Online Appendix to "Civil Service Reform"

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Part 1 of this Online Appendix justifies equilibrium selection in the benchmark model. Part 2 contains the complete analysis of the model with strategic bureaucrats (Section 4) and proves Proposition 4 in the paper. Part 3 derives various results described in the extensions of Section 5. Part 4 presents numerical examples to illustrate the conditions characterizing the welfare effect of civil service reform in the benchmark model (Propositions 2 and 3 in the paper) and the infinite horizon extension (Section 5.4).

1 Equilibrium selection in the benchmark model

The main text focuses on the equilibrium where voters reelect the politician iff $e = S$ in period 1. Here, I show that either this is the only strategy that can be part of an equilibrium once the game is perturbed slightly, or all voter strategies result in the same outcomes of interest.[1]

Recall that, in the paper, voters' updated beliefs regarding the politician's type were given by

$$\hat{\Pi}|_{e=S} = \frac{\Pi\phi^G}{\Pi\phi^G + (1-\Pi)[\lambda\phi^G + (1-\lambda)(1-\phi^B)]}, \quad (1)$$

[1] Note also that the equilibrium considered in the main text would survive even if voters were *not* able to draw rational inferences about the politician's type from observing the bureaucrat's action. If voters mistakenly believed that implemented policies came directly from the politician, they would still reelect if and only if the implemented policy is good. Assuming that voters are irrational in this sense would not affect any of the results.

and

$$\hat{\Pi}|_{e=1-S} = \frac{\Pi(1-\phi^G)}{\Pi(1-\phi^G) + (1-\Pi)[\lambda(1-\phi^G) + (1-\lambda)\phi^B]}, \tag{2}$$

(expressions (7) and (8) in the paper).

Voters have 3 other possible strategies: reelect iff $e = 1 - S$ in period 1, always reelect, never reelect. Suppose first that $\phi^G + \phi^B > 1$, and consider the strategy "always reelect" or "never reelect." Then good politicians should choose good policies, while bad ones should choose bad policies. But then (1) and (2) imply that voters should reelect after $e = S$ but not after $e = 1 - S$, contrary to the starting assumption. These strategies can never be part of an equilibrium. Now consider "reelect iff $e = 1 - S$ in period 1." Then bad politicians choose a bad policy. If $\Delta > \beta(\phi^G\Delta + V_0)$, good politicians choose a good policy, and (1) implies that voters should reelect after $e = S$, contrary to the starting assumption. If $\Delta < \beta(\phi^G\Delta + V_0)$, good politicians also choose a bad policy. For suitable off-equilibrium voter beliefs, this can be a Perfect Bayesian Equilibrium. However, consider the following perturbation of the game, following Maskin and Tirole (2004): assume that a small fraction ε of the politicians have $\beta = 0$. A fraction Π of these is good, a fraction $(1 - \Pi)$ is bad, and since $\beta = 0$, each of them chooses their preferred policy. (Note that this does not affect the equilibrium described in the text.) Then even if all politicians with $\beta > 0$ pool on the bad policy, for any $\varepsilon > 0$ voters have a strict preference for reelecting after $e = S$, since $\hat{\Pi}|_{e=S} = ((1-\phi^B)(1-\varepsilon) + \varepsilon\phi^G)\Pi/[(1-\phi^B)(1-\varepsilon) + \varepsilon\phi^G\Pi] > \Pi$. Therefore this strategy cannot be part of an equilibrium for $\varepsilon > 0$, no matter how small ε is. Finally, suppose that $\phi^G + \phi^B = 1$. Then politicians' choice does not matter for the implemented policy. Their actions are pinned down by the assumption that $\mu < 1$: good (bad) politicians choose good (bad) policies. Voters are always indifferent between reelecting or not, and all their strategies result in the same policy choices and welfare as the one considered in the text.

2 Equilibrium with strategic bureaucrats and the effect of tenure

In this section, I characterize the equilibrium of the tenured and nontenured versions of the model with strategic bureaucrats, and compare the two in terms of policies and voter welfare.

Let ϕ_t^G and ϕ_t^B denote the probability that the bureaucrat who holds the job at the start of period 1 will comply with, respectively, a good or a bad policy in period $t = 1, 2$ (if he is not fired). As in the benchmark model, voters form beliefs about the politician's type after seeing the policy implemented by the bureaucrat. These are given by (1) and (2). But now policies can also reveal information to the voters about the incumbent bureaucrat's type. Denote this belief $\hat{\pi}$, and let $\widehat{\phi}_2^G = \hat{\pi} + (1-\hat{\pi})I_{r<h}$ and $\widehat{\phi}_2^B = \hat{\pi} I_{\Delta<h} + 1 - \hat{\pi}$ denote the updated beliefs regarding compliance with period-2 policies for the bureaucrat currently holding the job. Voters decide whether or not to reelect the incumbent politician based on the probability of obtaining a good policy in period 2.

In a tenured system, the probability of a good policy in period 2 is $\widehat{\Pi}\widehat{\phi}_2^G + (1-\widehat{\Pi})(1-\widehat{\phi}_2^B)$ if the politician is reelected, and $\Pi\widehat{\phi}_2^G + (1-\Pi)(1-\widehat{\phi}_2^B)$ if he is not. Comparing the two and using (1) and (2), one may verify that reelecting the politician if and only if the bureaucrat implements a good policy is always a best response for voters.

In a nontenured system, beliefs regarding compliance in period 2 must take into account the fact that the politician may have fired the bureaucrat. If the incumbent is reelected, the probability of a good period-2 policy is $\widehat{\Pi}\widehat{\phi}_2^G(GP) + (1-\widehat{\Pi})(1-\widehat{\phi}_2^B(BP))$, where $\widehat{\phi}_2^G(GP)$ denotes the expected probability of compliance with a good policy in period 2 given the observed period-1 policy, conditional on a good politician, while $\widehat{\phi}_2^B(BP)$ is the corresponding value for a bad policy conditional on a bad politician. In a nontenured system, the condition for reelection is therefore

$$\widehat{\Pi}\widehat{\phi}_2^G(GP) + (1-\widehat{\Pi})(1-\widehat{\phi}_2^B(BP)) \geq \Pi\phi_2^G + (1-\Pi)(1-\phi_2^B), \tag{3}$$

since replacing the politician also implies replacing the bureaucrat.

Using these observations on voters' behavior, Lemmas 1-3 below characterize the equilibrium behavior of the bureaucrat and the politician under the assumption that voters reelect iff $e = S$. Proposition 1 completes the characterization of the equilibrium in each model, verifies that voters' strategy is a best response also in the nontenured case, and compares the resulting policies and welfare in the two models.

Lemma 1 *In both the nontenured and the tenured system*
(i) a good (bad) bureaucrat always complies with a good (bad) policy;
(ii) a good politician chooses a good policy;
(iii) a bad politician chooses a good policy if and only if

$$R < \beta\frac{(\rho^G - \rho^B)\bar{R} + (\phi_1^B + \phi_1^G - 1)V_0}{\phi_1^B + \mu(\phi_1^G - 1)}, \tag{4}$$

where $\rho^G \equiv \Pr(e_1 = S_1, e_2 = 1-S_2 | E_2 = 1-S_2, E_1 = S_1)$ *is the probability that the politician is reelected and the bureaucrat holding the job in period 2 complies with a bad policy choice, conditional on a good policy choice in period 1; and* $\rho^B \equiv \Pr(e_1 = S_1, e_2 = 1-S_2 | E_2 = 1-S_2, E_1 = 1-S_1)$ *is the same probability conditional on a bad policy choice in period 1.*

Proof. (i) This is clearly true in period 2. In period 1, not complying yields $-h$ immediately and potentially a positive payoff in period 2. However, the latter is at most equal to what compliance would have yielded today, therefore compliance is always better.

(ii) If the bureaucrat is good, choosing a good policy yields a strictly higher payoff. If the bureaucrat is bad, (i) implies that choosing a bad policy would cause the politician to be replaced, therefore choosing a good policy is at least as good. Thus, a good policy provides strictly higher expected payoff.

(iii) Given the voters' reelection rule, a politician's payoff from a good policy choice is $\beta(\rho^G\bar{R} + \phi_1^G V_0) + (1-\phi_1^G)\mu R$, while his payoff from a bad policy choice is $\beta(\rho^B\bar{R} + (1-\phi_1^B)V_0) + \phi_1^B R$. Comparing the two yields the condition in the Lemma. ■

Lemma 2 *In a nontenured system,*
(i) a good politician never fires the bureaucrat after $e = S$ and always fires him after $e = 1-S$. A bad politician does not fire after $e = 1-S$ and fires after $e = S \neq E$.
(ii) a good bureaucrat complies with a bad policy if and only if $\Delta < h$. A bad bureaucrat complies with a good policy if either $r < h$, or if a bad politician does not fire the bureaucrat after $e = E = S$ and $r > h > r\frac{1-\beta}{1-\beta\frac{\Pi}{\Pi+(1-\Pi)\lambda}}$, where λ is the probability that a bad politician chooses a good policy.

Proof. (i) Since $E = S$ for a good politician and a good bureaucrat always complies with this policy (Lemma 1), $e = S$ can never reveal a bureaucrat to be bad, while $e = 1-S$ always does. For a bad politician with $E = 1-S$, a bad bureaucrat would comply with this policy (Lemma 1), therefore $e = 1-S$ can never reveal a bureaucrat to be good. If $E = S$, a good bureaucrat would comply (Lemma 1), therefore $e = 1-S$ reveals the bureaucrat to be bad and he should not be fired.

(ii) Upon seeing a bad policy chosen, a good bureaucrat learns that the politician is bad. If he complies, the politician is not reelected, and the bureaucrat's payoff is 0. If he implements a good policy he receives $\Delta - h$ and he is fired (part(i)). The bad policy is better iff $\Delta < h$.

After seeing a good policy, a bad bureaucrat's belief regarding the politician is $p = \Pr(GP|E = S) = \frac{\Pi}{\Pi+(1-\Pi)\lambda}$. If he implements a bad policy, his payoff is $r-h$. If he complies with the good policy, using part (i), the bureaucrat's payoff is $\beta[pI_{r>h}(r-h) + (1-p)r]$ if a bad politician does not fire him, or $\beta[pI_{r>h}(r-h)]$ if a bad politician fires him. If $r - h < 0$, he complies. If $r > h$ and he is fired by a bad politician, the bad policy is better. If he is not fired, the good policy is better iff $h > r\frac{1-\beta}{1-\beta\frac{\Pi}{\Pi+(1-\Pi)\lambda}}$. ■

Lemma 3 *In a tenured system, a good bureaucrat complies with a bad policy if and only if* $\frac{\Delta}{1+\beta\Pi} < h$. *A bad bureaucrat complies with a good policy if and only if* $r(1+\beta\Pi(\frac{1}{\Pi+(1-\Pi)\lambda} - 1)) < h$, *where* λ *is the probability that a bad politician chooses a good policy.*

Proof. (i) Upon seeing a bad policy chosen, a good bureaucrat learns that the politician is bad. If he complies, his payoff is $\beta[\Pi\Delta + (1-\Pi)I_{\Delta>h}(\Delta-h)]$. If not, it is $\Delta - h + \beta I_{\Delta>h}(\Delta-h)$.The former is larger iff $\frac{\Delta}{1+\beta\Pi} < h$. After seeing a good policy chosen, a bad bureaucrat's belief regarding the politician's type is $p = \Pr(GP|E=S) = \frac{\Pi}{\Pi+(1-\Pi)\lambda}$. If he complies, his payoff is $\beta[pI_{r>h}(r-h) + (1-p)r]$. If he implements the bad policy, he gets $r - h + \beta[\Pi I_{r>h}(r-h) + (1-\Pi)r]$. Comparing the two yields the condition. ■

Next, simplify the notation by letting $q_1 = q[\beta(\bar{R} + V_0)]$, $q_2 = q[\beta((1-\pi)\bar{R} + V_0)]$, $q_3 = q[\beta(\bar{R}+V_0)\frac{\pi}{\mu\pi+1-\mu}]$, $q_4 = q[\beta V_0 \frac{\pi}{\mu\pi+1-\mu}]$ and $q_5 = q[0]$. Let W_t^T and W_t^{NT} denote the probability of a good policy implemented in period t under tenure (T) and no tenure (NT), respectively (this is equal to social welfare divided by Δ). The corresponding discounted present value is $W^T = W_1^T + \beta W_2^T$ and $W^{NT} = W_1^{NT} + \beta W_2^{NT}$. We are now ready to describe the effects of tenure.

Proposition 1 *Introducing the tenure system has the following effects.*
(i) Assume $\Delta < h$. *If* $h < rq_1$ *bad bureaucrats stop complying with good policies, and* λ, W_1 *and* W *go down. If* $h > rq_3$, *there is no change. If* $rq_1 < h < rq_3$, *either of these may occur depending on which equilibrium is played.*
(ii) Assume $\max(r, \frac{\Delta}{1+\beta\Pi}) < h < \Delta$. *Then* W_1 *and* W *go down. If* $rq_4 < h$, *good bureaucrats start complying with bad policies and* λ *remains unchanged. If* $h < rq_2$, *bad bureaucrats stop complying with good policies, good bureaucrats start complying with bad ones, and* λ *declines. If* $rq_2 < h < rq_4$, *either of these effects may occur depending on which equilibrium is played. Assume* $r < h < \frac{\Delta}{1+\beta\Pi}$. *If* $rq_5 < h$, *bureaucrats' behavior does not change but* λ, W_1 *and* W *increase. If* $h < rq_1$, *bad bureaucrats stop complying with good policies,* λ *becomes 0 and* W_1 *falls.* W *increases if* $\frac{\pi}{\Pi} > \frac{q_2}{q_2-1}$ *and falls otherwise. If* $rq_1 < h < rq_5$, *either of these effects may occur depending on which equilibrium is played.*
(iii) Assume $h < r$. *Then* W *declines. If* $\frac{\Delta}{1+\beta\Pi} < h$, *good bureaucrats start complying with bad policies,* λ *increases but* W_1 *goes down. If* $\frac{\Delta}{1+\beta\Pi} > h$, *there is no change in* λ *or* W_1.

Proof. (i) $\Delta < h$, therefore $\phi_2^G = \phi_2^B = 1$. Consider a nontenured system, Lemma 2 implies that $\phi_1^G = \phi_1^B = 1$. The bureaucrat's type remains hidden from the politician, and he is therefore retained: $\hat{\phi}_2^B(BP) = \hat{\phi}_2^G(GP) = 1$ after either a good or a bad observed policy. If a good policy is chosen (and implemented), voters' belief is $\hat{\Pi}|_{e=S} = \frac{\Pi}{\Pi+(1-\Pi)\lambda}$. Condition (3) holds in this case, and voters reelect. If a bad policy is chosen, we have

$\hat{\Pi}|_{e=1-S} = 0$, and (3) implies that voters don't reelect. The bureaucrat in period 2 always complies, but only $E_1 = S_1$ leads to reelection, we therefore have $\rho^G = 1$ and $\rho^B = 0$, and therefore $\lambda = G[\beta(\bar{R} + V_0)]$ from (4). We have $W_1^{NT} = \Pi + (1-\Pi)\lambda_{NT}$ (which is simply the probability that $E_1 = S_1$) and $W_2^{NT} = \Pi + (1-\Pi)(1-\lambda_{NT})\Pi$ (which is the probability of a good politician being reelected or a bad politician being replaced).

Consider a tenured system. Suppose $r(1 + \Pi\beta(\frac{1}{\Pi+(1-\Pi)\lambda} - 1)) < h$. Lemma 3 implies that $\phi_1^G = \phi_1^B = 1$. We again have $\rho^G = 1$ and $\rho^B = 0$, and therefore $\lambda = G[\beta(\bar{R} + V_0)]$. In this case, $W_1^T = W_1^{NT}$ and $W_2^T = W_2^{NT}$, introducing tenure has no effect. Suppose $r(1 + \Pi\beta(\frac{1}{\Pi+(1-\Pi)\lambda} - 1)) > h$. Lemma 3 now implies $\phi_1^G = \pi$, $\phi_1^B = 1$. Since only $E_1 = S_1$ leads to reelection, $\rho^G = \pi$ and $\rho^B = 0$. Therefore $\lambda = G[\beta(\bar{R} + V_0)\frac{\pi}{\mu\pi+1-\mu}]$ from (4). As stated in the proposition, introducing tenure causes bad bureaucrats to stop complying with good policies and politicians to choose bad policies with higher probability. We have $W_1^T = \Pi\pi + (1-\Pi)\pi\lambda_T$ and $W_2^T = \Pi\pi + (1-\Pi)\Pi(\lambda_T(1-\pi) + (1-\lambda_T))$, and $W_1^T - W_1^{NT} < 0$, $W^T < W^{NT}$.

(ii) $r < h < \Delta$, therefore $\phi_2^B = 1 - \pi$, $\phi_2^G = 1$. Consider a nontenured system. Lemma 2 implies $\phi_1^B = 1 - \pi$, $\phi_1^G = 1$. After a good policy, $\hat{\Pi}|_{e=S} = \frac{\Pi}{\Pi+(1-\Pi)[\lambda+(1-\lambda)\pi]}$. Since a bad politician who chose a bad policy learned that the bureaucrat is good, he will fire him. Thus, $\hat{\phi}_2^G(GP) = 1$ but $\hat{\phi}_2^B(BP) = \lambda(1-\hat{\pi}) + (1-\lambda)(1-\pi)$ where $\hat{\pi} > \pi$ is the voters' updated belief regarding the bureaucrat's type. Condition (3) holds, and voters reelect. After a bad policy, $\hat{\Pi}|_{e=1-S} = 0$, and $\hat{\phi}_2^G(GP) = \hat{\phi}_2^B(BP) = 1$ since a good politician would have fired the bureaucrat. Voters don't reelect. We have $\rho^G = 1 - \pi$ and $\rho^B = \pi(1-\pi)$.[2] Therefore $\lambda = G[\beta((1-\pi)\bar{R} + V_0)]$, $W_1^{NT} = \Pi + (1-\Pi)(\lambda_{NT} + (1-\lambda_{NT})\pi)$ and $W_2^{NT} = \Pi + (1-\Pi)(\pi(\lambda_{NT} + (1-\lambda_{NT})\pi) + (1-\pi)(1-\lambda_{NT})\Pi)$.

Consider a tenured system, and assume that $h > \max\{\frac{\Delta}{1+\beta\Pi}, r(1 + \Pi\beta(\frac{1}{\Pi+(1-\Pi)\lambda} - 1))\}$. From Lemma 3, $\phi_1^G = \phi_1^B = 1$, $\rho^G = 1-\pi$ and $\rho^B = 0$. Therefore $\lambda = G[\beta((1-\pi)\bar{R} + V_0)]$. In this case, introducing tenure causes good bureaucrats to start complying with bad policies while bad politicians remain equally likely to choose a good policy. Furthermore, $W_1^T = \Pi + (1-\Pi)\lambda < W_1^{NT}$, $W_2^T = \Pi + (1-\Pi)(\pi + (1-\pi)(1-\lambda)\Pi)$, and $W^T < W^{NT}$. Now suppose that $\frac{\Delta}{1+\beta\Pi} < h < r(1 + \Pi\beta(\frac{1}{\Pi+(1-\Pi)\lambda} - 1))$. From Lemma 3, $\phi_1^G = \pi, \phi_1^B = 1$, and $\rho^G = \rho^B = 0$. Therefore $\lambda = G[\beta V_0 \frac{\pi}{\mu\pi+1-\mu}]$. As stated in the proposition, introducing tenure causes the bad bureaucrat to stop complying with good policies, the good bureaucrat to start complying with bad ones, and the politician to choose bad policies with higher probability. Moreover, $W_1^T = \Pi\pi + (1-\Pi)\lambda_T\pi < W_1^{NT}$, $W_2^T = \pi + (1-\pi)\Pi$, and $W^T < W^{NT}$. Now

[2] With a good policy choice, reelection and compliance with a bad policy in period 2 requires a bad bureaucrat. With a bad policy choice, it requires a good bureaucrat in period 1 (who is fired) and then a bad bureaucrat in period 2.

suppose that $\frac{\Delta}{1+\beta\Pi} > h > r(1+\Pi\beta(\frac{1}{\Pi+(1-\Pi)\lambda}-1))$. From Lemma 3, $\phi_1^G = 1, \phi_1^B = 1-\pi$, $\rho^G = 1-\pi$, and $\rho^B = 0$. Therefore $\lambda = G[\beta(\bar{R}+V_0)]$. In this case, tenure causes no change in bureaucrats' behavior but makes the politician *more* likely to choose a good policy. We also have $W_1^T = \Pi + (1-\Pi)(\lambda_T + (1-\lambda_T)\pi) > W_1^{NT}$, $W_2^T = \Pi + (1-\Pi)(\pi + (1-\pi)(1-\lambda_T)\Pi)$, and $W^T > W^{NT}$. Finally, suppose that $h < \min\{\frac{\Delta}{1+\beta\Pi}, r(1+\Pi\beta(\frac{1}{\Pi+(1-\Pi)\lambda}-1))\}$. From Lemma 3, $\phi_1^G = \pi, \phi_1^B = 1-\pi$, and $\rho^G = \rho^B = 0$. Therefore $\lambda = 0$. As stated in the proposition, introducing tenure causes the bad bureaucrat to stop complying with good policies and the bad politician to stop choosing good policies. $W_1^T = \pi$, $W_2^T = \pi + (1-\pi)\Pi$, and after some algebra we find that $W^T > W^{NT}$ iff $\frac{\pi}{\Pi} > \frac{q[\beta((1-\pi)\bar{R}+V_0)]}{q[\beta((1-\pi)\bar{R}+V_0)]-1}$.

(iii) $h < r$, therefore $\phi_2^B = 1-\pi$, $\phi_2^G = \pi$. Consider a nontenured system. From Lemma 2, $\phi_1^B = 1-\pi$, $\phi_1^G = \pi$. After a good policy, $\hat{\Pi}|_{e=S} = \Pi$. Since the bureaucrat's type is revealed, he is fired if the politician is bad. Thus, $\hat{\phi}_2^G(GP) = 1$ and $\hat{\phi}_2^B(BP) = 1-\pi$. Condition (3) holds: voters reelect. After a bad policy, $\hat{\Pi}|_{e=S} = \Pi$. Since the bureaucrat's type is revealed, he is fired if the politician is good. Thus, $\hat{\phi}_2^G(GP) = \pi$ and $\hat{\phi}_2^B(BP) = 1$, and voters do not reelect. We have $\rho^G = \rho^B = \pi(1-\pi)$ and $\lambda = 0$. We also have $W_1^{NT} = \pi$, and $W_2^{NT} = \pi(\Pi - \pi\Pi + 1)$.

Consider a tenured system. When $h > \frac{\Delta}{1+\beta\Pi}$, Lemma 3 yields $\phi_1^G = \pi$, $\phi_1^B = 1$, and $\rho^G = \rho^B = 0$. Therefore $\lambda = G[\beta V_0 \frac{\pi}{\pi\mu+1-\mu}]$. As stated in the proposition, introducing tenure causes good bureaucrats to start complying with bad policies, and bad politicians to choose good policies with a positive probability. We also have $W_1^T = \Pi\pi + (1-\Pi)\pi\lambda_T < W_1^{NT}$, $W_2^T = \pi$, and $W^T < W^{NT}$. When $h < \frac{\Delta}{1+\beta\Pi}$, Lemma 3 yields $\phi_1^G = \pi, \phi_1^B = 1-\pi$, and $\rho^G = \rho^B = 0$. Therefore $\lambda_T = 0$, $W_1^T = W_1^{NT}$, $W_2^T = \pi$, and $W^T < W^{NT}$. ■

Proposition 4 in the paper is an immediate corollary of Proposition 1 above.

Figure 1 illustrates the parameter ranges for the various effects. Without tenure, a good bureaucrat only complies with a bad policy for punishments h larger than Δ. With tenure, this threshold shifts down because a bad policy now has the added benefit of getting the bad politician replaced.[3] A bad bureaucrat without tenure complies with a good policy if the punishment h exceeds r. With tenure the threshold shifts up to rq, where q is an increasing function of the probability that the good policy choice came from a good politician. This reflects the fact that implementing a bad policy gets the incumbent politician (but not the bureaucrat) thrown out of office, and creates the possibility of electing a bad politician in period 2.

[3] A good bureaucrat's gain from getting the politician replaced is the possibility of avoiding the punishment h for implementing the good policy in period 2. This is worth $\Pi\beta h$, which is compared to the immediate gain of $\Delta - h$ from choosing a good policy. The former is larger if $h > \Delta/(1+\beta\Pi)$.

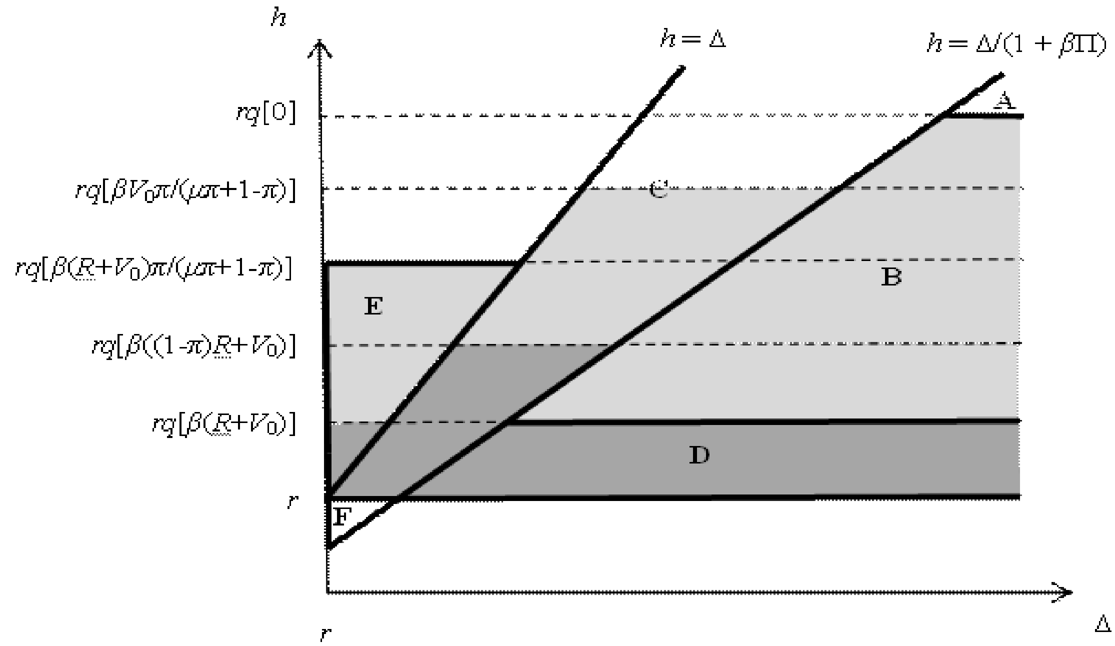

Figure 1: Parameter ranges for the effects of introducing a tenure system. For parameters in the light (dark) grey areas, bad bureaucrats stop complying with good policies in some (all) equilibria. For parameters in area C and F, good bureaucrats start complying with bad policies. In areas A, B, and F, the politician is more likely to choose a good policy, and in area A this leads to higher welfare in period 1. In area B, welfare increases in one of the equilibria. Welfare falls in areas C, D, F, and in one of the equilibria in area E.

It is only when tenure improves the politician's behavior and has no impact on bureaucrats that tenure can raise welfare. When the condition in part (ii) holds, a bad politician can learn the bureaucrat's type by choosing a bad policy, allowing him to fire a good bureaucrat in the untenured case. Tenure takes away this possibility and thus makes the bad policy less attractive, leading to higher welfare. In Figure 1, this effect represents the only equilibrium in area A and one of the two possible equilibria in area B.[4]

The present value of voter welfare increases when first-period welfare increases (areas A and B in Figure 1). In addition, the present value of welfare can increase also if $r < h < \min(\frac{\Delta}{1+\beta\Pi}, rq[\beta(R+V_0)]$ (area D in Figure 1), provided that the fraction of good bureaucrats π is sufficiently large.

[4]In area B, the model with tenure also has another equilibrium in which the bad politician never exercises discipline. In this case, introducing tenure lowers welfare.

3 Derivations for section 5

3.1 Politician's choice can be observed

Formally, the proof of Proposition 2 and 3 part (i) in the paper's Appendix remains unchanged except that λ is given by the new expression stated in Section 5.1. For part (ii), $\Pr(E_2 = S_2)$ becomes

$$\Pr(E_2 = S_2) = \begin{cases} \Pi + \Pi(1-\Pi)(1-\lambda) & if \quad \Delta < h \\ \Pi + \Pi(1-\Pi)(1-\lambda)(1-(1-p)\pi) & if \quad r < h < \Delta \\ \Pi + \Pi(1-\Pi)(1-\lambda)p & if \quad h < r \end{cases} \tag{5}$$

For example, this implies that selective control leads to worse politicians than full control iff $\xi < (1-p)\pi$. As p increases, this is less likely to hold.

For the welfare calculations in part (iii), note that period-1 welfare is not affected by p. Thus, the impact of p on the welfare effects is determined by how it affects period-2 welfare. This is still determined by

$$\Pr(e_2 = S_2) = \begin{cases} \Pr(E_2 = S_2) & if \quad \Delta < h \\ \Pr(E_2 = S_2)(1-\pi) + \pi & if \quad r < h < \Delta \\ \pi & if \quad h < r \end{cases}$$

except that $\Pr(E_2 = S_2)$ is now given in (5). For example, p does not affect welfare under full control, but it increases welfare under selective control. Again, reduced control is more likely to be beneficial when p is high. Similarly, consider a change in π. Welfare falls when $h \in (r, \Delta)$ and $2(1-G) - \frac{1}{\Pi(1-\pi)} - \frac{p}{1-(1-p)\pi}[1 - G + \frac{\pi}{(1-\pi)\Pi}] > G'\beta\bar{R}(1-\pi)$, and increases otherwise. Increasing p makes the inequality less likely to hold, so raising π is more likely to be beneficial when p is high.

3.2 Perverse control

To show the results described in the text, use the following expressions when $\Delta < h < r$:

$$\begin{aligned} \lambda &= G[\beta(\bar{R} + V_0)\frac{\pi}{1-\mu(1-\pi)}] \\ \Pr(e_1 &= S_1) = \pi[\Pi + (1-\Pi)\lambda] \\ \Pr(E_2 &= S_2) = \Pi + \Pi(1-\Pi)\pi(1-\lambda) \\ \Pr(e_2 &= S_2) = \pi \Pr(E_2 = S_2). \end{aligned}$$

Comparing welfare $\Pr(e_1 = S_1) + \beta \Pr(e_2 = S_2)$ to the case of no control ($(1+\beta)\pi$) establishes that perverse control is always worse. Taking the derivative with respect to π shows that improved bureaucrat selection always helps.

3.3 Career concerns

To obtain expression (5) in the paper, let $v_b(|e-S|, |E-e|) = |e-S|r - |E-e|h + m\hat{\pi}(|e-S|)$ and $v_g(|e-S|, |E-e|) = (1-|e-S|)\Delta - |E-e|h + m\hat{\pi}(|e-S|)$ denote, respectively, the good and the bad bureaucrat's utility. For $(\phi^G, \phi^B) = (1, 1)$, it has to be that $v_b(x, 0) > v_b(1-x, 1)$ and $v_g(x, 0) > v_g(1-x, 1)$ for $x = 0, 1$. Since $\hat{\pi} = \pi$ after both policies, this becomes $h > \Delta (> r)$. For $(\phi^G, \phi^B) = (1, 1-\pi)$, we need $v_b(x, 0) > v_b(1-x, 1)$ for $x = 0, 1$, $v_g(0, 0) > v_g(1, 1)$, and $v_g(1, 0) < v_g(0, 1)$. In this case, $\hat{\pi}(0) = \pi$ and $\hat{\pi}(1) = 0$, which yields $|r - \pi m| < h < \Delta + \pi m$. For $(\phi^G, \phi^B) = (\pi, 1)$, we get a contradiction, leaving $(\phi^G, \phi^B) = (\pi, 1-\pi)$ as the only possibility. This requires $v_b(1, 0) > v_b(0, 1)$, $v_b(0, 0) < v_b(1, 1)$, $v_g(0, 0) > v_g(1, 1)$, and $v_g(0, 0) < v_g(1, 1)$. Since $\hat{\pi}(0) = 1$ and $\hat{\pi}(0) = 0$, this gives $h < r - m$.

3.4 Infinite horizon

To obtain expression (6) in the paper, solve for the continuation value to obtain

$$V(R^*) = \frac{V^0 + \int\limits_{R^*}^{\infty} R dG(R) \phi^B + (1-\phi^G)\mu \int\limits_{0}^{R^*} R dG(R)}{1 - (1-\phi^B)\beta(1 - G(R^*)) - G(R^*)\phi^G \beta}. \tag{6}$$

Indifference at the cutoff R^* requires the payoff from choosing a bad policy today, $\phi^B R^* + (1-\phi^B)\beta V(R^*)$, to equal that from choosing a good policy, $(1-\phi^G)\mu R^* + \phi^G \beta V(R^*)$. The cutoff R^* is therefore defined by

$$R^* = \beta V(R^*) \frac{\phi^B + \phi^G - 1}{\phi^B + \mu(\phi^G - 1)},$$

where $V(R^*)$ is given by (6). When $h \in (r, \Delta)$, we have $\phi^G = 1$ and $\phi^B = 1 - \pi$. Plugging these in yields expression (6) in the paper.

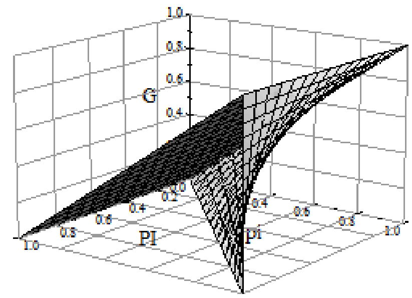

Figure 2: Welfare effects of changing control in period 1

4 Numerical examples

4.1 The welfare effects of changing control

Consider changing control in the special case when selective control completely removes the discipline of bad politicians: $0 = G[\beta((1-\pi)\bar{R}+V_0)] < G[\beta(\bar{R}+V_0)] \equiv G$. For example, if R is distributed uniformly on $[\bar{R}-z/2, \bar{R}+z/2]$, then this would be the case if $\beta((1-\pi)\bar{R}+V_0) < \bar{R}-z/2 < \beta(\bar{R}+V_0)$.

Assume first that voters' discount factor is 0 (so that only period-1 welfare matters). Proposition 2(iii) then implies that selective control always dominates no control, full control dominates selective control if $G > \pi$, and it dominates no control if $\Pi + (1-\Pi)G > \pi$. These parameter combinations are shown in Figure 2. Values of Π and π are on the two horizontal axes, and the value of G is on the vertical axis. The dark plane corresponds to the first condition and the light plane to the second condition. For points above the dark plane, full control provides the highest welfare, followed by selective control and no control. For parameter combinations between the two planes, selective control is best, followed by full control and no control. For combinations below the light plane, selective control is best, followed by no control and full control. As discussed in the paper, more control tends to be better when the quality of politicians (Π) is high and the quality of bureaucrats (π) is low. However, giving even low-quality politicians more control can be desirable if this creates high discipline G.

Now set voters' discount factor equal to 1. Proposition 2(iii) then implies that full control dominates selective control when $2 < \Pi(2-\pi) + \frac{G}{\pi}(1-\Pi)$, and it dominates no control when $(1-\Pi)(\Pi + (1-\Pi)G) > 2(\pi - \Pi)$. These conditions are shown on Figure 3. For points above the dark plane, full control provides the highest welfare, followed by selective control and no control. For parameter combinations between the two planes, selective control is best, followed by full control and no control. For combinations below the light plane,

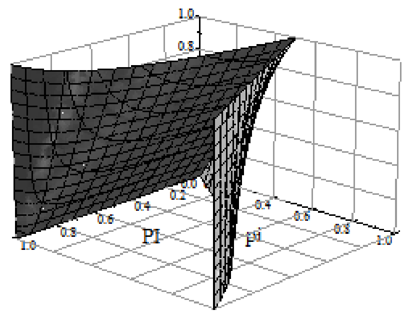

Figure 3: Welfare effects of changing control on the present value of voter welfare

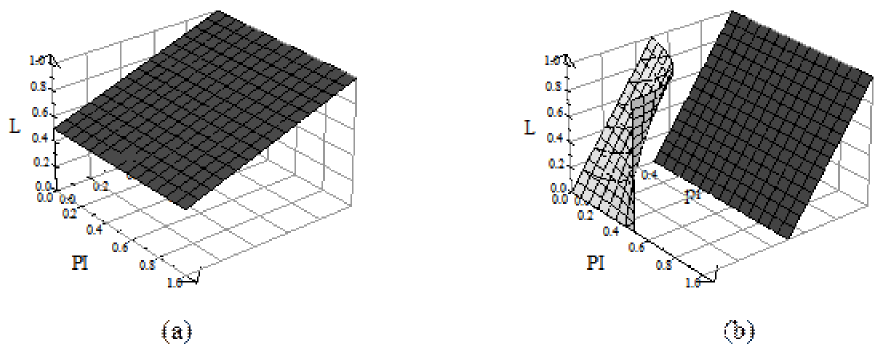

Figure 4: Welfare effects of improved selection for (a) $\beta r = \frac{1}{2}$ and (b) $\beta r = 2$.

selective control is best, followed by no control and full control. Qualitatively, these patterns resemble those observed previously. More control is better if politicians' quality is high and bureaucrats' quality is low, but discipline can often compensate for low politician quality.

4.2 The welfare effects of changing selection

I now illustrate the effects of changing the quality π of bureaucrats for $h \in (r, \Delta)$ (the only case in which the welfare effects are ambiguous). I assume that R is distributed uniformly on $[\bar{R} - z/2, \bar{R} + z/2]$. Define $r = \bar{R}/z$, $V = V_0/z$, and let $L = \beta((1-\pi)r + V) - r + 1/2$ represent the probability that a bad politician exercises discipline.

Again, start by setting voters' discount factor to 0, so that only period-1 welfare matters. Proposition 3(iii) implies that improving selection lowers welfare in period 1 whenever $1 - L < \beta r(1-\pi)$. This condition is illustrated by the dark planes on Figure 4 (a) and (b) for $\beta r = \frac{1}{2}$ and $\beta r = 2$, respectively. Better selection lowers welfare above this plane and increases welfare below it

Now set voters' discount factor equal to 1. Proposition 3(iii) implies that the present value of welfare falls iff $\beta r(1-\pi)(1-\Pi(1-\pi))+(1-L)(2\Pi(1-\pi)-1)>1$. When $\beta r=\frac{1}{2}$ (the case in Figure 4(a)), better selection always improves the present value of welfare. When $\beta r=2$ (Figure 4(b)), better selection lowers voter welfare above the light plane and increases welfare below it.

4.3 Welfare effects in the infinite horizon model

I now study some of the welfare effects of civil service reform in the infinite horizon model. First, I compare full control and selective control under the assumption that selective control yields no discipline ($\lambda=0$). Let W denote the ex ante expected present value of voter welfare, and W^B the expected present value of welfare conditional on a bad politician and a good policy being implemented. Let $\lambda^*=G(R^*)$, where R^* is the cutoff value of the bad politician's rent defined in the paper. Under full control, voter welfare may be written as

$$W_{full}=\frac{\Pi}{1+\beta}+(1-\Pi)\left[(1-\lambda^*)\beta W_{full}+\lambda^* W_{full}^B\right],$$

where the first term corresponds to a good politician (who is always reelected), and the terms in square brackets to a bad politician and, respectively, $e=E=1-S$, and $e=E=S$. In turn,

$$W_{full}^B=1+\beta\left[(1-\lambda^*)\beta W_{full}+\lambda^* W_{full}^B\right].$$

These two equations can be solved to obtain an expression for voter welfare W_{full} as a function of Π,λ^*, and β.

Under selective control with $\lambda^*=0$, we have

$$W_{sel}=\frac{\Pi}{1+\beta}+(1-\Pi)\left[(1-\pi)\beta W_{sel}+\pi W_{sel}^B\right],$$

where the first term corresponds to a good politician, and the terms in square brackets to a bad politician. Similarly,

$$W_{sel}^B=1+\beta\left[(1-\pi)\beta W_{sel}+\pi W_{sel}^B\right].$$

Solving, I find

$$W_{sel}=\frac{1}{1+\beta}\frac{\Pi(1-\beta\pi)+(1+\beta)(1-\Pi)\pi}{1-\beta+\Pi\beta(1-\pi)}. \tag{7}$$

Figure 5 shows the welfare comparison of full and selective control. The values of π and Π are on the horizontal axes, and the value of λ^* under full control is on the vertical axis.

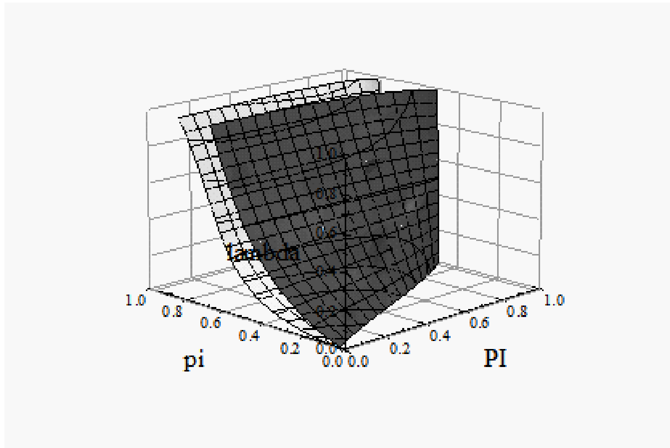

Figure 5: Full vs. selective control in the infinite horizon model

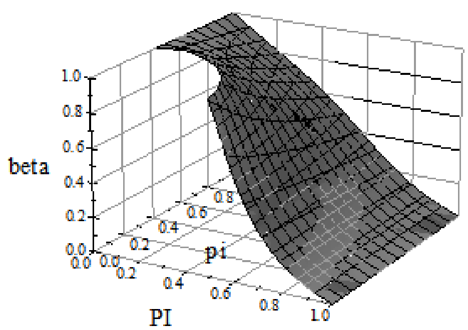

Figure 6: Welfare effects of improved selection, infinite horizon model

The figure shows the case of $\beta = 0.5$ (light plane) and $\beta = 0.8$ (dark plane). In each case, full control is better than selective control above the plane, and selective control is better below it. Thus, more control tends to be preferable when politician quality and discipline is high, and bureaucrat quality is low.

Finally, I study the impact of improving bureaucrat selection when $h \in (r, \Delta)$. Taking the derivative of (7) with respect to π, we find that improving the quality of bureaucrats raises voter welfare below the plane in Figure 6, and lowers welfare above it. Improving the quality of bureaucrats tends to hurt welfare when politician quality or the discount factor is high.