

The Declining Talent Pool of Government

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Abstract. We consider a government for which success requires high performance by talented ministers. A leader provides incentives to her ministers by firing those who fail. However, the consequent turnover drains a finite talent pool of potential appointees. The severity of the optimal firing rule and ministerial performances decline over time: the lifetime of an effective government is limited. We relate this lifetime to various factors including external shocks; the replenishment of the talent pool; and the leader's reputation. Some results are surprising: an increase in the stability of government and the exogenous imposition of stricter performance standards can both shorten the era of effective government, and an increase in the replenishment of the talent pool can reduce incumbent ministers' performance.

Commentators often highlight differences in the performances of governments. What accounts for these differences? At a basic level, performance depends upon the qualities of the executive's ministers and the actions they take: we expect high performance when talented individuals use their skills to pursue the collective goals of the government, rather than private ambitions.

The inherent talents of office-holders have been apparent in many governments of note. For example, the remarkable legislative achievements of the United Kingdom's Liberal government of 1908–14 were arguably related to the combination of talent in Herbert Asquith's cabinet which included such notable figures as David Lloyd George and Winston Churchill. Similarly if we consider George Washington's first cabinet, or that of Abraham Lincoln, what is striking is the number of talented individuals in each. According to one view, the problem of enhancing performance is resolved by attracting high-calibre individuals to serve in office (Caselli and Morelli, 2004; Besley, 2006); once the talented have been induced to serve then they should be retained and not discarded. In describing his view, Besley (2006, p. 37) traced his influences to Key (1956, p. 10):

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“The nature of the workings of government depends ultimately on the men who run it. The men we elect to office and the circumstances we create that affect their work determine the nature of popular government.”

Yet to consider only the talents of office-holders is to miss a critical piece of the puzzle; it is important to recognize “the circumstances we create that affect their work.” Absent other incentives a minister may pursue his private ambitions rather than the objectives of the government. It is the role of the executive’s leader to tackle this agency problem.²

So, to understand government performance we must consider the ministerial management strategy adopted by the executive’s leader. In so doing, we suggest that political agency problems differ from those in economic settings: the instruments available are blunter than those available in a private-sector organization. In the business world, incentive contracts can allow financial compensation to vary with performance measures. Even if a sophisticated incentive contract is not feasible, an agent may be offered a high “efficiency wage” (Akerlof, 1982; Shapiro and Stiglitz, 1984). These mechanisms are often absent in a political world: typically, ministerial salaries are not chosen by the executive’s leader and performance-related pay schemes are impossible.

The absence of performance-related pay does not eliminate the incentives to perform. Ministers value their positions and are motivated by a desire to keep their jobs. In using her prerogative to hire and fire the executive’s leader can align the incentives of her ministers with her own. This mechanism is central to the classic account of the development of cabinet government (Cox, 1987) as well as to more recent formal work: Indridason and Kam (2006) have argued that cabinet reshuffles can be used to bring departmental spending under control, while Dewan and Myatt (2007) have suggested that the judicious use of the firing prerogative can provide incentives for ministers to pursue radical policies even when, by so doing, they come under attack from interest groups. In the context of our paper, an executive’s leader encourages better performance by firing those who fail.

Alas, firing those who fail has unintended consequences: even high-performance ministers sometimes experience failures. Fired ministers must be replaced and new talent must be found. If the

²As Kearns Goodwin (2005) has argued, such was the genius of Abraham Lincoln who formed an effective cabinet that included his rivals for the Republican presidential candidacy in 1860.

pool of talent is deep then this presents few problems. However, in many systems, particularly under parliamentary governance, ministers are drawn from a shallow pool. In the United Kingdom, for instance, most ministers are drawn from the House of Commons; others are from the House of Lords. Moreover, even in Presidential systems where the talent pool is in principle less restrictive, the President may be constrained to appointing only those who hold a particular viewpoint.

The difficulty of filling positions when the pool of talent is shallow has been subject to commentary. Paxman (2003, p. 209) recounted that Tristan Garel-Jones, a whip in a United Kingdom government of the 1980s and a confidante of Prime Minister John Major, recalled scanning a list of fifteen candidates for a junior post and thinking

“I wouldn’t employ a single one of them. The problem was that, if you include all the various ranks of ministers, you have to find maybe ninety people to form a government. You have perhaps 350 or so people to choose from. Once you’ve eliminated the bad, mad, drunk and over-the-hill, you’ve got rid of a hundred. You then have to pick ninety people out of a pool of 250. Is it any wonder that the calibre is so low?”

Our account of government performance begins with the observation that a shallow talent pool constrains the resolution of agency problems: to provide incentives a leader fires those who fail, but in so doing she drains a finite reservoir of talent. The leader’s firing rule—her response to a failure or scandal attributable to a minister—balances a conflict between incentive provision and talent retention: by operating a stricter firing rule, she raises performance and reduces the likelihood of scandals, but she loses more readily those implemented by such scandals.

Whilst, a priori, the effect of a stricter standard on turnover and performance is ambiguous, we show that it leads to higher ministerial hazard rates. Moreover, the optimal firing rule deployed by the executives’ leader weakens incentives over the lifespan of a government and so diminishes the executive’s performance. We build on this basic analysis to explore the response of an optimal firing rule to various factors including the size of the talent pool, the arrival of external shocks, the possibility of talent-pool replenishment, and the need for a leader to maintain her reputation.

Our results reveal that any period of effective governance eventually ends.³ We focus on the length of time that a government remains effective. Commentators often highlight the “first hundred days” of government as being its most important. But some governments maintain high performance for longer, whilst others fall short before a hundred days have passed. We examine how exogenous factors combine with an optimal firing rule to determine the lifetime of an effective government.

We also explore the effect of institutional procedures intended to enhance standards in public life. For instance, in the United Kingdom a Committee into Standards in Public Life was created by Prime Minister John Major (in October, 1994) to examine “concerns about standards of conduct of all holders of public office” and “to ensure the highest standards of propriety.” Such standards impose a lower bound to the severity of any firing rule. We explore the effects of an exogenous increase in the standards imposed on ministers; such an increase can reduce the lifetime of an effective government by shortening the era during which higher standards are endogenously used.

In an extension to our model we consider institutional features that might influence the ministerial talent pool. In many parliamentary systems selection into government is restricted to those who serve in the legislature. By contrast, in presidential systems ministers may be chosen from all walks of life (though if a president is constrained to selecting only those who are aligned with her policy goals then the finite pool remains shallow). This feature appears attractive since it can deepen the reservoir of talent. This is one reason why many parliamentary systems have seen attempts to build inclusive cabinets. For example, the Italian cabinets led by Prime Ministers Giuliano Amato (1992–93) and Carlo Azeglio Ciampi (1993–94) contained so-called technocrats. Similarly, Prime Minister Gordon Brown of the United Kingdom recently called for a “cabinet of all the talents” including ministers selected for their professional expertise.⁴ We explore the effects of introducing new blood into the talent pool. Perhaps surprisingly, a replenishing talent pool can reduce rather than enhance the performance of incumbent ministers.

³Sartori (1997, p. 113) questioned and dismissed the view that effective governments must be long-lasting. He asked: “Why is it important that governments should not fall? The answer generally is that stable government indicates effective government. Alas, no. Government stability stands for a mere duration; and government can be both long lived and impotent: their duration over time is by no means an indicator even less an activator of efficiency or efficacy.”

⁴In Spain, Ireland, and several countries in Middle and Eastern Europe ministers can also be drawn from outside the parliament. Recent work by Dowding and Dumont (2008) provides details.

We conclude our analysis by assessing the credibility of the Prime Minister's firing rule. The promise to fire a failing minister provides incentives, but the Prime Minister would prefer not to carry out her threat and so preserve her pool of talent. To maintain credibility she must carry out her promises. When the ministerial talent pool is fixed, this is impossible: eventually her talent pool dries up and she will be unwilling to fire her last remaining talented minister. An unravelling argument then leads to the collapse of her entire ministerial management strategy. However, talent-pool replenishment can restore credibility by creating a future in which the Prime Minister's reputation matters, and this can induce her to carry out her threats.

A MODEL OF MINISTERIAL PERFORMANCE, SCANDALS, AND RESIGNATIONS

We begin our formal analysis by describing a simple model of ministerial performance.

Ministerial Payoffs and Performance. The Prime Minister appoints a minister to his post by selecting him from a talent pool of suitable candidates. During his time in office a minister enjoys a flow payoff of $\bar{v} > 0$ which reflects his salary, the perquisites of office such as a ministerial car and research staff, and the personal benefits of being in a position of power and influence. Our model differs from principal-agent analyses of labor relations in one critical aspect: salaries are exogenously fixed, and so performance-related pay cannot be used to provide incentives.

While in post the minister controls a single variable: at each moment in continuous time he chooses his performance $e \in [0, \bar{e}]$, where the upper bound \bar{e} is one aspect of the minister's talent. Higher performance helps the government, but is costly for the minister; this divergence of interests is the source of an agency problem. Specifically, the minister incurs a flow cost of ce .⁵ Rather than think of this as the cost of effort, we instead think of it as the opportunity cost to the minister of not pursuing his own personal agenda. The parameter $c > 0$ is a second aspect of the minister's talent; when c is low the minister finds it relatively easy to follow the government's agenda.

Bringing the payoff components together, a minister enjoys a net flow payoff of $\bar{v} - ce$, so long as he retains his job, and he is free to vary his performance over time if he so wishes. He receives

⁵The linear functional form is without loss of generality; the property we use is the convexity of the relationship between the arrival rate of scandals (described in the next subsection) and the cost of performance.

nothing if either he is fired or the government falls. If the minister's tenure in office were fixed and he faced no other incentives then he would choose $e = 0$.

Failures and Scandals. During her time in office, which ends only when her government falls, the Prime Minister (whose preferences are those of her government) enjoys a flow payoff of $\bar{w} > 0$. However, she suffers a penalty whenever her minister encounters a policy failure or becomes embroiled in a scandal. When a minister falls short in such ways he faces a resignation call, made by the opposition, by the media, or even by the wider membership of the governing party. We refer to such resignation calls as scandals. The magnitude of scandals varies: the penalty s from a scandal is drawn from the cumulative distribution function $F(\cdot)$ with expectation $\bar{s} \equiv E[s]$.⁶

Scandals arrive according at a (Poisson) rate of $\bar{\lambda} + \lambda(e)$. This arrival rate comprises two components. Firstly, there is an exogenous hazard rate $\bar{\lambda} > 0$ which is unrelated to the minister's actions. This term might reflect elements of the minister's portfolio which place him at particular risk. For example, the difficulty of the task facing him may increase his exposure or policies enacted by a predecessor may come back to haunt him.⁷ Secondly, the endogenous hazard rate $\lambda(e)$ is decreasing in the minister's performance. (Technically, we assume that it is also convex and differentiable in e .) By increasing his performance a minister increases the quality of his policies and their execution and so, correspondingly, reduces the likelihood that resignation calls are made. For some of our results we highlight one specific functional form for $\lambda(e)$.

Definition. *Scandal arrivals* linearly decreasing in performance if $\lambda(e) = \hat{e} - e$ where $\hat{e} \geq \bar{e}$.

Bringing the payoff components of the Prime Minister together, she enjoys a net expected flow payoff of $\bar{w} - [\bar{\lambda} + \lambda(e)]\bar{s}$ when her minister devotes performance e to his portfolio of tasks. Notice that a conflict of interest arises: other things equal, the minister wishes to choose $e = 0$ to minimize his cost of performance, whereas the Prime Minister would like him to choose $e = \bar{e}$ and so slow down the arrival of damaging scandals.

⁶We could also relate the severity of scandals to performance. Under this alternative specification, the tension we highlight between incentive provision and talent retention remains.

⁷In the United Kingdom during the 1960s and 70s successive ministers attempted to reform industrial relations and failed. The most famous, Barbara Castle, was undoubtedly a talented minister who gave her all. Arguably it was the nature of her task, rather than her poor performance, which led to her downfall.

Ministerial and Government Termination. So far, we have noted that the minister and his boss enjoy flow payoffs of $\bar{v} - ce$ and $\bar{w} - [\bar{\lambda} + \lambda(e)]\bar{s}$ respectively. These payoffs are enjoyed only while these actors survive in office. But what determines their survival?

Both actors are exposed to a background risk of losing office. Following the early empirical literature we specify a risk of critical events, such as a financial crisis or international conflict, that may topple a government (Browne, Frensdreis, and Gleiber, 1984, 1986; Diermeier and Stevenson, 2000). Such events arrive at a (Poisson) rate $\gamma > 0$. Consistent with the later literature on government termination there may be institutional features that enhance a government's durability when shocks arrive. For example King, Alt, Burns, and Laver (1990) found that majority status and the existence of an investiture requirement are both positively related to government duration. Here, the existence of these features corresponds to a lower value of γ .⁸ The parameter γ can also be interpreted as a continuous-time discount rate, and so can represent impatience.

A minister faces a further risk: a scandal prompts a call for his resignation. In response the Prime Minister can retain him or fire him. This risk is endogenous since it depends upon the attitude of the Prime Minister to resignation calls. Furthermore, the minister can reduce his exposure via his performance. We suppose that some risk is inescapable: the Prime Minister is unable to protect her minister in the face of extreme scandals. Formally, there is a critical threshold s^\ddagger such that a minister is always fired whenever $s > s^\ddagger$. However, the Prime Minister retains her hiring-and-firing prerogative whenever $s \leq s^\ddagger$.

The key assumptions of our model are (i) the availability of qualified replacements declines with the number of ministers who have served; and (ii) the Prime Minister strictly prefers to work with talented ministers. One interpretation, though not the only one, is that her government can only survive so long as talent is available. Thus if a minister is forced to resign and there is no suitable replacement then the government is removed from office through some mechanism, constitutional or otherwise. We suppose that the government begins with a talent pool comprising n potential ministerial appointees. Each time a minister is removed from office, the pool loses a member. (In a later extension to our model, we allow the pool to become replenished by new arrivals.)

⁸Similarly, and following Warwick (1992), a lower γ may capture relatively stable economic conditions.

MINISTERIAL PERFORMANCE

Here we study the performance of a minister and his response to the hiring-and-firing stance of a Prime Minister (Propositions 1–2). Fixing the firing rule, we relate the expected length of his career to factors including the value of office, the exogenous risk of government termination, and the exogenous risk of resignation calls (Proposition 3).

The Prime Minister’s Firing Rule. We assume that the performance of the minister cannot be directly observed: a classic moral-hazard problem. However, there is an imperfect performance measure: the arrival of scandals and subsequent resignation calls. Although the Prime Minister is unable to observe directly the performance of her ministers, she can respond to a scandal.

We restrict attention (with little loss of generality) to the following firing rule: if a minister faces a resignation call then the Prime Minister fires him if and only if $s > s^\dagger$. (Later we allow this threshold to depend upon the size of the ministerial talent pool.) The threshold s^\dagger must satisfy $s^\dagger \leq s^\ddagger$ since resignation calls are irresistible (by assumption) when $s > s^\ddagger$. Given that the penalty of a scandal is drawn from $F(\cdot)$, this means that the minister is fired with probability $q^\dagger \equiv 1 - F(s^\dagger) \geq q^\ddagger \equiv 1 - F(s^\ddagger) > 0$. Given this firing probability, the hazard rate of the minister’s resignation is $[\bar{\lambda} + \lambda(e)]q^\dagger$. Fixing his performance, this rate is increasing in q^\dagger . However, the endogenous hazard rate $\lambda(e)$ of scandals responds to q^\dagger via e , and so to understand the overall effect of q^\dagger we must consider the minister’s performance choice.

The Choice of Performance. Faced by the risk of losing his job, a minister is concerned to slow the arrival of resignation calls. In doing so he balances the direct flow cost of performance against the change in the hazard rate. The second factor is weighted by the present value V that he places on his career. His environment is stationary and hence so is V . Hence this career value satisfies

$$\underbrace{\bar{v} - ce}_{\text{flow benefits and costs}} = \underbrace{[\bar{\lambda} + \lambda(e)]q^\dagger V}_{\text{risk of resignation}} + \underbrace{\gamma V}_{\text{exogenous risk}}. \quad (1)$$

The first term comprises the flow benefits of holding office \bar{v} minus the cost ce of performance. The second term reflects the endogenous risk of a successful resignation call: scandals arrive according

to the hazard rate $\bar{\lambda} + \lambda(e)$; the minister is subsequently forced to resign with probability q^\dagger ; and following his resignation the minister loses the value V of his career. Finally, the third term stems from the exogenous risk of government failure.

Given the optimal choice of performance e we can use Equation (1) to solve for the value V of the minister's career. However, we need to characterize the optimal choice of e . When increasing his performance the minister balances the marginal flow cost c against the marginal impact on the expected flow penalty of resignation calls. Bringing these two effects together, the optimal choice of e satisfies the simple first-order condition

$$c = -\lambda'(e)q^\dagger V \quad (2)$$

so long as this solution satisfies $0 < e < \bar{e}$.⁹ Equations (1) and (2) can be used to solve jointly for the minister's optimal performance e and the value of his career V . However, some immediate observations flow from Equation (2). Since $\lambda(e)$ is convex (there are decreasing returns to performance) the solution for e , other things equal, is increasing in $q^\dagger V$ (the penalty of a resignation call) and decreasing in c (the cost of performance).

The Effect of the Firing Rule. Although the Prime Minister cannot use monetary transfers to encourage performance she does control the tenure of her minister via her firing rule, which affects him via the resignation probability q^\dagger . There are two effects to consider.

Firstly, as q^\dagger increases it becomes more likely that a scandal terminates a ministerial career. A minister may respond by raising his performance, thereby minimizing the risk of scandal. This is a substitution effect: Equation (2) reveals that an increase in q^\dagger encourages a minister to substitute away from private concerns and toward the government's agenda.

Secondly, an increase in q^\dagger has an income effect. Conditional on his performance, a minister is more likely to lose his job when q^\dagger is large. This reduces the present value V of his career. He cares less about keeping his job and so is more willing to divert his efforts toward his own private projects. This income effect can weaken his performance.

⁹Otherwise performance attains its upper bound (if $c \leq -\lambda'(\bar{e})q^\dagger V$) or its lower bound (if $c \geq -\lambda'(0)q^\dagger V$).

Whereas these two effects of an increasingly severe firing rule conflict, their net effect is indeed to enhance performance as we confirm in our first formal result.

Proposition 1. *Ministerial performance increases with the severity q^\dagger of the firing rule, the benefits \bar{v} of office, and the minister's talent \bar{e} , but decreases with the opportunity cost c of performance, the exogenous risk γ of government termination, and the exogenous risk $\bar{\lambda}$ of resignation calls.*

Our comparative-static results indicate the importance of income effects.¹⁰ Any factor that increases the value of a ministerial career increases performance and vice-versa. One example is office-holding benefits, which increase whenever the minister receives a more stately home, a larger limousine, or an increase in his entourage.¹¹ In response, his career becomes more desirable (relative to languishing on the backbenches) and so the minister devotes more effort to his tasks. This enhances the performance of his department and reduces the risk of resignation calls.

Similarly, as the exogenous hazard $\bar{\lambda}$ of scandals increases it becomes more likely that, irrespective of performance, the minister's career will be curtailed. This lowers the value of his career; with less to lose his performance falls. One interpretation of a higher $\bar{\lambda}$ is that the minister may be haunted by the scandals of his predecessor: a failure may have more to do with a previous incumbent than anything a minister has done since being in post. The anticipation of such a scandal lowers the value of his career. Accordingly, since he has less to lose he devotes less effort to his ministerial tasks and the performance of his department declines, thus reinforcing the likelihood of a scandal.

Finally, e decreases with γ . Our interpretation of γ is the background risk of government termination. As the expected lifespan of the government shortens, the value of a ministerial career drops, and so the performance of the minister declines. The comparative-static effects of both $\bar{\lambda}$ and γ reveal that the risks are self-reinforcing: whenever a minister or government is expected to fail the income effect depresses the incentives to perform and so accelerates the onset of further scandals.

¹⁰The various comparative-static effects are easily illustrated by examining a specific example. If the endogenous risk of scandals is inversely proportional to a minister's chosen performance, so that $\lambda(e) = 1/e$, then

$$e = \frac{\sqrt{1 + \frac{\bar{v}}{c}[\frac{\gamma}{q^\dagger} + \bar{\lambda}]} - 1}{\frac{\gamma}{q^\dagger} + \bar{\lambda}} \quad (3)$$

so long as this solution satisfies $e < \bar{e}$; the minister chooses performance $e = \bar{e}$ otherwise.

¹¹Such benefits correspond to the payment of an efficiency wage (Akerlof, 1982; Shapiro and Stiglitz, 1984).

All-or-Nothing Performance. To derive further insight we turn to our illustrative specification in which the arrival rate of scandals is linearly decreasing in the minister's performance. This linearity ensures that a “bang bang” solution is optimal: the minister chooses either the maximum feasible performance or devotes no effort to his tasks.

Proposition 2. *When the arrival rate of ministerial scandals is linearly decreasing in performance the Prime Minister can only induce positive performance from her minister if $\bar{v} \geq c[\gamma + \bar{\lambda} + \hat{e}]$. If this is so, then the minister provides performance that satisfies $e = \bar{e}$ if and only if $q^\dagger \geq q^*$ where*

$$q^* = \frac{c\gamma}{\bar{v} - c[\bar{\lambda} + \hat{e}]} \quad (4)$$

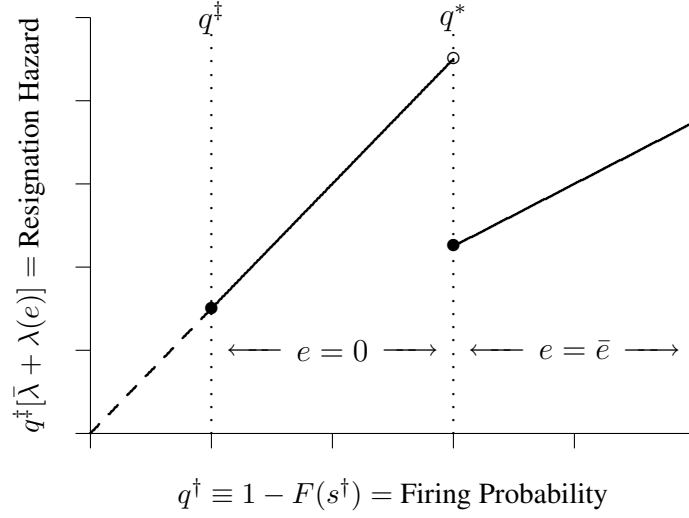
Otherwise, when either $\bar{v} < c[\gamma + \bar{\lambda} + \hat{e}]$ or $q^\dagger < q^$, the minister chooses $e = 0$.*

To induce high-performance the Prime Minister must threaten to sack a scandal-hit minister with sufficiently high probability. However, she can do no worse than respond to every resignation call. Hence $q^* \leq 1$ or equivalently $\bar{v} \geq c(\gamma + \bar{\lambda} + \hat{e})$: to induce high performance, office benefits must be large. Others have argued that such benefits attract higher quality politicians (Caselli and Morelli, 2004; Messner and Polborn, 2004). Our focus on income effects suggests that the same factor influences action choice. Turning to the right-hand side of the inequality, high performance becomes harder to induce as exogenous risks grow: such risks erode the value of a career.

When $\bar{v} > c(\gamma + \bar{\lambda} + \hat{e})$ (local) changes in parameters feed through via a change in the severity of the firing rule required for high performance. From Equation (4), q^* is decreasing in office benefits and increasing in the opportunity cost of performance and the exogenous-risk parameters. Factors that encourage performance, then, may generate a more lenient response to scandals.

Resignations. Before concluding this section we consider the arrival of resignations, rather than scandals. This hazard rate is the product of two effects: the arrival rate $\bar{\lambda} + \lambda(e)$ of scandals, and the proportion q^\dagger of scandals that result in the minister's resignation.

Fixing the other parameters, the effect of an increase in q^\dagger can go either way: its direct effect is to increase the hazard rate, while the consequent increase in performance (Proposition 1) reduces



Notes. The relationship between the firing probability q^\dagger and the arrival of resignations can be non-monotonic. Here the hazard rate of scandals is linear in performance. For $q^\dagger \leq q^* < q^*$, the resignation hazard is $q^\dagger[\bar{\lambda} + \lambda(0)]$, which is increasing in q^\dagger . However, at $q^\dagger = q^*$ the minister's performance jumps up, and so the resignation hazard falls to $q^\dagger[\bar{\lambda} + \lambda(\bar{e})]$, before continuing to increase with q^\dagger once again.

FIGURE 1. Firing Rules and the Arrival Rate of Resignations

it. The conflicting effects are most easily seen when the arrival of scandals is linearly decreasing in performance. Local to q^* and starting from $q^\dagger < q^*$ an increase in the firing probability to $q^\dagger > q^*$ prompts a jump in performance from $e = 0$ to $e = \bar{e}$ and so a discrete fall in the arrival of resignations. However, local increases in q^\dagger away from q^* generate more resignations with no associated increase in performance (Figure 1.)

Fixing the firing rule, however, the effects of other parameters are clear. An increase in the exogenous risk $\bar{\lambda}$ directly increases resignations whilst also increasing the arrival of scandals via reduced performance. All other parameters feed via the minister's performance choice. The tenure of a minister is then inversely related to the hazard of resignations and the exogenous risk γ of government termination. Assembling these observations we obtain the following formal result.

Proposition 3. *Given a firing rule, the expected length of a minister's career increases with the benefits \bar{v} of holding office and the minister's talent \bar{e} , but decreases with the opportunity cost c of performance, the exogenous hazard γ of government termination, and the exogenous hazard $\bar{\lambda}$*

of resignation calls. When the arrival of scandals is linearly decreasing in performance and the firing rule adjusts so that $q^\dagger = q^*$ then these comparative-static predictions continue to apply.

Our analysis of the *ex ante* exogenous termination risk deserves further comment. Whilst the effect of *ex ante* shocks on government duration has been modeled (Lupia and Strøm, 1995) ours is the first model that explores their impact on ministerial tenure. An increase in γ decreases the value of a career and so necessitates stronger incentives to perform. Of course γ may also account for institutional effects that enhance a government's durability. Huber and Martinez-Gallardo (2008) show that these effects can have the opposite impact on tenure, but our result suggests that their findings may be due to the omission of variables accounting for individual ministerial performance.

THE OPTIMAL FIRING RULE

Having established the behavior of a minister, we turn our attention to the firing rule chosen by the Prime Minister. We assume for now that she commits fully to her desired firing rule; later in the paper we revisit this assumption, and so ascertain the credibility of different firing rules.

Firing Rules and the Size of the Talent Pool. The Prime Minister's strategy is her firing rule: she chooses a threshold $s^\dagger \leq s^\ddagger$, interpreted as the maximum severity of a scandal that a minister is permitted to experience; this is equivalent to selecting a firing probability $q^\dagger \equiv 1 - F(s^\dagger)$.

The Prime Minister might wish to change her firing rule to suit the size of her talent pool. Recall that she begins with n potential ministerial appointees. She begins by hiring one of them, and so the initial size of her talent pool is $n - 1$. Whenever a sufficiently severe scandal arrives she fires the incumbent and replaces him; the size of her talent pool declines. We write $k \in \{0, 1, \dots, n - 1\}$ for the current size of the talent pool. If a minister is fired when $k = 0$ then, since the talent pool has evaporated, the government falls. We note that, absent any replenishment of the talent pool (we will allow for the possibility of such replenishment later in our paper) k cannot grow. Furthermore, since $\bar{\lambda} > 0$ and $q^\ddagger > 0$ there is always the risk of a scandal that results in a resignation, and hence k will strictly fall, (in expectation), over time. The rate of decline depends, of course, on the firing rule and the response of the ministers to whom it applies.

As k declines the Prime Minister may become more concerned with talent retention and so may adjust her firing rule. We write $s_k^\dagger \leq s^\ddagger$ for the threshold she operates when there are k remaining members of her talent pool. Equivalently, $q_k^\dagger \equiv 1 - F(s_k^\dagger)$ is the resignation probability faced by a scandal-hit minister when there are k potential replacements. Corresponding to this probability is the performance e_k chosen by the incumbent. Of interest to us is the relationship between the size k of the talent pool and the endogenous variables q_k^\dagger and e_k ; these variables then jointly determine the arrival rate of resignations and hence the expected length of each minister's career.

Optimal Firing Rules and Declining Performance. We have shown (Proposition 1) that a stricter firing rule enhances ministerial performance. If this were the only concern of the Prime Minister then she would be as strict as possible. However, firing ministers is costly: the talent pool dries up, and the end of the government draws nearer. Here we characterize the optimal firing rule in the presence of these conflicting pressures.

To do this we begin by calculating the present value of the Prime Minister's career (equivalent here to the value of her government). We write W_k for this value when there are k members of the talent pool. The flow payoffs accruing to the Prime Minister must balance the arrival of events which change the composition of the talent pool. For $k \geq 1$ we have

$$\underbrace{\bar{w} - [\bar{\lambda} + \lambda(e_k)]\bar{s}}_{\text{flow benefits and costs}} = \underbrace{q_k^\dagger [\bar{\lambda} + \lambda(e_k)] [W_k - W_{k-1}]}_{\text{risk of talent depletion}} + \underbrace{\gamma W_k}_{\text{exogenous risk}}. \quad (5)$$

The first term comprises the flow benefits of holding power minus the expected inflow of costly scandals. The second term reflects the risk of successful resignation calls: scandals arrive at rate $\bar{\lambda} + \lambda(e_k)$; the minister quits with probability q_k^\dagger ; following a resignation the loss $W_k - W_{k-1}$ is the marginal value of the k th member of the talent pool. Finally, the third term stems from the exogenous risk of government termination. A variant of Equation (5) holds when $k = 0$: since the talent pool is empty, the Prime Minister loses W_0 when her minister leaves office and so $\bar{w} - [\bar{\lambda} + \lambda(e_0)]\bar{s} = ([\bar{\lambda} + \lambda(e_0)]q_0^\dagger + \gamma)W_0$.

Once the Prime Minister has specified and committed to her strategy (a sequence of firing probabilities indexed by k) we can use Equation (5) to calculate the value of her government. However, her strategy will be chosen optimally to balance the different effects of a change in q_k .

So what are these effects? Consider an increase in the firing probability q_k^\dagger . The most direct effect is higher performance and so lower penalties from the arrival of scandals. The change also influences the arrival of resignations: the increase in performance slows the arrival of scandals, while the higher firing probability increases the fraction of scandals which turn into resignations. As noted earlier in the paper, the net effect on $[\bar{\lambda} + \lambda(e_k)]q_k^\dagger$ can take either sign. However, if the net effect is negative, so that an increase in the firing probability reduces the hazard of resignations, then the Prime Minister will always choose to increase q_k^\dagger . This, in turn, means that q_k^\dagger will always be raised to a point at which either the minister's performance satisfies $e_k = \bar{e}$, or a point at which $[\bar{\lambda} + \lambda(e_k)]q_k^\dagger$ is increasing in q_k^\dagger . Furthermore, this logic implies that if different firing probabilities are employed for different talent-pool sizes, then higher choices of q_k^\dagger must be associated with an accelerated arrival of resignations. We record this observation as a simple lemma.

Lemma 1. *Greater severity of the firing rule is always associated with an increase in the arrival of resignations: for talent-pool sizes k and k' if $q_k^\dagger > q_{k'}^\dagger$ then $[\bar{\lambda} + \lambda(e_k)]q_k^\dagger > [\bar{\lambda} + \lambda(e_{k'})]q_{k'}^\dagger$.*

Combining this lemma with our earlier results, an increase in the severity of the firing rule is associated with greater performance but more resignations; the last factor results in a reduction in the length of a ministerial career. However, we have not yet established the relationship between these co-moving variables and the size k of the talent pool.

To move further we consider the effect of a local increase in q_k^\dagger . When performance responds continuously to the firing probability such an increase is optimal if and only if

$$\underbrace{-\bar{s} \frac{d\lambda(e_k)}{dq_k^\dagger}}_{\text{fewer scandals}} > \underbrace{(W_k - W_{k-1}) \frac{d[(\bar{\lambda} + \lambda(e_k))q_k^\dagger]}{dq_k^\dagger}}_{\text{quicker talent depletion}}. \quad (6)$$

The left-hand side captures the effect of a stricter regime (higher q_k^\dagger) on performance: a marginal increase in q_k^\dagger leads to fewer resignation calls and so the left-hand side is positive. The right-hand

side captures the cost of this stricter regime: as the Prime Minister fires more often she runs down her talent pool. The size of the talent-depletion effect depends directly on the loss $W_k - W_{k-1}$ experienced when a minister is fired. This implies that the Prime Minister is more willing to fire a member of her team whenever the marginal value of a talent pool member is small. Intuitively, this marginal value is small whenever the talent pool is large, as confirmed by the following lemma.

Lemma 2. *The value of the government is increasing in the size of the talent pool but exhibits decreasing returns to talent-pool size: W_k is increasing in k , while $W_k - W_{k-1}$ is decreasing in k .*

Combining Lemma 2 with the insight of Equation (6) we follow these logical steps: when the talent pool is large (high k) the marginal value of a talent pool member is small; this reduces the severity of the talent-pool depletion effect; the Prime Minister is more willing to fire and so q_k^\dagger is high; higher firing probabilities are associated with higher performance and faster arrival of resignations. This logic results in our next formal proposition which is central to our paper.

Proposition 4. *Under an optimal firing rule, the firing probability q_k^\dagger , ministerial performance e_k , and the arrival rate $q_k^\dagger \times [\bar{\lambda} + \lambda(e_k)]$ of resignations all increase with the size k of the talent pool. If γ is small enough, so that there is little exogenous risk of government failure, then the expected rate of decline $q_k^\dagger [\bar{\lambda} + \lambda(e_k)] (W_k - W_{k-1})$ of the government's fortunes is increasing in k .*

Since k is inversely related to the number of ministers who have served, the result shows that a minister's is affected not only by his own actions but also by the cumulative number of resignations from the government he serves: his tenure is longer when the talent pool is shallow. Of course, the talent pool evaporates over time, since the arrival rate of scandals and the firing probability are both strictly positive. We can, therefore, re-state Proposition 4 in terms of time-based expectations.

Corollary to Proposition 4. *Under an optimally chosen firing rule, the firing probability, the ministerial performance, the arrival rate of ministerial resignations, and (when γ is sufficiently small) the rate of decline of the government's fortunes are all expected to fall over time.*

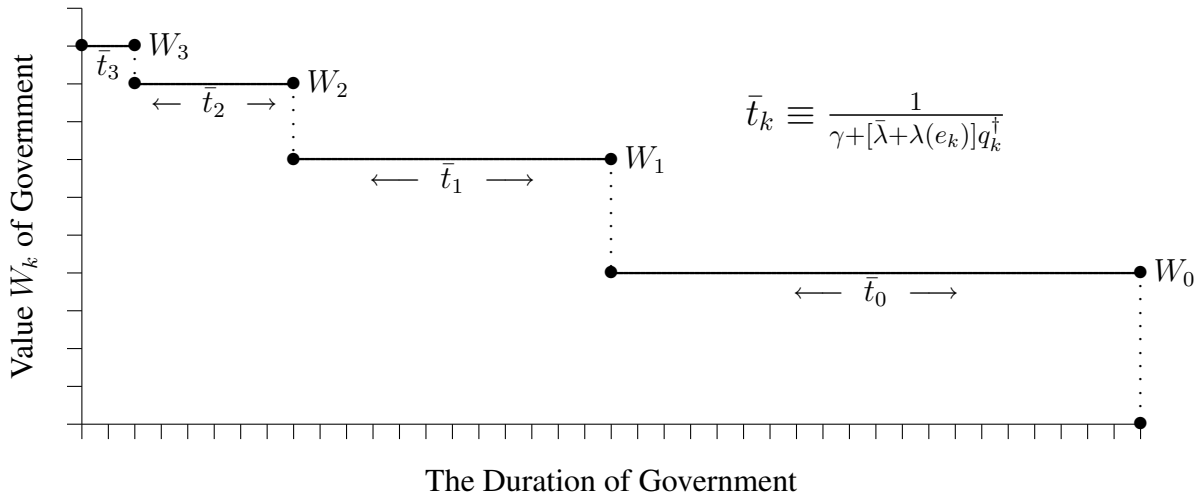
A Decline in Government Performance. The optimal firing probability declines as the talent pool shrinks, so that ministers perform less well and yet last for longer. This has implications for the interpretation of statistics on ministerial hazard rates. Berlinski, Dewan, and Dowding (2007) argued that “length of tenure must be some indicator of performance” and used indicators of a minister’s quality to explain variation in hazard rates. We provide a caveat: fixing his talent, a minister who enters the government later (when the talent pool is depleted) performs less well than one who served earlier (and was replaced) but survives for longer. Thus to understand the relationship between performance and tenure we consider the strategy deployed by the Prime Minister.

As a further illustration consider again the second United Kingdom government of Prime Minister John Major. By the middle of 1993 the government had been rocked by successive scandals involving first David Mellor (Secretary of State for Heritage) and Michael Mates (Minister of State for Northern Ireland). As more ministers were forced to resign the performance of Major’s government declined. Ministers became involved in feuds over policy, most notably over the Maastricht Treaty, and jockeyed for position in the leadership contest that would follow Major’s eventual downfall. By the middle of 1993 Major had become so exasperated by the performance of three of his main cabinet colleagues that, in an astonishing outburst, he openly branded them as “bastards”. And yet Major could not fire his rebels: the reserve of talent had been so depleted as to make further turnover untenable. Tristan Garel-Jones observed (Paxman, 2003, p. 210) that

“... things had got even worse. Not only had the overall number of Conservative MPs fallen, while the number of incompetents and has-beens had grown, there was also a much larger group who had already served in government and been worn out or found wanting by the process. Small wonder that it was so hard for John Major to give his administration an aura of either coherence or competence.”

THE LENGTH OF EFFECTIVE GOVERNMENT

An optimal firing rule yields declining performance. This might explain why governments push forward their programs early, and supports a common intuition: commentators often see the “first



Notes. Starting with a talent-pool of size $k = 3$, the figure illustrates the value W_k of the Prime Minister's career (or, equivalently, the value of her government) as her talent-pool declines. The height of each step reflects the decrease in value ($W_k - W_{k-1}$) as she runs down her talent-pool. This loss increases as k declines and so q_k declines with k . The length \bar{t}_k of each step illustrates the expected tenure of a minister: this is inversely related to the risk he is exposed to in turn comprises the exogenous risk γ of government failure together with the endogenous risk $[\bar{\lambda} + \lambda(e_k)]q_k^\dagger$ of his resignation. This tenure is increasing as the size of the talent-pool declines: the expected tenure of a minister increases although his performance decreases. The expected rate of decline of the government's fortunes is determined by $(W_k - W_{k-1})/\bar{t}_k$ which is the steepness of each step. When γ is sufficiently small this expected rate of decline falls as the talent pool evaporates.

FIGURE 2. The Declining Talent Pool of Government

hundred days" as being the most important.¹² This raises questions: how long does a government remain effective? And what determines the length of effective (rather than ineffective) governance?

The Duration of Effective Government. As Figure 2 illustrates, performance suffers as k declines. When the arrival of scandals is linear in performance we can precisely describe the duration of effectiveness. For the linear specification, performance is "all or nothing" ($e = \bar{e}$ or $e = 0$) so there is a natural interpretation of effectiveness: the government is effective when ministers devote all of their available talent to the tasks of government, and ineffective when they do not.

Whether government is effective depends on the standards operated by the Prime Minister: effective government requires a high standard ($q_k^\dagger = q^*$) rather than a low standard ($q_k^\dagger = q^\ddagger$).

¹²The phrase originates with the New Deal under Franklin D. Roosevelt. Whilst some administrations have sought to emulate FDR's achievement, most notably Ronald Reagan's first administration, others have set more modest targets; John F. Kennedy famously remarked that "it won't be done in the first hundred days."

Proposition 4 establishes the relationship between q^\dagger and k . The Prime Minister operates a stricter threshold (higher q^\dagger) early on and, as her talent pool shrinks, correspondingly relaxes her firing rule. Bringing these elements together leads directly to the following corollary to Proposition 4.

Corollary to Proposition 4. *When scandal arrival is linearly decreasing in performance, there is a critical talent-pool size k^* such that the Prime Minister sets $q_k^\dagger = q^*$ (effective performance) when $k \geq k^*$, but sets $q_k^\dagger = q^\ddagger$ (ineffective performance) for $k < k^*$. Ministerial performance falls after $n - k^*$ ministerial resignations, and from then on the government is ineffective.*

We have established that a government remains effective so long as its talent pool is deep enough. The duration of effective government stems from two elements: (i) the tenure of each minister in the high performance regime; and (ii) the number of ministers ($n - k^*$) involved in that regime.

The first factor may be calculated straightforwardly. In general, the expected tenure \bar{t}_k of a minister in the context of a k -strong talent pool satisfies $\bar{t}_k = 1/(\gamma + [\bar{\lambda} + \lambda(e_k)]q_k^\dagger)$. If the arrival rate of scandals is linearly decreasing in performance and $k \geq k^*$ then $q_k^\dagger = q^*$ (the firing probability emerging from Proposition 2) and $\lambda(e_k) = \hat{e} - \bar{e}$. Using Equation (4) the expected tenure of a minister in the effective phase of government satisfies

$$k \geq k^* \quad \implies \quad \bar{t}_k = \frac{1}{\gamma} \left[\frac{\bar{v} - c(\bar{\lambda} + \hat{e})}{\bar{v} - c\bar{e}} \right].$$

An inspection of this expression confirms the predictions of Proposition 3: a minister's tenure grows with his benefits of holding office and his talent, but decreases with the exogenous hazard rates of government termination and resignation calls.

The second determinant of the duration of effective government (the number of ministers $n - k^*$ affected by the high-performance regime or, equivalently, the talent-pool threshold k^*) is the primary endogenous control variable of the Prime Minister. We use this as our measure of the length of effective government.

Definition. *When the arrival rate of scandals is linearly decreasing in performance, the length of effective government is the number of ministers $n - k^*$ who resign before the Prime Minister abandons her high-performance regime and switches to using the weakest feasible firing rule.*

We turn to analyze the determinants of this length, summarizing our results in the following proposition, before providing a more detailed discussion of our findings. For the purposes of this proposition we say that an endogenous variable is “U shaped” in a parameter if it is at first (at least weakly) decreasing and then (at least weakly) increasing, and so is maximized by the extreme (high and low) values of the parameter.¹³

Proposition 5. *When the arrival of scandals is linearly decreasing in performance, the length of effective government is decreasing in the Prime Minister’s value \bar{w} from holding office but increasing in the average severity \bar{s} of scandals. It is increasing in a minister’s benefits \bar{v} from office and his maximum performance \bar{e} but decreasing in the cost c of performance. Over the range of parameters for which high performance is feasible the length of effective government is a U-shaped function of the exogenous hazard rate γ of termination and of the minimum firing probability q^\ddagger .*

The first pair of monotonic comparative-static predictions are unsurprising. When the Prime Minister cares deeply about holding on to office (\bar{w} is high) and little about scandals (\bar{s} is low) then she maximizes her tenure by keeping standards low and reducing the length of effective government.

The remaining monotonic predictions are also natural. When a minister covets his job and performance is cheap then he is influenced by a relatively low firing probability q^* . Furthermore, when his ability is high (\bar{e} is high) then a switch to the high-performance regime substantially reduces the arrival of scandals. These things extend the era of effective government, and also enhance the tenure of a high-performing minister; the duration of effective government rises unambiguously. These results provide further support for the hypothesis that high office benefits help performance. As argued by Caselli and Morelli (2004), such benefits can attract talented politicians.¹⁴ We have already established that such benefits induce greater effort. We now see that the Prime Minister imposes higher standards for longer. Furthermore, when ministers are more talented (c is lower and \bar{e} is higher) the Prime Minister is more willing to exploit the talent available to her.

¹³This definition of “U shaped” includes monotonic functions. However, it is always possible to choose values of \bar{w} and \bar{s} such that the length of effective government is a non-monotonic function of the parameters γ and q^\ddagger .

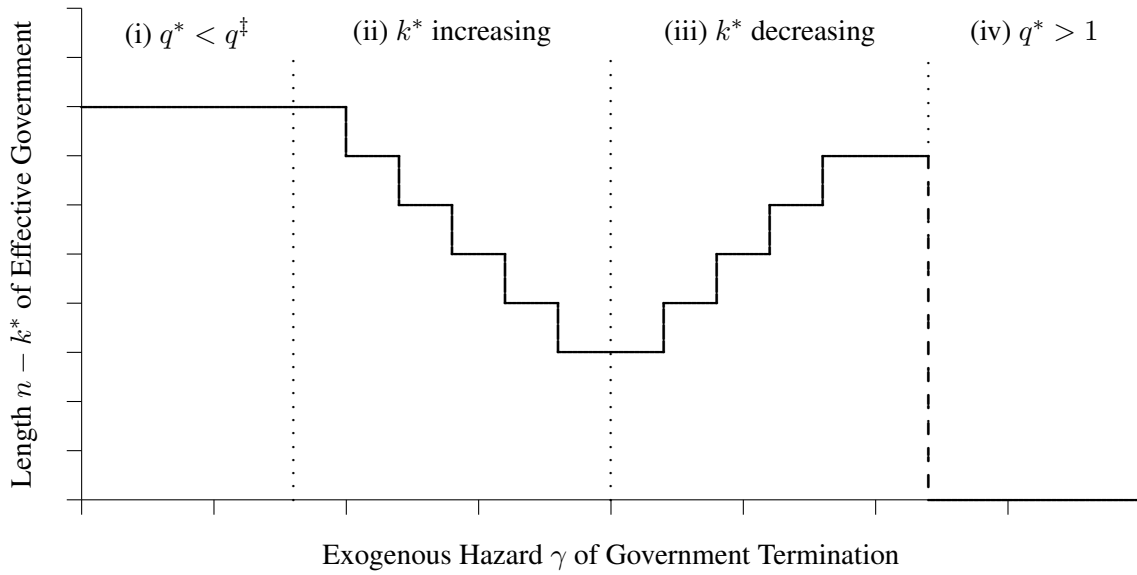
¹⁴This view was disputed by Mattozi and Merlo (2008). In their model a citizen entering political life signals her quality to the private sector. They found that higher salaries reduce the average quality of entrants.

Stability and Effectiveness. Although political scientists have long studied government durability, neither the theoretical nor the empirical literature says much about the relationship between government survival and performance. Here this turns out to be subtle: Proposition 5 reveals a non-monotonic relationship between the length of effective government and the arrival rate of exogenous failure. The “U shaped” nature of this relationship ensures that the length of effective government is maximized when exogenous instability is largely absent (γ is low) or is very important (γ is large). The non-monotonicity stems from a conflict between two forces.

Firstly, as γ increases it is harder to induce high performance since (Proposition 2) q^* is increasing in γ . The increase in γ makes it more likely that a minister will exogenously lose his position, which lowers the value of his career. An income effect means that he now cares less about avoiding costly resignation calls. Secondly, as γ increases the Prime Minister cares less about maintaining her talent pool: her government is unlikely to survive long enough to run out of talent. Under these circumstances the Prime Minister cares more about the current performance of her ministers and avoiding costly scandals than about the longer-term effect of talent-pool depletion: adopting a “live for today” attitude she endogenously increases the length of effective government.

Bring these two forces together, the first dominates for smaller γ , while the second can dominate for larger γ . Thus an increase in exogenous government instability and reduction in the overall duration of government can result in an increase in the length of effective government. A caveat is that the constraint $q^* \leq 1$ breaks for γ large enough: if $\gamma > (\bar{v}/c) - \bar{\lambda} - \hat{e}$ then it is impossible to induce high effort. Hence, as γ increases, we can identify (Figure 3) four phases of response: (i) when γ is low enough to yield $q^* < q^\ddagger$ then the government is always effective; (ii) for larger γ , the length of effective government falls as it becomes more costly to encourage performance; (iii) due to high instability the Prime Minister “lives for today” and increases standards; and (iv) finally γ is so large that ministers no longer value their careers and so devote minimum effort to their tasks.

These results are significant for considering the effects of institutions designed to enhance stability, such as a requirement for an investiture vote for an incoming government. Our results suggest that such changes need not lead to more effective government. Any such constitutional engineering, to



Notes. For region (i), the lower bound q^\ddagger on the firing probability is enough to induce high effort, whereas in region (iv) the value of a minister's career is so low that it is impossible to generate positive effort. The remaining two regions illustrate the “U shape” response described in Proposition 5.

FIGURE 3. The Duration of Effective Government

borrow Sartori's phrase, must be informed by an understanding of agency problems of governance, including the endogenous reaction to changes in institutional design by the executive's leader.

Imposing Standards. When faced with a scandal, the Prime Minister has partial discretion: if the severity s of a scandal exceeds s^\ddagger then the misdemeanor is so grave that the minister must go. What counts as a grave event may depend on the mood of the populace or on political circumstance.

A Prime Minister's discretion may be circumscribed by institutions. For example, in the United Kingdom ministerial misdemeanors are referred to the Committee for Standards in Public Life. The committee's judgement need not determine the Prime Minister's action. However, in practice a rebuke from it terminates a career. For example, Home Secretary David Blunkett resigned in December 2004 after the committee found that he had broken rules of conduct by fast-tracking a visa for the nanny of his then lover Kimberly Quinn.

The imposition of standards in public life is seen as a means of enhancing accountability, leading to better performance. However, the length of effective government is a “U shaped” function of the minimum feasible firing probability (Proposition 5). Of course, this minimum probability satisfies

$q^\dagger = 1 - F(s^\dagger)$ which grows with the exogenous imposition of stricter standards (a reduction in s^\dagger). Thus, starting from a position of low standards (high s^\dagger) the gradual imposition of higher ministerial standards will first lead to a contraction in the length of effective government, and only extends this length when such standards become sufficiently high (so that s^\dagger is low).

This non-monotonic response stems from two conflicting forces. Firstly, an increase in exogenous standards, raising q^\dagger , lowers the net cost of inducing high performance. This net cost is determined by the increase $q^* - q^\dagger$ in the firing probability needed for a minister to devote high effort to his tasks. Secondly, the increase in q^\dagger makes it difficult to maintain longevity in the low-performance regime. The Prime Minister responds by requiring a larger buffer of low-performing ministers.

These effects are easiest to see by setting $q^\dagger = 0$. In this case, the Prime Minister can insist on high performance from the first $n - 1$ minister since she will never be forced to fire the last minister. Thus, when exogenous standards are eliminated the length of effective government is at least $n - 1$. As q^\dagger increases this safety net disappears and the Prime Minister responds with lower standards by applying the $q_k^\dagger = q^*$ regime to fewer ministers. This second force can dominate the first.

Corollary to Proposition 5. *The exogenous imposition of higher ministerial standards can lead to an endogenous contraction in the length of effective government.*

The U-shaped response to q^\dagger means that a contraction in the length of effective government happens when q^\dagger is initially low. However, the clamor for stricter exogenous regulation of ministers is likely to be larger when existing standards are low. Under these circumstances our results suggests it pays to strengthen the discretion of the Prime Minister (via a lower q^\dagger) rather than to diminish it.

REPLENISHING THE TALENT POOL

The limited depth of the ministerial talent pool weakens the willingness to fire and so dulls the incentives of ministers. Here we turn our attention to the possibility that the talent pool may be replenished. We consider the reactions of ministers to increased replenishment, the impact of replenishment on the reaction of ministers to a stricter firing rule, and the relationship between replenishment and the Prime Minister's credibility.

Expanding the Talent Pool. When the talent-pool is finite, then so is the lifespan of effective government. This problem might be mitigated when a larger talent pool is available or when new talent can emerge. This suggests, in turn, that restrictive selection methods might damage government performance. For example, in parliamentary systems, since the executive must maintain the confidence of the legislature (and in some cases faces a formal vote of investiture) selection into government is usually restricted to members of the legislative body.¹⁵ Lifting this restriction may raise the size of the ministerial talent pool. Of course, the value of the Prime Minister’s career (and of her government) is increasing in the state variable k and hence in the initial size n of her talent pool. This suggests that more talent is always a good thing, at least from her perspective.¹⁶

Introducing New Talent. Whereas the talent pool may be fixed at a particular time, and subject to an upper bound (perhaps the size of the legislature), we can envisage a world in which talent flows into the pool. For instance, a new backbencher might gain enough experience to become a candidate for office. We adapt our model so that as talent evaporates it might be replenished.

Formally, new talent arrives with Poisson arrival rate β so long as $k < n$. We think of a situation where β is low as the adoption of restrictive selection methods: for example, the government might be selected from amongst the talents in the majority party; or a strict minimal winning coalition of parties; or, even more restrictively, from certain factions within those parties. A higher β might correspond, on the other hand, with a situation where the Prime Minister can develop the candidacy of other citizens, whether elected or not. When $\beta = 0$ there is a risk that the government terminates prematurely due to endogenous talent-pool depletion. Conversely, as $\beta \rightarrow \infty$ the talent pool is replenished as quickly as it is depleted, so that only the exogenous termination risk remains.

The Effect of Replenishment. We imagine that the Prime Minister continues to employ a firing rule contingent only on the size of the talent pool. In this situation, the problem faced by a minister in office changes: he recognizes that the talent pool may expand, which will change the firing

¹⁵As Vernon Bogdanor, quoted in “Bevin Offers Hope to Outsiders,” *Financial Times*, London, June 29, 2007, stated: “The notion that any government could staff its entire ministerial team from the small talent pool of MPs in parliament is absurd. No private sector company would operate like this.”

¹⁶Things are not so straightforward if the talent pool expands with members whose objectives that are not well aligned with those of the government. In the context of the model, this might raise the opportunity cost of effort c : there may well be a trade-off between the talent pool’s size and composition.

probability he faces and hence the value of his career. Subscripting the value of a ministerial career by the current talent-pool size, with a k -strong talent pool the arrival of a new member of the pool changes the value of the minister's career by $V_{k+1} - V_k$. Modifying Equation (1) appropriately,

$$\underbrace{\bar{v} - ce_k}_{\text{flow benefit and cost}} = \underbrace{[\bar{\lambda} + \lambda(e_k)]q_k^\dagger V_k}_{\text{risk of resignation}} - \underbrace{\beta[V_{k+1} - V_k]}_{\text{effect of replenishment}} + \underbrace{\gamma V_k}_{\text{exogenous risk}}. \quad (7)$$

As β is exogenous, the first-order condition of Equation (2) is unchanged and given by

$$c = -\lambda(e)q_k^\dagger V_k. \quad (8)$$

It might seem reasonable to suggest that increased replenishment will lead a minister to fear for his position. However, this influences the behavior of a minister only via the income effect on the value of his career V_k . If it lowers the value of his career then his fear of resignation will fall it with it, leading to a reduction in performance. The value of his career does indeed fall with an increase in β whenever the firing probability q_k increases with the size of the talent pool.

Proposition 6. *If the firing probability is increasing in the size of the talent pool then, fixing the firing strategy, an increase in the replenishment rate reduces ministerial performance.*

A higher firing probability reduces the value of a career. Replenishment means that the minister faces the possibility that he will be exposed to a harsher regime, which reduces V_k . We have already seen that the firing probability increases with the size of the talent pool in a world without replenishment (Proposition 4) and so, beginning from this world, we obtain the following corollary.

Corollary to Proposition 6. *Beginning from zero replenishment, so that the firing probability increases with the size of the talent pool, a local increase in replenishment reduces performance.*

We might also consider a marginal increase in the severity of the firing rule with positive replenishment. This is more complicated than without replenishment; in the context of a k -strong talent pool, a minister considers not only q_k^\dagger but also the effect of q_j^\dagger for $j > k$.

Proposition 7. *Fixing a replenishment rate $\beta > 0$ an increase in the firing probability q_k^\dagger for a k -strong talent pool increases the performance of a minister facing such a talent pool (e_k rises) but reduces the performance of ministers when the talent pool size is smaller (e_j falls for $j < k$).*

We have noted that an increase in the severity of the firing rule can have both an income and a substitution effect. Following a rise in q_k^\dagger , both effects influence e_k ; the substitution effect dominates and so performance rises. However, $j \neq k$ only the income effect is present. For $j > k$, the firing probability doesn't matter whereas for $j < k$ the income effect works against the minister's performance. Replenishment of the talent pool can sometimes diminish performance, suggesting that the relaxation of restrictions on the selection of ministers is not necessarily an unalloyed blessing.

Replenishment and Reputation. Ministers respond to the threat of resignation by performing well, but they are subject to shocks: there will be occasions when, despite their efforts, they fail. To provide incentives the Prime Minister must implement her firing rule. But will she carry out her threats? Here we show how the presence of a replenishing talent pool can help support the credibility of the Prime Minister's firing rule.

The credibility issue arises due to the finite depth of the talent pool. When the pool is drained the "last man standing" is pivotal and so the Prime Minister never willingly fires him: a firing rule specifying $q_0^\dagger > q^\ddagger$ lacks credibility. Insisting on dynamic consistency, the firing rule must satisfy $q_0^\dagger = q^\ddagger$. Of course, we can now apply the same logic for the $k = 1$ case: even if the Prime Minister sacrifices her reputation by failing to implement a firing rule $q_1^\dagger > q^\ddagger$, this will have no repercussions. Continuing this argument iteratively, we conclude that $q_k^\dagger = q^\ddagger$ for all k .

This argument relies upon a talent pool that dries up. But what if new talent may emerge? To explore this issue we specify an arrival rate of scandals that is linear in performance and, to simplify notation, we set $\hat{e} = 0$.¹⁷ We also restrict attention to a two-state world with $k \in \{0, 1\}$, so that the talent pool is either "full" or "empty". When the talent pool is empty, it is replenished (it switches from $k = 0$ to $k = 1$) at the Poisson arrival rate $\beta > 0$. The last-man-standing argument

¹⁷Setting $\hat{e} = 0$ is without loss of generality, since \hat{e} can be absorbed into the exogenous scandal hazard $\bar{\lambda}$. Doing so, the assumption that $\hat{e} > \bar{e}$ translates to $\bar{\lambda} > \bar{e}$.

continues to apply when the talent pool is empty, and so $q_0^\dagger = q^\ddagger$. Setting $q_1^\dagger > q^\ddagger$ only makes sense if it induces high effort, and it does so if and only if $q_1^\dagger \geq q^*$. Hence, when choosing the firing probability for the “full” talent pool the Prime Minister chooses either $q_1^\dagger = q^\ddagger$ or $q_1^\dagger = q^*$.

Suppose, then, that the Prime Minister would strictly prefer to set $q_1^\dagger = q^* > q^\ddagger$ if only this were credible. This generates performances of $e_1 = \bar{e}$ and $e_0 = 0$.¹⁸ Using Equation (5) for the case $k = 1$ and modifying the corresponding equation for $k = 0$ yields

$$\bar{w} - (\bar{\lambda} - \bar{e})\bar{s} = q^*(\bar{\lambda} - \bar{e})[W_1 - W_0] + \gamma W_1.$$

$$\text{and } \bar{w} - \bar{\lambda}\bar{s} = q^\ddagger\bar{\lambda}W_0 + \gamma W_0 - \underbrace{\beta(W_1 - W_0)}_{\text{effect of replenishment}}.$$

The second equation differs from earlier analysis via the inclusion of the final term: this captures the replenishment effect. These equations solve to yield W_1 and W_0 . If instead the Prime Minister were to set $q_1^\dagger = q^\ddagger$ then the corresponding values \tilde{W}_1 and \tilde{W}_0 satisfy

$$\bar{w} - \bar{\lambda}\bar{s} = q^\ddagger\bar{\lambda}[\tilde{W}_1 - \tilde{W}_0] + \gamma\tilde{W}_1.$$

$$\text{and } \bar{w} - \bar{\lambda}\bar{s} = q^\ddagger\bar{\lambda}\tilde{W}_0 + \gamma\tilde{W}_0 - \beta[\tilde{W}_1 - \tilde{W}_0].$$

Once again, we can solve for \tilde{W}_0 and \tilde{W}_1 . We are considering a case where the Prime Minister would wish to implement high performance when $k = 1$, so that $q_1^\dagger = q^*$. This desire is captured by the inequality $W_1 \geq \tilde{W}_1$. This inequality may determine what is desirable; but is it credible?

Defining s^* to satisfy $q^* = 1 - F(s^*)$, credibility requires that scandals satisfying $s^* < s \leq s^\ddagger$ result in a resignation. Of course, the Prime Minister is tempted to renege by keeping her minister in post after such a scandal. In order to prevent her from doing so, let us suppose that if she deviates in this way then future ministers refuse to believe her threats and hence, facing effective firing probabilities of $q_1^\dagger = q_0^\dagger = q^\ddagger$, they then supply zero effort.

The trade-off is this: if the Prime Minister fires her scandal-hit minister then her value falls from W_1 to W_0 ; she maintains her reputation but loses a member of her talent pool. On the other hand, if she retains him then her value shifts from W_1 to \tilde{W}_1 ; her talent pool is intact but her

¹⁸Setting $q_1^\dagger = q_0^\dagger = q^\ddagger$ yields $e_1 = e_0 = 0$. Raising q_1^\dagger can only reduce e_0 , via the negative income effect.

threats no longer carry weight. Summarizing, for the high-performance regime to be desirable we require $W_1 \geq \tilde{W}_1$, but for it to be credible we require $W_0 \geq \tilde{W}_1$. Now, $W_1 > W_0$ and so the credibility constraint is harder to satisfy than the desirability constraint. This means that there are parameters for which the Prime Minister wishes to impose high performance but is unable to maintain credibility. Whether these inequalities are satisfied depends on the replenishment rate.

Proposition 8. *Suppose that (i) the arrival rate of scandals is linearly decreasing in performance; (ii) $k \in \{0, 1\}$ so that the talent pool is either full or empty; and (iii) an empty talent pool is replenished with arrival rate β . There are two critical replenishment rates satisfying $\beta_H > \beta_L \geq 0$ such that if $\beta \geq \beta_H$ then the Prime Minister wishes to set $q_1^\dagger = q^*$ and is able to do so credibly; but if $\beta_H > \beta > \beta_L$ then she wishes to set $q_1^\dagger = q^*$ but is unable to do so credibly.*

As the replenishment rate rises the Prime Minister is less concerned with talent depletion and so the desire for higher standards is natural. Furthermore, this also makes her more willing to sacrifice her minister when $k = 1$, for precisely the same reasons. However, when $\beta_L < \beta < \beta_H$ replenishment is not rapid enough for her to resist the temptation to renege on her threat.

CONCLUDING REMARKS

In our model the a Prime Minister provides incentives by firing those seen to fail. This feature is common to other agency models (Huber and Gordon, 2002; Gailmard and Patty, 2007; Shotts and Wiseman, 2008) but here we shed light on a tension between the need to provide incentives through turnover and the desire to preserve talent. Whilst, a priori, the effect of stricter standards is ambiguous, the optimal firing rule weakens over the lifespan of a government. An important implication is that variation in tenure can reflect differences in the way the Prime Minister manages her ministers: ministers who perform less well can survive for longer.

Our model thus explains variations in ministerial turnover and in the related performance of governments. Anything that increases the value of a ministerial career increases performance and tenure. Consistent with other recent studies (Besley, 2004; Caselli and Morelli, 2004; Messner and

Polborn, 2004) an increase in salaries and perquisites is related to lower turnover although here, and in contrast to those other papers, this is due to the better performance of ministers.

Our analysis led us to ask: how long does a government remain effective and what helps to sustain effectiveness? We obtained some surprising findings. Whilst some parliamentary democracies deploy committees to oversee public standards, our results do not chime with a conventional wisdom that exogenous standards lead to better performance: limiting the discretion of the Prime Minister can lead her to relax her own standards, thus curtailing the length of effective government. Similar logic applied to measures designed to enhance government durability.

In our view, a limit to the pool of available talent can lie at the root of the decline in government performance. When the talent pool has evaporated an incumbent minister is essentially a lame duck: lacking incentives he does relatively little to enhance the government's performance. A (currently popular) resolution for perceived poor performance is for the Prime Minister to cast her net wider when filling vacant posts: choosing from "all the talents" ensures that her talent pool is always replenished. We found that the introduction of new blood is, however, no panacea: replenishment can dilute the incentives of incumbent ministers further. Such replenishment does however enhance a Prime Minister's concern for her reputation, allowing her to commit credibly to her firing rule in situations where, absent replenishment, she would be unable to do so.

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OMITTED PROOFS

Proof of Proposition 1. Differentiating Equation (2) with respect to q^\dagger we obtain

$$\underbrace{\lambda''(e)q^\dagger V}_{+ve} \times \frac{de}{dq^\dagger} = \underbrace{-\lambda'(e)}_{+ve} \times \left[V + q^\dagger \frac{dV}{dq^\dagger} \right] \implies \frac{de}{dq^\dagger} > 0 \Leftrightarrow V + q^\dagger \frac{dV}{dq^\dagger} > 0.$$

Next, differentiating Equation (1) with respect to q^\dagger we obtain

$$\begin{aligned} \gamma \frac{dV}{dq^\dagger} &= - \underbrace{[c + \lambda'(e)q^\dagger V]}_{\text{zero from Eq. (2)}} \frac{de}{dq^\dagger} - [\bar{\lambda} + \lambda(e)] \left[V + q^\dagger \frac{dV}{dq^\dagger} \right] \\ \implies V + q^\dagger \frac{dV}{dq^\dagger} &= V \left[1 - \frac{\bar{\lambda} + \lambda(e)}{(\gamma/q^\dagger) + \bar{\lambda} + \lambda(e)} \right] > 0 \implies \frac{de}{dq^\dagger} > 0. \end{aligned}$$

This argument extends straightforwardly to the boundary cases of $e = 0$ and $e = \bar{e}$. For the remaining claims, an increase in \bar{v} or a reduction in either γ or $\bar{\lambda}$ serve to increase V . Using Equation (2), when V increases e must rise. An increase in c leads to a reduction in V and a consequent fall in e via the same logic; c also enters Equation (2) directly, and this direct effect also reduces e . Lifting \bar{e} can only increase effort, since it loosens the constraint $e \leq \bar{e}$. \square

Proof of Proposition 2. The arrival rate is linearly decreasing in so and so $\lambda'(e) = -1$. The linearity ensures that the optimal effort is either $e = \bar{e}$ or $e = 0$. Using Equation (1),

$$V|_{e=\bar{e}} = \frac{\bar{v} - c\bar{e}}{\gamma + q^\dagger(\bar{\lambda} + \hat{e} - \bar{e})} \quad \text{and} \quad V|_{e=0} = \frac{\bar{v}}{\gamma + q^\dagger(\bar{\lambda} + \hat{e})}.$$

The minister exerts high effort if and only if the first expression exceeds the second. (We assume $e = \bar{e}$ whenever he is indifferent.) This is so if and only if $q^\dagger \geq q^*$ where q^* is given in Equation (4). This latter inequality can only be satisfied if $q^* \leq 1$, which holds if and only if $\bar{v} \geq c[\gamma + \bar{\lambda} + \hat{e}]$. \square

Proof of Proposition 3. From Propositions 1 and 2, together with arguments in the text. \square

Proof of Lemma 1. Follows from the argument given in the text. \square

Proof of Lemma 2. We first show that W_k is increasing in k , so that $W_k > W_{k-1}$. Defining $W_{-1} \equiv 0$ (a failed government following complete depletion of the talent pool) this is certainly true for $k = 0$. We show inductively that is true for all larger k . Re-arrange Equation (5) to obtain

$$W_k = \frac{\bar{w} + [\bar{\lambda} + \lambda(e_k)][q_k^\dagger W_{k-1} - \bar{s}]}{\gamma + q_k^\dagger[\bar{\lambda} + \lambda(e_k)]},$$

Now consider W_{k+1} . This value is optimized by choosing a firing probability q_{k+1}^\dagger . Suppose that the Prime Minister instead chooses a firing probability q_k^\dagger when there are $k + 1$ members of her

talent pool, and write \tilde{W}_{k+1} for the associated present value of her government. This satisfies

$$\tilde{W}_{k+1} = \frac{\bar{w} + [\bar{\lambda} + \lambda(e_k)][q_k^\dagger W_k - \bar{s}]}{\gamma + q_k^\dagger [\bar{\lambda} + \lambda(e_k)]}.$$

Since q_{k+1}^\dagger is the optimal choice, it must be that $W_{k+1} \geq \tilde{W}_{k+1}$. Now,

$$W_{k+1} - W_k \geq \tilde{W}_{k+1} - W_k = \frac{q_k^\dagger [\bar{\lambda} + \lambda(e_k)][W_k - W_{k-1}]}{\gamma + q_k^\dagger [\bar{\lambda} + \lambda(e_k)]}.$$

By inspection if $W_k > W_{k-1}$ then $W_{k+1} > W_k$. We have already noted that $W_k > W_{k-1}$ for $k = 1$. Hence, by the principle of induction, W_k is strictly increasing in k . We now show that there are decreasing returns to the talent pool size: $W_{k+1} - W_k \leq W_k - W_{k-1}$ for each k . To do this, suppose that the Prime Minister chooses a firing probability q_{k+1} when there are k members of her talent pool, and write \hat{W}_k for the associated present value of her government:

$$\hat{W}_k = \frac{\bar{w} + [\bar{\lambda} + \lambda(e_{k+1})][q_{k+1}^\dagger W_{k-1} - \bar{s}]}{\gamma + q_{k+1}^\dagger [\bar{\lambda} + \lambda(e_{k+1})]}.$$

Since q_k^\dagger is the optimal choice, it must be that $W_k \geq \hat{W}_k$. Hence

$$W_{k+1} - W_k \leq W_{k+1} - \hat{W}_k = \frac{q_{k+1}^\dagger [\bar{\lambda} + \lambda(e_{k+1})][W_k - W_{k-1}]}{\gamma + q_{k+1}^\dagger [\bar{\lambda} + \lambda(e_{k+1})]} \leq W_k - W_{k-1}.$$

Note that the final inequality is strict whenever $\gamma > 0$. □

Proof of Proposition 4. When there are k members of the talent pool, the Prime Minister finds it optimal to use the firing probability q_k^\dagger , and hence she must be (at least weakly) worse off using the firing probability q_{k-1}^\dagger . Using Equation (5), this means that

$$[\lambda(e_{k-1}) - \lambda(e_k)]\bar{s} \geq \left(q_k^\dagger [\bar{\lambda} + \lambda(e_k)] - q_{k-1}^\dagger [\bar{\lambda} + \lambda(e_{k-1})] \right) [W_k - W_{k-1}].$$

When there are $k - 1$ members of the talent pool, the Prime Minister prefers to use the firing probability q_{k-1}^\dagger rather than q_k^\dagger . Using Equation (5) once more, we obtain

$$[\lambda(e_{k-1}) - \lambda(e_k)]\bar{s} \leq \left(q_k^\dagger [\bar{\lambda} + \lambda(e_k)] - q_{k-1}^\dagger [\bar{\lambda} + \lambda(e_{k-1})] \right) [W_{k-1} - W_{k-2}].$$

These two inequalities combine straightforwardly to yield

$$0 \geq \left(q_k^\dagger [\bar{\lambda} + \lambda(e_k)] - q_{k-1}^\dagger [\bar{\lambda} + \lambda(e_{k-1})] \right) \underbrace{([W_k - W_{k-1}] - [W_{k-1} - W_{k-2}])}_{\text{strictly negative}}.$$

The second term on the right-hand side is strictly negative, since there are decreasing returns to the size of the talent pool (Lemma 2). For the inequality to be satisfied, we must have $q_k^\dagger [\bar{\lambda} + \lambda(e_k)] \geq q_{k-1}^\dagger [\bar{\lambda} + \lambda(e_{k-1})]$, so that (as claimed) the arrival rate of resignations increases with k . Using Lemma 1, this implies the firing probability is increasing in k , so that $q_k^\dagger \geq q_{k-1}^\dagger$. Finally, applying Proposition 1, we conclude that the minister's performance is increasing in k . Turning to the final claim of the proposition, the left-hand side of Equation (5) is increasing in k , and hence so is the right-hand side. For γ small enough, the right-hand side is the expected rate of decline as defined in the statement of the proposition. \square

Proof of Proposition 5. An optimal firing rule satisfies $q_k^\dagger \in \{q^\dagger, q^*\}$ for each k since intermediate values of q^\dagger generate more resignations than q^\dagger while failing to elicit positive performance (Proposition 2). Applying Proposition 4, the optimal firing probability is increasing in k . Thus there must be a critical talent-pool size k^* such that $q_k^\dagger = q^\dagger$ for $k < k^*$ and $q_k^\dagger = q^*$ for $k \geq k^*$.

We now calculate k^* . We write $W_k^{\hat{k}}$ for the present value obtained by setting $q^\dagger = q^*$ if and only if $k \geq \hat{k}$ and W_k^∞ for the present value of setting $q_k^\dagger = q^\dagger$ for every feasible talent-pool size. If the critical threshold k^* is chosen optimally then it must be the case that $W_{k^*}^{k^*} \geq W_{k^*}^\infty$ since otherwise the Prime Minister could do better by increasing the threshold to $k^* + 1$. It must also be the case that $W_{k^*-1}^{k^*-1} \leq W_{k^*-1}^\infty$ since otherwise she would gain by switching to $k^* - 1$.

To establish when these inequalities are satisfied we need to calculate $W_k^{\hat{k}}$ and W_k^∞ . Using Equation (5) and setting $\hat{e} = 0$ to simplify notation (this is without loss of generality):

$$W_{\hat{k}}^{\hat{k}} = \frac{\bar{w} + [\bar{\lambda} - \bar{e}][q^* W_{\hat{k}-1}^\infty - \bar{s}]}{\gamma + q^* [\bar{\lambda} - \bar{e}]} \quad \text{and} \quad W_k^\infty = \frac{\bar{w} + \bar{\lambda}[q^\dagger W_{k-1}^\infty - \bar{s}]}{\gamma + \bar{\lambda} q^\dagger}.$$

Using these two expressions straightforward but tedious algebra reveals that

$$W_{\hat{k}}^{\hat{k}} \geq W_{\hat{k}}^\infty \iff W_{\hat{k}-1}^\infty \geq \frac{1}{\gamma} \left[\bar{w} - \bar{\lambda} \bar{s} - \frac{\bar{e} \bar{s} (\gamma + \bar{\lambda} q^\dagger)}{\bar{\lambda} (q^* - q^\dagger) - \bar{e} q^*} \right].$$

Next, we solve for W_k^∞ by repeated substitution to obtain

$$W_k^\infty = \frac{\bar{w} - \bar{\lambda}\bar{s}}{\gamma} \left[1 - \left(\frac{\bar{\lambda}q^\dagger}{\gamma + \bar{\lambda}q^\dagger} \right)^{k+1} \right]$$

and so

$$W_{\hat{k}}^{\hat{k}} \geq W_{\hat{k}}^\infty \iff (\bar{\lambda}(q^* - q^\dagger) - \bar{e}q^*) \left(\frac{\bar{\lambda}q^\dagger}{\gamma + \bar{\lambda}q^\dagger} \right)^{\hat{k}} \leq \frac{\bar{e}\bar{s}(\gamma + \bar{\lambda}q^\dagger)}{\bar{w} - \bar{\lambda}\bar{s}}.$$

A first case to consider is when $\bar{\lambda}(q^* - q^\dagger) \leq \bar{e}q^*$. If this holds then the left-hand side of the inequality is negative, and so $W_{\hat{k}}^{\hat{k}} \geq W_{\hat{k}}^\infty$ for all \hat{k} . This implies that the optimal talent-pool threshold must satisfy $k^* = 0$. The alternative case is when $\bar{\lambda}(q^* - q^\dagger) > \bar{e}q^*$. In that case the inequality holds so long as \hat{k} is sufficiently large. Recalling that an optimal threshold k^* satisfies $W_{k^*}^{k^*} \geq W_{k^*}^\infty$ and $W_{k^*-1}^{k^*-1} \leq W_{k^*-1}^\infty$, we bring this pair of equalities together to obtain

$$\left(\frac{\bar{\lambda}q^\dagger}{\gamma + \bar{\lambda}q^\dagger} \right)^{k^*} \leq \frac{\bar{e}\bar{s}(\gamma + \bar{\lambda}q^\dagger)}{(\bar{w} - \bar{\lambda}\bar{s})(\bar{\lambda}(q^* - q^\dagger) - \bar{e}q^*)} \leq \left(\frac{\bar{\lambda}q^\dagger}{\gamma + \bar{\lambda}q^\dagger} \right)^{k^*-1}.$$

Generically there is a unique integer k^* satisfying these inequalities. This is the smallest integer greater than \tilde{k} , where \tilde{k} satisfies

$$\begin{aligned} \left(\frac{\bar{\lambda}q^\dagger}{\gamma + \bar{\lambda}q^\dagger} \right)^{\tilde{k}} &= \frac{\bar{e}\bar{s}(\gamma + \bar{\lambda}q^\dagger)}{(\bar{w} - \bar{\lambda}\bar{s})(\bar{\lambda}(q^* - q^\dagger) - \bar{e}q^*)} \\ \iff \tilde{k} &= \frac{\log[(\bar{w} - \bar{\lambda}\bar{s})(\bar{\lambda}(q^* - q^\dagger) - \bar{e}q^*)] - \log[\bar{e}\bar{s}(\gamma + \bar{\lambda}q^\dagger)]}{\log[\gamma + \bar{\lambda}q^\dagger] - \log[\bar{\lambda}q^\dagger]}. \end{aligned}$$

Recall that we are dealing with the case $(\bar{\lambda} - \bar{e})q^* > \bar{\lambda}q^\dagger$, so that \tilde{k} is well defined. \tilde{k} is increasing in \bar{w} and decreasing in \bar{s} , implying that the length of effective government $n - k^*$ is decreasing in \bar{w} and increasing in \bar{s} , as claimed. \bar{v} and c enter only via the firing probability q^* . By inspection, \tilde{k} is increasing in q^* . (This is because $\bar{\lambda} > \bar{e}$, which is a necessary consequence of the absorption \hat{e} into $\bar{\lambda}$ when we set $\hat{e} = 0$ in order to simplify notation.) q^* is increasing in c and decreasing in \bar{v} (Proposition 2) and so \tilde{k} responds in the same way. Hence $n - k^*$ is decreasing in c and increasing in \bar{v} . Next we study the effects of changes in γ and q^\dagger . We will show that \tilde{k} is quasi-concave in γ and quasi-concave in q^\dagger when evaluated at parameter values which ensure that the expression for \tilde{k} is well defined (requiring $(\bar{\lambda} - \bar{e})q^* > \bar{\lambda}q^\dagger$) and high performance is feasible (requiring $q^* < 1$). It

proves convenient to use the notation $A \equiv \log[(\bar{w} - \bar{\lambda}\bar{s})(\bar{\lambda}(q^* - q^\dagger) - \bar{e}q^*)] - \log[\bar{e}\bar{s}(\gamma + \bar{\lambda}q^\dagger)]$ for the numerator of \tilde{k} and $B \equiv \log[\gamma + \bar{\lambda}q^\dagger] - \log[\bar{\lambda}q^\dagger]$ for its denominator. We begin by considering the effect of an increase in the hazard rate γ of exogenous government termination. By inspection, B is increasing in γ and hence $\frac{\partial \tilde{k}}{\partial \gamma} > 0 \iff \frac{\partial A/\partial \gamma}{\partial B/\partial \gamma} > \tilde{k}$. To establish quasi-concavity we investigate the sign of the second derivative of \tilde{k} when evaluated at a stationary point. Straightforwardly, $\frac{\partial \tilde{k}}{\partial \gamma} = 0 \implies \frac{\partial^2 \tilde{k}}{\partial \gamma^2} < 0 \iff \frac{\partial}{\partial \gamma} \left[\frac{\partial A/\partial \gamma}{\partial B/\partial \gamma} \right] < 0$. Differentiating and re-arranging we obtain

$$\frac{\partial A/\partial \gamma}{\partial B/\partial \gamma} = \frac{(\bar{\lambda} - \bar{e})q^* + \frac{(\bar{\lambda} - \bar{e})c\bar{\lambda}q^\dagger}{v - c\bar{\lambda}}}{(\bar{\lambda} - \bar{e})q^* - \bar{\lambda}q^\dagger} - 1.$$

By inspection this is strictly decreasing in q^* and so in turn q^* is strictly increasing in γ . Hence the expression is decreasing in γ , which establishes the quasi-concavity of \tilde{k} in γ . We now turn attention to q^\dagger . We note that the denominator B is decreasing in q^\dagger . This implies that

$$\frac{\partial \tilde{k}}{\partial q^\dagger} = 0 \implies \frac{\partial^2 \tilde{k}}{\partial (q^\dagger)^2} < 0 \iff \frac{\partial}{\partial q^\dagger} \left[\frac{\partial A/\partial q^\dagger}{\partial B/\partial q^\dagger} \right] > 0.$$

Straightforward differentiation of A and B yields

$$\frac{\partial A}{\partial q^\dagger} = - \left[\frac{\bar{\lambda}}{(\bar{\lambda} - \bar{e})q^* - \bar{\lambda}q^\dagger} + \frac{\bar{\lambda}}{\gamma + \bar{\lambda}q^\dagger} \right] \quad \text{and} \quad \frac{\partial B}{\partial q^\dagger} = - \left[\frac{1}{q^\dagger} - \frac{\bar{\lambda}}{\gamma + \bar{\lambda}q^\dagger} \right].$$

Taking the ratio of these two derivatives and re-arranging we obtain

$$\frac{\partial A/\partial q^\dagger}{\partial B/\partial q^\dagger} = \frac{\bar{\lambda}q^\dagger}{\gamma} \left[\frac{\gamma + (\bar{\lambda} - \bar{e})q^*}{(\bar{\lambda} - \bar{e})q^* - \bar{\lambda}q^\dagger} \right].$$

By inspection this is strictly increasing in q^\dagger which establishes the quasi-concavity of \tilde{k} in q^\dagger . \square

Proof of Proposition 6. The proposition follows from the argument in the text: increased replenishment speeds ministers toward harsher regimes (given that q_k^\dagger is increasing in k) and hence lowers the value of each ministerial career. The income effect drives performance down. \square

Proof of Proposition 7. The increase in q_k^\dagger reduces V_j for all $j < k$. This income effect lowers e_j for all $j < k$. Using Equation (8), e_k is increasing in q_k^\dagger if and only if $q_k^\dagger V_k$ is increasing in q_k^\dagger . This

is so, following the argument used to prove Proposition 1. To see this, rewrite Equation (7) as

$$(\bar{v} + \beta V_{k+1}) - ce_k = [\bar{\lambda} + \lambda(e_k)]q_k^\dagger V_k + (\beta + \gamma)V_k.$$

This takes the same form as Equation (1) but where \bar{v} has been replaced by $\bar{v} + \beta V_{k+1}$ (noting that V_{k+1} is independent of q_k^\dagger) and γ has been replaced by $\gamma + \beta$. \square

Proof of Proposition 8. Solving explicitly for W_0 , W_1 , and \tilde{W}_1 yields

$$W_0 = \frac{[\beta + \gamma + (\bar{\lambda} - \bar{e})q^*](\bar{w} - \bar{\lambda}\bar{s}) + \beta\bar{e}\bar{s}}{\beta\gamma + (\gamma + \bar{\lambda}q^\ddagger)[\gamma + (\bar{\lambda} - \bar{e})q^*]}, \quad W_1 = W_0 + \frac{\bar{\lambda}q^\ddagger(\bar{w} - \bar{\lambda}\bar{s}) + (\gamma + \bar{\lambda}q^\ddagger)\bar{e}\bar{s}}{\beta\gamma + (\gamma + \bar{\lambda}q^\ddagger)[\gamma + (\bar{\lambda} - \bar{e})q^*]}$$

$$\text{and } \tilde{W}_1 = \frac{[\beta + \gamma + 2\bar{\lambda}q^\ddagger](\bar{w} - \bar{\lambda}\bar{s})}{\beta\gamma + (\gamma + \bar{\lambda}q^\ddagger)^2}.$$

By inspection $W_1 > W_0$ so that (naturally) a full talent pool is preferred. There are three possibilities: (a) $\tilde{W}_1 \geq W_1 > W_0$ so that high performance (when the talent pool is full) is neither feasible nor strictly desirable; (b) $W_1 > W_0 \geq \tilde{W}_1$ so that high performance is both feasible and strictly desirable; and (c) $W_1 > \tilde{W}_1 > W_0$ high performance is strictly desired but, alas, is not feasible.

We turn our attention to which of these cases holds as β varies. For large β :

$$\lim_{\beta \rightarrow \infty} W_0 = \lim_{\beta \rightarrow \infty} W_1 = \frac{\bar{w} - \bar{\lambda}\bar{s} + \bar{e}\bar{s}}{\gamma} \quad \text{and} \quad \lim_{\beta \rightarrow \infty} \tilde{W}_1 = \frac{\bar{w} - \bar{\lambda}\bar{s}}{\gamma}.$$

By inspection $W_1 > W_0 \geq \tilde{W}_1$ must hold for β sufficiently large. Evaluating at $\beta = 0$,

$$W_0 = \frac{[\gamma + (\bar{\lambda} - \bar{e})q^*](\bar{w} - \bar{\lambda}\bar{s})}{(\gamma + \bar{\lambda}q^\ddagger)[\gamma + (\bar{\lambda} - \bar{e})q^*]}, \quad W_1 = W_0 + \frac{\bar{\lambda}q^\ddagger(\bar{w} - \bar{\lambda}\bar{s}) + (\gamma + \bar{\lambda}q^\ddagger)\bar{e}\bar{s}}{(\gamma + \bar{\lambda}q^\ddagger)[\gamma + (\bar{\lambda} - \bar{e})q^*]}$$

$$\text{and } \tilde{W}_1 = \frac{[\gamma + 2\bar{\lambda}q^\ddagger](\bar{w} - \bar{\lambda}\bar{s})}{(\gamma + \bar{\lambda}q^\ddagger)^2}.$$

From these expressions we conclude that $\tilde{W}_1 > W_0$ for small β . Drawing our observations together, case (b) obtains for β large enough, and set $\beta_H \equiv \inf\{\hat{\beta} : \beta \geq \hat{\beta} \Rightarrow W_1 > W_0 \geq \tilde{W}_1\} > 0$. ($\beta_H > 0$ holds since case (b) cannot hold for β small enough.) By continuity, for small $\varepsilon > 0$ we can ensure that $W_1 > \tilde{W}_1 > W_0$ for $\beta \in (\beta_H - \varepsilon, \beta_H)$ so that case (c) obtains. Hence there is a $\beta_L < \beta_H$ such that high performance is strictly desirable but not feasible when $\beta_H > \beta > \beta_L$. \square