contracts offered by a bureaucrat to her agent. The bureaucrat operates under a fixed budget and can engage in policy drift, which we define as inversely related to her intrinsic motivation. We show that a less motivated bureaucrat offers higher-powered incentives to release resources for policy drift. We determine how a funding authority sets the budget given to the bureaucrat. The interaction between a fixed budget and policy drift results in low-powered incentives in bureaucracies. Finally, we provide a justification for delegation when the bureaucrat is motivated enough.

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1. Introduction

"*In the days leading up to September 30, the federal government is Cinderella, courted by legions of individuals and organizations eager to get grants and contracts from the unexpended funds still at the disposal of each agency. At midnight on September 30, the government's coach turns into a pumpkin. That is the moment – the end of the fiscal year—at which every agency, with few exceptions, must return all unexpended funds to the Treasury Department.*" (In *Bureaucracy*, by James Wilson, Basic Books, 1989, p.116)

It is a characteristic of many government bureaucracies to operate under a mostly fixed budget that has to be returned if unspent. At the beginning of the fiscal year, a typical agency receives a budget that allows it to operate during the next twelve months. If the budget is not spent by the end of the fiscal year, it has to be returned to the funding authority. Such an arrangement is not limited to government bureaucracies. It is also widely observed in public and non-profit organizations including many state universities.

While bureaucrats are supposed to return this unspent budget to the funding authority, it is well-known that they instead go on a "spending spree." For instance, the end of the fiscal year often witnesses the purchase of new equipment and travel to exotic places for conferences. In the U.S., July marks the start of the last quarter of the fiscal year and this period is known among federal contractors as "Christmas in July."[1] In 2005, an audit by the U.S. Department of Defense Inspector General denounced the approval of hundreds of millions of dollars on questionable "last-minute" projects.[2] It revealed that 74 out of 75 selected purchases scheduled at the end of fiscal 2004 "were either hastily planned or improperly funded." Noting that bureaucrats can also appropriate unspent budgets, it also found the Department of Defense "parked" $2 billion that were unspent at the end of 2004 in a special account intended for information technology purchases, apparently to keep it out of sight of Congress and so it could be spent later. "They know the money is lost to them if they don't use it," says Eugene Waszily, an assistant inspector general at the General Services Administration.[3]

The example above shows that the unspent budget can be appropriated by bureaucrats and become a discretionary budget. The discretionary budget allows the bureaucrat to pursue

[1] Wall Street Journal editorial, "Christmas in July," July 19, 2006.
[2] Department of Defense Office of the Inspector General (2005), http://www.dodig.osd.mil/Audit/ reports/FY05/05-096.pdf.
[3] Wall Street Journal editorial, *ibid*.

goals different from those of the funding authority. This is known as "policy drift" (Johnson and Libecap (1986)) and is distinct from standard shirking. The discretionary budget, also known as "slack" (Antle and Eppen (1985)), is sometimes seen as the "bureaucratic equivalent of personal income" (Moe (1997)).[4]

With these distinctive features of the bureaucratic environment in mind, we aim to characterize incentive schemes in bureaucracies by focusing on contracts *offered by* bureaucrats. Because bureaucrats operate under very different environments and with different motivation than private managers, it is essential to build a model that takes such differences into account. In particular, we present a model of a bureaucracy by highlighting three related features: (i) policy drift, (ii) fixed budgets, and (iii) motivated bureaucrats. Having already discussed policy drift, we will next explain the remaining two features.

Along with policy drift, a second notable feature of bureaucracies is that they operate under fixed budgets. There is a large literature in political science that argues why funding authorities may have little control over a bureaucratic agency other than being able to fix its budget.[5] Brehm and Gates (1997) note that civil servants enjoy considerable protection from political influence, and they cite several commentators who have advocated for such protection. Besides Weber's (1947) well-known fear of "dilettantism" by politicians, Wilson (1887) also argued that a bureaucracy should remain "outside the sphere of politics" to shield bureaucrats from the narrow interests of politicians.

Even if one questions whether bureaucrats should be shielded from the influence of politicians, as a practical matter, political bodies have little knowledge in delivering public service. While Congress may want to provide an education-friendly budget by providing an increase in the allocation to education, they have to leave the details of implementation to the Department of Education run primarily by career bureaucrats. Congress may well state general goals but, as Wilson (1989) explains, bureaucracies are best defined by "tasks." Promoting the "long-range security interests of the United States" may be the stated goal of the State

[4] A bureaucrat's preference for policy drift is also noted by Migué and Bélanger (1975), which is the most well-known variation of Niskanen (1971). Another example is public employees moonlighting in the private sector (Biglaiser and Ma (2007)).

[5] Niskanen's (1971) argument that the bureaucrat determines and maximizes the budget has been widely challenged in the political science literature. Aberbach et al. (1981) state that agency chiefs may argue for increments in their budgets but have little control over their budgets, and Moe (1997) cites authors who question the budget-maximizing assumption.

Department, but it is bureaucrats who must develop guidelines and implement actions to achieve such a goal. The Congress has limited ability to condition the budget on specific performance measures.

In the economics literature, Tirole (1994) also recognizes the difficulty of measuring the performance of agencies characterized by such general goals and by the absence of yardstick competition.[6] The lack of measurement capacity is conducive to fixed budgets for bureaucrats. Tirole also highlights the lack of commitment abilities of political authorities. Not only are the tastes of political authorities fairly diverse but they change over time "in a non-contractible manner." This lack of time consistency prevents political authorities from committing to budgets that are contingent on performance.[7]

Whether by design (to prevent undue political influence) or by necessity (due to lack of measurement capacity or commitment ability), the budget can be seen as depending very little on the agencies' actual performance.[8] This view of bureaucracy begs a question: how to provide incentives to bureaucrats? The literature has indicated that bureaucracies rely on the bureaucrat's self-motivation and professionalism to resolve incentive problems.[9] Bureaucrats are professionals: they are trained in "professions which emphasize not only technical competence but also conscientious devotion to duty" (Rose-Ackerman (1986)). They receive most of their incentives from outside the bureaucracy, mainly from organized groups of fellow practitioners and the self-satisfaction of doing their duty well.[10] Prendergast (2007) and Besley and Ghatak

[6] To quote Tirole: "…even an econometrician may have a hard time measuring the regulator's contribution to the net consumer surplus. And who will put reliable numbers on the US Department of States performance in 'promoting the long range security and well-being of the United States, and on the US Department of Labor's success in 'fostering, promoting, and developing the welfare and the wage earners of the US'?" (p. 4).

[7] Budgets unrelated to performance, i.e., fixed budgets, are akin to low-powered incentives for bureaucrats. In addition to lack of time-consistency, other reasons for low-powered incentives for bureaucrats are career concerns (Dewatripont et al. (1999) and Alesina and Tabellini (2007)), multitasking (Holmstrom and Milgrom (1991)), and multiple principals (Dixit (2002) and Martimort (2007)). For empirical evidence of low-powered incentives for bureaucrats, see Borcherding and Besocke (2003).

[8] Moreover, as noted by Johnson and Libecap (1989), at the individual level, a bureaucrat is difficult to fire and a bureaucrat's salary is not tied to the agency's budget.

[9] In addition to professionalism, Dewatripont et al. (1999) and Alesina and Tabellini (2007) suggest that bureaucrats are motivated by career concerns.

[10] Brehm and Gates (1997) discussing the role of professional standard norms and self-selection that plays an important role write in the preface to their book, "the police officer, the social worker, the NASA engineer, the health inspector chose their jobs not for the possibility of maximizing leisure, or even for the material rewards of the job, but for the intrinsic character of the job itself.", and elsewhere, "Our book offers one answer: bureaucratic accountability depends most of all on the preferences of individual bureaucrats. Fortunately for us, those preferences are overwhelmingly consistent with the jobs the American democracy sets for them to do."

(2005) have pointed out that agents in public office are often intrinsically motivated to deliver goods or services they are engaged to produce (see also Benabou and Tirole (2003) on intrinsic motivation). They argue that bureaucracies are organized around a mission and bureaucrats work harder when they buy into the mission of the organization.[11] In this paper, we will call the bureaucrats "motivated" when they are intrinsically motivated to produce the goods or services of the bureaucracy. This is the third distinctive feature of our model of bureaucracy. For example, a bureaucrat in charge of the EPA would be called motivated if she is an environmentalist at heart. More motivated bureaucrats are less tempted by policy drift.[12]

To introduce these distinctive features of bureaucracies (fixed budgets and policy drift due to less motivated bureaucrats), we present a model with three layers: a principal ("it"), an upper-level manager ("she"), and an agent ("he") as illustrated in Figure 1. The first layer is the funding authority, which may represent the Congress for instance. It has no informational capability, ability, or time to run the many agencies it funds. In the language of Aghion and Tirole (1997), the funding agency has formal authority but it must relinquish real authority to an upper-level manager – whom we call the bureaucrat – who runs the agency. This bureaucrat herself contracts with an agent (a procurement firm or a street-level bureaucrat) who produces the output.

[11] Wilson (1989) defines a mission as a culture "that is widely shared and warmly endorsed by operators and managers" (p.95).

[12] In the rest of this paper, a bureaucrat with a stronger preference for policy drift will be equivalent to a less intrinsically motivated bureaucrat (and vice-versa).

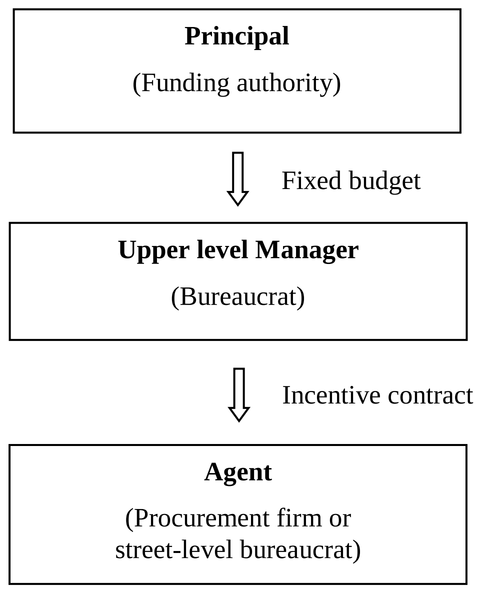

Figure 1. The structure of the model

Our analysis offers a new explanation for low-powered incentive schemes in bureaucracies. While previous studies have largely focused on why contracts *for* bureaucrats are low powered, they are silent about contracts offered *by* bureaucrats.[13] We offer a reason why such contracts may be low powered. Since contracts in public-sector hierarchies are determined by bureaucrats, our study offers complementary insights into the power of incentive schemes in bureaucracies.

We show that the interaction of the bureaucrats' intrinsic motivation and fixed budgets leads to low-powered incentives. A key insight is that high-powered schemes are not necessarily valuable as they are chosen by less motivated bureaucrats who want to use the unspent budget to engage in policy drift. With the ability to determine only the size of a budget, the funding authority limits the budget given to less motivated bureaucrats. In response, they offer lower-powered incentive schemes to their agents. On the other hand, more motivated bureaucrats offer low-powered schemes since they do not value unspent budgets. However, they are also given limited budgets since they tend to produce 'too much.' In effect, bureaucracies will have low-powered incentives regardless of how mission-oriented is the unit.

[13] We discuss two exceptions below, Banerjee (1997) and Prendergast (2003).

We also find that the funding authority prefers more motivated bureaucrats and allocates relatively larger budgets to them. Even though less motivated bureaucrats would offer stronger incentive schemes, they would generate lower expected output and larger unspent budgets.

This result is complementary to Besley and Ghatak (2005), who argue that matching motivated agents to mission-oriented tasks acts as a substitute for high-powered incentives and leads to more efficient outcomes. Together, the two papers suggest that well-matched bureaucracies may be characterized by large budgets and low-powered incentives schemes, both for contracts offered *to* the bureaucrat and *by* the bureaucrat, while the expected output may remain high.

We discuss stricter accountability standards imposed by the funding authority on the bureaucrat, and the role of asymmetric information about the bureaucrat's preference for policy drift. Stricter accountability results in larger budgets, and asymmetric information about the bureaucrat's preference makes budget allocation less sensitive to the bureaucrat's type. Finally, we explain that a high level of motivation of a bureaucrat can justify delegating to her the contracting authority when collusion is an issue.

Although we focus on government bureaucracies, our model can also apply to large private corporations. The fiscal rule of a fixed budget that has to be returned if unspent is also common in the private sector where large firms are organized similarly. Jack Welch, a former CEO of General Electric, once described this process with his often quoted statement: "The budget is the bane of corporate America." (Fortune Magazine 1995) Private firms tend to be more flexible with budgets as they do not have to follow strict administrative rules of public bureaucracies. Still it is common for private companies to operate with fixed budgets for their various departments and the rule that unspent budgets are lost at the end of the fiscal year. With various means and ways, the departments end up spending the unspent budgets as the fiscal year moves toward its end.

Several papers in the economics and political science literatures have studied the power of incentives in bureaucracies. However, as mentioned above, most of them focus on the incentive scheme offered to a bureaucrat in a standard two-level hierarchy with a principal and an agent. Exceptions are Banerjee (1997) and Prendergast (2003). Both of them consider a situation where the bureaucrat, on the behalf of the government, designs resource allocation schemes for consumers who have private information about their types and show how these schemes are distorted or result in inefficiency. These papers are similar to ours in that they consider a three-level hierarchy in bureaucracies and analyze the distortion on incentive schemes offered by the bureaucrat to her clients who have private information. An important difference is that, while the principal in their models controls the bureaucrat by monitoring, the principal in our model has no access to monitoring and can only control the bureaucrat by choosing the size of her budget. We consider the possibility of monitoring in section 5.

A binding (fixed) budget constraint can be seen as a form of "upper limited liability." The limit on contingent transfers that the bureaucrat can offer in a contract is akin to Levin's (2003) constraint of limited compensation imposed by self-enforcement. Levin studies self-enforced relational contracts and shows that self-enforcement restricts promised compensation. The interaction between this upper limited liability and the traditional limited liability of the agent has dramatic effects on the incentive contract, which may imply pooling as in our case with a fixed budget, which is binding due to policy drift. Relatedly, in a non-linear screening model, Thomas (2002) shows that the optimal contract offered by a monopolist is pooling if a consumer has a limited budget.

Our paper is also related to Hiriart and Martimort (2011) who consider a hierarchy congress-regulator-firm. The regulator offers an incentive contract to the firm in order to limit some potential damage (e.g., pollution) by the firm. The regulator has private information about the potential damage, so delegation – letting the regulator choose the optimal contract – allows the regulator to tailor the contract to the potential damage. However, the regulator puts more weight on the firm's payoff than congress, so congress limits the regulator's ability to design the contract (its discretion) by imposing rules (limits on transfers) on the optimal contract. Similarly, we find that the principal can curb the bureaucrat's discretion by limiting her budget. Both papers provide examples of how agency problems may propagate within a hierarchy.

The rest of the paper is organized as follows. We present a model of bureaucracy with a funding authority, a bureaucrat, and an agent in Section 2. After characterizing the contract a bureaucrat will offer an agent in Section 3, we study the funding authority's problem in Section 4 to show that there will be low-powered incentives in a bureaucracy. We consider extensions in Section 5 and conclude in Section 6.

2. The model

We consider a three level hierarchy with hidden information: a funding authority, a bureaucrat, and an agent, where the agent has private information about production cost. The funding authority could be the legislature. It is interested in the production of some output but does not have the time or the ability to manage the agent who runs the production process. It delegates the task of contracting with the agent to the bureaucrat.[14]

The agent is the productive unit in the hierarchy. He produces an output, denoted by $X \geq 0$, at cost $C(X) = \frac{c}{2}X^2$, where $c > 0$; so efficiency implies that $X^* = \frac{1}{c}$. The constant c is private information of the agent and represents his type. It can take two values: c_L with probability q_L and c_H with probability q_H (with $\Delta c \equiv c_H - c_L > 0$ and $q_L + q_H = 1$). The bureaucrat offers a contract to the agent specifying the output (X_L or X_H) and a contingent transfer (t_L or t_H).

The agent is a standard procurement firm, which has private information about his production cost and must be given an incentive scheme to limit its information rent. The procurement problem has received much attention in economics (see, e.g., Laffont and Tirole (1993)). Our contribution is to analyze a procurement contract offered by a motivated bureaucrat operating under a fixed budget, and to show how and why this contract is different from the one offered by a private principal. The agent could also be seen as a street-level bureaucrat, who is not a professional and requires a formal incentive scheme. Street-level bureaucrats may have conflicting preferences with the upper management (our bureaucrat).[15]

The funding authority allocates a fixed budget, denoted by B, to maximize expected net benefit, $q_L X_L + q_H X_H - B$.

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[14] In section 5.2, we explore the choice between delegation (decentralization) and centralization.

[15] For example, Heckman et al. (1996) present a detailed empirical study of the Job Training Partnership Act (JTPA). They find that case workers (street-level bureaucrats) in JTPA training centers were motivated to help the less employable participants even though it decreased the performance measure of the training center and the middle manager (bureaucrat). As Dixit (2002) notes, perhaps the bureaucrat *"should have devised an incentive scheme to induce truthful revelation of information by the case workers."* In the political science literature, Brehm and Gates also point out the informational advantage of the agent: "One can easily imagine similar task idiosyncrasies in public bureaucracies: regulators who understand the ways in which polluting, firms disguise their transmissions of toxins, police officers who have a sense of when community tensions are peaking, or social workers who are personally familiar with the work records of their clients" (Brehm and Gates (1997) on p. 16).

As argued in the introduction, the bureaucrat is motivated to deliver the goods or services of the bureaucracy ($q_L X_L + q_H X_H$), but she also values unspent budgets ($B - q_L t_L - q_H t_H$) to engage in policy drift. We capture this by introducing a parameter $k \in [0,1]$ to represent the bureaucrat's relative preference for policy drift, i.e., her intrinsic motivation.[16] Thus, we have the following objective function for the bureaucrat:

$$(1) \qquad U = q_L X_L + q_H X_H + k[B - q_L t_L - q_H t_H].$$

If $k = 0$, the bureaucrat only cares about the output – she is "extremely motivated" like an environmentalist running the EPA or a school teacher running the department of education. If $k = 1$, the bureaucrat cares about policy drift as much as the output. Accordingly, a higher k indicates that the bureaucrat is less motivated and has a stronger preference for policy drift.[17]

The timing of the game is as follows: the funding authority presents the bureaucrat with a fixed budget B. Next, the bureaucrat offers an incentive contract to the agent specifying the output (X_L and X_H) expected from each type of agent as well as the corresponding transfers (t_L and t_H). We assume that the agent learns his type before signing this contract and therefore we have a model of adverse selection. Finally, production takes place and the appropriate contingent transfer is given to the agent.

We also assume that the funding authority does not observe the details of the contract offered by a bureaucrat. As argued in the introduction, the funding authority is not able to measure with precision the output produced. If it could, it would also know the amount of any unspent budget and easily prevent misdirected spending by the bureaucrat.

Using the Revelation Principle, we impose the following incentive constraints on the bureaucrat's maximization problem:

$$(IC_i) \quad t_i - \frac{c_i}{2} X_i^2 \geq t_j - \frac{c_i}{2} X_j^2 \quad \text{for } i, j = L, H,$$

[16] In section 5.1, we discuss the case where k is private information. In section 5.3, we relax the assumption that $k \leq 1$ and show that our main result about low-powered incentives generalizes. By assuming $k \leq 1$ in the main text, we are restricting attention to the case where the bureaucratic mission matters more than policy drift to a bureaucrat. Implicitly, we are assuming that the funding authority has other instruments, such as monitoring and administrative controls, to limit policy drift (see McCubbins et al. (1987), for example). Alternatively, as emphasized in Brehm and Gates (1997) and Besley and Ghatak (2005), there is likely to be matching of preferences between a bureaucrat and the unit's mission such that the mission remains more important than any alternatives. When such matching is not possible, they argue that the mission should not be fulfilled by a public bureaucracy.

[17] In section 5.1, we allow the funding authority to monitor the bureaucrat such that it can control how the budget is spent by the bureaucrat.

along with the participation constraints,

$$(IR_i) \quad t_i - \frac{c_i}{2} X_i^2 \geq 0 \qquad \text{for } i = L, H,$$

and the budget constraints,

$$(BG_i) \quad t_i \leq B \qquad \text{for } i = L, H .$$

(IC_i) and (IR_i) are standard constraints in a model of adverse selection, and (BG_i) is the budget constraint limiting the transfers to the agent by the budget B available to the bureaucrat.

We use the *standard second-best contract* as our benchmark, but we label it *the private procurement contract* since it characterizes the optimal contract for a principal who can observe output and can therefore contract directly with an agent. As noted above, a key difference between our model of bureaucracy and private procurement is the principal's (funding authority) inability to observe output. Thus, our analysis can also be thought of as characterizing optimal contracts under the two different monitoring technologies. The private procurement (*PP*) contract is given by the menu: [18]

$$\text{(PP)} \quad \left\{ \left[X_L^{PP} = \frac{1}{c_L};\ t_L^{PP} = \frac{c_L}{2}\left(X_L^{PP}\right)^2 + \frac{\Delta c}{2}\left(X_H^{PP}\right)^2 \right], \left[X_H^{PP} = \frac{1}{\left(c_H + \frac{q_L}{q_H}\Delta c\right)};\ t_H^{PP} = \frac{c_H}{2}\left(X_H^{PP}\right)^2 \right] \right\}$$

The low-cost (efficient) type produces at the efficient level and obtains a rent while the high-cost (inefficient) type has his output distorted below the efficient level and receives no rent. This is a separating contract that sorts agents based on their types or production costs. The low-cost type produces more than what the high-cost type does, $X_L^{PP} > X_H^{PP}$, which implies that $t_L^{PP} > t_H^{PP}$.

We define the ratio of outputs X_L / X_H as the power of incentives. If $X_L = X_H$, there are no incentives: the agent produces the same output and receives the same transfer regardless of the state. Since stronger incentives must induce a higher effort/output when the cost is low, the ratio X_L / X_H is a simple but informative measure of the power of incentives in a procurement contract with adverse selection. Next we will study how the power of incentives varies with B and k in bureaucracies.

[18] It can be characterized by maximizing $q_L X_L + q_H X_H - q_L t_L - q_H t_H$ such that (IC_i) and (IR_i), for $i = L, H$, are satisfied. See, for example, Laffont and Tirole (1993).

3. The Bureaucrat's Problem

We begin our main analysis with the bureaucrat's problem taking as given the budget B from the funding authority. The bureaucrat maximizes (1), such that (IC_i), (IR_i), and (BG_i), for $i = L$, H, are satisfied.

Note that this problem is different from the private procurement benchmark in two ways: the objective function (1) includes two new parameters, k and B, and there are two new budget constraints (BG_i). As explained below, the bureaucrat will offer the private procurement contract only if neither budget constraints are binding and $k = 1$. Thus, there are two sources of departures from the private procurement contract, those implied by a binding budget, and those implied by $k < 1$. A binding budget may prevent the bureaucrat from having enough resources to implement the private procurement contract even if $k = 1$. If $k < 1$, the bureaucrat will not implement the private procurement contract even with an unlimited budget since the marginal cost of transfers is smaller. The focus of this paper is to study the interaction of a binding budget and intrinsic motivation on the optimal contract offered by a bureaucrat.

The first analytic departure from the private procurement benchmark is that the typically ignored (IC_H) becomes relevant. In the private procurement case, the low-cost agent produces the efficient level of output and receives an information rent, while the (IC_H) can be ignored as the high-cost agent does not want to claim that his cost is low. However, with a budget constraint, the private procurement t_L may exceed the budget. Then it may be optimal to distort X_L below the efficient level. If (IC_H) is ignored, X_L could fall below X_H, which would violate (IC_H).

Since (IC_L) is binding in equilibrium, to make the exposition simpler, we can replace (IC_H) by the following monotonicity condition:

(M) $\quad X_L \geq X_H$.

We can verify ex post that (IC_H) is satisfied by our optimal contract.[19] If the constraint (M) is binding, the optimal contract is *pooling*, and otherwise, it is separating.

As usual, we can ignore (IR_L) since it is implied by (IR_H) and (IC_L), and given $X_L \geq X_H$, the constraint (IC_L) implies that $t_L \geq t_H$. Therefore, the budget constraint (BG_H) will be satisfied

[19] It is easy to check that binding (IC_L) and (M) imply that (IC_H) holds.

if the constraint (BG_L) holds. Based on these arguments, we can present the bureaucrat's problem using only the relevant constraints. The bureaucrat chooses the contract $\{X_L, X_H, t_L, t_H\}$ to solve the problem given below, denoted by:

(***BP***) *Max* (1), subject to (IR_H), (IC_L), (BG_L), and (M)

3.1. Equilibrium contracts

First, note that (IR_H) and (IC_L) are binding since otherwise the bureaucrat could reduce the transfers and gain. Substituting t_L and t_H using the binding (IR_H) and (IC_L), we can write the Lagrangian as follows:

$$L = q_L X_L + q_H X_H + k\left[B - q_L\left(\frac{c_L}{2}X_L^2 + \frac{\Delta c}{2}X_H^2\right) - q_H\frac{c_H}{2}X_H^2\right]$$
$$+\lambda\left[B - \left(\frac{c_L}{2}X_L^2 + \frac{\Delta c}{2}X_H^2\right)\right] + \mu(X_L - X_H),$$

where $\lambda \geq 0$, $\mu \geq 0$ are the Lagrange multipliers for (BG_L) and (M), respectively. The two first-order conditions with respect to the outputs are:

(2) $$\frac{\partial L}{\partial X_L} = q_L - \left(kq_L c_L + \lambda c_L\right)X_L + \mu = 0,$$

(3) $$\frac{\partial L}{\partial X_H} = q_H - \left(kq_H c_H + kq_L\Delta c + \lambda\Delta c\right)X_H - \mu = 0.$$

There are several cases to analyze depending on whether the two constraints, (BG_L) and (M), are binding or not.

If the budget is not binding ($\lambda = 0$) but $k > 0$,[20] it is easy to see from (2) and (3) that $X_L > X_H$, i.e., the optimal contract is a separating contract and $\mu = 0$. The optimal outputs are given by

(4) $$X_L = \frac{1}{kc_L}, \quad \text{and} \quad X_H = \frac{q_H}{k\left(q_H c_H + q_L\Delta c\right)}.$$

The optimal contract is very similar to the private procurement contract (PP) and is identical if $k = 1$. For $k < 1$, the outputs are larger than those under the private procurement. Intuitively, with

[20] Note that the budget must be binding if $k = 0$. When $k = 0$, the bureaucrat cannot benefit from unspent budgets. She only cares about the output and will want to spend the entire budget for production, implying $t_L = B$. Technically, if $k = 0$, the first order conditions (2) and (3) imply that $\lambda > 0$, meaning that the budget constraint is binding.

an unrestricted budget, the bureaucrat increases the output until the marginal value of output equals the marginal cost (including information rents) evaluated at rate *k*. So the separating equilibrium occurs because the agents' marginal costs are different and overproduction occurs because the bureaucrat evaluates the marginal cost at a lower rate than the private principal.

Next, we consider the case where the budget is binding ($\lambda > 0$). As we will show later in Section 4, the funding authority will pick a budget such that the bureaucrat's budget constraint is binding in equilibrium. Accordingly, this case is the focus of our analysis.

If the budget is binding, $B = (c_L/2)X_L^2 + (\Delta c/2)X_H^2$, an increase in one output must be accompanied by a reduction in the other, which introduces an additional (implicit) cost of increasing either of the outputs. These additional costs are captured in (2) and (3) by the terms associated with λ, and they play a critical role in the occurrence of pooling. We can obtain the necessary and sufficient condition for a pooling contract by setting μ = 0 in the first order conditions (2) and (3) and checking when the monotonicity condition (*M*) is violated:

$$X_L \le X_H,$$
$$(P) \quad \Leftrightarrow \quad \lambda(q_H c_L - q_L \Delta c) \ge k q_L \Delta c.$$

As shown earlier, pooling is not optimal in the private procurement contract, which is also true in our model when the budget is not binding, i.e., $\lambda = 0$.

Pooling can only occur if the budget is binding ($\lambda > 0$), but whether pooling will actually occur is determined by the bureaucrat's balancing of her twin objectives of output and unspent budget. By considering the special case of $k = 0$, we can isolate the effect of the bureaucrat's preference for policy drift and characterize a critical expression $(q_H c_L - q_L \Delta c)$ in condition (*P*):

$$(NP) \quad q_H c_L - q_L \Delta c \ge 0.$$

When $k = 0$, the bureaucrat only cares about output, and therefore, the necessary condition for pooling (*NP*) determines when separation leads to smaller expected output. If this condition is violated, the optimal contract is a separating contract. Given that separation is optimal when $k = 0$, it is optimal to separate for all $k > 0$ since then the bureaucrat has an additional incentive to separate in order to appropriate the unspent budget. Thus separation is optimal if (*NP*) *does not* hold. In contrast, if (*NP*) holds, either separation or pooling can be optimal depending on values of k and λ.

As can be seen from (*P*), it is necessary to have a high enough k for separation to be optimal. This is because, a key benefit to the bureaucrat from offering a separating contract is the unspent budget, and unless she is interested in it, the bureaucrat will not offer a separating contract. Thus, condition (*P*) shows that the bureaucrat may prefer to separate, even when (*NP*) holds, if she cares sufficiently about the unspent budget.

If condition (*P*) holds, we have $X_L = X_H$, and the binding (IC_L) implies that $t_L = t_H$, with each type obtaining an identical contract. The optimal output and transfer in the pooling contract, denoted by (X^P, t^P), can be derived by using (IR_H) in the binding budget constraint:

(5) $$B - \frac{c_H}{2}\left(X^P\right)^2 \equiv 0, \quad \text{and} \quad t^P = B.$$

If condition (*P*) does not hold, we have a separating contract with $X_L > X_H$, and the binding (IC_L) implies that $t_L > t_H$. The optimal separating outputs and transfers, denoted by (X_i^S, t_i^S), can be derived using $\mu = 0$ in (2) and (3) and the binding (IC_L) and (IR_H) constraints:

(6) $$\left\{\left[X_L^S = \frac{q_L}{kq_Lc_L + \lambda c_L};\ t_L^S = B\right], \left[X_H^S = \frac{q_H}{k\left(q_Hc_H + q_L\Delta c\right) + \lambda\Delta c};\ t_H^S = \frac{c_H X_H^{2}}{2}\right]\right\}$$

where λ is obtained from the binding budget constraint:

(7) $$B = \left(\frac{c_L}{2}\left(X_L^S\right)^2 + \frac{\Delta c}{2}\left(X_H^S\right)^2\right).$$

We gather in Proposition 1 the results proven so far.

Proposition 1: *If the budget constraint is not binding, it is optimal for the bureaucrat to offer the separating contract characterized in (4). If the budget constraint is binding, offering the pooling contract (5) is optimal if condition (P) holds; otherwise, the separating contract (6) is optimal.*

We now turn our attention to the effects of k and B on the power of incentive schemes and the expected output, given that the budget is binding.

3.2. Different preference for policy drift *k*

For pooling contracts, it is easily seen from (5) that the output is independent of k: pooling contracts ignore incentives as they require a constant output, X^P, irrespective of the actual cost of production.

For separating contracts, we need a more careful investigation to characterize the effects of changing k. While it is intuitive that an increase in k makes the budget constraint less tight (λ falls since the bureaucrat is now less interested in output),[21] the impact of k on the outputs is not immediate from (6). A key insight is that, given a fixed B, the bureaucrat can increase the unspent budget only by reducing X_H. Therefore, she lowers X_H if her preference for policy drift, k, increases. The reduction of X_H implies that the rent to the L-type decreases, which allows the bureaucrat to increase X_L and pursue her parallel objective of obtaining high output. Therefore, the power of incentives increases with k.[22] With a larger k, the bureaucrat offers a stronger incentive scheme because she knows she will be able to benefit more from the unspent budget. In other words, for given binding budgets, bureaucracies will tend to have lower-powered incentives if bureaucrats are more motivated (small k). Our model suggests a new argument why bureaucracies may find lower-powered incentives optimal: the lower value of an unspent budget for a more motivated bureaucrat under the constraint of fixed budgets.

Note, however, that the expected output, denoted by $E[X^S]$, falls with k. Since the cost functions are convex, more dissimilar output levels (making X_L/X_H larger) would violate the fixed budget unless the expected output is reduced. Then $E[X^S]$ decreases with k since X_L/X_H increases with k. Therefore, bureaucracies with more motivated bureaucrats produce higher output. However, bureaucrats do not consider the cost of raising funds. The funding authority controls motivated bureaucrats with the size of the fixed budget as will be shown later in Section 4.

These results are summarized in Proposition 2.

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[21] Indeed, we prove in Appendix A.1 that $\frac{\partial \lambda}{\partial k} < 0$.

[22] We formally prove in Appendix A.1 that $\frac{\partial X_H}{\partial k} < 0$ and $\frac{\partial X_L}{\partial k} > 0$, and therefore $\frac{\partial}{\partial k}\left(\frac{X_L}{X_H}\right) > 0$.

Proposition 2: *In a separating equilibrium, the more motivated the bureaucrat (smaller k), the larger the expected output and the weaker the power of incentives.*

Proof: In Appendix A.1.

3.3. Different levels of budget *B*

We now examine the new features implied by a change in the budget B. Clearly, this is only relevant when the budget is binding. For pooling contracts, the output increases with B as can be seen in (5).

To analyze the effect of changing B on separating contracts, we rely on (6). Since a decrease in B tightens the budget constraint (BG) and increases its shadow value, λ, both outputs decrease with the budget: $\frac{\partial X_L^S}{\partial B} > 0$ and $\frac{\partial X_H^S}{\partial B} > 0$. The more interesting issue is the power of incentives, i.e., the ratio of outputs. The bureaucrat decreases X_L more than X_H and $\frac{\partial}{\partial B}\left(\frac{X_L}{X_H}\right) > 0$, i.e., the power of incentives decreases as the budget falls. A decrease in B implies a decrease in t_L. Decreasing X_L has a direct impact on t_L as the cost of production goes down, while a decrease in X_H only affects t_L indirectly via the rent.

Therefore, our model suggests a new argument why bureaucracies may find lower-powered incentives optimal: because they are under-funded. An agency facing a small fixed budget will offer low-powered incentive schemes.

Proposition 3: *In a separating equilibrium, the larger the budget, the larger the expected output, and the higher the power of incentives.*

Proof: In Appendix A.2.

3.4. When is pooling likely?

Having established how output and the power of incentive schemes are affected by the two key parameters, we can now state when pooling is likely. The power of incentives falls as B and k

decrease. A smaller budget or a stronger preference for output, both imply a tighter budget constraint (λ increases), which makes it more likely that the pooling condition (*P*) will be satisfied, provided the necessary condition (*NP*) holds. Indeed, if (*NP*) holds strictly, a pooling contract is optimal for small values of *k*, while a separating contract can be optimal for large values of *k*.

We illustrate, for a given *B*, this transition of the equilibrium contract with respect to *k* in Figure 2.[23] Consider first the extreme case where $k = 0$. A pooling contract is optimal as the bureaucrat places no value on the unspent budget.[24] As *k* increases, the bureaucrat may move from offering a pooling to a separating contract, which happens at the critical value of $k \equiv k_T$, and we have $X^P = X_L^S = X_H^S$ when $k = k_T$.[25] For higher values of *k*, the bureaucrat decreases the expected output as she puts more value on the unspent budget.

The critical value k_T depends on the budget, and we note that $\frac{\partial k_T}{\partial B} < 0$.[26] As *B* increases, the potential gain from the unspent budget ($kq_H(B - t_H)$) increases as well because t_H increases but by less than the increase in *B*. Thus, the bureaucrat begins to offer a separating contract for a smaller *k* when budgets are larger.

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[23] The graph is based on the following values for the parameters: c_L=.1; c_H=.15; q_L=q_H=.5; B=3.33.

[24] As *k* goes to zero, we must have $\lambda > 0$ by (6). Otherwise X_L and X_H would become unbounded which is impossible given a fixed budget. Therefore (*P*) is strictly satisfied for *k* small enough.

[25] The cutoff k_T is defined by $\lambda(B,k_T)(q_H c_L - q_L \Delta c) \equiv k_T q_L \Delta c$. Given $q_H c_L > q_L \Delta c$, $k_T > 0$. Since λ is decreasing in *k* and $\lambda(B,k)(q_H c_L - q_L \Delta c) > k q_L \Delta c$ when separating occurs, k_T defined above is unique.

[26] From $\lambda(B,k_T)(q_H c_L - q_L \Delta c) \equiv k_T q_L \Delta c$, $\frac{\partial k_T}{\partial B} = -\left[\frac{\partial \lambda}{\partial k}(q_H c_L - q_L \Delta c) - q_L \Delta c\right]^{-1} \frac{\partial \lambda}{\partial B}$. As shown in the proofs of Propositions 2 and 3, $\frac{\partial \lambda}{\partial k} < 0$ and $\frac{\partial \lambda}{\partial B} < 0$. Thus, given $q_H c_L - q_L \Delta c > 0$, $\frac{\partial k_T}{\partial B} < 0$.

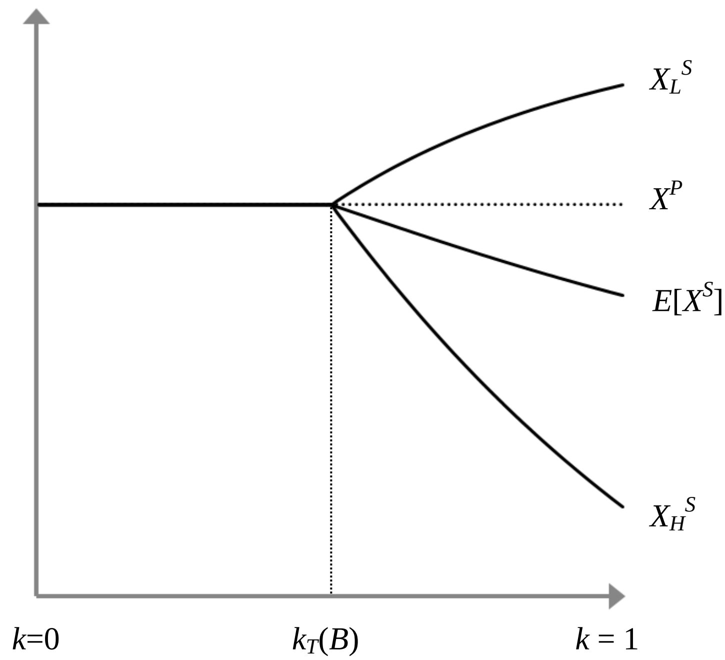

Figure 2. Changes in the optimal outputs as a function
of *k* assuming (*NP*) holds strictly

To summarize, the bureaucrat prefers a pooling contract until k_T since the higher output with pooling is more attractive than the relatively small unspent budget, and only introduces separation when the value of the unspent budget outweighs the loss in expected output.

Again assuming the necessary condition (*NP*) holds strictly and $k > 0$, we show in Figure 3 how the outputs change with *B* for a given *k*.[27] For small budgets, the bureaucrat offers a pooling contract.[28] The unspent budgets obtained by offering a separating contract are not worth the loss in expected output. This is because convex costs make it less costly to increase output for small budgets. As the budget increases, the bureaucrat will eventually offer a separating contract to enjoy the unspent budgets and the power of incentives will increase.

[27] The graph is based on the following values for the parameters: c_L=.1; c_H=.15; q_L=q_H=.5; *k*=.5.

[28] As *B* goes to zero, (7) implies that both outputs must go to zero, which is only true if λ becomes unbounded (see (6)). But then, (*P*) must be satisfied as a strict inequality since all other variables are bounded.

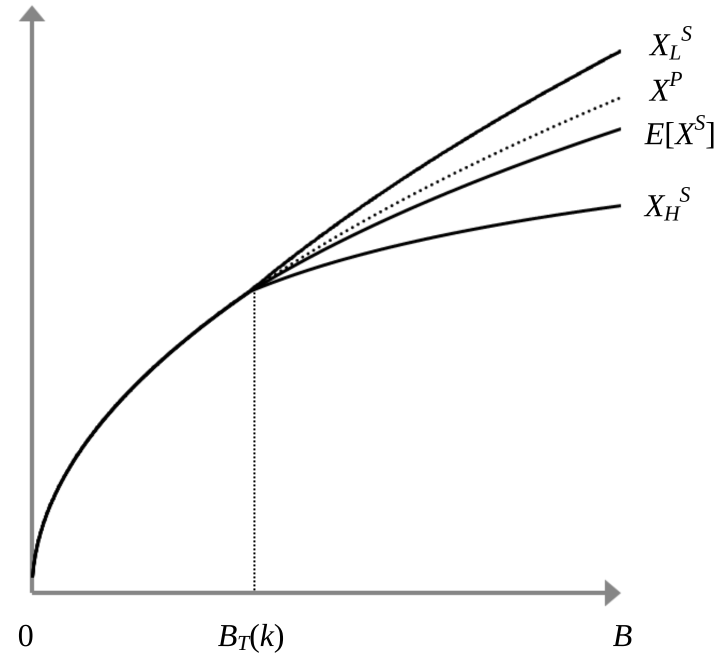

Figure 3. Changes in the optimal outputs as a function
of B assuming (*NP*) holds strictly

B_T is the critical budget level dividing the pooling and separating regions.[29] Since the pooling condition also depends on k, the critical B_T also depends on k, and we can derive $\frac{\partial B_T}{\partial k} < 0$.[30] With a higher k, the bureaucrat benefits more from the unspent budget. Since only separating contracts generate the unspent budget, the bureaucrat begins to offer a separating contract earlier (smaller B) for higher values of k.

To summarize, for large values of k, the bureaucrat cares more about the unspent budget, which can be enjoyed only if she offers a separating contract. In contrast, for small values of k, the bureaucrat cares more about output levels and offers a pooling contract whose output is greater than the output of a separating contract for a given budget (assuming (*NP*) holds).

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[29] The cutoff B_T is defined by $\lambda(B_T,k)\left(q_H c_L - q_L \Delta c\right) \equiv k q_L \Delta c$. Given $q_H c_L > q_L \Delta c$, $B_T(k) > 0$. Since λ is decreasing in B, and $\lambda \to \infty$ as B goes to zero and $\lambda \to 0$ as B goes to infinite, B_T is unique.

[30] From $\lambda(B_T,k)\left(q_H c_L - q_L \Delta c\right) \equiv k q_L \Delta c$, $\frac{\partial B_T}{\partial k} = \left[\frac{\partial \lambda}{\partial B}\right]^{-1}\left[q_L \Delta c - \frac{\partial \lambda}{\partial k}\left(q_H c_L - q_L \Delta c\right)\right]$. As shown in the proofs of Propositions 2 and 3, $\frac{\partial \lambda}{\partial k} < 0$ and $\frac{\partial \lambda}{\partial B} < 0$. Thus, given $q_H c_L - q_L \Delta c > 0$, $\frac{\partial B_T}{\partial k} < 0$.

Similarly, given a large *B*, the bureaucrat can afford to create a large unspent budget, which is only possible under separation. For a small *B*, the bureaucrat focuses only on expected output by offering a pooling contract which does not leave any unspent budget. We collect these results in the proposition below.

Proposition 4: *Pooling is more likely to occur with smaller budgets and with more motivated bureaucrats (smaller k).*

4. The funding authority's problem

In Section 3, we characterized the optimal contract a bureaucrat would offer an agent given a fixed budget from the funding authority. In this section, we will discuss the role of *B* and *k* in the funding authority's problem anticipating the optimal contract offered by the bureaucrat.

4.1. The role of the budget *B*

In this subsection, we allow the funding authority to choose the size of the budget given a *k*. We show that this choice will induce the bureaucrat to offer lower-powered contracts relative to a private procurement contract, which is consistent with the popular notion about bureaucracies. In our model, this result is based on two arguments. First, the results in Section 3 show that the lower the value of the unspent budget, whether due to a lower *k* or a smaller *B*, the weaker the incentives. Second, we will argue next that the funding authority will give a budget to the bureaucrat, such that the budget constraint is binding in the bureaucrat's problem regardless of *k*.

With the ability to offer only a fixed budget to a bureaucrat, the funding authority sees the incentive contract differently than she would if she could contract directly with the agent. As a result, it will offer the bureaucrat a restrictive budget. To see this, consider the extreme case of $k = 1$, where the bureaucrat and the authority have identical relative values of money. If the budget is not binding, the bureaucrat would implement the private procurement outputs, but the funding authority would not be pleased because the unspent budget poses a problem.[31] Since it must give a fixed budget, the funding authority is not able to save money when the cost is high

[31] We assume that the authority does not benefit from however the unspent budget is used. This does not necessarily mean the money is 'stolen'. It may be used to produce output that the bureaucrat values, e.g., research in a teaching college, that the Administration does not value.

(and the output is small), which it would be able to do if it were able to contract directly with the agent. The funding authority's marginal cost of the contract offered to the agent (through a fixed budget) is larger than the bureaucrat's marginal cost (through a contingent transfer). This implies that the bureaucrat would produce more than what the funding authority wants if she has access to an unlimited budget. Therefore, the funding authority wants to give a smaller budget to the bureaucrat than the amount necessary to implement the private procurement outputs even if we had $k = 1$. For the bureaucrat, then, the budget constraint would be binding.

For $k < 1$, if the budget is not binding, the bureaucrat would even overproduce relative to the case where $k = 1$ because she has a stronger preference for output (as shown in Section 3). It implies that the funding authority would again give her a small budget to insure that the constraint is binding. Therefore, the budget constraint is always binding in the bureaucrat's problem.

In the previous section, we learned that the power of incentive schemes increases with both k and B, and that the private procurement benchmark corresponds to the case where $k = 1$ and B is unrestricted. Thus the fact that the budget is always limited for any k implies that the power of incentives is lower in a bureaucracy than in the private procurement benchmark. These results are summarized in the following proposition.

Proposition 5: *The funding authority will offer a budget such that the budget constraint is binding for the bureaucrat, which implies that bureaucracies will have lower-powered incentives than in the private procurement case.*

Proof: In Appendix A.3.

It is important to point out that a contract with strong incentives is not necessarily good for the funding authority when budgets are fixed. With a fixed budget, stronger incentives are associated with large unspent budgets, which are costly for the funding authority.

4.2. The role of preference for policy drift *k*

While we have shown that the budget is binding regardless of *k* in Proposition 5, we have not discussed how the optimal budget varies with *k*. In this subsection, we first show that the optimal budget declines with *k*, i.e., less motivated bureaucrats receive smaller budgets. This result raises an interesting trade-off regarding the power of incentives when the budget is endogenous: while less motivated bureaucrats tend to offer higher-powered incentives (see Proposition 2), they also receive smaller budgets implying lower-powered incentives (see Proposition 3). We later show which effect dominates and conclude this subsection by discussing the optimal value of *k* for the funding authority.

To understand how the optimal budget varies with *k*, we must solve the funding authority's problem for different values of *k*. This problem is complex because it requires the funding authority to anticipate the bureaucrat's optimization problem that itself results in different types of equilibria. That is, the funding authority's problem is a nested problem. Rather than imposing arbitrary restrictions, we have chosen to use numerical methods and show that the optimal budget is weakly decreasing in *k* (see Appendix A.4).[32]

The intuition is as follows. Recall that the funding authority allocates the fixed budget to maximize its expected net benefit, $q_L X_L + q_H X_H - B$. It anticipates that for higher values of *k* the bureaucrat offers a stronger incentive scheme. However, the bureaucrat does so to engage in policy drift (by increasing the amount of unspent budget), which comes at the cost of a lower expected output. Therefore, for higher values of *k*, the funding authority curtails the bureaucrat's ability to engage in policy drift by lowering the budget.

Since the budget size counteracts the bureaucrat's preference for offering strong incentive schemes to her agent, it is not obvious how the power of incentives will be affected by *k*. We show in Appendix A.4. that the power of incentives rises with *k* when the budget is endogenous.[33] In response to an increase in *k*, the funding authority lowers the budget, but it would be too costly to completely counteract the bureaucrat's preference, which implies that the power of incentive still rises with *k*. Similarly, more motivated bureaucrats still offer lower-powered incentive schemes despite the higher budgets offered by the funding authority.

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[32] For instance, if $\left(\partial^2 X_H / \partial k \partial B\right) \leq 0$, then we can show that the optimal budget is weakly decreasing in *k*.

[33] But, as shown in Proposition 5, the power of incentives is always less than in the private procurement contract.

This leads us to ask which type of bureaucrat would the funding authority prefer if it had a choice. We find that the funding authority still prefers a more motivated bureaucrat (low k) to a less motivated one even if she offers a weaker incentive scheme to her agent. We show in Appendix A.5. that the value of the funding authority's objective function decreases with k. The reason is that stronger incentive schemes will lead to smaller expected output and larger unspent budgets.[34]

Our result is complementary to Besley and Ghatak (2005). They argue that matching motivated agents to mission-oriented tasks acts as a substitute for high-powered incentives and leads to more efficient outcomes. Thus a motivated bureaucrat would receive a low-powered incentive scheme but will nevertheless be productive. Examining contracts offered by a bureaucrat under a fixed budget, we also find that the funding authority prefers a more motivated bureaucrat, i.e., better matching, despite the fact that the bureaucrat will offer lower-powered schemes to her agents. The authority will offer the more motivated bureaucrat a larger budget and obtain a higher expected output. Combining the messages of the two papers, we may conclude the well-matched bureaucracies may be characterized by large budgets and low-powered incentives schemes, both for contracts offered *to* the bureaucrat and *by* the bureaucrat, while the expected output may remain high.

5. Extensions

In this section, we discuss several extensions of the main model. First, we allow the funding authority to exercise some control on the bureaucrat's budget spending. This extension is particularly interesting under asymmetric information about k as the funding authority's control becomes a screening device. Second, we consider an alternative framework where the funding authority contracts directly with the agent and uses the bureaucrat as a monitor of the output. We compare this centralized framework to our main model where the principal delegates the contracting authority to the bureaucrat. Finally, we generalize the bureaucrat's value function of unspent budget.

[34] Note that the funding authority has no preference over k if the bureaucrat were to offer a pooling contract since the outputs would be independent of k and there would be no unspent budget.

5.1. Tighter control by the funding authority

So far, we have assumed that the funding authority has little control over the bureaucrat as it cannot observe the output or the unspent budget. Suppose now that the funding authority can create some accountability by exerting some control over how the budget is spent and increase its effective utilization. Tighter control by the funding authority makes it difficult for the bureaucrat to divert funds from the production of the agency's main mission. Not surprisingly, we first show that tighter control allows the funding authority to increase expected output and offer larger budgets. This raises the potential issue of bureaucrats claiming to be more motivated than they are in order to obtain a larger budget, which we explore by modeling asymmetric information about the bureaucrat's motivation. We show how control by the funding authority can be used as a screening device to offer different budgets for bureaucrats with different levels of motivation. Asymmetric information makes the funding authority's level of control and the budget less sensitive to the bureaucrat's motivation.

We model the funding authority's control in a simple way by assuming that it reduces the value of the unspent budget.[35] If the funding authority exerts control with intensity $p \in [0,1]$, the bureaucrat's relative value of money is given by $k(1-p)$. Control cost is given by a convex function, $m(p)$, such that $m(0) = m'(0) = 0, m'(1) = \infty$. We assume that the funding authority can commit to the control intensity. The bureaucrat's objective function is now:

$$U = q_L X_L + q_H X_H + k(1-p)[B - q_L t_L - q_H t_H].$$

If the funding authority does not exert any control ($p = 0$), our previous model applies. If it could control with intensity 1, it would be impossible for the bureaucrat to benefit from unspent budget. Given B and p, the bureaucrat solves her own problem with the same (*IC*) and (*IR*) constraints as before and determines the optimal outputs and transfers for the agent, $X\big(B, k(1-p)\big), t\big(B, k(1-p)\big)$, and her own (indirect) utility can be presented as $U\big(B, k(1-p)\big)$.

Our results can be understood from our earlier analysis. The impact of control is to lower the value of the unspent budget; the '*effective* k' is now $k(1-p)$. This leads to more resources being spent on producing output given any budget. Thus, we find that if the funding authority can control budget expenditures, it will offer the bureaucrat a larger budget and the bureaucrat

[35] See Pagano and Roell (1998) or Khalil, Martimort, and Parigi (2007) for similar models of monitoring.

will respond by producing more (expected) output. The power of incentives will fall, even though the expected output increases, since the ‘effective k’ has decreased.

We prove in the appendix A.6 that the funding authority will exert control (i.e., choose p) so that the effective k still increases with k. Therefore, a less motivated bureaucrat will receive a smaller budget. This observation leads us to explore the possibility that a bureaucrat may have an incentive to over-state her degree of motivation in an attempt to secure a larger budget.

To explore this incentive we now introduce asymmetric information about k. The bureaucrat knows her own type $k \in \{k^H, k^L\}$ with $k^H > k^L > 0$, while the funding authority just believes that the probability of k^j is $\pi^j \in (0,1)$, where $j \in \{L, H\}$, and $\pi^H + \pi^L = 1$. Again, we present the key ideas here and keep the details for the appendix A.6.

If there was no scope for control, the funding authority would have no screening instrument, and it would have to offer the same budget to all types of bureaucrat.[36] If the funding authority can control the bureaucrat, it can couple different amounts of budgets with different control intensities to ensure incentive compatibility for each type of bureaucrat. Thus the contract for the bureaucrat is given by the menu, $\{B^j, p^j\}_{j=L,H}$. Since only the less motivated will have an incentive to claim to be more motivated, the funding authority’s contract will satisfy the following incentive constraint for the bureaucrat:

$$U(B^H, k^H(1-p^H)) \geq U(B^L, k^H(1-p^L)).$$

Given our previous analysis, we know that the bureaucrat’s utility increases with the budget and with $k(1-p)$, the effective k. If the incentive constraint is binding, the funding authority will choose B^j and p^j to increase $U(B^H, k^H(1-p^H))$ and decrease $U(B^L, k^H(1-p^L))$. Therefore, B^H will increase and p^H will decrease relative to the complete information case, while B^L will fall and p^L will rise. That is, asymmetric information about k will have the effect of increasing the budget and effective k for the less motivated bureaucrat, while decreasing them for the more motivated bureaucrat (see appendix A.6 for the proof).

[36] Thus, more motivated bureaucrats would get smaller budgets than under complete information, while less motivated types would get larger ones. The effect of this would be to increase the expected output but lower the power of incentives for those with a higher k, while the opposite would be true for those with a lower k.

In summary, because highly motivated bureaucrats tend to receive larger budgets under complete information, the funding authority should be concerned when the bureaucrat can misrepresent her motivation. We have shown that both the funding authority's control and the budget are less sensitive to the bureaucrat's type than under complete information.

5.2. Delegation and centralization

In this section, we revisit the question as to why the funding authority delegates the contract design to the bureaucrat instead of offering the contract directly to the agent. More specifically, we want to study if there are circumstances under which delegation is optimal without changing the key information structure, i.e., the fact that the funding authority cannot observe output. An obvious starting point, then, is to ask the bureaucrat to report information about the output to the funding authority while the funding authority contracts with the agent directly (based on the bureaucrat's report of output). We call this contract the centralization contract to distinguish it from the contract in our main model, which we call the delegation contract. We will also re-label the bureaucrat as a "monitor" in the centralization contract since she only reports the output and does not offer the contract.

The funding authority could implement the second best (private procurement) contract assuming (i) the monitor can observe the output freely and (ii) she reports it truthfully. Then, centralization would obviously dominate delegation since we have shown earlier that the second best contract cannot be implemented under delegation. We now relax the two assumptions by allowing for collusion between the monitor and the agent and by introducing a cost of collecting information about the output.

We obtain two key findings. First, even under centralization, the lack of output observation by the funding authority results in lower-powered schemes than under private procurement. We show that the reward that the funding authority must pay to the monitor to deter collusion plays a role similar to the fixed budget, and our earlier intuition applies here too. This result allows us to compare centralization and delegation, which gives us our second main finding that delegation may dominate centralization. We show that if the bureaucrat is motivated enough, delegation may be more profitable than centralization because the funding authority can use the bureaucrat's preference for output to compensate her for the cost of observing output.

Suppose that the agent can bribe the monitor to distort the information about the output reported to the funding authority.[37] To deter collusion, the principal must now satisfy a new constraint, labeled (*CIC*), that requires the funding authority to pay the monitor a reward whenever the agent could find it profitable to bribe her.[38] Let us define by s_i, where $i \in \{H, L\}$, the reward to the monitor when she reports X_i. Because $t_L > t_H$ in equilibrium, the agent always prefers that the monitor reports X_L. Thus, $s_L = 0$ in equilibrium, but to deter collusion it is necessary that,

$$(CIC) \quad s_H \geq t_L - t_H$$

We can now write the funding authority's maximization problem with relevant constraints as follows:

$$\max \; q_L\left(X_L - t_L\right) + q_H\left(X_H - t_H - s_H\right)$$

$$s.t. \quad \left(IR_H\right), \left(IC_L\right), \left(M\right), \text{and } (CIC).$$

Interestingly the new constraint (*CIC*) brings back an essential element of our basic model: the fixed budget. When this constraint is binding, the funding authority will have to pay t_L regardless of the output level (because $t_L = s_H + t_H$). However, there is an incentive effect from using the monitor since the agent can still be paid different transfers based on the monitor's report of output.

As (IR_H), (IC_L), and (CIC) are binding at the optimum, from the first-order conditions we find that the contract is separating if and only if $q_H c_L \geq q_L \Delta c$ with

$$X_L = \frac{q_L}{c_L}; \;\; X_H = \frac{q_H}{\Delta c}.$$

Otherwise, the contract is pooling: $X_L = X_H = \frac{1}{c_H}$.

To reduce the stake of collusion, the funding authority lowers the higher output ($X_L < X_L^{PP}$) and increases the lower output ($X_H > X_H^{PP}$), therefore reducing the power of incentives.

[37] We rule out extortion by requiring that the monitor needs a help from the agent to manipulate information (see Khalil, Lawarree, and Yun (2010)).

[38] See for example, Tirole (1986, 1992), Kofman and Lawarree (1993), and Laffont and Martimort (1998).

Therefore the centralization contract has lower power of incentives than the private procurement contract due to the threat of collusion.

Let us now compare the centralization contract with the delegation contract. If $k = 0$, from (6), we can see that delegation achieves the same outcome as under centralization.[39] However, centralization will dominate delegation for $k > 0$ because the payoff of the funding authority decreases with k under delegation.

We now also relax our second assumption that monitoring is free. To keep our model simple, suppose that the monitor or the bureaucrat must spend $z > 0$ to observe the output. For instance, spending z could mean setting up an accounting reporting system or hiring auditors. We assume that such spending is observable by the funding authority and the agent, and that the monitor or the bureaucrat can commit to such spending.[40]

Even with such a simple structure, our model can provide a new insight about the benefit of delegation. Of course, there are other papers that justify the principal's delegation of contracting authority to a supervisor (monitor) in a two-tier hierarchy. For instance, Hiriart and Martimort (2011) show that delegation can be optimal if the supervisor has an informational advantage over the principal, so the contract offered to the agent is better tailored under delegation. Faure-Grimaud, Laffont, and Martimort (2003) show that delegation is equivalent to centralization if the supervisor and the agent collude under asymmetric information. See also Celik (2009) for the optimality of delegation in the presence of collusion between the supervisor and the agent. In our model of bureaucracy, we argue that the bureaucrat's motivation, i.e., her preference for output, can make delegation optimal.

The funding authority needs to make sure that the monitor and the bureaucrat can cover the monitoring costs and a new individual rationality constraint appears. Under centralization, the funding authority relies on the reward used to deter collusion to pay for the monitoring cost z, whereas, under delegation, it can use the bureaucrat's preference for output. We show next that there are values of z such that delegation can dominate centralization due to the preference for output by the bureaucrat.

[39] Under delegation, since the bureaucrat cares only about output when $k = 0$, relaxing the budget constraint by \$1 increases output by a value of \$1, implying that $\lambda = 1$.

[40] We can therefore avoid complications due to a moral hazard problem under collusion (see Mookherjee and Png (1995)).

Consider first the centralization model. The principal must now satisfy a participation constraint for the monitor. This constraint, labeled (IR^m), requires that the payment to the monitor must at least cover z. The optimal collusion-proof contract solves the same problem as above, with the addition of the constraint (IR^m).

$$(IR^m) \quad s_H \geq \frac{z}{q_H}.$$

The (CIC) constraint is stricter than (IR^m) if z is small $(z \leq z_0)$,[41] and the reward to deter the bribe also pays for z. The (IR^m) constraint is stricter than (CIC) if z is large. Indeed, if the z is large enough, the payment to cover z will be so large that there is no incentive to collude, i.e., the (CIC) is not binding. See the appendix A.7 for more details and the critical values of z.

Let us consider next the delegation model when the bureaucrat must also spend z to observe the output. Instead of relying on the reward used to deter collusion to pay for z, the funding authority can now use the bureaucrat's preference for output to pay for z. However, as we saw above, centralization becomes more attractive as k increases. Thus, we argue next that if k is small enough, a large monitoring cost would make delegation optimal.

Consider the case where $k = 0$, for which we have shown that outcomes are identical under delegation and centralization if $z = 0$. Now we will show that delegation is still the same as centralization if $0 < z \leq z_0$, and it can be better if $z > z_0$. The output produced by the agent enters in the objective function of the bureaucrat and it may be enough to pay for z. More specifically, if $z \leq z_0$, the output produced under delegation can cover z, and it is identical to the output produced under centralization.[42] Accordingly, delegation is equivalent to centralization. If z is slightly above z_0, the output still covers z under delegation but the centralization contract must pay a higher s_H and becomes worse than the delegation contract. It further implies that delegation can dominate centralization even for $k > 0$.[43] We conclude that, when a bureaucrat is sufficiently motivated, delegation can dominate centralization.

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[41] Define $z_0 \equiv q_H(\tilde{t}_L - \tilde{t}_H)$, where $\tilde{t}_L$ and $\tilde{t}_H$ are separating-equilibrium transfers given to the agent under a collusive monitor with free monitoring.

[42] To see that the bureaucrat's cost z is covered by the output under *delegation*, define by $\tilde{X}_i$ as the output produced under *centralization* when $z \leq z_0$. Note that the output produced under centralization is identical to the output produced under delegation for $z \leq z_0$ as (IR^m) is still non-binding. The funding authority's payoff is $E[\tilde{X}_i] - \tilde{t}_L > 0$, implying that $E[\tilde{X}_i] > \tilde{t}_L > z_0 = q_H(\tilde{t}_L - \tilde{t}_H)$.

[43] If we consider higher values of k, centralization will eventually dominate delegation.

5.3. Non-linear value function of unspent budget

So far, we have assumed a linear value function for the unspent budget, $k(B - t)$, but now we consider a more general formulation. The bureaucrat's preference for policy drift is given by the non-linear function $V(B-t)$, where $lim_{t\to B}V'(B-t)=\infty, V'(\cdot)>0>V''(\cdot)$. There are two key benefits of this formulation. First, the bureaucrat's marginal value of the unspent budget becomes very large as the unspent budget becomes small.[44] Second, as a result of these large marginal values, we will see that the budget is not binding, which allows us to characterize the power of incentives without the impact of a binding budget. We find that our main result still holds: due to the bureaucrat's preference for policy drift, the power of incentives offered by the bureaucrat remains lower than that in the private procurement contract.

The bureaucrat's objective function is now given by:

$$U = q_L X_L + q_H X_H + q_L V(B-t_L) + q_H V(B-t_H).$$

The marginal value of the unspent budget is the opportunity cost of producing more output, and this cost becomes very high as the unspent budget becomes small. Thus, the bureaucrat will always want to keep some unspent budget even when the cost of production is low (c_L), indicating that the budget will not be binding ($\lambda = 0$). Recall from the pooling condition (P), that this implies a separating contract since $\lambda > 0$ is necessary for pooling to occur.

Since the incentive and participation constraints for the agent remain unchanged, we will still have $t_L = \frac{c_L}{2}X_L^2 + \frac{\Delta c}{2}X_H^2$, and $t_H = \frac{c_H}{2}X_H^2$, with $t_L > t_H$ in equilibrium. Maximizing the bureaucrat's objective function above, subject to (IR_H), (IC_L), (BG_L), and (M), the optimal separating equilibrium outputs are given by,

$$X_L = \frac{1}{V'(B-t_L)c_L}, X_H = \frac{1}{V'(B-t_H)c_H + \frac{q_L}{q_H}V'(B-t_L)\Delta c},$$

[44] In our main model, the result on the power of incentive holds for the case of $k > 1$ as well. The key idea of examining the large marginal value of unspent budget is to explore the implication of relaxing the binding budget, which we now do in a more general manner in this sub-section. But, if we were to continue with our base model with k, note that the optimal quantities offered by the bureaucrat, given by (6), are still valid for $k > 1$. A little algebraic manipulation shows that the power of incentives given by the outputs in (6) is lower than that under private procurement if $\lambda > 0$. Since the ratio X_L/X_H is identical to that under private procurement when $\lambda = 0$, this completes the proof.

which would be identical to the private procurement benchmarks X_L^{PP} and X_H^{PP} if $V'(\cdot) \equiv 1$. The power of incentives is given by

$$\frac{X_L}{X_H} = \frac{1}{c_L}\left(\frac{V'(B-t_H)}{V'(B-t_L)}c_H + \frac{q_L}{q_H}\Delta c\right),$$

which is strictly less than the power of incentives under private procurement, $\frac{1}{c_L}\left(c_H + \frac{q_L}{q_H}\Delta c\right)$,

since $\frac{V'(B-t_H)}{V'(B-t_L)} < 1$.

The bureaucrat's preference for policy drift represents the opportunity cost of increasing output and this cost is higher for X_L since $t_L > t_H$.[45] Therefore, we are able to generalize our result that the power of incentive is lower than in the private procurement contract due to the bureaucrat's preference for policy drift.

6. Conclusion

Bureaucrats who operate under the budget rule "use it or lose it" are expected to return any unspent budget at the end of a fiscal year. Instead, they tend to view unspent budgets as discretionary and go on spending sprees towards the end of the fiscal year even though much of the expenses are not in the interest of the funding authority. This phenomenon is known as policy drift. Sometimes, bureaucrats even "park" the unspent budget in "no year" accounts. Staffers from the Homeland Security and Government Affairs Subcommittee on Federal Financial Management, Government Information, and International Security estimated such amount to be $376 billion in 2006.[46]

In this paper, we investigated how fixed budgets and the bureaucrat's preference for policy drift imply that the optimal incentive contract of an agent employed in a bureaucracy will be distorted from the private procurement benchmark (equivalent to the incentive contract that would be offered by the funding authority if it could contract directly with the agent). Fixed budgets, which can be interpreted as low-powered incentive schemes offered to bureaucrats,

[45] As already noted in section 3.3, reducing X_L is more effective in lowering t_L as it directly lowers cost of production, while reducing X_H lowers t_L indirectly by lowering the rent.

[46] http://coburn.senate.gov/ffm/index.cfm?FuseAction=LatestNews.NewsStories&ContentRecord_id= 1f90396c-802a-23ad-4386-174142756310

translate into low-powered schemes offered by bureaucrats to agents. Thus, bureaucracies exhibit low-powered incentives throughout the hierarchy.

We showed that a more motivated bureaucrat who cares less about policy drift offers a contract with lower-powered incentives but larger output. We also showed that contracts in bureaucracies may offer flat incentives for small budgets. Even though it ultimately lowers the power of incentives, the funding authority finds it optimal to limit the budget given to the bureaucrat. These results are consistent with the casual observation that contracts in bureaucracies are largely impaired by the problem of a lack of incentives, compared to contracts in private sectors.

We also showed that delegating the task of contracting with the agent to the bureaucrat can be optimal if the bureaucrat is motivated enough. If tighter control by the funding authority can reduce policy drift, the bureaucrat will be given larger budgets, but the power of incentives will be lower. Asymmetric information about the bureaucrat's taste for policy drift makes the budget and the power of incentives less sensitive to the bureaucrat's taste.

We showed that the funding authority prefers a more motivated bureaucrat, which can explain matching motivated bureaucrats to mission-oriented tasks. Our contribution is to point out that two key features of bureaucracies, fixed budgets and a bureaucrat's taste for policy drift, may explain why contracts in bureaucracies exhibit lower-powered incentives.

Appendix

A.1. Proof of Proposition 2

Given that the pooling condition, (*P*), does not hold and therefore the monotonicity constraint, (*M*), does not bind (μ = 0 in (2) and (3)), the solution (X_L^S, X_H^S) to the bureaucrat's problem satisfies the following first-order conditions:

(A1) $$\frac{\partial L}{\partial X_L} = q_L - \left(kq_L c_L + \lambda c_L\right) X_L^S = 0,$$

(A2) $$\frac{\partial L}{\partial X_H} = q_H - \left(kq_H c_H + kq_L \Delta c + \lambda \Delta c\right) X_H^S = 0,$$

(A3) $$\frac{\partial L}{\partial \lambda} = B - \frac{c_L}{2}\left(X_L^S\right)^2 - \frac{\Delta c}{2}\left(X_H^S\right)^2 = 0.$$

(i) We first prove that λ decreases with *k*. The derivatives of the first-order conditions with respect to *k* can be expressed as

(A4) $$-\alpha_0 - \alpha_1 \frac{\partial \lambda}{\partial k} - \alpha_2 \frac{\partial X_L^S}{\partial k} = 0,$$

(A5) $$-\beta_0 - \beta_1 \frac{\partial \lambda}{\partial k} - \beta_2 \frac{\partial X_H^S}{\partial k} = 0,$$

(A6) $$-\gamma_1 \frac{\partial X_L^S}{\partial k} - \gamma_2 \frac{\partial X_H^S}{\partial k} = 0,$$

where $\alpha_0 = q_L c_L X_L^S$, $\alpha_1 = c_L X_L^S$, $\alpha_2 = kq_L c_L + \lambda c_L$, $\beta_0 = (q_H c_H + q_L \Delta c) X_H^S$, $\beta_1 = \Delta c X_H^S$, $\beta_2 = kq_H c_H + kq_L \Delta c + \lambda \Delta c$, $\gamma_1 = c_L X_L^S$, $\gamma_2 = \Delta c X_H^S$, and all of these coefficients are positive. From these, solving for $\frac{\partial \lambda}{\partial k}$ gives

(A7) $$\frac{\partial \lambda}{\partial k} = -\frac{\alpha_0 \beta_2 \gamma_1 + \alpha_2 \beta_0 \gamma_2}{\alpha_1 \beta_2 \gamma_1 + \alpha_2 \beta_1 \gamma_2} < 0.$$

(ii) Next we prove that $\frac{\partial}{\partial k}\left(\frac{X_L^S}{X_H^S}\right) > 0$, $\frac{\partial X_H^S}{\partial k} < 0$, and $\frac{\partial X_L^S}{\partial k} > 0$: From (A1) and (A2), $\frac{X_L^S}{X_H^S} = \frac{q_L\left(kq_H c_H + kq_L \Delta c + \lambda \Delta c\right)}{q_H\left(kq_L c_L + \lambda c_L\right)}$. Then,

(A8) $$\frac{\partial}{\partial k}\left(\frac{X_L^S}{X_H^S}\right) = \frac{q_L c_H c_L}{\left(kq_L c_L + \lambda c_L\right)^2}\left(\lambda - k\frac{\partial \lambda}{\partial k}\right) > 0$$

because $\frac{\partial \lambda}{\partial k} < 0$ from (A7).

Let us define $g \equiv \frac{X_L^S}{X_H^S}$. Then (A3) becomes $B - \frac{c_L g^2 + \Delta c}{2}\left(X_H^S\right)^2 = 0$. From this, $X_H^S = B^{\frac{1}{2}}\left(\frac{2}{c_L g^2 + \Delta c}\right)^{\frac{1}{2}}$. Then

(A9) $$\frac{\partial X_H^S}{\partial k} = -B^{\frac{1}{2}} 2c_L g\left(\frac{2}{c_L g^2 + \Delta c}\right)^{\frac{1}{2}}\frac{\partial g}{\partial k} < 0$$

because $\frac{\partial g}{\partial k} > 0$ from (A8). Then, (A6) and (A9) imply that

(A10) $$\frac{\partial X_L^S}{\partial k} > 0 .$$

(iii) Finally, we prove that $\frac{\partial E[X^S]}{\partial k} < 0$. Denote the optimal outputs by X' for $k = k'$, with $X_L' > X_H'$. Let k increase by a small amount to k''. An increase in k implies that X_L increases to X_L'' and X_H decreases to X_H''. The bureaucrat's objective function is $E[X^S] + kq_H(B - c_H X_H^2/2)$. Thus the second term increases with k, and we claim that the first term $E[X^S]$ must fall. Suppose not. Then the outputs X_i'' yield a higher payoff than X_i' to the bureaucrat with k', which is a contradiction. This is because the outputs X_i'' are feasible under k' (because both X' and X'' satisfy the budget constraint with the same budget), but not chosen. Therefore both terms could have been increased by choosing X_i'', which means that X_i' could not have been optimal. ■

A.2. Proof of Proposition 3

Given that the pooling condition, (*P*), does not hold, taking derivatives of the first-order conditions in (A1) − (A3) with respect to *B* gives

(A11) $-\alpha_1 \frac{\partial \lambda}{\partial B} - \alpha_2 \frac{\partial X_L^S}{\partial B} = 0$,

(A12) $-\beta_1 \frac{\partial \lambda}{\partial B} - \beta_2 \frac{\partial X_H^S}{\partial B} = 0$,

(A13) $1 - \gamma_1 \frac{\partial X_L^S}{\partial B} - \gamma_2 \frac{\partial X_H^S}{\partial B} = 0$,

where all coefficients α, β, and γ are positive and defined in the proof of Proposition 2. From (A11) and (A12), $\frac{\partial X_L^S}{\partial B} = \frac{\alpha_1 \beta_2}{\alpha_2 \beta_1} \frac{\partial X_H^S}{\partial B}$, implying that $\frac{\partial X_L^S}{\partial B}$ and $\frac{\partial X_H^S}{\partial B}$ have the same sign. Then, from (A13) it must be that $\frac{\partial X_L^S}{\partial B} > 0$ and $\frac{\partial X_H^S}{\partial B} > 0$, implying that

(A14) $\frac{\partial \lambda}{\partial B} < 0$,

from (A11) or (A12). Finally, from the expression $\frac{X_L^S}{X_H^S} = \frac{q_L \left(kq_H c_H + kq_L \Delta c + \lambda \Delta c\right)}{q_H \left(kq_L c_L + \lambda c_L\right)}$

(A15) $\frac{\partial}{\partial B}\left(\frac{X_L^S}{X_H^S}\right) = -\frac{1}{\left[q_H \left(kq_L c_L + \lambda c_L\right)\right]^2} kq_L q_H^2 c_L c_H \frac{\partial \lambda}{\partial B} > 0$

because $\frac{\partial \lambda}{\partial B} < 0$ from (A14). ■

A.3. Proof of Proposition 5

We first prove that the funding authority will choose *B* such that the budget constraint is binding in the bureaucrat's problem, and then we show that the contract offered by a bureaucrat has lower-powered incentives compared to a private procurement contract if the budget is binding.

Consider the bureaucrat's problem where the budget is not binding:

$$Max\ q_L X_L + q_H X_H + k\left(B - q_L t_L - q_H t_H\right)$$

$$s.t. \quad (IR_H) \quad t_H = \frac{c_H}{2} X_H{}^2$$

$$(IC_L) \quad t_L - \frac{c_L}{2} X_L{}^2 = t_H - \frac{c_L}{2} X_H{}^2$$

Using the binding (IR_H) and (IC_L), the outputs can be expressed as $X_H = X_H(t_H)$ and $X_L = X_L(t_L, t_H)$. Then the bureaucrat's problem becomes

$$\underset{t_H, t_L}{Max}\ q_L X_L(t_L, t_H) + q_H X_H(t_H) + k\left(B - q_L t_L - q_H t_H\right)$$

The first-order conditions are

(A16) $$\frac{\partial X_L(t_L, t_H)}{\partial t_L} = k$$

(A17) $$\frac{q_L}{q_H}\frac{\partial X_L(t_L, t_H)}{\partial t_H} + \frac{\partial X_H(t_H)}{\partial t_H} = k$$

Denoting the solutions to the above conditions as t_L^* and t_H^*, let us now define $\overline{B} \equiv t_L^*$.

Call Δ the total derivative of the funding authority's objective function, $q_L X_L(t_L^*, t_H^*) + q_H X_H(t_H^*) - B$, with respect to B.

$$\begin{aligned}
\Delta &= q_L\left(\frac{\partial X_L}{\partial t_L}\frac{\partial t_L}{\partial B} + \frac{\partial X_L}{\partial t_H}\frac{\partial t_H}{\partial B}\right)dB + q_H\frac{\partial X_H}{\partial t_H}\frac{\partial t_H}{\partial B}dB - dB \\
&= q_L\frac{\partial X_L}{\partial t_L}\frac{\partial t_L}{\partial B}dB + q_H\left(\frac{q_L}{q_H}\frac{\partial X_L}{\partial t_H} + \frac{\partial X_H}{\partial t_H}\right)\frac{\partial t_H}{\partial B}dB - dB \\
&= k\left(q_L\frac{\partial t_L}{\partial B} + q_H\frac{\partial t_H}{\partial B}\right)dB - dB
\end{aligned}$$

The last equality follows from the above first-order conditions (A16) and (A17).

Let's evaluate $\frac{\partial t_L}{\partial B}$ and $\frac{\partial t_H}{\partial B}$. From the definition of $\overline{B}$, we know that the budget constraint will become binding if the budget decreases from $\overline{B}$ since the bureaucrat will have to modify her unconstrained contract to satisfy the smaller budget. From the binding budget constraint, we have $t_L = B$, implying that

$$\frac{\partial t_L}{\partial B} = 1$$

From the binding (IC_L), which should hold as an identity at equilibrium with respect to B and k:

$$t_L = t_H + \frac{c_L}{2}\left(X_L^{\ 2} - X_H^{\ 2}\right)$$

Taking the derivative of the above expression with respect to B gives

$$\frac{\partial t_L}{\partial B} = \frac{\partial t_H}{\partial B} + c_L\left(X_L \frac{\partial X_L}{\partial B} - X_H \frac{\partial X_H}{\partial B}\right)$$

The fact that $\frac{\partial}{\partial B}\left(\frac{X_L}{X_H}\right) > 0$ implies that $\frac{\partial X_L}{\partial B} > \frac{\partial X_H}{\partial B}$. Then $\left(X_L \frac{\partial X_L}{\partial B} - X_H \frac{\partial X_H}{\partial B}\right) > 0$ as $X_L > X_H$. Therefore $\frac{\partial t_H}{\partial B} < \frac{\partial t_L}{\partial B}$. Finally, the fact that $\frac{\partial X_H}{\partial B} > 0$ implies that $\frac{\partial t_H}{\partial B} > 0$ from the binding (IR_H). Therefore, we have proved that $0 < \frac{\partial t_H}{\partial B} < \frac{\partial t_L}{\partial B} = 1$.

Thus, we can rewrite:

$$\begin{aligned}\Delta &= \left(q_L k \frac{\partial t_L}{\partial B} + q_H k \frac{\partial t_H}{\partial B}\right) dB - dB \\ &= k\left(q_L + q_H \frac{\partial t_H}{\partial B}\right) dB - dB < 0\end{aligned}$$

That is, when the budget decreases from $\overline{B}$, the funding authority's objective function increases. Therefore, the funding authority can improve its payoff by decreasing the budget below $\overline{B}$.

We next prove by contradiction that as long the budget is binding ($\lambda > 0$), the power of incentive is smaller than that in the private procurement contract. Suppose to the contrary that the power of incentives is greater than the private procurement contract:

$$\frac{\left(\dfrac{q_L}{kq_Lc_L + \lambda c_L}\right)}{\left(\dfrac{q_H}{k\left(q_Hc_H + q_L\Delta c\right) + \lambda\Delta c}\right)} > \frac{\left(\dfrac{1}{c_L}\right)}{\left(\dfrac{1}{c_H + \dfrac{q_L}{q_H}\Delta c}\right)}, \text{ or}$$

$$\frac{k\left(c_H + \dfrac{q_L}{q_H}\Delta c\right) + \dfrac{\lambda\Delta c}{q_H}}{kc_L + \dfrac{\lambda c_L}{q_L}} > \frac{c_H + \dfrac{q_L}{q_H}\Delta c}{c_L}, \text{ or}$$

$$k\left(c_H + \frac{q_L}{q_H}\Delta c\right) + \frac{\lambda\Delta c}{q_H} > \left(k + \frac{\lambda}{q_L}\right)\left(c_H + \frac{q_L}{q_H}\Delta c\right),$$

and therefore we can cancel k and λ. Then, it is easy to show there is a contradiction since it requires that $q_Hc_H < 0$. ■

A.4. Numerical analysis

We present below two sets of simulations to numerically show how the optimal budget (B) and the power of incentives (X_L/X_H) vary with k. In Table 1, we present the results for different values of c_H when $c_L = 0.1$ and $q_L = 0.5$, and in Table 2, we show the results for different values of q_L when $c_L = 0.1$ and $c_H = 0.3$. In all the cases, the optimal budget weakly decreases whereas the power of incentives weakly increases with k. We also present simulations that demonstrate that the value of the funding authority's objective function ($E[X] - B$) decreases with k and we prove it formally in Appendix A.5.

Table 1: Numerical results for different values of c_H when $c_L = 0.1$ and $q_L = 0.5$

	$c_H = 0.15$			$c_H = 0.20$			$c_H = 0.30$		
k	B	X_L/X_H	$E[X]$-B	B	X_L/X_H	$E[X]$-B	B	X_L/X_H	$E[X]$-B
0	3.3333	1.0000	3.3333	2.5000	1.0000	2.5000	1.8760	2.0000	1.8750
0.1	3.3333	1.0000	3.3333	2.4830	1.1045	2.4938	1.8690	2.1533	1.8728
0.2	3.3333	1.0000	3.3333	2.4330	1.2155	2.4764	1.8520	2.3115	1.8667
0.3	3.3333	1.0000	3.3333	2.3620	1.3296	2.4501	1.8280	2.4724	1.8577
0.4	3.3333	1.0000	3.3333	2.2820	1.4444	2.4180	1.8000	2.6344	1.8466
0.5	3.3333	1.0000	3.3333	2.2020	1.5585	2.3826	1.7700	2.7964	1.8341
0.6	2.6200	1.0385	3.2525	2.1250	1.6713	2.3458	1.7400	2.9580	1.8207
0.7	2.4600	1.1233	3.1503	2.0530	1.7824	2.3088	1.7110	3.1188	1.8069
0.8	2.3250	1.2059	3.0552	1.9880	1.8920	2.2726	1.6830	3.2785	1.7931
0.9	2.2110	1.2868	2.9675	1.9300	2.0003	2.2377	1.6570	3.4374	1.7793
1.0	2.1140	1.3662	2.8868	1.8780	2.1074	2.2041	1.6330	3.5955	1.7657
	$c_H = 0.40$			$c_H = 0.50$			$c_H = 0.60$		
k	B	X_L/X_H	$E[X]$-B	B	X_L/X_H	$E[X]$-B	B	X_L/X_H	$E[X]$-B
0	1.6680	3.0000	1.6667	1.5640	4.0000	1.5625	1.5010	5.0000	1.5000
0.1	1.6640	3.2030	1.6654	1.5610	4.2528	1.5616	1.4990	5.3027	1.4993
0.2	1.6540	3.4102	1.6619	1.5540	4.5096	1.5592	1.4940	5.6093	1.4975
0.3	1.6400	3.6199	1.6567	1.5440	4.7687	1.5556	1.4860	5.9179	1.4947
0.4	1.6240	3.8309	1.6503	1.5330	5.0290	1.5511	1.4780	6.2281	1.4914
0.5	1.6060	4.0419	1.6431	1.5210	5.2898	1.5461	1.4690	6.5386	1.4875
0.6	1.5890	4.2530	1.6353	1.5090	5.5505	1.5407	1.4590	6.8486	1.4834
0.7	1.5710	4.4632	1.6272	1.4960	5.8102	1.5351	1.4500	7.1589	1.4791
0.8	1.5540	4.6728	1.6190	1.4840	6.0697	1.5294	1.4400	7.4677	1.4747
0.9	1.5380	4.8817	1.6108	1.4730	6.3289	1.5236	1.4310	7.7764	1.4703
1.0	1.5230	5.0899	1.6027	1.4620	6.5871	1.5178	1.4230	8.0851	1.4659

Table 2: Numerical results for different values of q_L when $c_L = 0.1$ and $c_H = 0.3$

	$q_L = 0.1$			$q_L = 0.2$			$q_L = 0.3$		
k	***B***	X_L/X_H	$E[X]$-B	***B***	X_L/X_H	$E[X]$-B	***B***	X_L/X_H	$E[X]$-B
0	1.6667	1.0000	1.6667	1.6667	1.0000	1.6667	1.6667	1.0000	1.6667
0.1	1.6667	1.0000	1.6667	1.6667	1.0000	1.6667	1.6667	1.0000	1.6667
0.2	1.6667	1.0000	1.6667	1.6667	1.0000	1.6667	1.6250	1.0626	1.6583
0.3	1.6667	1.0000	1.6667	1.6667	1.0000	1.6667	1.5600	1.1791	1.6366
0.4	1.6667	1.0000	1.6667	1.6667	1.0000	1.6667	1.4800	1.2987	1.6075
0.5	1.6667	1.0000	1.6667	1.6667	1.0000	1.6667	1.3940	1.4179	1.5732
0.6	1.6667	1.0000	1.6667	1.2930	1.0435	1.6256	1.3100	1.5347	1.5361
0.7	1.6667	1.0000	1.6667	1.1720	1.1371	1.5691	1.2330	1.6487	1.4981
0.8	1.6667	1.0000	1.6667	1.0660	1.2258	1.5126	1.1630	1.7593	1.4603
0.9	1.6667	1.0000	1.6667	0.9740	1.3097	1.4576	1.1000	1.8665	1.4236
1.0	1.6667	1.0000	1.6667	0.8960	1.3903	1.4052	1.0450	1.9716	1.3884

	$q_L = 0.4$			$q_L = 0.5$			$q_L = 0.6$		
k	***B***	X_L/X_H	$E[X]$-B	***B***	X_L/X_H	$E[X]$-B	***B***	X_L/X_H	$E[X]$-B
0	1.7010	1.3333	1.7000	1.8760	2.0000	1.8750	2.2010	3.0000	2.2000
0.1	1.6910	1.4586	1.6966	1.8690	2.1533	1.8728	2.1980	3.1818	2.1989
0.2	1.6620	1.5919	1.6866	1.8520	2.3115	1.8667	2.1900	3.3661	2.1960
0.3	1.6190	1.7298	1.6712	1.8280	2.4724	1.8577	2.1780	3.5519	2.1916
0.4	1.5690	1.8694	1.6518	1.8000	2.6344	1.8466	2.1640	3.7384	2.1863
0.5	1.5160	2.0087	1.6298	1.7700	2.7964	1.8341	2.1490	3.9252	2.1802
0.6	1.4650	2.1470	1.6064	1.7400	2.9580	1.8207	2.1340	4.1120	2.1737
0.7	1.4160	2.2834	1.5825	1.7110	3.1188	1.8069	2.1190	4.2986	2.1668
0.8	1.3700	2.4177	1.5586	1.6830	3.2785	1.7931	2.1040	4.4848	2.1598
0.9	1.3280	2.5502	1.5352	1.6570	3.4374	1.7793	2.0900	4.6707	2.1526
1.0	1.2900	2.6811	1.5125	1.6330	3.5955	1.7657	2.0760	4.8560	2.1456

	$q_L = 0.7$			$q_L = 0.8$			$q_L = 0.9$		
k	***B***	X_L/X_H	$E[X]$-B	***B***	X_L/X_H	$E[X]$-B	***B***	X_L/X_H	$E[X]$-B
0	2.6751	4.6667	2.6750	3.3001	8.0000	3.3000	4.0751	18.0000	4.0750
0.1	2.6740	4.8774	2.6746	3.2999	8.2402	3.2999	4.0751	18.2700	4.0750
0.2	2.6710	5.0892	2.6736	3.2992	8.4807	3.2997	4.0750	18.5401	4.0750
0.3	2.6667	5.3017	2.6720	3.2982	8.7215	3.2993	4.0750	18.8102	4.0750
0.4	2.6615	5.5147	2.6700	3.2970	8.9625	3.2989	4.0749	19.0804	4.0749
0.5	2.6557	5.7280	2.6677	3.2955	9.2036	3.2983	4.0748	19.3505	4.0749
0.6	2.6495	5.9413	2.6652	3.2939	9.4449	3.2977	4.0746	19.6207	4.0748
0.7	2.6432	6.1547	2.6625	3.2922	9.6862	3.2970	4.0745	19.8909	4.0748
0.8	2.6367	6.3681	2.6596	3.2904	9.9275	3.2963	4.0743	20.1612	4.0747
0.9	2.6303	6.5813	2.6567	3.2886	10.1688	3.2955	4.0741	20.4314	4.0746
1.0	2.6240	6.7944	2.6538	3.2867	10.4102	3.2947	4.0739	20.7017	4.0746

A.5. Proof that the funding authority's payoffs weakly decrease with *k*

Call W the objective function of the funding authority: $W= E[X] - B$. The first order condition of the funding authority requires that $\frac{\partial W}{\partial B} = 0$. Therefore, using the envelope theorem, $\frac{dW}{dk} = \frac{\partial W}{\partial k} = \frac{\partial E[X]}{\partial k} \leq 0$ from section 3.2 (with a strict inequality in the separating equilibrium). ■

A.6. Control by the principal

Control under complete information about k

The funding authority's problem is

$$Max \;\; \bar{X}(B, k') - B - m(p(k'))$$

where $\bar{X} \equiv q_L X_L + q_H X_H$ and $k' \equiv k(1-p)$. The FOC with respect to B is

$$\frac{\partial \bar{X}(B, k')}{\partial B} = 1$$

Differentiating with respect to k gives

$$(A18) \quad \frac{\partial^2 \bar{X}}{\partial B^2}\frac{dB}{dk} + \frac{\partial^2 \bar{X}}{\partial B \partial k'}\frac{dk'}{dk} = 0$$

Here, $\frac{\partial^2 \bar{X}}{\partial B^2} < 0$ because of local second-order condition and $\frac{\partial^2 \bar{X}}{\partial B \partial k'} < 0$ because the sign of $\frac{\partial^2 \bar{X}}{\partial B \partial k'}$ is the same as $\frac{dB}{dk'}$, which has been shown to be negative in the main model where $k' = k$. Finally, $\frac{dk'}{dk} = \left(1 - p - k\frac{dp}{dk}\right) > 0$: Suppose not. Then $k_1 = a < k_2 = b$ (for any k_1, k_2) implies that $k_1' = c > k_2' = d$, and $c < a$ and $d < b$ for $p > 0$. Then given the convexity of the control cost function, the funding authority can achieve the same outcome with a smaller control cost by making $k_1' = d$ and $k_2' = c$, which is a contradiction.

With $\frac{\partial^2 \bar{X}}{\partial B^2} < 0$, $\frac{\partial^2 \bar{X}}{\partial B \partial k'} < 0$, $\frac{dk'}{dk} > 0$, (A18) implies that $\frac{dB}{dk} < 0$. ■

Control under asymmetric information about k

Suppose $k \in \{k^L, k^H\}$, where $k^L < k^H$. Since under complete information $B^L > B^H$, the incentive constraint of the bureaucrat with k^H (IC^{kH}) is the relevant one. The funding authority's problem is now:

$$L = \pi^L[\bar{X}^L - B^L - m(p^L)] + \pi^H[\bar{X}^H - B^H - m(p^H)] + \alpha[U\big(B^H, k^H(1-p^H)\big) - U(B^L, k^H(1-p^L))]$$

where α the Lagrange multiplier for (IC^{kH})

The FOCs are:

$$\frac{\partial L}{\partial B^L} = \pi^L\left[\frac{\partial \bar{X}^L}{\partial B^L} - 1\right] - \alpha\frac{\partial U(B^L, k^H(1-p^L))}{\partial B^L} = 0$$

$$\frac{\partial L}{\partial B^H} = \pi^H\left[\frac{\partial \bar{X}^H}{\partial B^H} - 1\right] + \alpha\frac{\partial U(B^H, k^H(1-p^H))}{\partial B^H} = 0$$

$$\frac{\partial L}{\partial p^L} = \pi^L\left[\frac{\partial \bar{X}^L}{\partial p^L} - m'(p^L)\right] - \alpha\frac{\partial U(B^L, k^H(1-p^L))}{\partial p^L} = 0$$

$$\frac{\partial L}{\partial p^H} = \pi^H\left[\frac{\partial \bar{X}^H}{\partial p^H} - m(p^H)\right] + \alpha\frac{\partial U(B^H, k^H(1-p^H))}{\partial p^H} = 0$$

Re-arranging these conditions give:

$$(A19) \quad \frac{\partial \bar{X}^L}{\partial B^L} = 1 + \frac{\alpha}{\pi^L}\frac{\partial U(B^L, k^H(1-p^L))}{\partial B^L}$$

$$(A20) \quad \frac{\partial \bar{X}^H}{\partial B^H} = 1 - \frac{\alpha}{\pi^H}\frac{\partial U\big(B^H, k^H(1-p^H)\big)}{\partial B^H}$$

$$(A21) \quad m'(p^L) = \frac{\partial \bar{X}^L}{\partial p^L} - \frac{\alpha}{\pi^L}\frac{\partial U\big(B^L, k^H(1-p^L)\big)}{\partial p^L}$$

$$(A22) \quad m'(p^H) = \frac{\partial \bar{X}^H}{\partial p^H} + \frac{\alpha}{\pi^H}\frac{\partial U(B^H, k^H(1-p^H))}{\partial p^H}$$

Here, from the bureaucrat's problem, using the envelop theorem

$$\frac{\partial U(B^L,k^H(1-p^L))}{\partial B^L} > 0;\ \frac{\partial U(B^H,k^H(1-p^H))}{\partial B^H} > 0;\ \frac{\partial U(B^L,k^H(1-p^L))}{\partial p^L} < 0;\ \frac{\partial U(B^H,k^H(1-p^H))}{\partial p^H} < 0$$

Then, given that $\frac{\partial^2 \bar{X}}{\partial B^2} < 0$ and $m''(p) > 0$ and that the case of symmetric information corresponds to $\alpha = 0$, (A19) ~ (A22) imply that asymmetric information decreases B^L, increases B^H, increases p^L, and decreases p^H (it strictly decreases or increases if ($\mathrm{IC}^{k\mathrm{H}}$) is binding). ■

A.7. The centralization contract under a collusive monitor with costly monitoring

Inspecting (CIC) and (IR^m) shows that (CIC) is stricter than (IR^m), so (CIC) is binding, if $z \leq z_0 \equiv q_H(\tilde{t}_L - \tilde{t}_H)$, where $\tilde{t}_L$ and $\tilde{t}_H$ are separating-equilibrium transfers given to the agent under a collusive monitor with free monitoring: $\tilde{t}_L - \tilde{t}_H = \left[\frac{c_L}{2}\left(\frac{q_L}{c_L}\right)^2 + \frac{\Delta c}{2}\left(\frac{q_H}{\Delta c}\right)^2\right] - \frac{c_H}{2}\left(\frac{q_H}{\Delta c}\right)^2 = \frac{c_L}{2}\left[\left(\frac{q_L}{c_L}\right)^2 - \left(\frac{q_H}{\Delta c}\right)^2\right]$. In this case, we have the same centralization contract as analyzed when monitoring is free (z = 0). The reward given to the monitor to deter the bribe, $s_H = \tilde{t}_L - \tilde{t}_H$, also pays for z.

If $z > z_0$, the (IR^m) constraint is stricter than (CIC). The funding authority will adjust the centralization contract by reducing the distortion due to collusion. In particular, for $q_H(\tilde{t}_L - \tilde{t}_H) < z < q_H(t_L^{PP} - t_H^{PP})$, both ($CIC$) and ($IR^m$) are binding and the funding authority increases the difference between t_L and t_H toward the second best level. The reward to the monitor is $s_H = \frac{z}{q_H}$.

If z becomes very large such that $z > q_H(t_L^{PP} - t_H^{PP})$, only ($IR^m$) is binding and the funding authority can actually offer the second best contract without fear of collusion as s_H becomes very large: $s_H = \frac{z}{q_H} > t_L^{PP} - t_H^{PP}$.

Bibliography

Aberbach, Joel, Robert Putnam and Bert Rockman, *Bureaucrats and Politicians in Western Democracies*, Harvard University Press, Cambridge, Massachusetts, 1981.

Aghion, Philippe and Jean Tirole, "Formal and Real Authority in Organizations," *Journal of Political Economy*, 105(1), 1-29, 1997.

Alesina, Alberto and Guido Tabellini, "Bureaucrats or Politicians? Part I: A Single Policy Task," *American Economic Review*, 97(1), 169-179, 2007.

Antle, Rick and Gary Eppen, "Capital Rationing and Organizational Slack in Capital Budgeting," *Management Science*, 31(2), 163-174, 1985.

Banerjee, Abhijit, "A Theory of Misgovernance," *Quarterly Journal of Economics*, 112(4), 1289-1332, 1997.

Benabou, Roland and Jean Tirole, "Intrinsic and Extrinsic Motivation," *Review of Economic Studies*, 70(3), 489-520, 2003.

Besley, Tim and Maitreesh Ghatak, "Competition and Incentives with Motivated Agents," *American Economic Review*, 95(3), 616-636, 2005.

Biglaiser, Gary and Ching-to Albert Ma, "Moonlighting: Public Service and Private Practice," *RAND Journal of Economic*s, 38(4), 1113-1133, 2007.

Borcherding, Thomas and Portia Besocke, "The Contemporary Political Economy Approach to Bureaucracy," in C. Rowley and F. Schneider (ed.), *The Encyclopedia of Public Choice*, 440-445, 2003.

Brehm, John and Scott Gates, *Working, Shirking, and Sabotage*, University of Michigan Press, Ann Arbor, Michigan, 1997.

Celik, Gorkem, "Mechanism Design with Collusive Supervision," *Journal of Economic Theory*, 144(1), 69-95, 2009.

Department of Defense Office of the Inspector General, *Do Purchases Made Through the General Services Administration* (D-2005-096), 2005. Available at http://www.dodig.osd.mil/Audit/reports/FY05/05-096.pdf

Dewatripont, Mathias, Ian Jewitt, and Jean Tirole, "The Economics of Career Concerns, Part II: Application to Missions and Accountability of Government Agencies," *Review of Economic Studies*, 66(1), 199–217, 1999.

Dixit, Avinash, "Incentives and Organizations in the Public Sector: An Interpretative Review," *Journal of Human Resources*, 37(4), 696–727, 2002.

Faure-Grimaud, Antoine, Jean-Jacques Laffont, and David Martimort, "Collusion, Delegation and Supervision with Soft Information," *Review of Economic Studies*, 70(2), 253-279, 2003

Hiriart, Yolande and David Martimort, "How Much Discretion for Risk Regulators?" *Working Paper*, 2011.

Holmstrom, Bengt and Paul Milgrom, “Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design,” *Journal of Law, Economics, and Organization,* 7 (special issue), 24-52, 1991.

Johnson, Ronald and Gary Libecap, “Agency Growth, Salaries and the Protected Bureaucrat,” *Economic Enquiry*, 27(3), 431-52, 1989.

Khalil, Fahad, David Martimort, and Bruno Parigi, “Monitoring a Common Agent: Implications for Financial Contracting,” *Journal of Economic Theory*, 135(1), 35-67, 2007.

Khalil, Fahad, Jacques Lawarree, and Sungho Yun, “Bribery versus Extortion: Allowing The Lesser of Two Evils,” *Rand Journal of Economics*, 41(1), 179-198, 2010.

Kofman, Fred and Jacques Lawarree, “Collusion in Hierarchical Agency.” *Econometrica*, Vol. 61 (1993), pp. 629-656.

Laffont, Jean-Jacques and David Martimort, “Collusion and Delegation,” *Rand Journal of Economics*, 29(2), 280-305, 1998.

Laffont, Jean-Jacques and Jean Tirole, *A Theory of Incentives in Procurement and Regulation*, MIT Press, Cambridge, Massachusetts, 1993.

Levin, Jonathan, “Relational Incentive Contract,” *American Economic Review*, 93(3), 835-847, 2003.

Lipsky, Michael, *Street-level Bureaucracy; Dilemmas of the Individual in Public Services*, 1980.

Martimort, David, “Multi-Contracting Mechanism Design,” in Blundell, Newey and Persson (eds.), *Advances in Economic Theory*, Proceedings of the World Congress of the Econometric Society, Cambridge University Press, 2007.

Mookherjee, Dilip and I. P. L. Png, “Corruptible Law Enforcers: How Should They Be Compensated?” *Economic Journal*, 105(1), 145-159, 1995.

McCubbins, Mathew D., Roger G. Noll, and Barry R. Weingast, “Administrative Procedures as Instruments of Political Control,” in *Journal of Law, Economics, & Organization*, 3(2), 243-77, 1987.

Migue, Jean-Luc and Gérard Bélanger, “Toward a General Theory of Managerial Discretion,” *Public Choice*, 17(1), 27–43, 1974.

Moe, Terry, “The Positive Theory of Public Bureaucracy,” in D. Mueller (ed.), *Perspectives on Public Choice*: A Handbook, Cambridge University Press, Cambridge, 1997.

Niskanen, William A., *Bureaucracy and Representative Government*, Aldine-Atherton, New York, 1971.

Pagano, Marco and Alisa Roell, “The Choice of Stock Ownership Structure: Agency Costs, Monitoring, and The Decision to Go Public,” *Quarterly Journal of Economics*, 113(1), 187-225, 1998.

Prendergast, Canice, “Limits of Bureaucratic Efficiency,” *Journal of Political Economy*, 111(5), 929-958, 2003.

Prendergast, Canice, “The Motivation and Bias of Bureaucrats,” *American Economic Review*, 97 (1), 180-196, 2007.

Rose-Ackerman, Susan "Reforming Public Bureaucracy through Economic Incentives?" *Journal of Law, Economics and Organization*, 2(1), 131-161, 1986.

Thomas, Lionel, "Non-linear Pricing with Budget Constraint," *Economic Letters*, 75, 257-263, 2002.

Tirole, Jean, "Hierarchies and Bureaucracies: On The Role of Collusion in Organizations," *Journal of Law, Economics, and Organization*, 2(2), 181-214, 1986.

Tirole, Jean, "Collusion and The Theory of Organizations," in J.-J. Laffont (ed.), *Advance in Economic Theory: Sixth World Congress*, 151-206, 1992.

Tirole, Jean, "The Internal Organization of Government," *Oxford Economic Papers*, 46(1), 1-29, 1994.

Wall Street Journal editorial, "Christmas in July," July 19, 2006.

Weber, Max, *The Theory of Social and Economic Organization.* The Free Press, New York, 1947.

Wilson, James Q., *Bureaucracy: What Government Agencies Do and Why They Do It*, Basic Books, New York, 1989.

Wilson, Woodrow "The Study of Administration," *Political Science Quarterly*, 2, 197-222, 1887.