The Declining Talent Pool of Government

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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 officeholders 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 (Besley 2006; Caselli and Morelli 2004); once the talented have been induced to serve, then they should be retained and not discarded. In describing his view, Besley (2006, 37) traced his influences to Key:

> 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. (1956, 10)

Yet to consider only the talents of officeholders 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.

Such political agency problems differ from those in economic settings: the instruments available are blunter than those available to a private-sector organization. In the business world, incentive contracts can allow financial compensation to vary with performance measures; more simply, 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 appropriately align the incentives of her

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ministers. 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 (2008) 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 a firing rule 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 article, 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 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, most ministers are drawn from the House of Commons; others are from the House of Lords. In Australia, Labour governments are more constrained still: ministers are usually chosen in consultation with the party caucus and faction leaders (although this precedent was ignored by the current incumbent Kevin Rudd). Even in presidential systems where the talent pool is in principle less restrictive, a leader may be constrained to appoint 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 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 15 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?" (2003, 209)

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 must fire 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 shorter ministerial tenure. Moreover, the optimal firing rule deployed by the executive's leader weakens incentives over the life span 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.[1] 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; equivalently, they limit a Prime Minister's leniency. We explore the effects of an exogenous increase in the standards imposed on ministers. We find that such an increase can reduce the lifetime of an effective government. The leader, anticipating that stricter external standards accelerate talent-pool depletion, preserves the talent pool by lowering the standards that she imposes; this shortens the length of effective government.

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

[1] Sartori 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" (1997, 113).

be chosen from all walks of life (although if a leader is constrained to selecting only those who are aligned with her policy goals then the talent pool remains shallow). This feature appears attractive since it deepens 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.[2] We explore the effects of introducing new blood into the talent pool. Perhaps surprisingly, a replenishing talent pool can sometimes reduce rather than enhance the performance of incumbent ministers.

We conclude our analysis by assessing the credibility of the leader's firing rule. The promise to fire a failing minister provides incentives, but the leader 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 leader's reputation matters, and this can induce her to carry out her threats.

For the most part, our model is based on a view of government as a set of bilateral relationships: at each point in time the minister chooses his performance; the leader observes a noisy performance indicator; upon observing this indicator she decides whether to fire or to retain her minister. Of course, a government is in some sense a collection of individuals working together. Although our reduced-form account abstracts from many essential team elements, our focus on replenishment in later sections of the article suggests one mechanism by which an individual's performance is affected by the relationship that the leader has with his colleagues.

The implications of a limited supply of talented agents has resonance beyond our application to executive politics. One could find the effects of a restricted talent pool under different constitutional arrangements and, moreover, as part of bureaucratic-sponsor relationships. Furthermore, our application perhaps has something to say in other walks of life that are not entirely governed by market relationships. For example, a soccer coach might use the threat of "substitutions" to encourage performance, although she may have only a limited number of talented replacements. Our approach is well suited to executive politics because of the clear-cut nature of the incentives: upon being appointed to the government, and conditional on a continued willingness to serve, a minister's tenure is at the behest of a leader who has few other instruments with which to control her agents. Moreover, unlike civil servants in some systems, there is no notion of permanence that shields a minister once she falls out of favor with her leader.

A Model of Ministerial Performance, Scandals, and Resignations

Ministerial Payoffs and Performance. The Prime Minister appoints a minister to his post by selecting him from a talent pool of suitable candidates. A minister enjoys a flow payoff $\bar{v} > 0$ which reflects his salary, the perquisites of office, and the benefits of being in a position of power and influence. Unlike textbook principal-agent models of labor relations, salaries are exogenous and so performance-related pay cannot be used to provide incentives.

Once in post, a minister can allocate effort to different tasks. He can devote effort to his government role, or he may instead support other activities that need not necessarily enhance government performance. At each moment in continuous time he chooses his performance $e \leq \bar{e}$, where the upper bound $\bar{e}$ is one aspect of his 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.[3] 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; when c is low the minister's interests are well aligned with the government's aims.

Bringing the payoff components together, a minister enjoys a net flow payoff of $\bar{v} - ce$ so long as he retains his job. He receives 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 $e = 0$.

[2] In 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.

[3] The linear functional form is without loss of generality; the only property we heavily use is the monotonicity of the relationship between the arrival rate of scandals (described in the next subsection) and the cost of performance.

Failures and Scandals. During her time in office, which ends only when her government falls, the Prime Minister enjoys a flow payoff $\bar{w} > 0$. However, she suffers whenever her minister encounters a policy failure or becomes embroiled in some other controversial event. 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 arrival of a scandal imposes an average penalty of $\bar{s}$ on the Prime Minister.[4]

Scandals arrive at a (Poisson) rate of $\bar{\lambda} + \lambda(e)$. The first component $\bar{\lambda} > 0$ reflects exogenous 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.[5] The second component $\lambda(e)$ is endogenously decreasing in the minister's performance. By increasing his performance a minister reduces the likelihood of resignation calls.[6]

Summarizing, the Prime Minister enjoys a net expected flow payoff $\bar{w} - [\bar{\lambda} + \lambda(e)]\bar{s}$ when her minister devotes performance e to his 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.

Ministerial and Government Termination. The minister and his boss enjoy their flow payoffs ($\bar{v} - ce$ and $\bar{w} - [\bar{\lambda} + \lambda(e)]\bar{s}$ respectively) only while they hold office. However, 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, Frendreis, 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 et al. (1990) found that majority status and the existence of an investiture requirement are both positively related to government duration; these features correspond to lower values of γ.[7] γ can also be interpreted as a continuous-time discount rate.

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, and because the minister can influence the arrival rate of damaging scandals. Some risk is inescapable: the Prime Minister is unable to protect her minister in the face of extreme scandals; even if she protects her minister whenever possible a scandal results in his dismissal with some minimum probability $q^{\ddagger} > 0$. For lesser scandals, however, the Prime Minister enjoys a hiring-and-firing prerogative, and so generally a scandal results in dismissal with some (possibly larger) probability $q^{\dagger}$ chosen by the Prime Minister.[8]

The Talent Pool. Our key assumptions are that (1) the availability of qualified replacements declines with the number of ministers who have served; and (2) the Prime Minister strictly prefers to work with talented ministers. One interpretation is that her government survives only so long as talent is available. Another interpretation is that once the pool of talented ministers is exhausted then the Prime Minister must draw upon a secondary source of lower-quality ministerial candidates; under this interpretation the "end of government" corresponds not to removal from office but rather a switch to a regime in which the executive is staffed by less effective personnel. Formally, 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, we allow the pool to become replenished by new arrivals.) This focus on the finiteness of the talent pool clearly differentiates our model from earlier models of ministerial turnover, which, although similar in some ways, do not consider this effect (Dewan and Myatt 2007).

[4]The severity of scandals is unrelated to the minister's actions. Instead, he influences the frequency with which scandals arrive. However, it is straightforward to consider a model in which performance does affect the nature of scandals, and under such a specification the central tension between incentive provision and talent retention remains.

[5]As an example, consider the recurring foot-and-mouth crises in U.K. agriculture caused by the outbreak of a virus that was clearly beyond the control of any particular minister.

[6]A related specification was employed by Dewan and Myatt (2007). Their hazard rate is increasing in a minister's policy activism: a minister who advocates radical policies is more likely to be involved in scandals, because opponents of change bring out of the cupboard skeletons that would be left hidden in the absence of proposals for reform.

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

[8]A fuller model is obtained by allowing the severity of the scandals to vary. Suppose that a scandal s is drawn from some distribution $F(\cdot)$. Further suppose that a resignation is automatic when $s \geq s^{\ddagger}$ and that the Prime Minister (endogenously) fires a minister when $s \geq s^{\dagger}$. Our specification is obtained via $q^{\dagger} = 1 - F(s^{\dagger})$ and $q^{\ddagger} = 1 - F(s^{\ddagger})$.

Ministerial Performance

Here we study the response of a minister's performance to the hiring-and-firing stance of a Prime Minister. 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.

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 consider this regime: the Prime Minister fires a scandal-hit minister with probability $q^\dagger \geq q^\ddagger > 0$. This probability is strictly positive, since some resignation calls are irresistible; beyond this, $q^\dagger$ may be chosen by the Prime Minister to provide incentives to her ministers. With this firing rule in place, the arrival rate of a minister's resignation is $[\bar{\lambda} + \lambda(e)]q^\dagger$. Fixing his performance, this rate is increasing in $q^\dagger$. However, this hazard rate also reacts to the performance of the minister, which is endogenously chosen by him in response to the firing rule which he faces.

The Choice of Performance. Facing the risk of losing his job, a minister balances the direct flow cost of performance against the slowed arrival of scandals. Avoiding a scandal helps to save his career, and this factor is weighted by the value that he places on that career. This career value, which we label V, and his optimally chosen performance e jointly satisfy two equations:

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

$$e = \arg\min_{\tilde{e} \in [0, \bar{e}]} \{c\tilde{e} + \lambda(\tilde{e})q^\dagger V\}. \tag{1}$$

The first equation determines a minister's career value. Its first term is the flow benefits of office minus the opportunity cost of performance. The second term reflects the endogenous risk of a successful resignation call: the arrival rate of scandals is $\bar{\lambda} + \lambda(e)$; 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. The second equation characterizes the optimal choice of e. The minister balances the flow cost (the left-hand term) against the expected flow penalty of resignation calls (the right-hand term). Performance 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 can influence the tenure of her minister via the firing probability $q^\dagger$. As this probability increases it becomes more likely that a scandal terminates a career. This substitution effect encourages a minister to shift away from private concerns and toward the government's agenda. However, there is also an income effect: conditional on his performance, a minister is more likely to lose his job and this reduces the value of his career. He cares less about protecting his position and so is more willing to pursue his own private projects. This income effect weakens his performance. 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 of the firing rule, the benefits of office, and the minister's talent; performance decreases with the opportunity cost of performance, the exogenous risk of government termination, and the exogenous risk of resignation calls.*

Our comparative-static results indicate the importance of income effects. 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; such benefits correspond to the payment of an efficiency wage (Akerlof 1982; Shapiro and Stiglitz 1984). 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 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 implication 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, performance is harmed by the background risk of government termination. As the expected life span of the government shortens, the value of a minister's career drops, and so his performance declines. 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.

All-or-Nothing Performance. For some of our results it is useful to specify a functional form for the endogenous hazard rate. We say that scandal arrivals are "linearly decreasing in performance" if $\lambda(e) = \hat{e} - e$ where $\hat{e} \geq \bar{e}$. This specification generates a "bang bang" solution in which a minister devotes either maximal or minimal performance to his tasks. The same results are obtained when he faces a binary choice of either following the government's agenda or not, where doing so involves an opportunity cost of $c\bar{e}$.

Proposition 2. *When the arrival rate of ministerial scandals is linearly decreasing in performance, a minister chooses either the maximum feasible performance or devotes no effort to his tasks. He chooses high performance if and only if the firing probability exceeds a critical threshold q^*. This threshold falls with the benefits of holding office but rises with the opportunity cost of performance, the exogenous risk of government termination, and the exogenous risk of resignation calls.*

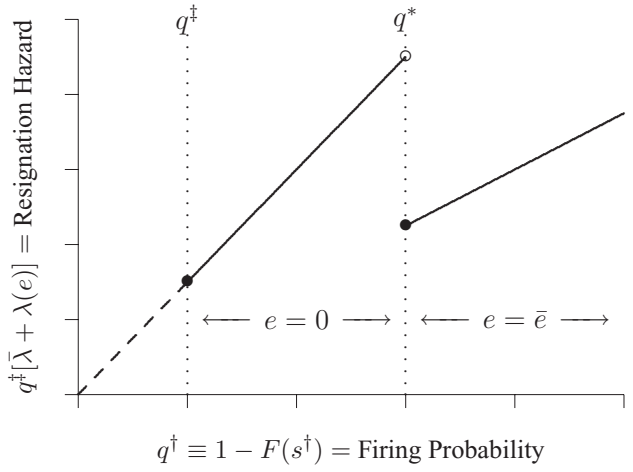
To induce high performance the Prime Minister must adopt a sufficiently high firing probability. However, she can do no worse than sack every scandal-hit minister, and so high performance is not always feasible; $q^* \leq 1$ if and only if office benefits are large relative to the opportunity cost of performance. Others have argued that office 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. Furthermore, high performance becomes harder to induce (q^* rises) as exogenous risks grow: such risks erode the value of a career. Finally, changes in the various parameters that lower q^* enable high performance via a lower firing probability, and so the factors that encourage performance may feed through via 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.

The effect of an increase in the firing probability can go either way: its direct effect is to increase the hazard rate, while the consequent increase in performance (Proposition 1) reduces it. The conflicting effects are most easily seen when the arrival of scandals is linearly decreasing in performance. Raising the firing probability from just below the critical threshold q^* to just above it only marginally increases the proportion of scandals that spark a resignation, but also prompts a discrete jump (by the minister) from low to high performance; hence the arrival rate of resignations falls. Further increases in the firing probability, however, raise resignations without influencing performance, and so ministerial careers are shortened. Figure 1 illustrates this effect.

Fixing the firing rule, however, the effects of other parameters are clear. An increase in the exogenous scandal risk directly increases resignations whilst also hastening 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 of government termination. Assembling these observations, we obtain the following formal result.

FIGURE 1 Firing Rules and the Arrival Rate of Resignations



Notes. The relationship between the firing probability $q^\dagger$ and the arrival of resignations can be nonmonotonic. Here the hazard rate of scandals is linear in performance. For $q^\ddagger \leq q^\dagger < q^*$, 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.

Proposition 3. *Given a firing rule, a minister's expected tenure increases with the benefits of office and his talent but decreases with his opportunity cost of performance and the exogenous risks of government termination and resignation calls. When the arrival of scandals is linear in performance and the firing probability adjusts to q^* then these statements also hold.*

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 article 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 might wish to change her firing rule to suit the size of her talent pool. Beginning with n potential ministerial appointees, she hires 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 for the current size of the talent pool. If a minister is fired when the talent pool has evaporated (that is, when $k=0$) then the government falls. (Equivalently, the government is forced to exploit a lower-quality talent pool.) We note that, absent any replenishment of the talent pool (we will allow for replenishment later in our article), k cannot grow. Furthermore, since the exogenous risk of scandals and the firing probability are both positive, there is always the risk of a scandal that results in a resignation, and so the talent pool will (in expectation) strictly shrink over time. The rate of decline depends, of course, on the firing rule and ministers' responses to it.

As k declines the Prime Minister may become more concerned with talent retention and so may adjust her firing rule. Modifying our earlier notation, $q_k^\dagger$ is the resignation probability faced by a scandal-hit minister when there are k potential replacements, and e_k is his chosen performance. Of interest to us is the relationship between the size of the talent pool and the two endogenous variables: the firing probability and the minister's chosen performance. These variables then jointly determine the arrival of resignations and each minister's expected tenure.

Optimal Firing Rules and Declining Performance. 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 response to these conflicting pressures.

To do this we calculate the 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. This leads to the value equation:

$$\underbrace{\bar{w}-[\bar{\lambda}+\lambda(e_k)]\bar{s}}_{\text{flow benefits and costs}} = \underbrace{q_k^\dagger[\bar{\lambda}+\lambda(e_k)][W_k-W_{k-1}]}_{\text{risk of talent depletion}} + \underbrace{\gamma W_k}_{\text{exogenous risk}} . \tag{2}$$

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 $W_k - W_{k-1}$ is the marginal value of the kth member of the talent pool in the eyes of the Prime Minister.[9] Finally, the third term stems from the exogenous risk of government termination. Once the Prime Minister's strategy (a sequence of firing probabilities indexed by k) is specified we can use equation (2) to calculate the value of her government for each possible talent-pool size.

The Prime Minister chooses her firing probability $q_k^\ddagger$ to maximize the value W_k when her talent pool contains k members. An increase in the firing probability induces higher performance and so lower penalties from scandals. It also influences the arrival of resignations:

[9]The Prime Minister loses W_0 when her last minister departs, and so we replace $W_k - W_{k-1}$ with W_0 when $k=0$.

the heightened 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 article, the net effect on the tenure of a minister can take either sign. However, if the net effect were negative (an increase in the firing probability reduces the flow of resignations), then the Prime Minister would shift toward a stricter regime. This means that the firing probability will be raised until there is a genuine trade-off between performance and resignations. An implication is that if different firing probabilities are employed for different talent-pool sizes, then higher probabilities must be associated with an accelerated arrival of resignations. We record this observation as a lemma.

Lemma 1. *Looking across the possible talent-pool sizes, greater severity of the firing rule (a higher firing probability) is associated with greater turnover (a higher arrival rate of resignations).*

There is a trade-off between performance and talent-pool retention. We now examine how this trade-off changes with the size of the talent pool. To do this, consider a small increase in the firing probability when there are k members of the talent pool. The benefit is the reduced arrival of costly scandals, and the size of this effect does not depend on the talent-pool size. The cost of such an increase is the increased likelihood that, via the resignation and replacement of a scandal-hit minister, the talent pool will shrink. The size of the talent-pool depletion effect is captured by the marginal value $W_k - W_{k-1}$ of the kth talent-pool member. The Prime Minister is more willing to fire a member of her team whenever this marginal value is small. Intuitively (and confirmed formally in our appendix) this marginal value is small whenever the talent pool is large; this reduces the severity of the talent-pool depletion effect; the Prime Minister is more willing to fire and does so; higher firing probabilities are associated with higher performance and more frequent resignations. This logic results in the next proposition, which is central to our article.

Proposition 4. *The optimal firing probability, ministerial performance, and the arrival rate of resignations all increase with the size of the talent pool, and so all are expected to fall over time.*

The talent pool evaporates over time (the arrival of scandals and the firing probability are both positive), which generates the final claim of the proposition: a minister's tenure is expected to be longer when there is a shorter history of resignations prior to his appointment.

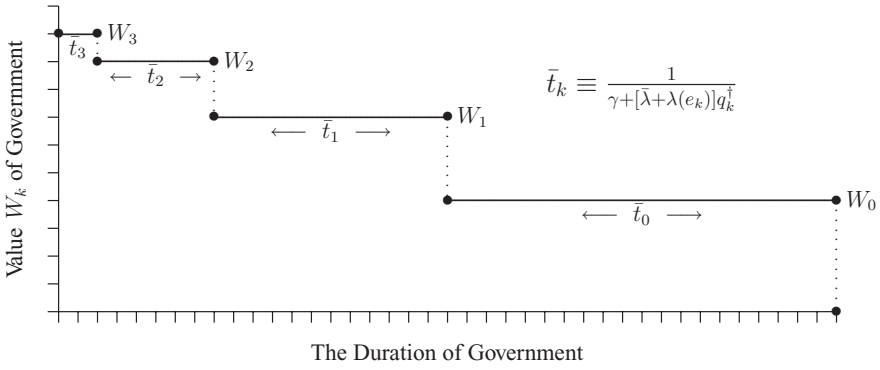
A Decline in Government Performance. The optimal firing probability declines as the talent pool shrinks, so that ministers perform less well and yet last for longer. This has implications for the interpretation of statistics on ministerial hazard rates. Berlinski et al. (2007) argued that "length of 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 an illustration consider again the second U.K. 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 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. (Paxman 2003, 210)

As a further example, consider the Australian government under Prime Minister John Howard, which began in March 1996. His Conservative party had campaigned on a policy of "clean government" and had introduced a "Code of Ministerial Conduct" as a means of fulfilling this pledge. This new code required ministers to be truthful in their communications to Parliament and to divest

FIGURE 2 The Declining Talent Pool of Government



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 and 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.

themselves of any shareholdings in companies affected by their ministerial portfolios. Between October 1996 and October 1997, seven cabinet ministers resigned following breaches of this ministerial code involving undisclosed shareholdings and unauthorized expenses. Ministers implicated later in the government term were dealt with more leniently. John Moore and Warwick Parer survived revelations about their shareholdings, and this indicated a relaxation of ministerial standards. Indeed in early 1999, the government announced that ministers would no longer be required to divest themselves of shareholdings.

The Length of Effective Government

An optimal firing rule yields declining performance. This might explain why governments push forward their programs, and raises questions: how long does a government remain effective? What determines the length of effective (rather than ineffective) governance?

The Duration of Effective Government. As Figure 2 illustrates, performance suffers as the talent pool declines. In situations with "all or nothing" choices by ministers, there is a natural interpretation of effectiveness: the government is effective when ministers devote maximal performance to their tasks and ineffective when they do not. Throughout most of this section we maintain the linear specification (or equivalent specifications, such as a binary work-or-not choice) so that our notion of effectiveness is unambiguous. Toward the end of the section we explain how most of our results and insights also hold under more general specifications.

Whether government is effective depends on the standards operated by the Prime Minister: it is effective when the firing rule is strict (formally, this is when the firing probability equals the critical threshold, so that $q_k^\dagger = q^*$) and ineffective when that rule is lax (when the firing probability is minimized, so that $q_k^\dagger = q^\ddagger$). Since the Prime Minister uses a stricter firing rule earlier on and relaxes it when the talent pool shrinks, we can obtain a corollary to Proposition 4.

Corollary to Proposition 4. *There is a critical talent-pool size k^* such that the optimal firing rule generates effective performance if and only if the talent pool meets or exceeds this threshold; performance falls after $n - k^*$ 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: the tenure of each minister in the high-performance regime

and the number of ministers involved in that regime.[10] This second element is the primary endogenous control variable of the Prime Minister and so we use it as our measure of the length of effective government: 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 the weakest feasible firing rule. We summarize the determinants of this length in the following proposition. For the purposes of this result 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.[11]

Proposition 5. *The length of effective government is decreasing in the Prime Minister's value from holding office but increasing in the severity of scandals. It is increasing in a minister's benefits from office and his ability but decreasing in his opportunity cost 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 risk of termination and of the minimum firing probability.*

The first pair of monotonic comparative-static predictions is unsurprising. When the Prime Minister cares deeply about holding office (that is, $\bar{w}$ 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. Furthermore, when his ability 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.[12] 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.

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. It is clear that the hazard rate of governments should be related to its performance; however, the performance of the government may be affected by beliefs about its survival. Here the relationship turns out to be subtle: Proposition 5 reveals a nonmonotonic relationship between the length of effective government and the arrival rate of exogenous failure. The "U shaped" feature 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 nonmonotonicity stems from a conflict between two conflicting forces.

Firstly, as the exogenous risk of termination rises then it becomes harder to induce high performance. This is because the extra risk lowers the value of a minister's career, and so (via the income effect) he cares less about avoiding resignation calls. To induce high performance requires a higher firing probability, and from the Prime Minister's perspective this is costly; she reacts by contracting the length of effective government. Secondly, the heightened exogenous risk means that the government is less likely 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.

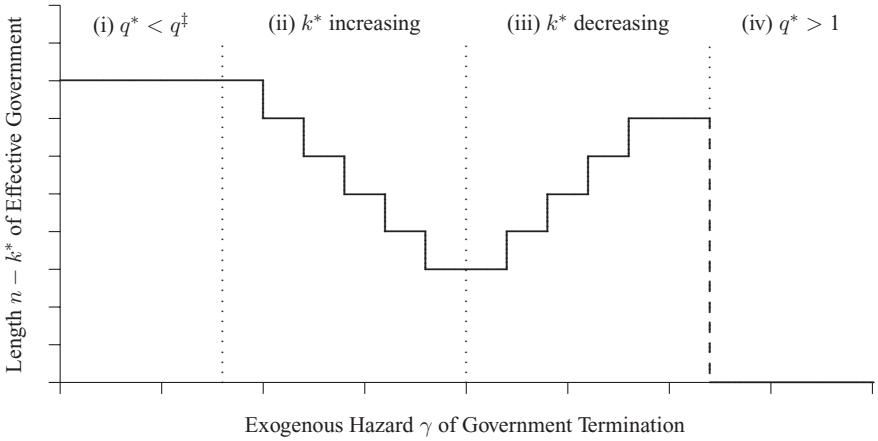
Bringing these two forces together, the first dominates for smaller γ, while the second can dominate for larger γ. Thus an increase in exogenous government instability and reduction in the overall duration of government can result in an increase in the length of effective government. A caveat is that it becomes impossible to induce high performance once the exogenous risk of termination becomes large enough; essentially, if that risk is very high then a minister values his career so little that even the highest penalty for being hit by a scandal is not enough to overcome the opportunity cost of

[10]The first element is explicitly calculated in our appendix. Following Proposition 3, a high-performance minister's tenure rises with office benefits and his ability but falls with his cost of performance and the exogenous risk factors.

[11]This 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 nonmonotonic function of the parameters γ and $q^{\ddagger}$.

[12]This view was disputed by Mattozzi 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.

FIGURE 3 The Duration of Effective Government



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 shaped" response described in Proposition 5.

performance.[13] Hence, as the exogenous risk increases, we identify (Figure 3) four phases of response: (1) when γ is low enough, then even the minimum firing probability $q^\ddagger$ is enough to induce high performance and so the government is always effective; (2) for larger γ, the length of effective government falls as it becomes more costly to encourage performance; (3) due to high instability the Prime Minister "lives for today" and increases standards; and (4) finally γ is so large that ministers no longer value their careers and so always 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 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 only partial discretion: if the severity of a scandal is severe enough 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; more generally 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 judgment 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). This minimum probability grows with the exogenous imposition of stricter standards. Thus, starting from a position of low standards, the gradual imposition of higher ministerial standards contracts the length of effective government and it only extends this length when standards become sufficiently high.

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

[13]This can happen because the inequality $q^* \leq 1$ fails for γ large enough, or for $\bar{v}/c$ small enough.

These effects are easiest to see by setting $q^{\ddagger} = 0$. In this case, the Prime Minister can insist on high performance from the first $n-1$ ministers 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 $q^{\ddagger}$ increases, this safety net disappears and the Prime Minister responds with lower standards by inducing high performance from 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 the minimum firing probability means that a contraction in the length of effective government happens when standards are initially low. However, the clamor for stricter exogenous regulation of ministers is likely to be largest in this case. Under these circumstances it might pay to strengthen the discretion of the Prime Minister rather than to diminish it.

Beyond All-or-Nothing Performance. So far in this section we have considered situations in which ministers devote either maximal or minimal performance to their tasks, so enabling us to discuss cleanly the notion of effective government. Nevertheless, it is important to consider more general specifications. A natural measure of effectiveness becomes the ministerial performance which the Prime Minister chooses to induce for each possible talent-pool size. If e_k falls for every k following a change in a parameter, then we can say that government becomes less effective.

Under a general specification for $\lambda(e)$, our first observation is that our insights regarding the effect of both the exogenous risk of termination and the minimum firing probability are robust. Whereas performance is not necessarily U-shaped in these parameters, the important insight is that performance (and hence effectiveness) is not always monotonic. The role of the Corollary to Proposition 5 (a statement which is generally true) is to demonstrate that higher exogenous standards do not necessarily increase effectiveness. This demonstration requires only a counterexample, and the all-or-nothing specification is a simple way of satisfying that requirement.

Turning to our other results, the first claims of Proposition 5 concerning the Prime Minister's preferences do not rely on any particular form for the arrival rate of scandals. For instance, when the Prime Minister places greater value on holding office (so that $\bar{w}$ rises) then, other things equal, she wishes to extend her tenure by slowing the depletion of the talent pool; slackening her firing rule, along with the reduced performance which this entails, is an obvious way to do that.

Proposition 6. *Under a general specification for $\lambda(e)$, an increase in the Prime Minister's value from holding office or a decrease in the severity of scandals both reduce the effectiveness of government: for every talent-pool size, the firing probability and ministerial performance both fall.*

The remaining claims of Proposition 5 concern a minister's office benefits, his ability, and the opportunity cost of his performance. It is straightforward to confirm that the effectiveness of government is increasing in the minister's ability. To show that effectiveness is increasing with office benefits (or, equivalently, decreasing in the opportunity cost of performance) requires some structure on $\lambda(e)$. Nevertheless, there are specifications of $\lambda(e)$ for which the claim holds.[14]

Replenishing the Talent Pool

The limited depth of the talent pool weakens the willingness to fire and so dulls the incentives of ministers. Here we allow the talent pool to 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 life span 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 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 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

[14] For example, consider a specification in which the arrival rate of scandals is inversely related to performance, so that $\lambda(e) = 1/e$. The performance of the last remaining minister increases with $\bar{v}$ but decreases with c.

[15] As 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."

of the Prime Minister's career (and of her government) is increasing in the size of her talent pool. This suggests that more talent is always a good thing.[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 from 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 $\beta \to \infty$ the talent pool is replenished as quickly as it is depleted, so that only the exogenous termination risk remains.

The Effect of Replenishment. We assume for now that the Prime Minister continues to employ a firing rule which depends 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 probability he faces and hence the value of his career.

To understand this argument, consider a minister who holds his post when the talent pool contains k members. He faces a firing probability $q_k^\dagger$. In the absence of replenishment, this single firing probability determines his performance via the substitution-effect and income-effect channels. Now consider a world in which replenishment is positive. This same minister anticipates that the talent pool may grow from k to $k+1$ members. If this happens, then the firing probability he faces changes, since this firing probability depends on the talent-pool size. If $q_{k+1}^\dagger > q_k^\dagger$, then this change is unwelcome, since the expansion of the talent pool prompts a reduction in the Prime Minister's tolerance of scandals. The anticipation of such an event lowers the value of the minister's career even prior to the talent pool's replenishment.

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. If it lowers the value of his career then his fear of resignation will also fall, leading to an (unwanted) reduction in performance. The value of his career does indeed decline with an increase in the replenishment rate β whenever the firing probability increases with the size of the talent pool; this claim stems directly from the argument given here and (following some formal analysis contained in our appendix) generates the following proposition.

Proposition 7. *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.*

In particular, starting from zero replenishment the firing probability does increase with the size of the talent pool, and so the first step toward a world with replenishment harms performance.

Summarizing: a higher firing probability reduces the value of a career; higher replenishment means that the minister faces the possibility that he will be exposed to a harsher regime in the future; this reduces the value of his career today; the income effect means that he reduces his performance. The message here is that the apparently welcome shift to a world with a greater inflow of new talent can, perhaps surprisingly, have some negative effects. The central reason is that ministers are not myopic: they react not only to the environment which they face today, but anticipate changes in their environment when the Prime Minister's circumstances (the size of her talent pool) change.

A corollary of Proposition 7 is that any exogenous depletion of the talent pool can help to increase performance: the firing rule weakens as the pool dries up, and so a minister foresees an easier life in the future; by enhancing his performance today he increases the likelihood of being able to enjoy that future easy life. An open question here is this: what might cause the talent pool to become depleted, other than the minister's own resignation and replacement? One answer is that the Prime Minister may be using the talent pool as a supply for multiple ministerial posts; thus a minister may benefit from a weaker firing rule when another minister is fired.

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

Beyond our comparative-static analysis of replenishment, we also consider a marginal increase in the severity of the firing rule. When replenishment is absent, the firing probability $q_k^\dagger$ influences only the performance of a minister faced with a k-strong talent pool. However, when the talent pool is replenished, the probability $q_k^\dagger$ also influences ministers faced with smaller talent pools.

Consider, for instance, a situation where the talent pool is shallower; it contains k' members where $k' < k$. A minister recognizes that if $k - k'$ new members arrive then he will face a firing probability $q_k^\dagger$ rather than $q_{k'}^\dagger$. An attempt to increase performance by strengthening a firing rule may have unintended consequences by dampening the behavior of those who are not directly faced by such a firing rule. The reason for this is that, once again, ministers look to the incentives they are likely to face in the future as well as the present when they calculate the value of their careers.

Proposition 8. *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 but reduces the performance of ministers when the talent-pool size is smaller.*

We have noted that an increase in the severity of the firing rule can have both income and substitution effects. Following a rise in $q_k^\dagger$, both effects influence e_k; the substitution effect dominates and so performance rises. For larger talent-pool sizes (a talent pool with k' members where $k' > k$) the probability $q_k^\dagger$ has no effect: after all, a minister recognizes that the talent pool can only grow while he is in post, and so he will never face the firing probability $q_k^\dagger$. For shallow pools, however, the income effect is present; it works against performance, since the increase in $q_k^\dagger$ lowers the value of a minister's future career and hence (since he is farsighted rather than myopic) his present career. In summary, talent-pool replenishment can sometimes diminish performance, suggesting that the relaxation of restrictions on ministerial selection is not necessarily an unalloyed blessing.

Replenishment and Reputation. 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 to 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 which specifies a firing probability above the minimum when the talent pool is empty (formally, a rule satisfying $q_0^\dagger > q^\ddagger$) lacks credibility. Insisting on dynamic consistency, the minimum firing probability is used when $k = 0$. Of course, we can now apply the same logic for a talent pool with only one member; even if the Prime Minister sacrifices her reputation by failing to implement a relatively strict firing rule, this will have no repercussions. Continuing this argument iteratively, we conclude that threats are empty; somewhat more formally, $q_k^\dagger = q^\ddagger$ for all k.

Proposition 9. *In the absence of talent-pool replenishment (that is, when $\beta = 0$), the Prime Minister will never willingly fire a scandal-hit minister. Hence, if she enjoys no commitment power then the only credible firing rule involves the minimum feasible firing probability.*

It is generally true that when the talent pool is empty a Prime Minister will never willingly fire her minister; if she did so then her government would end. However, the argument that she will never carry out her threat to the penultimate minister (so that there is one replacement remaining in the talent pool) relies on the absence of replenishment; this absence means that there is no future in which the Prime Minister's reputation for fulfilling her promises matters. With positive replenishment, however, there is a future in which a reputation is valuable. The presence of reputation effects, therefore, opens the door to the credibility of a Prime Minister's firing strategy.

To explore this issue more formally, we consider the simplest possible "2×2" setting: a world with all-or-nothing performance and where the talent pool contains either one member or nobody. Specifically, we suppose that full performance by a minister at a cost of $c\bar{e}$ reduces the arrival rate of scandals from $\bar{\lambda}$ to $\bar{\lambda} - \bar{e}$. We also set $n = 1$ so that the talent pool is either "full" ($k = 1$) or "empty" ($k = 0$). When the talent pool is empty, it is replenished (it switches to a full state) at the Poisson arrival rate $\beta > 0$. The last-man-standing argument continues to apply when the talent pool is empty, and so $q_0^\dagger = q^\ddagger$. When choosing the firing probability for the "full" talent pool, the Prime Minister chooses either $q_1^\dagger = q^\ddagger$ (low performance) or $q_1^\dagger = q^*$ (high performance).

Suppose that the Prime Minister would strictly prefer to induce high performance when the talent pool is full. Using equation (2), modified to incorporate the replenishment effect (see the appendix), we can calculate W_1 (the value when the talent pool is full) and W_0 (the value when it is empty); of course, these values satisfy $W_1 > W_0$. The alternative firing strategy available to the Prime Minister is to minimize the firing probability when the talent

pool is full and so remain content with low performance. Using similar calculations we can find values $\tilde{W}_1$ and $\tilde{W}_0$.

If $\tilde{W}_1 > W_1$ then there are no credibility problems; the Prime Minister has no desire to induce high performance and so there are no threats to carry out. However, if $W_1 > \tilde{W}_1$, so that high performance from a full talent pool is desirable, the Prime Minister is tempted to renege on her promises. This leads us to ask: when is her firing rule credible?

To answer, let us begin by supposing that the Prime Minister has convinced her ministers that she carries out her promises. If the talent pool is full and her minister encounters a scandal over which she has discretion, and the firing rule determines that she should sack him, then she faces a loss of $W_1 - W_0$ if she backs her threat with action. However, if she reneges then her ministers might not believe her in the future. The worst that can happen is that her ministers never believe her again; that is, from then on they assume that she will never fire a minister. This means that the Prime Minister keeps her minister (thus $k = 1$) but moves into a permanent "low performance" regime with a value of $\tilde{W}_1$. This entails a loss of $W_1 - \tilde{W}_1$. Assembling these observations, a Prime Minister is willing to carry out her threat if and only if $W_0 > \tilde{W}_1$; this says that having a reputation for carrying out promises is worth more than having an extra talent-pool member. The inequality $W_0 > \tilde{W}_1$ is a credibility constraint: if it is satisfied then there is an equilibrium (indeed, there may be many equilibria) in which the Prime Minister can credibly sustain her reputation; but if it fails then she cannot. Of course, $W_1 > W_0$ 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. Within the context of this "2×2" world (the talent pool is full or empty; performance is high or low) we obtain the following proposition.

Proposition 10. *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* $q_1^{\ddagger} = q^*$ *and is able to do so credibly; but if* $\beta_H > \beta > \beta_L$ *then she wishes to set* $q_1^{\ddagger} = q^*$ *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, 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.

Discussion

Our theory adds to a growing principal-agent literature applicable to parliamentary democracies that focuses on cabinet accountability. In our model, ministers may undermine the government if they do not devote themselves to government policy. This aspect of our model is related to previous work that focuses on the implementation of policy in parliamentary democracies.[17] In our model, a leader provides incentives by firing those seen to fail. This feature is common to other agency models (Gailmard and Patty 2007; Huber and Gordon 2002; Shotts and Wiseman 2008), but here our contribution is to shed light on a tension between the provision of incentives via turnover and the desire to preserve talent. Whilst, a priori, the effect of stricter standards is ambiguous, the optimal firing rule weakens over the life span of a government. An important implication is that variation in tenure can reflect differences in the way that ministers are managed; when the firing rule becomes more lenient, ministers who perform less well can survive for longer.

An empirical contribution of our theory is that it helps us to understand the mechanisms that lie beneath observed relations in the data on ministerial careers. In particular, we challenge the view that longer tenure is associated with better performance. That view does not take into account how a firing rule may vary over time: we show that longer tenure may in fact be associated with lower endogenous standards (a lower firing probability) and thus lower performance.

Our account is not the only one that may explain a decline in executive performance. Recall that we began our investigation with Key (1956), who stated that "the men we elect to office and the circumstances we create that affect their work determine the nature of popular government." We have considered a world where the "circumstances that affect their work" are responsible for declining performance. Of course, such a decline may instead be attributed to "the men we elect to office." We might, for example, think of a world where ministers are heterogenous in their ability, and where the leader first appoints to office the most talented of her ministrables. Absent the moral-hazard problem, such ministers will devote maximal effort to their tasks, and the Prime Minister will adopt the most lenient firing rule. As the administration proceeds through the talent pool, performance falls

[17] Thies (2001) and Martin and Vanberg (2004) examined different institutional mechanisms that allow a government to implement its policies. Thies (2001) focused on the appointment of senior and junior ministers from opposing parties; Martin and Vanberg (2004) highlighted the role of parliamentary scrutiny.

and scandals arrive more quickly. There is no change in the firing rule, and so the accelerated arrival of scandals also accelerates the arrival of ministerial resignations.

Whilst these alternatives both explain a decline in executive performance, they present very different predictions with regard to ministerial hazard rates. Whilst our moral-hazard story shows that the firing rule weakens as more ministers are fired and so predicts that those entering government later will survive longer, the alternative hypothesis leads to the opposite prediction.

Omitted Proofs

Proof of Proposition 1. Solving equation (1) yields $V(e) = [\bar{v} - ce]/[\gamma + [\bar{\lambda} + \lambda(e)]q^{\dagger}]$. Consider two performance levels $e_L < e_H$. If the minister prefers e_H then

$$V(e_H) \geq V(e_L) \Leftrightarrow \frac{\bar{v} - ce_H}{\bar{v} - ce_L} \geq \frac{\gamma + [\bar{\lambda} + \lambda(e_H)]q^{\dagger}}{\gamma + [\bar{\lambda} + \lambda(e_L)]q^{\dagger}}.$$

If this holds then (by inspection) it also holds (strictly) for lower values of c, γ, and $\bar{\lambda}$, and for higher values of $q^{\dagger}$ and $\bar{v}$. Furthermore, raising $\bar{e}$ enables higher choices of e. □

Proof of Proposition 2. The linearity of the arrival rate ensures that the optimal effort is either $e = \bar{e}$ or $e = 0$. Using equation (1), $V(\bar{e}) = [\bar{v} - c\bar{e}]/[\gamma + q^{\dagger}(\bar{\lambda} + \hat{e} - \bar{e})]$ and $V(0) = \bar{v}/[\gamma + q^{\dagger}(\bar{\lambda} + \hat{e})]$. 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

$$q^{*} = \frac{c\gamma}{\bar{v} - c[\bar{\lambda} + \hat{e}]}. \tag{3}$$

The comparative-static claims follow by inspection. The claims following the proposition hold because high performance requires $q^{*} \leq 1$, which holds if and only if $\bar{v} \geq c[\gamma + \bar{\lambda} + \hat{e}]$. □

Proof of Proposition 3. From Propositions 1 and 2, together with arguments in the text. The expected tenure $\bar{t}_k$ of a minister facing a k-strong talent pool is $\bar{t}_k = 1/(\gamma + [\bar{\lambda} + \lambda(e_k)]q_k^{\dagger})$. If scandal arrival is linear in performance and $k \geq k^{*}$ then $q_k^{\dagger} = q^{*}$ and $\lambda(e_k) = \hat{e} - \bar{e}$. Using equation (3),

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

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

Proof of Proposition 4. We first show that W_k is increasing in k. Defining $W_{-1} \equiv 0$, this holds for $k = 0$. We show inductively that this is true for larger k. Rearrange equation (2) to obtain

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

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

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

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. As a second step before proving the proposition, we show that there are decreasing returns: $W_{k+1} - W_k \leq W_k - W_{k-1}$ 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:

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

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

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

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

When there are k members of the talent pool, the firing probability $q_k^{\dagger}$ is optimal, and so the Prime Minister must be (at least weakly) worse off using the firing probability $q_{k-1}^{\dagger}$. Using equation (2),

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

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 (2) once more, we obtain

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

These two inequalities combine straightforwardly to yield

$$0 \ge \left(q_k^{\dagger}[\bar{\lambda}+\lambda(e_k)]-q_{k-1}^{\dagger}[\bar{\lambda}+\lambda(e_{k-1})]\right) \times ([W_k-W_{k-1}]-[W_{k-1}-W_{k-2}]).$$

The second term on the right-hand side is strictly negative, since there are decreasing returns to k (as proven). For the inequality to be satisfied, we must have $q_k^{\dagger}[\bar{\lambda}+\lambda(e_k)] \ge q_{k-1}^{\dagger}[\bar{\lambda}+\lambda(e_{k-1})]$, 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 $q_k^{\dagger} \ge q_{k-1}^{\dagger}$. Finally, applying Proposition 1, we conclude that performance is increasing in k. Turning to the final claim of the proposition, the left-hand side of equation (2) 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. □

Proof of Proposition 5. An optimal firing rule satisfies $q_k^{\dagger} \in \{q^{\ddagger}, q^*\}$ for each k since intermediate values of $q^{\dagger}$ generate more resignations than $q^{\ddagger}$ 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 $q_k^{\dagger} = q^{\ddagger}$ for $k < k^*$ and $q_k^{\dagger} = q^*$ for $k \ge k^*$.

We now calculate k^*. $W_k^{\hat{k}}$ is the value obtained by setting $q^{\dagger} = q^*$ if and only if $k \ge \hat{k}$ and W_k^{∞} is the value of setting $q_k^{\dagger} = q^{\ddagger}$ for every k. If k^* is chosen optimally then $W_{k^*}^{k^*} \ge W_{k^*}^{\infty}$ since otherwise the Prime Minister would increase the threshold to k^*+1. It must also be the case that $W_{k^*-1}^{k^*-1} \le W_{k^*-1}^{\infty}$ since otherwise she would gain by switching to k^*-1. To assess these inequalities we calculate $W_k^{\hat{k}}$ and W_k^{∞}. Using equation (2) and setting $\hat{e}=0$ (without loss):

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

$$W_k^{\infty} = \frac{\bar{w}+\bar{\lambda}\left[q^{\ddagger} W_{k-1}^{\infty}-\bar{s}\right]}{\gamma+\bar{\lambda}q^{\ddagger}}.$$

Using these two expressions, straightforward but tedious algebra reveals that

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

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

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

and so

$$W_k^{\hat{k}} \ge W_{\hat{k}}^{\infty} \iff (\bar{\lambda}(q^*-q^{\ddagger})-\bar{e}q^*)\left(\tfrac{\bar{\lambda}q^{\ddagger}}{\gamma+\bar{\lambda}q^{\ddagger}}\right)^{\hat{k}} \le \frac{\bar{e}\bar{s}(\gamma+\bar{\lambda}q^{\ddagger})}{\bar{w}-\bar{\lambda}\bar{s}}.$$

A first case to consider is when $\bar{\lambda}(q^*-q^{\dagger}) \le \bar{e}q^*$. If this holds the left-hand side of the inequality is negative, and so $W_{\hat{k}}^{\hat{k}} \ge W_{\hat{k}}^{\infty}$ 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 $W_{k^*}^{k^*} \ge W_{k^*}^{\infty}$ and $W_{k^*-1}^{k^*-1} \le W_{k^*-1}^{\infty}$, we bring this pair of equalities together to obtain

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

Generically a unique k^* satisfies these inequalities: the smallest integer greater than $\tilde{k}$, where

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

Recall that we are dealing with the case $(\bar{\lambda}-\bar{e})q^* > \bar{\lambda}q^{\ddagger}$, 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 $q^{\ddagger}$. We will show that $\tilde{k}$ is quasi-concave in γ and quasi-concave in $q^{\ddagger}$ when evaluated at parameter values which ensure that the expression for $\tilde{k}$ is well defined (requiring $(\bar{\lambda}-\bar{e})q^* > \bar{\lambda}q^{\ddagger}$) and high performance is feasible (requiring $q^* < 1$). It proves convenient to use the notation $A \equiv \log[(\bar{w}-\bar{\lambda}\bar{s})(\bar{\lambda}(q^*-q^{\ddagger})-\bar{e}q^*)]-\log[\bar{e}\bar{s}(\gamma+\bar{\lambda}q^{\ddagger})]$ for the numerator of $\tilde{k}$ and $B \equiv \log[\gamma+\bar{\lambda}q^{\ddagger}]-\log[\bar{\lambda}q^{\ddagger}]$ 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 $\frac{\partial \tilde{k}}{\partial \gamma} > 0 \Longleftrightarrow \frac{\partial A/\partial \gamma}{\partial B/\partial \gamma} > \tilde{k}$. To establish quasi-concavity we investigate the sign of the second derivative of $\tilde{k}$ when evaluated at a stationary point. Straightforwardly, $\frac{\partial \tilde{k}}{\partial \gamma} = 0 \Longrightarrow \frac{\partial^2 \tilde{k}}{\partial \gamma^2} < 0 \Leftrightarrow \frac{\partial}{\partial \gamma}[\frac{\partial A/\partial \gamma}{\partial B/\partial \gamma}] < 0$. Differentiating and rearranging, we obtain

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

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 $q^{\ddagger}$. We note that the denominator B is decreasing in $q^{\ddagger}$. This implies that

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

Straightforward differentiation of A and B yields

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

$$\frac{\partial B}{\partial q^{\ddagger}} = -\left[\frac{1}{q^{\ddagger}} - \frac{\bar{\lambda}}{\gamma + \bar{\lambda}q^{\ddagger}}\right].$$

Taking the ratio of these two derivatives and rearranging, we obtain

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

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

Proof of Proposition 6. Consider the Prime Minister's choice between inducing two performance levels $e_H > e_L$. Write λ_H and λ_L for the associated arrival rates of scandals, and r_H and r_L for the arrival rates of resignations. High performance is preferred if and only if

$$\frac{\bar{w} - \lambda_H \bar{s} + r_H W_{k-1}}{\gamma + r_H} \geq \frac{\bar{w} - \lambda_L \bar{s} + r_L W_{k-1}}{\gamma + r_L}$$

$$\Leftrightarrow \frac{\bar{w} - \lambda_H \bar{s} + r_H W_{k-1}}{\bar{w} - \lambda_L \bar{s} + r_L W_{k-1}} \geq \frac{\gamma + r_H}{\gamma + r_L}.$$

Higher performance continues to be preferred for lower values of $\bar{w}$ (which implies that induced performance is decreasing in $\bar{w}$) if the left-hand side of the second inequality is decreasing in $\bar{w}$. Writing W'_{k-1} for the derivative of W_{k-1} with respect to $\bar{w}$, this is so if

$$\frac{\bar{w} - \lambda_H \bar{s} + r_H W_{k-1}}{\bar{w} - \lambda_L \bar{s} + r_L W_{k-1}} \geq \frac{1 + r_H W'_{k-1}}{1 + r_L W'_{k-1}}.$$

A sufficient condition for this to hold is if $(1 + r_H W'_{k-1})/(1 + r_L W'_{k-1})$ is less than $(\gamma + r_H)/(\gamma + r_L)$, which in turn holds if and only if $W'_{k-1} < (1/\gamma)$. But this final inequality must hold: the value of an increase in a Prime Minister's per-period benefit $\bar{w}$ from holding office is bounded above by the increase she would enjoy with a limitless talent pool, and that increase is $1/\gamma$. □

Ministerial Performance with Replenishment. When the talent pool can be replenished, the equations characterizing ministerial performance are modified. 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,

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

□

Proof of Proposition 7. 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. □

Proof of Proposition 8. The increase in $q_k^{\dagger}$ reduces $V_{k'}$ for all $k' < k$. This income effect lowers $e_{k'}$ for all $k' < k$. 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, write the value equation 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 $\gamma + \beta$. □

Proof of Proposition 10. Imposing a linear arrival rate of scandals, setting $\hat{e} = 0$ without loss of generality, setting $n = 1$, introducing replenishment, and modifying equation (2) for $k = 0$ and $k = 1$ for a regime in which the Prime Minister induces high performance when $k = 1$, we obtain:

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

$$\bar{w} - \bar{\lambda}\bar{s} = q^{\ddagger}\bar{\lambda} W_0 + \gamma W_0 - \beta(W_1 - W_0).$$

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

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

Solving explicitly for W_0, W_1, and $\tilde{W}_1$ yields

$$W_0 = \frac{[\beta + \gamma + (\bar{\lambda} - \bar{e})q^*](\bar{w} - \bar{\lambda}\bar{s}) + \beta\bar{e}\bar{s}}{\beta\gamma + (\gamma + \bar{\lambda}q^{\ddagger})[\gamma + (\bar{\lambda} - \bar{e})q^*]},$$
$$W_1 = W_0 + \frac{\bar{\lambda}q^{\ddagger}(\bar{w} - \bar{\lambda}\bar{s}) + (\gamma + \bar{\lambda}q^{\ddagger})\bar{e}\bar{s}}{\beta\gamma + (\gamma + \bar{\lambda}q^{\ddagger})[\gamma + (\bar{\lambda} - \bar{e})q^*]} \quad \text{and}$$
$$\tilde{W}_1 = \frac{[\beta + \gamma + 2\bar{\lambda}q^{\ddagger}](\bar{w} - \bar{\lambda}\bar{s})}{\beta\gamma + (\gamma + \bar{\lambda}q^{\ddagger})^2}.$$

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) $W_1 > \tilde{W}_1 > W_0$ so that 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:

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

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

$$W_0 = \frac{[\gamma + (\bar{\lambda} - \bar{e})q^*](\bar{w} - \bar{\lambda}\bar{s})}{(\gamma + \bar{\lambda}q^{\ddagger})[\gamma + (\bar{\lambda} - \bar{e})q^*]},$$
$$W_1 = W_0 + \frac{\bar{\lambda}q^{\ddagger}(\bar{w} - \bar{\lambda}\bar{s}) + (\gamma + \bar{\lambda}q^{\ddagger})\bar{e}\bar{s}}{(\gamma + \bar{\lambda}q^{\ddagger})[\gamma + (\bar{\lambda} - \bar{e})q^*]} \quad \text{and}$$
$$\tilde{W}_1 = \frac{[\gamma + 2\bar{\lambda}q^{\ddagger}](\bar{w} - \bar{\lambda}\bar{s})}{(\gamma + \bar{\lambda}q^{\ddagger})^2}.$$

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 $\beta_H > \beta > \beta_L$. □

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