Political accountability and sequential policymaking

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A R T I C L E   I N F O

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A B S T R A C T

We develop a model of political accountability with sequential policymaking. When a bureaucrat’s actions are transparent, his overseer faces a political time inconsistency problem—she is tempted to revise her retention rule in the middle of the policymaking process. As a result, the bureaucrat’s equilibrium behavior overemphasizes later tasks. If the overseer knows the technology by which policies translate into outcomes, then she can eliminate these distortions using task-specific budget caps. However, if the overseer is uncertain about this technology, such budget caps introduce ex post inefficiency. When uncertainty is sufficiently large and consequential, the overseer prefers an institutional environment with a fungible budget and no transparency. Such an environment allows the overseer to exploit the bureaucrat’s expertise, though at the cost of weaker overall incentives.

The launch of the Healthcare.gov website in October 2013 was a significant policy setback for the federal government. The site was meant to provide access to an online marketplace to facilitate the purchasing of mandatory health insurance under the 2010 Patient Protection and Affordable Care Act. However, it did not work as intended—users had trouble accessing the website, experienced long delays, and were unable to enroll in health insurance—setting off a political and policy crisis.

Many factors contributed to the problems at Healthcare.gov. The United States Government Accountability Office (GAO) reports that one important factor was a failure of oversight inside the Centers for Medicare & Medicaid Services (CMS). According to the GAO report, in early 2013, CMS identified significant problems in the work done by one of its major contractors, CGI Federal. CMS had the authority to hold CGI Federal accountable. But, the GAO reports, CMS “delayed key governance reviews” and “chose to forego actions, such as withholding the payment of fee, in order to focus on meeting the website launch date.” Indeed, in August of 2013, CMS sent a letter stating it “would take aggressive action, such as withholding fee ... if CGI Federal did not improve or if additional concerns arose,” but quickly withdrew the letter in order to “better collaborate with CGI Federal in completing the work in order to meet the October 1, 2013, launch.” It was only after the actual website launch failure that CMS took any significant actions to hold CGI Federal to account, transitioning responsibility from CGI Federal to Accenture Federal Services in January, 2014. This episode illustrates a general problem in accountability and oversight in political settings. The sequential nature of the policymaking and implementation process creates issues of dynamic consistency. Up front, an overseer may assert that agents will be held accountable for actions taken throughout the process. But once a given action is taken, the overseer is primarily concerned with obtaining good outcomes going forward and, thus, may be tempted to revise the accountability standard to optimize future incentives. This appears to be what CMS did when it failed to punish CGI Federal for early failures in order to avoid future delays. If agents anticipate that overseers will so revise accountability standards, they can exploit this fact by shirking early in the process, as CGI Federal may have done.

We consider how the sequential nature of the policymaking process impacts the efficacy of political accountability and optimal political institutions. Political economy models typically assume that there is only a single policy action prior to moments of accountability. However, in most important policy domains, a policymaker or bureaucrat takes multiple sequential actions between decisions by an overseer.

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regarding whether to reward or punish the agent. Such dynamic considerations have not been captured in the context of models of political agency.6

We develop a model of political agency with sequential actions. Our model is in the tradition that focuses on agency problems in bureaucratic politics associated with incentives for effort or budget expenditures (McCubbins et al., 1987; Moe, 1990).7 Our model yields two key kinds of results that underscore the importance of explicitly modeling sequential policymaking. First, our model gives rise to equilibrium behavior that overemphasizes the late stages of the policymaking process. The intuition behind this result is the political time inconsistency problem described above.

Second, we provide a novel argument for the potential benefits of eliminating transparency in political settings. This argument starts with the observation that, if the overseer knows the technology by which policy translates into outcomes, then she can solve the time inconsistency problem, while maintaining the most powerful incentives possible, by establishing perfectly tailored task-specific budget caps. However, if the overseer is uncertain about this technology, such task-specific budget caps introduce ex post inefficiency by constraining the policymaker's ability to allocate resources to those tasks that turn out to have the highest marginal returns. In effect, in the presence of uncertainty, task-specific budget caps achieve ex ante efficiency at the cost of sacrificing the overseer's ability to use the ex post expertise of the policymaker. We show that when uncertainty is large and consequential, the optimal institution for the overseer can be one that is strictly inferior without uncertainty—in particular, the optimal institution may have neither transparent actions nor task-specific budgets. Eliminating transparency weakens incentives. However, it can nonetheless be beneficial on net because the overseer, lacking information about the policymaking process, can do better by forcing herself not to manage the details of the policymaker's behavior. She does so by tying her hands to condition retention decisions only on outcomes and leaving the budget fungible.

As we highlight in Section 7, the logic of this argument has a number of implications for both institutional and policy design. It suggests that, in institutional settings characterized by transparency, policy designers may wish to mandate policy interventions that are less sensitive to early stage inputs (e.g., crafting rules) and are more sensitive to late stage inputs (e.g., monitoring and enforcement). This may be true even when such an approach would not be optimal absent the distortions associated with the overseer's time inconsistency problem. With respect to institutional design, our analysis sheds new light on debates over the merits of "fire alarm" vs. "police patrol" approaches to legislative oversight (McCubbins and Schwartz, 1984). Police patrols involve active oversight and, thus, induce transparency and allocative distortions of the sort we model. A fire alarms approach, by contrast, conditions oversight only on outcomes, eliminating allocative distortions, albeit at the cost of reduced incentive power. For policy problems characterized by sequential policymaking, our model provides an argument for the potential relative appeal of a fire alarms approach.

The paper proceeds as follows. Section 1 discusses empirical settings captured by our modeling approach and presents a simple numerical example of our main argument. Section 2 describes the model. Sections 3–4 provide the main formal analysis of the baseline model, including a characterization of a second-best benchmark and equilibrium. Section 5 considers the effect of transparency and task-specific budget caps in the baseline model. Section 6 shows that non-transparency can be optimal when the overseer is uncertain of the production technology. Section 7 discusses applications. Section 8 offers concluding remarks, including a discussion of the extent to which our results can be expected to extend to other canonical approaches to modeling bureaucratic politics.

1. Setting and basic argument

We study a game between an Overseer (she) and a Bureaucrat (he). Before turning to the formalization, we first describe the basic structure of our model and the political settings it is meant to describe, and provide a simple numerical example that illustrates our argument.

In our game, the Bureaucrat allocates resources to two sequential tasks (call the allocations $a_1$ and $a_2$), both of which impact the eventual success or failure of a policy. The Overseer has an opportunity to communicate with the Bureaucrat prior to each action. After the Bureaucrat has taken both actions and the policy outcome has been realized, the Overseer retains or dismisses the Bureaucrat.

Modeling the Overseer's decision as being about whether to retain the Bureaucrat captures a key feature of political environments in a simple way. In many political settings, overseers are constrained to use blunt instruments, such as retaining or replacing policymakers, allocating or not allocating a fixed budget, or reassigning an agent to a less desirable job. Our model of the retention decision may be interpreted more broadly as a model of such blunt instruments.

The two key features that characterize the institutional environment we model—an Overseer with retention authority and a fixed moment of accountability—describe a large number of government bureaucratic appointees, where our model of communication between the Overseer and Bureaucrat is particularly natural. As our opening example highlights, such relationships exist within the hierarchy of the bureaucracy itself at many levels. In the United States, they are perhaps most visible between the President and many senior appointed bureaucratic officials. For instance, many heads of executive bureaus (e.g., the Federal Energy Regulatory Commission, Internal Revenue Service, and Federal Aviation Administration, among many others) and independent agencies (e.g., the National Transportation Safety Board, Securities and Exchange Commission, Federal Trade Commission, Defense Nuclear Facilities Safety Board, and Federal Communications Commission, among many others) hold their offices for a fixed term subject to reappointment or replacement by the President.8 Similar institutional arrangements are common outside the United States. For instance, the members of the European Food Safety Authority and the French Competition Authority (which polices anti-competitive behavior), Prudential Supervisory Authority (which monitors banks and insurance companies), and High Health Authority, among many others, all serve for fixed, renewable terms.

Now consider a simple numerical example of our argument. The Bureaucrat values retaining office and also values resources that he doesn't expend on policy. In the example, the value of retaining office is $B = 1$, the Bureaucrat's budget is $\tilde{A} = 4$, and the value of resources not expended on policy is given by the square root. For the sake of the example, assume that the probability the policy succeeds is given by a symmetric and concave function, so that, for any given level of spending, the probability of success is maximized if the resources are divided evenly between the two tasks.

Start by noticing that the most the Bureaucrat could possibly be induced to spend between the two tasks is an amount, $A^\text{Thos}$, that leaves

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6 The most closely related theoretical literature we are aware of is papers by Sarafidis (2007) and Muthoo and Shepsle (2010) that focus on explaining the well-known pattern of behavior whereby voters primarily focus their attention on the later stages of a politician’s term leading incumbents to allocate disproportionately more effort or resources to these later stages (Popkin et al., 1976; Shepsle and Weingast, 1981; Weingast et al., 1981; Figlio, 2000; Rothenberg and Sanders, 2000; Albouy, 2011). Even in these models, the overemphasis of late stages emerges due to the assumption that the voters have a “recency bias”. In our model, related time inconsistency is the result of strategic factors with a rational overseer.

7 Another research tradition in bureaucratic politics focuses on ideological disagreements (Epstein and O’Halloran, 1994; Clinton and Lewis, 2008; Lavertu et al., 2013). We discuss the extent to which our results can be expected to extend to such environments in Section 8.

8 See Lewis and Selin (2012) for a complete description of all federal bureaucratic positions with fixed terms of office.
him just indifferent between expending $A^{\text{max}}$ and being retained (making a payoff of $1 + \sqrt{4 - A^{\text{max}}}$) or expending nothing and not being retained (making $\sqrt{4} = 2$). Setting these equal we have $A^{\text{max}} = 3$. Since it is optimal to split resources evenly between the two tasks, the Overseer’s second best is $a_1 = 1.5$ and $a_2 = 1.5$. If the Overseer could fully commit to a retention rule at the beginning of the game, she could achieve this second-best outcome by committing to retain if and only if the Bureaucrat chose $a_1 = 1.5$ and $a_2 = 1.5$. Under this retention rule, the Bureaucrat has a best response to do so.

The key feature of our setting is that we limit the Overseer’s commitment power. In particular, we allow the Overseer to revise her retention rule (at small cost) after each of the agent’s allocation decisions. Once such revisions are allowed for, the Overseer can no longer achieve the second best.

To see this, consider what would happen if the Bureaucrat allocated 1.5 units to the first task. Prior to the second allocation decision, the Overseer has an incentive to revise the retention rule, conditioning the Bureaucrat’s retention only on the second expenditure. By doing so, the Overseer can extract almost all of the Bureaucrat’s remaining budget (inducing total expenditures close to 4). To see this, suppose, after an initial allocation of $a_1 = 1.5$, the Overseer informs the Bureaucrat that he will only be retained if he expends an amount $a_2$ on the second task. Now the Bureaucrat faces a choice between expending $a_2$ and being retained (thereby making $1 + \sqrt{4 - 1.5 - a_2} = \sqrt{4 - a_2}$) or not expending $a_2$ and being replaced (thereby making $\sqrt{4 - 1.5}$). The maximal amount that can be extracted from the Bureaucrat at this point is the $a_2$ that leaves him just indifferent:

$$1 + \sqrt{4 - 1.5 - a_2} = \sqrt{4 - 1.5} \Rightarrow a_2 = -1 + \sqrt{10} \approx 2.16.$$  

The Bureaucrat can anticipate the Overseer’s incentive to revise the retention rule. So, in our example, the Bureaucrat anticipates that if he spends $a_1 = 1.5$ in the first governance period, his total expenditures will end up being approximately $3.66 > A^{\text{max}} = 3$. The Bureaucrat would have been better off simply spending nothing and foregoing retention. Indeed, the Bureaucrat anticipates that if he makes any allocation to the first task that is greater than 0, the Overseer will revise her retention rule to extract total expenditures that are greater than $A^{\text{max}}$.

As such, the Bureaucrat has a best response to expend nothing on the first task, and then achieve certain retention by expending exactly $a_2 = A^{\text{max}}$ on the second task in response to the Overseer’s revised retention rule. As a consequence, in equilibrium, the Bureaucrat’s expenditures end up inefficiently backloaded.

We explore institutional approaches to eliminating this distortion. One avenue is concealing the Bureaucrat’s resource expenditures from the Overseer, thereby forcing the Overseer to condition her retention decision only on whether the project succeeds, not on allocations to specific tasks. This has two effects. First, it weakens incentives, thereby reducing the Bureaucrat’s total expenditures. Second, it creates incentives for the Bureaucrat to allocate those resources that he does expend efficiently across tasks. The option to eliminate transparency, thus, creates a trade-off between incentive power and efficiency. As such, eliminating transparency, while potentially improving the Overseer’s welfare, does not allow her to achieve the second best.

Another avenue is using task-specific budget caps to eliminate distortions. Budget caps allow the Overseer to commit to extract no more than a certain amount of resources from the Bureaucrat for a given task. In our example, if the budget cap for the second task is 1.5, the Bureaucrat no longer has to worry about being forced to allocate more than 1.5 to the second task after allocating 1.5 to the first task. Perfectly tailored task-specific budget caps, then, allow the Overseer to eliminate her time-inconsistency problem and achieve the second best.

Perfectly tailoring the task-specific budget caps requires the Overseer to have detailed knowledge of the policy production function—an informational requirement that may be too strong in many settings. We show that, if the Bureaucrat has private information about the relative importance of the two tasks, budget caps lead to ex post inefficiency, since the best the Overseer can do is impose the optimal budget caps given her ex ante information. When such informational asymmetry exists, eliminating transparency and leaving the budget fungible may in fact be a better institutional arrangement than imposing ex ante optimal budget caps.

2. The model

The game consists of two successive policymaking stages followed by a retention stage. At the beginning of policymaking stage $t$, the Overseer sends a message, $m_t$, which is interpreted as the Overseer’s declaration of her retention rule. The Bureaucrat observes the message $m_t$ and chooses a resource allocation, $a_t$. The game ends with the retention stage in which the policy outcome is realized and the Overseer either retains or dismisses the Bureaucrat. The timeline is in Fig. 1.

All actions are observable to all players. (We will, later, consider a variant in which $a_1$ and $a_2$ are unobservable.) The retention rule that the Overseer uses in the retention stage may differ from the rules announced in the Overseer’s messages in the policymaking stages. Indeed, the retention rules declared during the policymaking stages are cheap talk, only the final retention rule determines whether the Bureaucrat is actually retained.9

In our main model, the total resources, $\bar{A}$, are fungible across tasks—i.e., the only constraint on allocations is $a_1 + a_2 \leq \bar{A}$. We will also consider a variant of the model with task-specific budget caps—i.e., requiring $a_1 \leq \bar{a}_1$, $a_2 \leq \bar{a}_2$, with $\bar{a}_1 + \bar{a}_2 = \bar{A}$.

The outcome, $\mathcal{O}$, of the policymaking process is either success $(s)$ or failure $(f)$. The probability of success is $p(a_1, a_2)$. We assume that $p(\cdot, \cdot)$ is increasing, twice continuously differentiable and strictly concave in each of its arguments, and has weak complementarities (i.e., $p_{a_1 a_2} \geq 0$). We also assume the following Inada conditions: $\lim_{a_i \to \infty} p_i(a_1, a_2) = 0$ for $i = 1, 2$ and any $a_i$. We refer to the function $p$ interchangeably as the policy success technology or the policy success function.

2.1. Payoffs

The Overseer cares only about the outcome of the policymaking process. She has a von Neumann–Morgenstern expected utility function with a payoff from policy success of one and a payoff from policy failure of zero.

The Bureaucrat values retention and rents from resources not allocated to policymaking. The Bureaucrat’s preferences are described by the following von Neumann–Morgenstern expected utility function:

$$v(a_1, a_2) = \begin{cases} B + u(\bar{A} - a_1 - a_2) & \text{if retained} \\ u(\bar{A} - a_1 - a_2) & \text{if not retained} \end{cases}$$

The term $B > 0$ represents the Bureaucrat’s benefit from being retained. The function $u(\cdot)$ represents the Bureaucrat’s payoffs from

9 As will become apparent below when we discuss our solution concept, we model communication explicitly, as in Persson and Tabellini (2000, Chapter 4.4), to make clear the role of revising communicated retention rules in determining equilibrium behavior.
resources that he controls but does not expend on policy. We assume that \( u \) is increasing, weakly concave, and twice continuously differentiable. To focus on the interesting case in which the Overseer cannot extract the entire budget from the Bureaucrat, we assume

\[ B < u(\bar{\lambda}) - u(0). \]

### 2.2 Strategies

A strategy for the Bureaucrat is a mapping from histories into a choice of actions. In particular, it is a pair of functions \((a_1(\cdot), a_2(\cdot; \cdot))\), where \(a_1(m_1)\) is the first stage allocation for any first-stage message and \(a_2(m_1, m_2, a_1)\) is the second stage allocation for any history \((m_1, m_2, a_1)\).

Let \( \mathcal{R} \) be the set of all retention rules—i.e., mappings from Bureaucrat actions and policy outcomes into a probability of retention. A strategy for the Overseer is a message choice in the first policymaking stage, a history-contingent message choice in the second policymaking stage, and a history-contingent retention rule in the retention stage. The Overseer’s strategy, then, is a triple \((m_1, m_2(\cdot), \rho(\cdot; \cdot; \cdot))\), where \(m_1 \in \mathcal{R}\) is the first-stage message, \(m_2(m_1, a_1) \in \mathcal{R}\) is the second-stage message following a history \((m_1, a_1)\), and \(\rho(m_1, m_2, a_1, a_2) \in \mathcal{R}\) is the retention rule actually used. Hence, following a history \((m_1, m_2, f, a_1, a_2, O)\), the probability of retention is \(\rho(m_1, m_2, a_1, a_2 | a_1, a_2, O) \in [0, 1]\).

### 2.3 Solution concept

Our basic solution concept is subgame perfect Nash equilibrium (SPNE). Since declarations of retention rules during policymaking stages are cheap talk, SPNE does not prevent the Overseer from declaring a retention rule early in the game and making a different declaration or using a different rule later. Moreover, the retention rule actually used in the retention stage is chosen after all actions are taken, so any rule is sequentially rational. As is usual in such environments, there are many equilibria.

We select an equilibrium by considering a perturbed game in which the Overseer bears a cost, \( \epsilon > 0 \), for changing a declared retention rule from one stage to the next. We call an SPNE robust to small revision costs if it is the limit of a sequence of equilibria in a sequence of nearby games with even smaller costs. Formally:

**Definition 2.1.** A SPNE, \( s^* = (m_1^*, m_2^*, \rho^*, a_1^*, a_2^*) \), is robust to small revision costs if, for all \( \delta > 0 \), there exists an \( \epsilon > 0 \) such that, for all \( \epsilon < \tau \), there is an equilibrium, \( s^\prime = (m_1^\prime, m_2^\prime, \rho^\prime, a_1^\prime, a_2^\prime) \), of the perturbed game, satisfying:

1. \( |m_1^\prime(a_1, a_2, O) - m_1^*(a_1, a_2, O)| < \delta \) for all \((a_1, a_2, O)\);
2. \( |m_2^\prime(m_1, a_1)(a_2, O) - m_2^*(m_1, a_2)(a_1, O)| < \delta \) for all \((m_1, a_1)\) and \((a_1, a_2, O)\);
3. \( |\rho^\prime(m_1, m_2, a_1, a_2)(a_1, a_2, O) - \rho^*(m_1, m_2, a_1, a_2)(a_1, a_2, O)| < \delta \) for all \((m_1, m_2, a_1, a_2, O)\);
4. \( |a_1^\prime(m_1) - a_1^*(m_1)| < \delta \) for all \(m_1\); and
5. \( |a_2^\prime(m_1, m_2, a_1) - a_2^*(m_1, m_2, a_1)| < \delta \) for all \((m_1, m_2, a_1)\).

The intuition for our selection criterion is that the Overseer may face small costs—reputational, psychological, or in terms of lost clarity of expectations—for acting contrary to her messages. As such, we select those equilibria in our pure cheap-talk game that are robust to the presence of small costs for the Overseer if she revises her declared retention rule from one stage to another.

Note that the equilibrium selected by this criterion corresponds to an equilibrium of a game identical to ours but with no communication. The cheap talk messages and selection criterion are picking out from a large set of equilibria of that game those equilibria that have the feature that the principal announces credible retention rules.

Before turning to the analysis, we add three interpretive comments on our solution concept. The first concerns the difference between our selection criterion and selection on Overseer welfare, which is a common approach in moral hazard models of political agency. Selection on Overseer welfare assumes that the Overseer can credibly commit, ex ante, to the retention rule that provides the best possible incentives. In a setting where the Bureaucrat takes only one action, this assumption may be innocuous. Indeed, in such a game, our selection criterion and selection on Overseer welfare are equivalent. However, as highlighted in our example, when we consider sequential policymaking, the commitment assumption runs up against the Overseer’s incentive to revise any declared rule that fails to provide optimal incentives at each continuation game. For instance, suppose that the Overseer declares that she will retain the Bureaucrat if and only if he takes some very good action in both policymaking stages. If the Bureaucrat shirks in the first policymaking stage, an Overseer who is fully committed to her originally declared rule will now fail to give the Bureaucrat any incentives in the second policymaking stage (since retention is already foregone). While institutional or informational constraints may prevent the Overseer from revising her rule, a convincing theoretical approach should first acknowledge the Overseer’s incentive to revise and then characterize when and whether those reasons have bit explicitly. Robustness to small revision costs formalizes the limit on the Overseer’s commitment power and facilitates our analysis of the welfare implications of institutional and informational constraints.

Second, our selection criterion is the appropriate counterpart, for our political economy setting, of renegotiation proofness. A contract is not renegotiation proof if both parties would be willing to change terms at some interim stage. In the contracting setting, both parties must agree to a change in terms. However, in our political economy setting, it is natural to think that the Overseer can unilaterally change the retention rule she plans to use. Thus, under our selection criterion, like under renegotiation proofness, the Overseer has some commitment power, but it is not complete. In particular, since there are positive costs to revising the retention rule and all Bureaucrat actions are taken prior to the retention stage, the Overseer can commit to a retention rule in the second policymaking stage. However, since the costs of revision are small, in the first policymaking stage the Overseer can credibly commit to a retention rule only to the extent that there will be no positive benefit to revising it in the second policymaking stage.

Finally, Fearon (1999) notes that often the predictions of pure moral hazard models of political agency are not robust to the introduction of very small amounts of type heterogeneity (among agents) because those predictions depend on the principal being indifferent between retaining and replacing. The argument is that, in the presence of even infinitesimally small amounts of type heterogeneity, retention decisions are pinned down by concerns about future payoffs. The applicability of this critique to our results is subtle because, while the Overseer is indeed indifferent at the retention stage, we also introduce the idea of revision costs in our solution concept. For any strictly positive revision cost, our Overseer (principal) would not be indifferent at the point of making her retention decision. As such, positive, but sufficiently small, amounts of future-payoff-relevant type heterogeneity would not necessarily lead the Overseer to abandon her declared retention rule. Of course, our solution concept focuses on the limiting case as revision costs go to zero, so the Overseer is becoming arbitrarily close to indifferent. We leave the non-limiting case—where the key question would be the relative magnitudes of the costs and the effect of type on the probability of success—for future research.

In what follows, we refer to an SPNE that is robust to small revision costs as an equilibrium.

\footnote{One can think of these revision costs as a kind of “lying cost” although, here, the costly lie is about future behavior rather than private information, as it is in Kartik (2009). Leaders in organizations routinely face such costs with respect to their subordinates, whose effort choices they motivate with the promise of future rewards.}
3. Benchmark with commitment

Before analyzing equilibrium behavior and the welfare consequences of various institutions, we characterize a useful benchmark: the outcome the Overseer achieves if she can commit to a retention rule ex ante. We begin with this benchmark because it identifies an upper bound on the Overseer’s welfare that is consistent with meeting the Bureaucrat’s participation constraint. As such, it can be thought of as a second best against which we can evaluate the costs of the Overseer’s time inconsistency problem.

If the Overseer wants to induce the Bureaucrat to spend a total amount $A^*$, the strongest incentives she can provide the Bureaucrat are to retain him if and only if he spends $A^*$. Hence, the most the Overseer can induce the Bureaucrat to spend between the two tasks is $A^\text{max}$ given by:

$$B + u(\bar{A} - A^\text{max}) = u(\bar{A}).$$

Notice that $A^\text{max}$ is increasing in the overall budget, $\bar{A}$. We suppress this functional dependence to avoid proliferation of notation. Denote the efficient division of resources across tasks as follows.

**Definition 3.1.** Let $(a_1(A), a_2(A))$ be the efficient division of total spending $A$. That is:

$$(a_1(A), a_2(A)) = \arg \max_{(a_1, a_2)} p(a_1, a_2) \text{ subject to } a_1 + a_2 = A.$$

The solution is unique and interior because of the concavity of $p$ and the Inada conditions. Hence, differentiability of $(a_1(\cdot), a_2(\cdot))$ follows from the implicit function theorem.

The Overseer can induce the Bureaucrat to spend $A^\text{max}$ efficiently by using a rule that retains if and only if the Bureaucrat chooses the allocation $(a_1(A^\text{max}), a_2(A^\text{max}))$. This implies the following.

**Proposition 3.1.** If the Overseer can commit to a retention rule ex ante, then the best outcome the Overseer can obtain is to induce the Bureaucrat to choose $(a_1(A^\text{max}), a_2(A^\text{max}))$.

**Proof.** Follows from the definitions of $A^\text{max}$ and $(a_1(\cdot), a_2(\cdot))$. 

The example in Section 1 highlights why this second-best outcome is not consistent with equilibrium. If the Bureaucrat were to allocate $a_1^*(A^\text{max})$ to the first task, because the Overseer can revise her retention rule, she would be able to extract more than $a_2^*(A^\text{max})$ in the second policy-making stage. This fact becomes crucial to the characterization of equilibrium in the next section.\(^{11}\)

4. Equilibrium with a fungible budget

We now turn to analysis of equilibrium in the model with a fungible budget. Lemma B.1 in the Online Appendix provides necessary and sufficient conditions for a strategy profile to be a SPNE that is robust to small revision costs. The logic of equilibrium is as follows. At the retention stage, all Bureaucrat actions have been taken. Hence, the Overseer will stick to whatever retention rule she declared in the second policymaking stage. Given this, the Bureaucrat will choose an allocation to the second task that is a best response to the retention rule declared by the Overseer at the beginning of the second policymaking stage. Further, once the second policymaking stage is reached, the actions in the first policymaking stage are already taken. As such, regardless of what happened in the first policymaking stage, in the second policymaking stage the Overseer will announce and then follow a retention rule that, when best responded to, maximizes the second allocation. Anticipating this fact, in the first policymaking stage the Bureaucrat will find an announced rule credible only if the Overseer will have no incentive to revise the rule in the second policymaking stage. The Bureaucrat will choose an allocation to the first task that is a best response to the rule he anticipates the Overseer will announce in the second policymaking stage, given that first allocation. Thus, in the first policymaking stage, the Overseer will announce a rule that, when best responded to, maximizes the first allocation, subject to the constraint that it then maximizes the second allocation at all histories. Given this logic, we solve for equilibrium behavior starting at the second policymaking stage.

Suppose the first allocation was $a_1$ and the Overseer wants to induce the Bureaucrat to allocate $a_2'$. The strongest incentive the Overseer can give the Bureaucrat is to reward that choice with certain retention, while punishing all other choices with certain non-retention. If the Overseer adopts such a rule, the best the Bureaucrat can do is either to choose $a_2'$ and be retained or allocate nothing to the second task and be replaced. Hence, the allocations to the second task that the Overseer can induce the Bureaucrat to choose following some history $(m_1, a_1)$ are characterized by the following result (omitted proofs are in the appendix):

**Lemma 4.1.** Let $\delta_2(a_1)$ satisfy

$$B + u(\bar{A} - a_1 - \delta_2) = u(\bar{A} - a_1)$$

and $\delta_2(a_1) = \min(\delta_2(a_1), \bar{A} - a_1)$. There exists $m_2 \in \mathbb{R}$ such that the Bureaucrat’s best response is to allocate $a_2$ following a history $(m_1, m_2, a_1)$, if and only if $\delta_2 \leq \delta_2(a_1)$.

Moreover, if $\delta_2(a_1) \leq \bar{A} - a_1$, then any $m_2$ that induces $\delta_2(a_1)$ as a best response must reward $\delta_2(a_1)$ with certain retention and any $a_2 < \delta_2(a_1)$ with certain replacement.

It is straightforward from our description of equilibrium (see point 3 of Lemma B.1 in the Online Appendix) that at any history $(m_1, a_1)$, the Overseer will declare a rule in the second policymaking stage that extracts $\delta_2(a_1)$.

What does this imply about the Bureaucrat’s allocation to the first task? Regardless of the $m_1$ announced, the Bureaucrat anticipates that, following any first-task allocation $(a_1)$, if he wants to be retained, he will have to expend $\delta_2(a_1)$. This will leave the Bureaucrat with a payoff of

$$B + u(\bar{A} - a_1 - \delta_2(a_1)).$$

Hence, the Bureaucrat wants to choose the $a_1$ that minimizes the sum $S(a_1) = a_1 + \delta_2(a_1)$.

As we saw in the example in Section 1, the Overseer’s ability to revise her retention rule following the first allocation increases the Overseer’s ability to extract resources from the Bureaucrat after the first allocation is sunk. Put differently, the sum $S(a_1)$ is increasing in $a_1$—the more the Bureaucrat spends on the first task, the more he is forced to spend overall. To see this, notice that at an $a_1$ where $S(a_1) < \bar{A}$, Eq. (2) implies:

$$u(\bar{A} - S(a_1)) = u(\bar{A} - a_1) - B.$$  

Consider an increase in $a_1$ to some $a_1' > a_1$. Clearly the right-hand side of Condition (3) decreases. Hence, the left-hand side must also decrease, which implies $S(a_1') > S(a_1)$.

Given this, it is straightforward that, anticipating the Overseer’s incentive to revise her retention rule, the Bureaucrat expends nothing on the first task. As such, to avoid bearing any revision costs, the Overseer in fact announces a rule that demands no expenditures on the
first task, but at each history will only retain if the expenditure is at least \( \delta_2(a_1) \) on the second task.\(^{12}\) This gives rise to the following result.

**Proposition 4.1.** In any equilibrium of the model with a fungible budget, the Bureaucrat's actions on the equilibrium path are \((a_1^*, a_2^*) = (0, \delta_2(0))\).

**Proof.** The result follows from Lemma 4.1, Lemma B.1, and the argument in the text. \(\blacksquare\)

With a fungible budget, the Overseer faces a severe time inconsistency problem. Because she cannot commit to a retention rule, she is unable to induce the Bureaucrat to expend any resources at the first policymaking stage.

Importantly, as the next result shows, total expenditures by the Bureaucrat are the same in the equilibrium of the model with a fungible budget and with ex ante commitment by the Overseer. Hence, the welfare consequences of the Overseer's time inconsistency problem are entirely due to a distortion of the allocation of expenditures across tasks.

**Proposition 4.2.** Total expenditures by the Bureaucrat are the same under ex ante commitment and in the equilibrium of the model under a fungible budget. That is,

\[
\bar{a}_1^* + \bar{a}_2^* = \bar{a}_2(0) = A^{\text{max}}.
\]

**Proof.** Follows from a comparison of Eqs. (1) and (2) evaluated at \(a_1 = 0\). \(\blacksquare\)

Let us relate these results back to the example in Section 1. There the second-best outcome was for the Bureaucrat to divide \(A^{\text{max}} = 3\) evenly between the two tasks. Proposition 4.2 shows that, in equilibrium, the Bureaucrat's total expenditures remain \(A^{\text{max}}\). However, Proposition 4.1 implies that, because of the Overseer's time inconsistency problem, the Bureaucrat will not divide the expenditures efficiently between the two tasks. Instead, he will spend nothing on the first task, allocating all three units to the second task.

5. Institutional responses: Transparency and budget caps

We now consider two potential institutional reforms to mitigate the effects of the Overseer's time inconsistency problem. The first is to eliminate transparency—i.e., make expenditures unobservable to the Overseer, so she can only condition retention decisions on the success or failure of the policy. The second is task-specific budget caps.

5.1. Eliminating transparency

Suppose the Overseer observes only the final policy outcome, not the Bureaucrat's expenditures. We will refer to this as a situation with non-transparent actions. The Overseer is constrained to use retention rules that are constant in \(a_1\) and \(a_2\). Denote the set of such retention rules with \(\mathcal{R}\). Here, equilibrium behavior is simple. Since actions are unobservable, the Overseer will never have a reason to revise her announced retention rule. Hence, the Overseer announces and sticks to the retention rule (in \(\mathcal{R}\)) that, when best responded to, maximizes her ex ante expected utility. The Bureaucrat chooses his expenditures as a best response to this retention rule.

Before turning to the analysis, one additional piece of notation will be useful. Define

\[
P(A) = p\left(\bar{a}_1^*(A), \bar{a}_2^*(A)\right)
\]

as the probability of success, given the efficient allocation of total effort \(A\). Given that \(p\) is differentiable in \(a_1\) and \(a_2\), and that \((a_1(\cdot), a_2(\cdot))\) is differentiable in \(A\), it is straightforward that \(p\) is differentiable in \(A\).

When actions are non-transparent, if the Overseer leaves the budget fungible, the retention rule conditions only on outcomes and so the probability of retention is pinned down by the probability of success. The cheapest way for the Bureaucrat to achieve any given probability of success (and, thus, retention) is to divide the resources efficiently between the two tasks. Consequently, regardless of the retention rule, eliminating transparency induces efficiency, as formalized in the next result:

**Lemma 5.1.** Fix any retention rule \(r \in \mathcal{R}\). The Bureaucrat's best response involves dividing whatever resources she expends efficiently between the first and second tasks.

Given that any rule induces an efficient division of resources, the Overseer's equilibrium rule must maximize the Bureaucrat's incentives for total expenditures. Not surprisingly, this rule is unique: the Overseer rewards policy success with certain retention and punishes policy failure with certain replacement. Given this, the equilibrium outcome is recorded in the following result.

**Proposition 5.1.** If actions are non-transparent and the budget is fungible, then the Overseer announces and sticks to a retention rule that retains with certainty following a successful outcome and replaces with certainty following a failed outcome. The Bureaucrat’s equilibrium expenditures are \((a_1(\mathcal{A}^{NT}), a_2(\mathcal{A}^{NT}))\), with \(\mathcal{A}^{NT} \in (0, \bar{A})\) given by:

\[
\frac{dp}{\mathcal{A}}(\mathcal{A}^{NT}) = u'(\bar{A} - \mathcal{A}^{NT}).
\]

By taking away the possibility of revising the retention rule part way through the policymaking process, non-transparency eliminates the Overseer’s time inconsistency problem. However, the efficiency associated with eliminating transparency comes at a cost. Without transparency, the Overseer can only condition her retention rule on outcomes, which are a noisy signal of expenditures. As such, the Bureaucrat’s incentives for expending resources are weaker. The next result formalizes this difference in incentive power.

**Proposition 5.2.** Total expenditures are strictly lower without transparency than with transparency, i.e., \(\mathcal{A}^{NT} < \bar{A}^{\text{max}}\).

Eliminating transparency induces a trade-off between the efficiency of the allocation of expenditures across tasks and the total size of the expenditures. Hence, eliminating transparency does not achieve the second best. Nonetheless, it is straightforward that, if the marginal impact of the first task in the policy success function is large enough relative to the impact of the second task, then the Overseer prefers non-transparency to transparency with a fungible budget.

5.2. Task-specific budget caps

We now consider the possibility that budgeting institutions could alleviate the distortions associated with the Overseer's time inconsistency problem, while leaving expenditures observable. In particular, if the amount of the total budget that can be spent on the second task is capped, then the Overseer's time inconsistency binds less fully and she may be able to induce some expenditure in the first policymaking period. Indeed, we show that the Overseer can fully solve the time inconsistency problem by choosing optimal task-specific budget caps.

The characterization of equilibrium in the case of budget caps is a bit more involved than with a fungible budget. The full characterization is in the Online Appendix. To get a sense of how equilibrium behavior differs under task-specific budget caps, suppose the second-task budget is \(\bar{a}_2 < \bar{A}^{\text{max}}\). Consider some history with \(a_1 > 0\). If the Overseer declares a

\[\text{Note two things. First, it does not matter what retention decision the Overseer announces for } a_2 > \delta_2(a_1),\text{ since taking this action is never a best response for the Bureaucrat. Second, if (contrary to our assumptions) } B > u(\bar{A}) - u(0),\text{ then the Overseer can extract the whole budget, allocated efficiently.}\]
retention rule, $m_2$, that retains the Bureaucrat with probability $r$ if he allocates the full budget, $a_2$, and replaces him otherwise, the Bureaucrat has a best response to allocate $a_2$ as long as:

$$rB + u(\bar{A} - a_1 - \pi_2) \geq u(\bar{A} - a_1).$$

Given this, we show the following in Lemma B.5 in the Online Appendix: If $a_1 + a_2 < A^{max}$, the Overseer can extract the entirety of $a_2$ without promising certain retention. If $a_1 + a_2 > A^{max}$, then the Overseer cannot extract all of $a_2$ even with the promise of certain retention. If $a_1 + a_2 = A^{max}$, the Overseer can only extract $a_2$ with the promise of certain retention.

These facts imply that, when there are task-specific budget caps, the Overseer can extract some spending on the first task while still announcing retention rules that she will not have an incentive to revise. She does so by exploiting the fact that, for $a_1 < A^{max} - a_2$, there are retention rules that are consistent with extracting the full second-task budget ($a_2$), but which do not promise certain retention. In particular, the Overseer uses a retention rule of the following form:

- If the Bureaucrat allocates ($A^{max} - a_2, a_2$), he is retained for certain.
- If the Bureaucrat allocates ($a_1, a_2$) with $a_1 < A^{max} - a_2$, he is retained with a probability $r < 1$ that is just sufficient to extract $a_2$.
- If the Bureaucrat allocates ($a_1, a_2$) with $a_1 > A^{max} - a_2$, he is retained for certain if $a_2 = a_2(a_1)$ and otherwise is replaced for certain.

Of course, this last option is not attractive to the Bureaucrat because $a_1 + a_2(a_1) > A^{max}$, for the same reason as in the case of a fungible budget when $a_1 > 0$.

Given this, Proposition 5.3 describes equilibrium allocations under task-specific budget caps. The proof is in the Online Appendix.

**Proposition 5.3.** Consider the game with task-specific budget caps $(\bar{a}_1, \bar{a}_2)$ satisfying $\bar{a}_1 + \bar{a}_2 = \bar{A}$. In equilibrium, the Bureaucrat’s actions on the equilibrium path are

$$(a_1^*, a_2^*) = \begin{cases} (0, A^{max}) & \text{if } \pi_2 \geq A^{max} \\ (A^{max} - \pi_2, \pi_2) & \text{if } \pi_2 < A^{max}. \end{cases}$$

This immediately implies that by capping the second allocation at precisely $\bar{a}_2 = \bar{a}(A^{max})$, the Overseer can constrain herself not to induce the Bureaucrat to spend a greater share of $A^{max}$ than is optimal on task 2. She must then put the balance of the overall budget in the task 1 budget. This optimal division and its welfare consequences are recorded in the next result.

**Proposition 5.4.** The Overseer’s equilibrium payoff under observable actions and fixed budget caps is:

1. The same as her payoff under ex ante commitment if and only if those budget caps are exactly
   $$(\bar{a}_1, \bar{a}_2) = \left(\bar{A} - \bar{a}_2(A^{max}), \bar{a}_2(A^{max})\right);$$

2. Strictly higher under these budget caps than under any other budget caps or under a fungible budget.

**Proof.** Follows from Proposition 5.3 and the definition of $\bar{a}_2$. □

Proposition 5.4 implies that the Overseer’s welfare is maximized by choosing precisely the right budget caps. Optimally chosen task-specific budgets undo the distortions caused by the Overseer’s time inconsistency problem, ensuring an efficient division of spending between the two tasks. Moreover, since there is no loss of incentive power, the Overseer is strictly better off under these budget caps than under a different set of budget caps or a fungible budget.

It is important to note that, although optimal budget caps allow the Overseer to achieve the welfare she would achieve under ex ante commitment, under such caps, it would appear to an observer that the Bureaucrat is over- emphasising tasks late in the policymaking process. In particular, under the optimal budget caps, the Bureaucrat always spends the full second-task budget allocation, but never spends the full first-task budget allocation. This is because, in order to overcome the Overseer’s time inconsistency problem and induce the Bureaucrat to divide the resources efficiently, the optimal budget caps put the entire portion of the budget that the Bureaucrat will consume as rents, $\bar{A} - A^{max}$, into the first-task’s budget.

Given Proposition 5.4, it might seem that an Overseer with budgetary control could eliminate rent-seeking entirely by allocating the optimal second-task budget and then reducing the first-task budget cap by $\bar{A} - A^{max}$. But this won’t work because $A^{max}$ itself is decreasing in the total resources available ($\bar{A}$). Hence, reducing the first-task budget (which is a reduction in the total budget) would decrease total expenditures by the Bureaucrat. In sum, even under the optimal budget caps, which eliminate the distortions associated with time inconsistency, the behavior of the Bureaucrat still will appear biased toward tasks late in the policymaking process, relative to the size of the budget caps.

Proposition 5.4 indicates that the Overseer can fully solve the time inconsistency problem and achieve the second best by creating an institutional environment that allows her to exert very strict control over the Bureaucrat. In particular, two aspects of the institutional environment are critical. First, the Overseer must set precisely the right task-specific budget caps. Second, it is important that the environment is transparent—that is, the Overseer can observe the Bureaucrat’s task-specific allocations and, thus, can exercise fine-grained control by conditioning her retention decisions on those allocations. While non-transparency is sometimes preferred to leaving actions observable and the budget fungible, it is dominated by optimal task-specific budget caps. In the next section we will see that this need not be the case if the Overseer has uncertainty over the policy success technology.

6. Uncertainty regarding policy success technology

The fact that the Overseer can do so well with task-specific budget caps and observable actions depends on a key informational assumption: in order to perfectly tailor the task-specific budget caps, the Overseer must know exactly what the policy success technology is. Given how demanding this assumption is, it is important to explore what happens when the Overseer lacks such information. We do so in this section by studying a setting with an incompletely informed Overseer and fully informed Bureaucrat.

We assume that the Bureaucrat knows the relative importance of the two inputs to achieving policy success, but that the Overseer does not. The case of a Bureaucrat with such expertise is natural in contexts relevant for our model.13 For instance, consider an intelligence agency tasked with preventing terrorism. Such agencies are often responsible for both intelligence gathering and for acting on such intelligence (e.g., through increases in security, drone strikes, and so on). These agencies tend to have significantly more information than legislative- or executive-branch overseers about the relevant security environment, and thus, about the relative effectiveness of each input for successfully thwarting terrorism. Similarly, consider the rollout of the federal health care exchange discussed in the Introduction. This rollout involved several steps, including identifying and approving health plans for inclusion in the exchange, promulgating a variety of regulations, and building and managing both the back- and front-ends of a website. The Department

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13 Similar types of expertise have been studied by a number of papers in the literature. See, among others, Epstein and O’Halloran (1994); Stephenson (2006); Gailmard and Patty (2007); Callander (2008, 2011); Ting (2009) and the literature reviewed by Gailmard and Patty (2012).
of Health and Human Services had access to significantly more information than the White House about the relative difficulty of these tasks and, thus, the amount of resources and effort each required. It is this kind of informational asymmetry about the importance of the various inputs to policy success that we model below.

As highlighted in the Introduction, our results will indicate a complete reversal in the Overseer’s preferred institutions relative to the setting with complete information. The basic logic for this reversal is as follows. When the Overseer is uncertain of the policy success technology, the budget caps that optimally solve the time inconsistency problem from the Overseer’s ex ante perspective induce an ex post inefficient division of resources across tasks. As we have already seen, this is not the case absent transparency. By eliminating transparency, the Overseer ties her hands to condition her retention decision only on the success or failure of policy. This induces the Bureaucrat to use his expertise to allocate resources efficiently between the two tasks. Moreover, once she eliminates transparency, the Overseer also wants to do away with her budget caps, instead deferring to the Bureaucrat by leaving the budget fungible.

Of course, as we have also already seen, the ex post efficiency that the Overseer gains by eliminating transparency and budget caps comes at a cost. Eliminating transparency reduces the power of incentives, lowering overall expenditures by the Bureaucrat. As we show below, if the Overseer’s uncertainty about the policy success technology is sufficiently large and consequential, she may be willing to accept this diminution in total expenditures in order to gain the benefits of ex post efficiency.

To study these ideas, we assume that the policy success function is given by \( p(a_1, a_2, \omega) \), where \( \omega \in \Omega \) is the state of the world. The Bureaucrat observes \( \omega \), which is his private information. Let \( \mu_0 \) be the Overseer’s prior that the state is \( \omega \). For each \( \omega \in \Omega \), \( p(\cdot, \omega) \) satisfies all of the conditions on \( p(\cdot, \cdot) \) above. We are interested in uncertainty over the relative importance of the two tasks, not the potential power of the policy success function. To focus our analysis on such uncertainty, we posit the following symmetry property:

**Assumption 1.** For any \((a_1, a_2)\), \( p(a_1, a_2, \omega) = p(a_2, a_1, \omega) \).

We continue to use the same equilibrium selection criterion—robustness to small revision costs—to select a perfect Bayesian equilibrium of this game. It will be useful to define the efficient division of resources, conditional on the state.

**Definition 6.1.** Let \((\alpha_1^E(A), \alpha_2^E(A))\) be the efficient division of total spending \( A \) conditional on \( \omega \). That is:

\[
(\alpha_1^E(A), \alpha_2^E(A)) = \arg \max_{(a_1, a_2)} \mu_0 p(a_1, A_{max} - a_1, \omega) + (1 - \mu_0) p(a_2, A_{max} - a_2, \omega) \quad \text{subject to} \quad a_1 + a_2 = A.
\]

The solution is unique and interior because of the concavity of \( p \) and the Inada conditions. Differentiability of \((\alpha_1^E(\cdot), \alpha_2^E(\cdot))\) follows from the implicit function theorem.

We now consider two scenarios: transparent and non-transparent allocation choices by the Bureaucrat.

### 6.1. Transparent actions and optimal budget caps

When actions are observable, behavior in a perfect Bayesian equilibrium that is robust to small revision costs in the model with uncertainty over the state is identical to behavior in a subgame perfect Nash equilibrium that is robust to small revision costs in the model without uncertainty. This is because, at each stage, regardless of beliefs, the expected probability of success is increasing in that stage’s allocation. Hence, the Overseer has incentives to revise in order to optimize incentives for the second allocation, just as in the model without uncertainty.

**Proposition 5.4** shows that, when the Overseer does not face uncertainty over the policy success technology, her welfare is maximized by setting perfectly tailored task-specific budget caps that induce the efficient division of \( A_{max} \) between the two tasks. Similarly, when the Overseer faces uncertainty over the policy success function, the best she can do is to choose task-specific budget caps that induce the ex ante optimal division of \( A_{max} \) between the two tasks. The concavity and Inada conditions on each \( p \) ensure that this optimal division is unique and interior. Hence, the Overseer’s problem reduces to choosing a task-two budget cap, \( a_2 = A_{max} - a_1 \), with \( a_1 \) satisfying

\[
\hat{a}_1 = \arg \max_{a_1} \left[ \mu_0 p(a_1, A_{max} - a_1, \omega) + (1 - \mu_0) p(a_1, A_{max} - a_1, \omega) \right].
\]  (5)

To summarize:

**Proposition 6.1.** If the Overseer is uncertain of the policy success function and the Bureaucrat’s actions are transparent, then the budget caps that maximize the Overseer’s ex ante expected utility from the game are \((A - A_{max} - \hat{a}_1, A_{max} - \hat{a}_1)\), \( \hat{a}_1 \) defined by Eq. (5). The Overseer’s ex ante expected utility under these caps is:

\[
\mu_0 p(\hat{a}_1, A_{max} - \hat{a}_1, \omega) + (1 - \mu_0) p(\hat{a}_1, A_{max} - \hat{a}_1, \omega).
\]

Moreover, the Overseer’s welfare is weakly higher under these caps than under any other task-specific caps or a fungible budget.

**Proof.** Follows from the argument in the text. ■

The division induced by the Overseer is ex ante optimal. Importantly, because of the uncertainty over the policy success function, it is not optimal ex post.

### 6.2. Non-transparent actions

Suppose the Overseer observes only the final policy outcome, but not the Bureaucrat’s actions. She must now use a retention rule that is constant in actions—i.e., a retention rule drawn from the set \( \mathcal{R} \). Here, behavior in an equilibrium that is robust to small revision costs is identical to the case of non-transparency with no uncertainty over the policy success function. Since actions are unobserved, the Overseer will never have a reason to revise her announced retention rule. An argument identical to **Lemma 5.1** implies that, when the Bureaucrat’s actions are non-transparent, if the budget is fungible, then the Bureaucrat allocates his expenditures ex post efficiently (conditional on the state) across the two tasks, regardless of what retention rule the Overseer uses. Given this, an argument identical to **Proposition 5.1** shows that the optimal rule for the Overseer rewards policy success with certain retention and punishes policy failure with certain replacement. Finally, given the efficiency induced by a fungible budget in the absence of transparency, the Overseer is weakly better off in the equilibrium with a fungible budget than in the equilibrium with any task-specific budget caps. (This last fact is confirmed in Lemma B.2 in the Online Appendix.)

Define

\[
\hat{p}(A) = \hat{p}(\alpha_1^E(A), \alpha_2^E(A), \omega)
\]

as the probability of success, given the efficient allocation of total effort \( A \). **Assumption 1** implies that, while \((\alpha_1^E(\cdot), \alpha_2^E(\cdot))\) depends on \( \omega \), \( \hat{p} \) is constant in \( \omega \). Given that \( \hat{p} \) is differentiable in \( a_1 \) and \( a_2 \), and that
(\(\sigma^p(\cdot), \sigma^q(\cdot)\)) is differentiable in \(A\). The argument above now implies that the equilibrium allocation in any state \(\omega\) is \((\sigma^p(\hat{A}^{NT}), \sigma^q(\hat{A}^{NT}))\), with \(\hat{A}^{NT}\) satisfying the following first-order condition:

\[
\frac{d\bar{p}}{dA}(\hat{A}^{NT}) B = u'(\hat{A} - \hat{A}^{NT}).
\] (6)

6.3. Comparing the two institutions

Behavior with and without transparency are in marked contrast. Under transparency expenditures are allocated ex post inefficiently. The best the Overseer can do is to precisely tailor budget caps to achieve ex ante efficiency. In contrast, absent transparency, expenditures are allocated ex post efficiently if the Overseer gives the Bureaucrat the freedom of a fungible budget. But there is a trade-off for the Overseer. Without transparency, the Overseer can only condition her retention on outcomes, which are a noisy signal of expenditures. As such, the Bureaucrat’s incentives for expending resources are weaker. Indeed, an argument identical to Proposition 5.2 shows that total expenditures are strictly lower without transparency than with transparency, i.e., \(\hat{A}^{NT} < A^{max}\).

The trade-off between the two institutions points to the possibility that uncertainty over the policy success technology can completely reverse the characteristics of the optimal institution: from one with tight budgetary controls and transparency to one with a fungible budget and non-transparency. Indeed, we show that this is the case below. Whether the Overseer prefers a system with transparent allocations and carefully tailored, task-specific budgets or a system with non-transparent allocations and a fungible budget depends on the relative importance of the power of incentives versus ex post efficiency.

The costs of transparency, in terms of ex post inefficiency, are largest when the Overseer’s uncertainty over the policy success technology is large. It is straightforward that as uncertainty goes to zero (i.e., \(\mu_0\) goes to zero or one), the Overseer strictly prefers transparency. The question remains as to whether the Overseer prefers non-transparency if uncertainty regarding the policy success technology is large enough (i.e., \(\mu_0\) sufficiently close to 1/2). The answer will turn out to be yes, if the uncertainty also is sufficiently consequential.

To show that this is the case, we begin with the following result:

Lemma 6.1. Under transparency, the allocation of resources between the two tasks induced by the Overseer’s optimal budget caps is differentiable in \(\mu_0\). Moreover, at \(\mu_0 = 1/2\), the Overseer induces an allocation of \(\frac{A^{max}}{2}\) to each task.

As uncertainty becomes large, the two tasks become equally important from an ex ante perspective, and so the Overseer will choose budget caps that induce an even split of resources between the two tasks. As we show next, when the uncertainty is sufficiently consequential, in the sense that the realization of the state has a big impact on the relative importance of the two tasks, the Overseer will prefer doing away with transparency.

Let the impact of task 1 at state \(\omega\) and allocation \((a_1, a_2)\) be:

\[
\Delta_1(a_1, a_2, \omega) = \hat{p}(a_1, a_2, \omega) - \hat{p}(0, a_2, \omega).
\]

The impact of task 2 is defined analogously. Then

\[
\Delta_{\min}(a_1, a_2, \omega) = \min(\Delta_1(a_1, a_2, \omega), \Delta_2(a_1, a_2, \omega))
\]

is the impact of the less important task at state \(\omega\) and allocation \((a_1, a_2)\). And

\[
\omega^*(a_1, a_2) = \arg \max_{\omega \in [0,1]} \Delta_{\min}(a_1, a_2, \omega)
\]

is the state where the less important task matters most at allocation \((a_1, a_2)\). Finally, the consequentialness of uncertainty at allocation \((a_1, a_2)\) is:

\[
\Delta^*(a_1, a_2) = \Delta_{\min}(a_1, a_2, \omega^*(a_1, a_2)).
\]

Why is \(\Delta^*(a_1, a_2)\) a measure of how consequential uncertainty is? If \(\Delta^*(a_1, a_2)\) is large (i.e., \(\Delta^*(a_1, a_2)\) goes to \(\max(\Delta_1(a_1, a_2, \omega^*(a_1, a_2)), \Delta_2(a_1, a_2, \omega^*(a_1, a_2)))\)), then the two tasks have similar impacts on outcomes, so uncertainty over which task is more important is relatively inconsequential. If \(\Delta^*(a_1, a_2)\) is small (i.e., close to zero), then only the important task matters, and uncertainty over which task is more important is very consequential. Hence, we will say that uncertainty becomes more consequential at \((a_1, a_2)\) as \(\Delta^*(a_1, a_2)\) gets smaller and becomes maximally consequential at \((a_1, a_2)\) as \(\Delta^*(a_1, a_2)\) goes to zero. Notice, this notion of consequentialness is only about the relative impact of the two tasks at a given allocation profile, not the absolute impact of either.

The next result shows that when uncertainty is large, as uncertainty becomes maximally consequential at the ex ante efficient division of \(A^{max}\), the Overseer prefers non-transparency to transparency if the diminished power of incentives is small enough relative to the gains from efficiency.

Proposition 6.2. Let \(\mu_0 = 1/2\). As uncertainty becomes maximally consequential at \((\bar{A} - \frac{A^{max}}{2})\), the Overseer prefers non-transparency to transparency if

\[
\frac{\bar{u}'(\bar{A} - \frac{A^{max}}{2})}{\bar{p}'(\frac{A^{max}}{2})} > 0.
\]

Proposition 6.2 shows that as uncertainty becomes maximally large and consequential, eliminating transparency is preferred if it does not diminish incentives too much—that is, if the marginal benefits of expenditures under non-transparency \(\bar{p}'(\frac{A^{max}}{2})\) are large relative to the marginal costs \(\bar{u}'(\bar{A} - \frac{A^{max}}{2})\). Proposition A.1 in the appendix shows that this result holds away from the limits of uncertainty and consequentialness (i.e., for an open set of parameter values) when the policy success function is additively separable. Fig. 2 illustrates this for the special case where

\[
\bar{p}(a_1, a_2, \omega) = \omega a_1^{\frac{3}{4}} + (1 - \omega) a_2^{\frac{3}{4}},
\]

\[
\bar{A} = 1, k = \frac{3}{4} \text{ and } \bar{u}(x) = \sqrt{x}^{14}.
\]

The horizontal axis of each cell of the figure is \(\bar{A}\). The dashed curve is the Overseer’s welfare under transparency and optimal budget caps, while the solid curve is the Overseer’s welfare without transparency (leaving the budget fungible). Uncertainty is increasingly consequential as \(\bar{A}\) moves away from one-half on the horizontal axes. As the figure shows, making uncertainty more consequential makes non-transparency more attractive relative to transparency. Moving across rows from left-to-right corresponds to an increase in the amount of uncertainty—i.e., to \(\mu_0\) approaching one-half. Again, the figure shows that, for any fixed level of how consequential uncertainty is, an increase in the amount of uncertainty increases how attractive non-transparency is relative to transparency. Finally, moving down the columns is increasing incentives \((B)\). As Proposition 6.2 shows, if \(B\) is sufficiently large, the difference in total expenditures

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14 Proposition B.1 in the Online Appendix shows that the conclusion implied by the figure holds for general \(k\).
under transparency and non-transparency diminishes, so that non-transparency becomes more attractive relative to non-transparency.

To recapitulate, in this section we have shown conditions under which eliminating transparency and leaving the budget fungible is preferred by the Overseer to leaving actions transparent and setting task-specific budgets. The cost of eliminating transparency is weakened incentives. The benefit of eliminating transparency is ex post efficiency. As the Overseer becomes increasingly uncertain about the policy success technology, these benefits loom larger relative to the costs. And, indeed, if uncertainty is both sufficiently large and sufficiently consequential, the Overseer prefers to do away with transparency and optimal budget caps.

7. Discussion

In this section we first highlight two possible applications of our results—the first to the design of policies and the second to the design of institutions—and then relate our findings to canonical results in both contract theory and political economy.

7.1. Policy design

Our model suggests a second-best approach to policy design in settings characterized by sequential policymaking and transparency. Consider, for example, a policymaker designing environmental regulations to be implemented by an executive agency. The policymaker can take one of two approaches: set emissions targets and engage in costly monitoring or impose a technological requirement on firms. The former policy requires effort from the agency late in the process, in the form of monitoring. The latter policy requires effort early in the process, in the form of choosing the right technological requirements.

Suppose that the first-best policy involves technological requirements, not emissions targets and monitoring. Nonetheless, a policy designer might want to instruct the agency to follow a second-best approach of emissions targets and monitoring. The reason is that the combination of sequential policymaking and transparency gives rise to inefficient behavior by the agency—focusing too much on the later stages of the policymaking process. The policy designer wants a policy that will not be too severely negatively affected by such distortions.

7.2. Design of oversight regimes

As McCubbins and Schwartz (1984) note, legislative oversight can be thought of as corresponding to two distinct informational regimes: police patrols, in which the Overseer actively supervises the agent’s actions, and fire alarms, in which Oversight involvement is only prompted by bad policy outcomes. McCubbins and Schwartz argue that the fire alarms regime may be more efficient: interest groups and other concerned parties have incentives to pay close attention to agency choices and bring them to Congress’s attention when the outcomes are particularly damaging.

Our analysis suggests a distinct and complementary rationale for fire alarms. A police patrols approach to oversight creates de facto transparency and, with it, the challenges to the principal of committing to an ex ante optimal reward/punishment scheme. By contrast, a fire alarms approach reduces these challenges by eliminating transparency. Our analysis, thus, suggests that the active oversight associated with police patrols can induce agencies to over-emphasize the later stages of the policymaking process at the expense of the earlier stages. Moving to a fire alarms regime can eliminate the inefficiencies induced by allocative distortions, but at the cost of decreased total expenditures or effort devoted to policy and increased rent seeking by the agency.

7.3. Political economy and transparency

An important literature, building on insights from Prendergast (1993), shows that transparency may not be optimal for political
oversight because it leads to pandering by policymakers seeking to establish a reputation for being a good type (Canes-Wrone et al., 2001; Maskin and Tirole, 2004; Fox, 2007; Fox and Shotts, 2009; Ashworth and Shotts, 2010; Shotts and Wiseman, 2010; Fox and Stephenson, 2011; Fox and van Weelde, 2012). Like in those models, in our model eliminating transparency allows the Overseer to induce the policymaker to use his expertise to choose better policies. However, unlike in models of pandering, our results do not depend on policymakers signaling information. Instead, our results derive from the benefits to the Overseer of deferring detailed decision making to the policymaker when the Overseer is uncertain regarding the technology by which policy translates into outcomes.

Our argument, thus, admits a very different kind of interpretation than previous arguments for the benefits of eliminating transparency. In pandering models, transparency can be bad because it allows strategic manipulation by policymakers. In our model, transparency can be bad because it gives the Overseer control that is too fine grained, leading to time inconsistency and allocative distortions.

7.4. Multitask and weak incentives

Multitask problems in political agency have been studied in a variety of papers (Lohmann, 1998; Besley and Coate, 2003; Ashworth, 2005; Ashworth and Bueno de Mesquita, 2006; Gehlbach, 2006; Bueno de Mesquita, 2007; Bueno de Mesquita and Stephenson, 2007; Hatfield and Padró i Miquel, 2007; Patty, 2009; Daley and Snowberg, 2011; Ashworth and Bueno de Mesquita, 2014; Landa and Le Bihan 2014). Importantly, none of these models consider the issue of sequential actions prior to a retention decision, which is our focus. Moreover, most existing work on institutional responses to agency problems due to multitask in political accountability relationships focuses on separation of powers (Persson et al., 1997; Gailmard and Patty, 2009) or other forms of unbundling (Calabresi and Rhodes, 1992; Ting, 2002, 2003; Besley and Coate, 2003; Marshall, 2006; Berry and Gersen, 2008; Patty, 2009; Gersen, 2010; Ashworth and Bueno de Mesquita, 2014; Landa and Le Bihan 2014). Here we consider institutional responses—including budgeting and eliminating transparency—which might be optimal in settings where responsibility for the tasks is not separately assigned.

At first glance, our results on eliminating transparency may seem similar to the well known fact that, in the standard model of multitask, the Overseer wants to reduce the power of incentives in order to avoid distorting effort toward a more observable task (Holmström and Milgrom, 1991). In particular, in our model, when the Overseer eliminates transparency in order to avoid the distortions associated with ex ante optimal budget caps, she weakens incentives. But there is a critical difference between the two results. In our model, eliminating transparency does not reduce distortions by weakening incentives. Instead, eliminating transparency reduces distortions by forcing the Overseer to only condition retention on outcomes, which (conditional on a level of expenditures) gives the Bureaucrat incentives to allocate resources efficiently. Another way to see this is the following. In a setting like Holmström and Milgrom (1991), the best possible arrangement for the principal is one with full transparency—i.e., one in which all tasks are perfectly observable. In our model, as shown in Propositions 6.2 and A.1, sometimes the optimal arrangement for the Overseer is for neither task to be observable.

8. Conclusion

We identify a novel political time inconsistency problem, resulting from an overseer’s incentive to revise her retention rule in environments with sequential actions by a bureaucrat. Our model predicts that bureaucrats will over-emphasize tasks late in the policymaking process. Indeed, even under the optimal task-specific budgets, the bureaucrat expends a larger percentage of the budget allocated to the second task than she expends of the budget allocated to the first task.

Apart from characterizing the nature of the overseer’s time inconsistency problem, we also provide a normative analysis of institutional responses to the distortions caused by the time inconsistency problem. We focus on two tools that may be available to political overseers: budgetary control and transparency. We show that when uncertainty over the policy production technology is sufficiently minimal, overseers can use task-specific budget caps to reduce distortions in the allocations of resources across tasks, including achieving the optimal allocation under full information; when uncertainty is sufficiently large and consequential, the overseer is better off eliminating transparency and removing task-specific budget caps. This institutional choice results in lower total expenditures on policy, but an ex post efficient allocation of expenditures across the two tasks.

At the root of this new argument about the potential liabilities of transparency is the conjunction of uncertainty and the time inconsistency problem we describe. If an overseer could commit ex ante to not revising her retention rule for the bureaucrat after the first allocation, transparency would enhance, rather than limit, bureaucrats’ performance, allowing the overseer to maintain a fungible budgetary environment and extract the ex post efficient allocations in equilibrium. The overseer’s temptation to revise the retention rule that underlies her time inconsistency problem means that, given transparency with respect to the bureaucrat’s actions, the overseer will prefer to impose a cap on the bureaucrat’s second allocation. The ex post inefficiencies associated with doing so, given uncertainty over the policy success technology, can lead the overseer to prefer an institutional environment with a fungible budget and non-transparency—tying her hands with respect to revision for the sake of harnessing the bureaucrat’s expertise.

Our results are derived in a model in which preference divergence between the overseer and the bureaucrat is reflected in the fact that expenditures are costly to the bureaucrat. While this is one plausible notion of disagreement between overseers and bureaucrats, there are others, including ideological disagreements, which have been the focus of an extensive literature in bureaucratic politics (Epstein and O’Halloran, 1994; Clinton and Lewis, 2008; Lavertu et al., 2013). While an analysis of a model with ideological preferences is beyond the scope of this paper, it is worth briefly considering how much of our analysis might be expected to carry through to settings in which the actions are ideological policy choices, players have different policy preferences, and the bureaucrat also values holding office. It is straightforward that something like our political time inconsistency problem continues to hold in such a model. If the agent has to make two ideological choices in sequence, then once the first choice is taken, the overseer has an incentive to revise her retention rule to optimize the bureaucrat’s incentives to choose a second policy with ideological content favorable to the overseer. Hence, policy choices later in the process are likely to be closer to the overseer’s ideological preferences, while policy choices earlier in the process are likely to be closer to the bureaucrat’s preferences. One could imagine limited discretion on the second task (as in Holmström (1984) or Epstein and O’Halloran (1994)) playing a role similar to task-specific budget caps in our model. Moreover, if the overseer could constrain herself to only observe an aggregate measure of welfare, rather than the ideological content of specific policies, this could induce an efficient balancing of the ideological content on the two tasks that would be similar to the effect associated with eliminating transparency in our model. The exact implications of the political time inconsistency problem, and potential institutional responses, in settings with ideological preferences, are left for future research.

15 The literature also considers other rationales for eliminating transparency based on avoiding distortions to policymaker incentives that are less closely related to the analysis here (e.g., Gavazza and Lizzieri, 2007, 2009; Bouton and Kirchsteiger, 2011).
Appendix A

Proof of Lemma 4.1. From Lemma B.1, the second allocation can be \(a_2\) following the history \((m_1, m_2, a_1)\) if

\[
\mathbb{E}_0[m_2(m_1, a_1)|a_1, a_2, 0]B + u(\bar{A} - a_1 - a_2) \\
\geq \mathbb{E}_0[m_2(m_1, a_1)|a_1, a_2, 0]B + u(\bar{A} - a_1 - a_2),
\]

for all \(a_2 \in [0, \bar{A} - a_1]\). It is easiest to induce the Bureaucrat to choose \(a_2\) by setting the retention probability to 0 for all other choices. Suppose \(m_2\) assigns probability to retention following \(a_2\) and 0 for all other choices. Then \(a_2\) is a best response if and only if \(rB + u(\bar{A} - a_1 - a_2) \geq u(\bar{A} - a_1 - a_2)\), for all \(a_2 \in [0, \bar{A} - a_1]\). Clearly, now, the binding constraint for the Bureaucrat is \(a_2 = 0\). Hence, \(a_2\) is a best response if and only if \(rB + u(\bar{A} - a_1 - a_2) \geq u(\bar{A} - a_1)\). Setting \(r = 1\) now establishes the result.

Proof of Lemma 5.1. Fix a retention rule \(r \in \bar{R}\). Suppose the Bureaucrat’s best response calls for total expenditures \(A'\).

At \(A' = 0\) the result is trivial.

Now consider some pair \((a_1, a_2)\), with \(\max(a_1, a_2) > 0\), that is a best response to \(r\). This implies the following:

\[
p(a_1', a_2')r(s) + (1 - p(a_1', a_2'))r(f) + u(\bar{A} - a_1' - a_2') \\
\geq p(a_1, a_2)r(s) + (1 - p(a_1, a_2))r(f) + u(\bar{A} - a_1 - a_2)
\]

for all \((a_1, a_2)\).

Define \(a_1' + a_2' = A'\). To get a contradiction, suppose that \((a_1', a_2') \neq (a_1(A'), a_2(A'))\). Now notice that:

\[
P(0) < P(a_1', a_2') < P(A')
\]

Thus, by the intermediate value theorem, there exists \(\bar{A} < A'\) such that

\[
P(A') = p(a_1', a_2').
\]

Now we have the following:

\[
p(a_1', a_2')r(s) + (1 - p(a_1', a_2'))r(f) + u(\bar{A} - a_1' - a_2') \\
= P(\bar{A})r(s) + (1 - P(\bar{A}))r(f) + u(\bar{A} - A') \\
< P(\bar{A})r(s) + (1 - P(\bar{A}))r(f) + u(\bar{A} - \bar{A}),
\]

so \((a_1', a_2')\) was not a best response to \(r\). This establishes the claim.

Proof of Proposition 5.1. Given Lemma 5.1, the Overseer will choose a rule that maximizes the Bureaucrat’s total expenditure. The Bureaucrat’s total expenditure solves:

\[
\max_{A} P(A)r(s) + (1 - P(A))r(f) + u(\bar{A} - A).
\]

Since \(B < u(\bar{A}) - u(0)\), spending the whole budget is strictly dominated. And since \(p\) satisfies the Inada conditions, the Bureaucrat will choose a positive allocation. Hence, the Bureaucrat’s effort is interior and given by the following first-order condition:

\[
\frac{dP}{d\bar{A}}(A'\bar{r}s - r(f)) = u(\bar{A} - A') - u(\bar{A} - A).
\]

It is straightforward that \(A^*\) is maximized at \(s = 1\) and \(r(f) = 0\). This, together with Lemma 5.1 gives the result.

Proof of Proposition 5.2. The result is implied by the following:

\[
u(\bar{A} - A^*) = u(\bar{A}) - B \\
< u(\bar{A} - p(A^{NT})B \\
\leq u(\bar{A} - A^{NT}),
\]

where the first equality is the definition of \(A^{max}\), the first inequality follows from the fact that for all \((a_1, a_2), p(a_1, a_2) \in (0, 1)\), and the final inequality follows from the optimality of \(A^{NT}\) under non-transparency.

Proof of Lemma 6.1. From Eq. (5), the ex ante optimal first-period budget cap solves:

\[
\max_{a_1} [\mu_0p(a_1, A^{max} - a_1, \omega) + (1 - \mu_0)p(a_1, A^{max} - a_1, \omega)].
\]

We can rewrite this:

\[
\max_{a_1} [\mu_0p(a_1, A^{max} - a_1, \omega) + (1 - \mu_0)p(A^{max} - a_1, \omega)].
\]

Since \(p\) is strictly concave in each of its arguments and has weak complementarities, this objective function is strictly concave. Moreover, since \(p(a_1, A^{max} - a_1, \omega)\) satisfies the Inada conditions the Bureaucrat will choose a positive allocation. And since \(B < u(\bar{A}) - u(0)\), allocating the entire budget is strictly dominated. Hence, there is a unique maximum and it is interior. It is differentiable by the implicit function theorem.

The optimal first-period budget cap satisfies the following first-order condition:

\[
\mu_0p(a_1^*, A^{max} - a_1^*, \omega) = p_2(a_1^*, A^{max} - a_1^*, \omega) \\
+ (1 - \mu_0)p(A^{max} - a_1^*, \omega) \\
= 0.
\]

At \(\mu_0 = 1/2\), this can be rewritten:

\[
\hat{p}_1(a_1^*, A^{max} - a_1^*, \omega) = \hat{p}_1(A^{max} - a_1^*, \omega) \\
= \hat{p}_2(a_1^*, A^{max} - a_1^*, \omega) - \hat{p}_2(A^{max} - a_1^*, \omega).
\]

It is straightforward that this condition is satisfied at \(a_1^* = \frac{A^{max}}{2}\) and since there is a unique solution, this establishes the result.

Proof of Proposition 6.2. First consider the case of transparency. By Lemma 6.1, when \(\mu_0 = 1/2\), the Bureaucrat allocates \(\frac{A^{min}}{2}\) to each task. As uncertainty becomes maximally consequential, this implies that Overseer’s expected payoff goes to \(P(A^{max})\).

Next consider the case of non-transparency. Here, Eq. (6) shows that the Bureaucrat spends total resources \(A^{NT}\). And an argument identical to Proposition 5.1 shows that he allocates them efficiently, conditional on the state. Hence, the Overseer’s expected payoff is \(P(A^{NT})\).

The Overseer prefers non-transparency to transparency if

\[
\hat{A}^{NT} > \frac{A^{max}}{2}.
\]

Since \(\hat{A}^{NT}\) is a solution to the following problem:

\[
\max_{A} P(A)B + u(\bar{A} - A).\]
it follows that if
\[
W^T\left(\frac{A - A^\text{max}}{\max}\right) = \frac{\mu_0 - A^\text{max}}{\max}.
\]
then \(A^\text{NT} > A^\text{max}/2\), as required. \(\blacksquare\)

**Proposition A.1.** Let
\[
\hat{p}(a_1, a_2, \omega) = \omega f(a_1) + (1 - \omega)f(a_2),
\]
for \(f : \mathbb{R}_+ \to [0, 1]\). If
\[
\lim_{\omega \to 1} A^\text{NT} > A^\text{max}/2,
\]
then there exists \(m > 0\) such that, for any \(\mu_0 \in \left(\frac{1}{2} - m, \frac{1}{2} + m\right)\)
\[
\text{there exists } w(\mu_0) < 1 \text{ such that if } \omega \in (w(\mu_0), 1],
\]
then the Overseer prefers non-transparency to transparency.

**Proof.** First consider the case of transparency. In equilibrium, the Bureaucrat will spend \(A^\text{max}\). Using symmetry, the optimal budget caps solve:
\[
\max_a \left[\mu_0[\omega f(a_1) + (1 - \omega)f(A^\text{max} - a_1)]
+ (1 - \mu_0)[(1 - \omega)f(a_1) + \omega f(A^\text{max} - a_1)]\right].
\]
Thus, the Bureaucrat will allocate resources \((a^*_1, A^\text{max} - a^*_1)\), sating:
\[
\frac{f(a^*_1)}{f(A^\text{max} - a^*_1)} = \frac{\mu_0(1 - \omega)}{(1 - \mu_0)\omega} + (1 - \mu_0)(1 - \omega).
\]
(7)

The Overseer’s expected payoff under transparency is thus,
\[
W^T(\mu_0, \omega) = \mu_0 [\omega f(a^*_1) + (1 - \omega)f(A^\text{max} - a^*_1)] + (1 - \mu_0)\sqrt{[1 - \omega f(a^*_1) + \omega f(A^\text{max} - a^*_1)].}
\]

Now consider the case of non-transparency. If the Bureaucrat spends total resources \(A\), he will divide them efficiently, conditional on the state. Moreover, note that for our additively separable policy success technology, \(d^\text{f}(A) = d^\text{g}(A)\). Thus, without loss of generality, we can assume \(\omega = \omega\) and calculate the total expenditures, which are given by:
\[
A^\text{NT}(\omega) = \arg \max \left[\omega f(a^\text{f}(A)) + (1 - \omega)f(A - a^\text{f}(A))\right]B
+ u(\lambda - A).
\]

Given this, the Overseer’s expected welfare under non-transparency is:
\[
W^\text{NT}(\omega) = \omega f\left(d^\text{f}\left(A^\text{NT}(\omega)\right)\right) + (1 - \omega)f\left(A^\text{NT}(\omega) - d^\text{f}\left(A^\text{NT}(\omega)\right)\right).
\]
The Overseer prefers non-transparency if \(W^\text{NT}(\omega) \geq W^T(\mu_0, \omega)\).

From Eq. (7), as \(\mu_0 \to 1/2, a^*_1 \to A^\text{max}/2\). Thus,
\[
\lim_{\mu_0 \to 1/2} W^T(\mu_0, \omega) = f\left(\frac{A^\text{max}}{2}\right).
\]
The payoff without transparency is not a function of the uncertainty. Thus,
\[
\lim_{\mu_0 \to 1/2} W^\text{NT}(\omega) = \omega f\left(d^\text{f}\left(A^\text{NT}(\omega)\right)\right) + (1 - \omega)f\left(A^\text{NT}(\omega) - d^\text{f}\left(A^\text{NT}(\omega)\right)\right) + f\left(\frac{A^\text{max}}{2}\right).
\]
Since actions and payoffs are continuous in \(\mu_0\), the above shows that, for any \(\omega\), if \(\mu_0\) is sufficiently close to 1/2, then non-transparency is preferred to transparency if
\[
\omega f\left(d^\text{f}\left(A^\text{NT}(\omega)\right)\right) + (1 - \omega)f\left(A^\text{NT}(\omega) - d^\text{f}\left(A^\text{NT}(\omega)\right)\right) > f\left(\frac{A^\text{max}}{2}\right).
\]
The left-hand side of this inequality is continuous in \(\omega\), while the right-hand side is constant \(\omega\). Hence, to establish the result, it now suffices to consider the limit of the left-hand side as \(\omega \to 1\).

Clearly, \(\lim_{\omega \to 1} \omega f\left(d^\text{f}(A)\right) = A\). Thus, we have:
\[
\lim_{\omega \to 1} \lim_{\mu_0 \to 1/2} W^\text{NT}(\omega) = \omega f\left(A^\text{NT}^1\right).
\]
Hence, for \(\mu_0\) sufficiently close to 1/2, there exists a \(w(\mu_0) < 1\) such that for \(\omega > w(\mu_0)\), non-transparency is preferred to transparency as long as
\[
A^\text{NT}^1 > A^\text{max}/2,
\]
as required. \(\blacksquare\)

**Appendix B. Supplementary data**

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.jpubeco.2015.09.012.

**References**


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