On the Merits of Meritocracy*

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Abstract

We study career choice when competition for promotion is a contest. A more meritocratic profession always succeeds in attracting the highest ability types, whereas a profession with superior promotion benefits attracts high types only if the hazard rate of the noise in performance evaluation is strictly increasing. Raising promotion opportunities produces no systematic effect on the talent distribution, while a higher base wage attracts talent only if total promotion opportunities are sufficiently plentiful.

1 Introduction

In the wee hours of September 20, 1881, Chester A. Arthur took the oath of office to become the 21st President of the United States. In a sense, he owed his entire career, and indeed the Presidency itself, to the spoils system—the selection of public servants on the basis of partisan loyalties rather than skill and experience. Arthur rose through the ranks of Senator Roscoe Conkling's Republican machine to become the Collector of the Port of New York.

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The position that had little to do with his previous professional experience but, nonetheless, saw his pay exceed that of President Grant who had appointed him. The spoils system also led to his ouster, when a hostile President Hayes, Grant's successor, removed him in favor of someone more politically aligned. This freed Arthur to pursue and attain the office of Vice-President, where he once again benefited from the spoils system, this time at the hands of a crazed gunman, Charles Guiteau, who believed that by shooting then-President James Garfield he would secure a spoils appointment from Arthur.

Despite his own deep involvement with the spoils system, the shock of Garfield's death led Arthur to embrace the Pendleton Act, a law that made US civil service appointments and promotions subject to merit rather than politics. The act transformed the civil service and dramatically changed the kind of individuals choosing to work for the government. The 19th century biographer James Parton noted that, under the spoils system, he who entered government service was of one of three characters, namely, "an adventurer, an incompetent person, or a scoundrel." Parton characterized the whole as representing "the refuse of the nation."[1] By the end of the 19th century, civil servants were of a wholly different caliber. For instance, 25% of those sitting for examinations for copyist or clerk had some college education, roughly double the rate of society as a whole. Changes in culture were no less dramatic. Performing the actual duties of the post, rather than serving a patron, became paramount. In line with this transformation, Silas Burt, then in charge of the New York Customhouse, commented on the "greater *esprit de corps* of the aggregate force" that came about with the demise of the spoils system.

In more recent times, Singapore has been lauded for attracting top talent to its bureaucracy, and its commercial success owes much to their efficiency (see, e.g., Vadlamani, 2012). One measure of this success is that, since Singapore's separation from Malaysia in 1965, per capita GDP has grown from around 150% of Malaysian levels to more than 500% today

[1] James Parton, *The Life of Andrew Jackson*, p. 220.

(Adam, 2010). Interestingly, the very basis for the separation was a conflict about *Bumiputera*, the idea that those of Malay descent should be given preferential treatment. Singapore strongly objected to this kind of affirmative action and made a point of tightly linking civil service appointments and promotions to academic achievement and performance on the job, rather than ethnicity. In its efforts to attract the best-and-the-brightest, Singapore has not relied exclusively on meritocracy, however. It also pays high salaries to top performers. Indeed, Singaporean senior civil servants are among the best-paid in the world (Chan, 2011). Hence, a natural question is whether its success in attracting top talent to public service is mostly due to its uncompromising meritocracy, its high remuneration of top performers, or both.

Finally, a large portion of the public sector workforce in US states consists of school teachers. Poor student performance in international tests such as PISA has led to calls for policies that attract more top graduates to teaching. An apparent roadblock is the lack of promotion opportunities: the ratio of teachers to principals is enormous, while higher level positions, such as school superintendent, are scarcer still. Indeed, August, Kihn, and Miller (2010) note that, "in the US, the teaching profession often seems 'unprofessional'—opportunities for advancement and recognition are few." This observation led a task force, set up by Alabama Governor Bob Riley, to recommend offering more promotion opportunities as a way to attract and retain good teachers.[2] A crucial question is whether such a policy would succeed in attracting talent, and more importantly, how it compares to alternatives, such as raising teacher pay or linking promotion decisions more closely to performance, rather than seniority.

With these questions in mind, we explore how the incentive systems of competing professions—which may be viewed as representing the public versus the private sector—impact the distribution of talent across professions and their respective work cultures. We focus on four

[2] http://www.livecareer.com/news/Education-Teaching-Childcare/State-Seeks-Advancement-Opportunities-For-Teachers_$$00599.aspx accessed 13 December 2011.

key variables: a profession's base wage, the number of promotion opportunities, the size of promotion benefits, and the meritocracy in promotion decisions. By meritocracy, we mean the extent to which promotions depend on the effort and skill of workers, rather than on other more idiosyncratic factors, such as luck or even nepotism. Our main finding is that, of these four instruments, only meritocracy serves as a reliable means of attracting top talent and promoting a high-effort work culture. By contrast, a higher base wage attracts talent only when total promotion opportunities are plentiful. It repels talent when opportunities are scarce. Increasing promotion opportunities expands the pool of workers attracted to a profession, but by no means assures that the profession attracts top talent. Raising promotion benefits also has ambiguous effects. Success or failure of this policy depends on a technical condition—the slope of the hazard rate of the noise in performance evaluation. Raising promotion benefits attracts talent when the hazard rate is increasing, but repels talent when the hazard rate is decreasing.

Meritocracy succeeds in attracting the talented and repelling the untalented, because ability strongly colors how individuals view more meritocratic performance evaluation. Talented individuals prefer more meritocracy, since it makes it more likely that their skills and performance will be properly recognized and rewarded. Untalented individuals, by contrast, positively prefer less meritocracy, since it allows them to hide their deficiencies in the noise of the performance measure. As a result, professions that differ in meritocracy induce a strict separation based on ability. Individuals whose ability exceeds a certain threshold choose the more meritocratic profession, while less talented individuals choose the less meritocratic profession.

It might seem that increasing promotion benefits would also succeed in attracting the best-and-the-brightest. This is not necessarily the case, however. The complication is that higher promotion benefits are appealing to *all* individuals, and not only to the most talented. Hence, entry into the profession increases and the promotion standard rises. The relevant trade-off is then between the benefit of higher promotion benefits versus the cost of reduced chances of gaining promotion. As we show, this trade-off is proportional to the hazard rate of the noise in performance evaluation. The cost-benefit ratio is relatively more favorable for high ability individuals only if the hazard rate is increasing, while the reverse is true when the hazard rate is decreasing.

Increasing promotion opportunities is likewise unreliable in attracting talent. To see why, notice that agents do not care about the number of promotion opportunities per se, but rather about the promotion standard they need to achieve in order to get promoted. A rise in promotion opportunities leads to an influx of workers until standards are once more equilibrated across professions. The influx can be of any ability level: low, high, or medium. As a result, increasing promotion opportunities succeeds in attracting more, but not necessarily better, individuals. Hence, this too is an ineffective strategy.

The intuition underlying the ineffectiveness of raising the base wage is rather different. While a higher base wage is equally attractive to all, the concomitant rise in the promotion standard is most costly to those who operate closest to the standard. When promotion opportunities are plentiful, only low ability individuals need worry about securing a promotion. Hence, it is they who are disproportionately hurt by a rise in standards. The opposite is true when promotions are scarce—now high ability types operate closest to the margin. As a result, raising the base wage succeeds in attracting talent in the former situation, but not in the latter. In intermediate cases, a high base wage attracts both the best *and* the worst.

Returning to the issue of attracting talent to the public sector, we conclude that merely "throwing money" at the problem provides no guarantee for success. Increased spending on base wages, promotion benefits, or promotion opportunities may even backfire and aggravate the problem it is intended to solve. Provided it can be implemented, a more effective policy is to tie promotion decisions more closely to individual performance. This, of course, requires jettisoning seniority-based promotion policies, which are quite common in the public sector.

Related Literature

Our paper lies at the intersection of several strands of the extant literature on how the structure of incentives affects selection and effort in competitive environments. In our model, the basic structure of competition within a profession is a rank-order tournament. That is, an individual's output, which is determined by effort, ability, and noise, is used to ordinally rank individuals from highest to lowest. The best performers are awarded a prize, i.e., promotion. Thus, we add to the considerable literature on how relative performance schemes affect effort. Beginning with Lazear and Rosen (1981), this literature is mainly concerned with incentives to exert effort in winner-take-all tournaments and, in particular, the comparison with other incentive schemes such as piece rates. These models focus on dyadic relationships between a single firm and a finite and, usually, small number of competing workers. Moreover, the performance evaluation technology is treated as fixed. In contrast, we consider a setting with a large number of competing individuals, which we model as a continuum. More importantly, we examine a general equilibrium setting where two or more professions compete to attract workers. Thus, selection, which tends to be treated as exogenous in this literature, is a key consideration. Moreover, we highlight how differences in performance evaluation affect both selection and effort.

The effect of heterogeneity in ability on effort exertion features prominently in the work of Moldovanu and Sela (2001, 2006), as well as in Minor (2011). These models abstract from measurement noise and study first-price all-pay auctions where a single tournament designer has a prize budget that he can divide over two prizes. They identify conditions where winner-take-all schemes are optimal. The assumptions of zero noise and a monopoly tournament designer (profession) may be appropriate in some settings, yet there are other settings where they are clearly unrealistic. Our main results highlight how differences in performance measurement, what we term meritocracy, affect selection and effort in settings with competing professions.

As Dixit (1980) first pointed out, a rank-order tournament is mathematically isomorphic to an imperfectly discriminating all-pay auction, often referred to as a contest in the literature on political rent-seeking (see, e.g. Tullock, 1980). This literature takes the contest success function (which corresponds to the noise generating process in a tournament) as given and studies how differences in risk-preferences, numbers of competitors, and abilities affect effort. Effort choices are interpreted as rent-seeking expenditures by interest groups (see, e.g., Nitzan, 1994, and Konrad, 2009, for surveys). For tractability reasons, these models typically impose the restriction that all relevant parameters, including the abilities of the contestants, are publicly known. Our setting with a continuum of individuals offers a tractable framework for studying contests with substantial variation in privately known individual abilities. Like the tournaments literature, the extant rent-seeking literature is also largely dyadic—a single principal awards a prize to one of the competing parties. We extend this literature by introducing competing principals in a setting where agents are free to choose which contest to participate in. We highlight how the structural features of the contest—the number and value of the prizes, as well as the contest success function—determine both selection and effort, which together determine rent-seeking expenditures.

Nearer to our work are a pair of papers that examine selection across contests. In Leuven, Oosterbeek, and van der Klaauw (2010) abilities are binary and success is determined by a lottery contest specification. Consistent with our results, they find that high ability individuals are not always attracted by higher prizes. However, meritocracy is not a consideration in their paper, since the contest success function is the same in both contests and fixed. Asmat and Muller (2009) study competing contest designers with a given budget who try to maximize their share of (identical) contestants. Their main finding is that the more discriminatory the contest—in our language: the more meritocratic—the more prizes should be offered. However, since Asmat and Muller do not allow for differences in ability, their model is silent about the effect of more prizes on selection. We show that more prizes do not necessarily attract talent or induce higher effort.

Our paper also adds to the career concerns literature (see Holmstrom, 1982). This literature is mainly concerned with a single principal who controls the size and timing of promotion benefits in order to induce good performance by an agent. We add to this literature by introducing competition among principals for talent, competition among individuals for promotions and, most importantly, variation and differentiation in performance evaluation systems. This aspect, in particular, is novel in the literature. It highlights that, when we account for selection, sufficiently meritocratic performance evaluation is essential for career concerns incentives to work as advertised.

We use the choice between a career in the public versus the private sector as our leading example. The existing literature on this topic largely focuses on the role of intrinsic motivation (see Perry and Wise, 1990). For example, Delfgaauw and Dur (2010) argue that intrinsic motivation to work in the public sector leads to higher wages in the private sector. They show that these compensating wage differentials are increasingness in ability and, hence, induce the more able to self-select into the private sector and the less able into the public sector. Finally, Prendergast (2007) studies how different kinds of public service motivation make certain individuals a better "fit" for some types of bureaucracies than for others.

The remainder of the paper proceeds as follows. In section 2, we introduce a basic version of the model with only a single profession. Section 3 adds a second profession in a benchmark setting where the two professions are identical. We then examine how small changes in a profession's base wage, promotion opportunities, promotion benefits, or meritocracy affect the distribution of talent across professions. Section 4 both specializes and extends the model. In particular, we introduce functional forms that allow the model to be solved in closed-form. We then study how global and simultaneous changes in promotion opportunities, promotion benefits, and meritocracy affect outcomes. Section 5 illustrates various ways in which our results are robust. We endogenize promotion benefits, extend the model to n professions, and allow agents to have idiosyncratic, non-pecuniary preferences for working in a particular profession. In all of these settings, our finding that meritocracy is the only reliable policy tool for attracting and motivating talent remains valid. Finally, section 6 concludes. The formal proofs of the results presented in the paper are relegated to an appendix. However, we do discuss the basic ideas behind the proofs in the main text.

2 Single Profession

We begin by studying effort choices and promotion outcomes in the context of a single profession. The situation we have in mind is one where a large number of individuals vie for promotion. Promotions are scarce relative to the number of individuals in the profession; thus, some of them will not be promoted. The benefit of promotion is a higher wage, whose lifetime value is $v > 0$. To obtain a promotion, individuals must undertake effort, which translates into output. While effort is costly for all, these costs differ across individuals; some are better at turning their time into productive effort than others. In addition to effort, (measured) output is also affected by some degree of luck. The available promotion slots are given to those individuals who have achieved the highest levels of (measured) output.

The Model

Consider a unit mass of atomless, risk-neutral agents with differential abilities $a \in A = [\underline{a}, \overline{a}] \subset (0, \infty)$. Abilities are distributed according to an atomless cdf G with strictly positive density g. An agent, a, exerts effort $X(a) \in [0, \infty)$ at a cost $C(X, a)$. The cost function has the following properties: Zero effort entails zero cost, as well as zero marginal cost. Outside of zero, effort is costly with strictly increasing marginal cost. Costs as well as marginal costs are strictly decreasing in ability. Formally, we assume that 1) $C(0, a) = \left.\frac{\partial C(X,a)}{\partial X}\right\rfloor_{X=0} = 0$; 2) $\frac{\partial C(X,a)}{\partial X} > 0$ for all $X > 0$; 3) $\frac{\partial^2 C(X,a)}{(\partial X)^2}$ is strictly positive and bounded away from zero; 4) $\frac{\partial C(X,a)}{\partial a} < 0$; and 5) $\frac{\partial^2 C(X,a)}{\partial a \partial X} < 0$.

An agent's output, Y, is determined by effort, X, and noise, E. Specifically,

$$Y = X \cdot E$$

where E is non-negative and independent across agents. Often, it is more convenient to express output, effort, and noise in terms of logs rather than levels. We use lower-case letters to denote the log of the corresponding upper-case letter. Hence, the log of output is

$$y = x + \varepsilon$$

where y, x, and ε lie on the (extended) reals. With slight abuse of notation, we also write $c(x, a)$ for $C(e^x, a)$.

We assume that the (log of) noise is nicely behaved: ε has zero mean and is single-peaked around zero. Its density, f, is strictly positive on $(-\infty, \infty)$ and has a bounded derivative f'. The associated cdf is F, which is parametrized by precision λ. The parameter λ orders ε_λ according to the dispersion order (see, e.g., Shaked and Shanthikumar, 2007). This means that F_λ^{-1} is supermodular in λ and its function argument. In other words, $F_{\lambda'}^{-1}(\cdot) - F_\lambda^{-1}(\cdot)$ is strictly decreasing if and only if $\lambda' > \lambda$. Many common distributions satisfy this property, including the Laplace, Normal, and Pareto distributions.

The parameter λ is intended to capture the idea that luck plays a larger role in some professions than in others. One obvious way this might be the case is if professions differ in how easily, or objectively, output can be measured. For example, measuring output is often quite difficult in certain public sector jobs, whereas it is more easily measured in for-profit, private sector jobs and "quantitative" professions such as professional sports. Alternatively, one can interpret ε as representing the influence of factors other than skill and effort on promotion decisions. For instance, while in some countries job performance is the key determinant of civil service promotions, in others, party allegiance, personal loyalties, nepotism, or other idiosyncratic factors play a significant role.

This possibility of promotion drives agents to undertake effort. Agents who are not promoted receive a normalized benefit of zero which, for later reference, we call the base wage and denote by w. Agents who *are* promoted enjoy an additional benefit $v > 0$, which one can think of as the increase in net present value of the wage trajectory associated with promotion. Promotions are given to the mass $m < 1$ of agents with highest outputs Y. Because there is a continuum of agents, the equilibrium output threshold that agents need to reach or surpass in order to be promoted is *deterministic*. We shall refer to this threshold as the promotion standard and denote it by $\Theta \in [0, \infty)$ or, in logs, by $\theta \in [-\infty, \infty)$.

An agent with ability a who exerts effort x when the promotion standard is θ enjoys an expected payoff

$$\pi(x, a, \theta) = v(1 - F(\theta - x)) - c(x, a)$$

Differentiating this expression with respect to effort yields the first-order condition (FOC)

$$vf(\theta - x) - \frac{\partial c(x, a)}{\partial x} = 0 \tag{1}$$

The second-order condition (SOC) ensuring that the FOC characterizes a maximum is

$$-vf'(\theta - x) - \frac{\partial^2 c(x, a)}{(\partial x)^2} < 0 \tag{2}$$

This condition holds provided that the cost function is sufficiently convex. We assume this to be the case throughout.

Properties of Optimal Effort

For the moment, we treat the promotion standard as exogenous and derive a number of useful properties of optimal effort. First, higher promotion benefits, v, raise the marginal benefit of effort, $vf(\theta - x)$, and hence everybody's effort level, x. Second, the FOC (1) also implies that effort is strictly increasing in ability, a. To see this, recall that, for a given level of effort, the marginal cost of effort is decreasing in ability. Thus, if $x(a)$ is the optimal effort for an individual of ability a, then an individual with ability $a' > a$ choosing the same effort will have a marginal benefit exceeding his marginal cost. As a result, it is optimal for him to raise his effort level.

One might think that raising the promotion standard, θ, would also raise effort. However, this is not necessarily the case. It critically depends on whether an agent needs a lucky break to surpass the promotion standard (i.e., a positive realization of ε), or merely needs to avoid an unlucky break (i.e., a negative realization of ε). When an agent needs to avoid an unlucky break, increasing the standard does raise his effort. The reason is that, for a given level of effort, an increase in the promotion standard narrows the gap between effort and the standard. That is, $|x - \theta|$ shrinks. Since the density of ε is single-peaked around zero, this narrowing raises the marginal benefit of effort and, hence, optimal effort. By contrast, when an agent needs a lucky break, higher standards widen the gap between effort and standard. Again owing to single-peakedness of ε, the marginal benefit of effort falls and so does optimal effort. Put differently, when agents need a lucky break, higher standards are discouraging. When agents need to avoid an unlucky break, higher standards are encouraging.

One might also think that optimal effort must fall when luck plays a greater role in promotion decisions (i.e., when λ falls). However, this is not necessarily true either. For example, suppose that ε is Normally distributed. In that case, an increase in noise reduces optimal effort of agents whose effort is close to the promotion standard, but *raises* the effort of agents whose effort is far away from the standard. To see why, consider an individual who needs a lucky break. When an extreme amount of luck is needed to hit the threshold—i.e., $|\theta - x|$ is very large—an increase in noise raises the marginal value of effort, since extreme events are now more likely. On the other hand, if an individual needs only a small amount of luck to reach the promotion standard, an increase in noise lowers the marginal benefit of effort, since such an event is now relatively less likely. This intuition carries over to all noise distributions whose densities satisfy *single-crossing.* Formally, we say that a noise density satisfies single-crossing if there exist values $\varepsilon_- < 0 < \varepsilon_+$ such that, for all $\lambda' > \lambda$,

$$f_{\lambda'}(\varepsilon) - f_{\lambda}(\varepsilon) \begin{cases} < 0 & \text{for } \varepsilon < \varepsilon_- \\ > 0 & \text{for } \varepsilon \in (\varepsilon_-, \varepsilon_+) \\ < 0 & \text{for } \varepsilon > \varepsilon_+ \end{cases}$$

For future reference, we summarize the properties of optimal effort in the following proposition:

Proposition 1 *When the promotion standard, θ, is exogenously given, effort x is strictly increasing in promotion benefits v and in ability a. Effort is strictly increasing in the promotion standard iff $x > \theta$. Provided that the noise density satisfies single-crossing, effort is strictly increasing in λ iff $|x - \theta|$ is small.*

Existence and Uniqueness of Equilibrium

In reality, promotion standard θ is not exogenous. It is determined by the market clearing condition that the mass of agents achieving or exceeding the promotion standard is equal to the mass m of promotion opportunities. We now show that there always exists a unique promotion standard that clears the market. Formally, equilibrium is defined as a tuple $\{x(a), \theta\}$ of effort profile $x(a)$ and promotion standard θ such that: 1) each ability type a chooses an effort $x(a)$ that maximizes his expected payoff π given the standard θ; and 2) the standard θ is such that the mass $W(\theta)$ of agents whose outputs surpass θ is equal to the mass of promotion opportunities, m. I.e.,

$$W(\theta) = \int_{\underline{a}}^{\overline{a}} (1 - F(\theta - x(a)))\, dG(a) = m \tag{3}$$

Proposition 2 *In the single-profession model, there exists a unique equilibrium promotion standard that clears the market.*

To see the workings of the proof, first suppose that the promotion standard were set arbitrarily low. In that case, even individuals undertaking no effort are (almost) assured of reaching the standard and, as a consequence, there are more candidates worthy of promotion than slots. Next, suppose that the promotion standard were set arbitrarily high. Now, arbitrarily few individuals attain the standard and, hence, there are more slots than qualified candidates. By continuity and the intermediate value theorem, there must exist a promotion standard that clears the market. Uniqueness follows from the fact that higher standards produce fewer "winners" W, or equivalently, that $\frac{dx(a)}{d\theta} < 1$ for all θ and a. This may be seen by implicitly differentiating the FOC (1).

From equation (3), it is immediate that promotion standards are higher when slots are scarce. The same equation also reveals that anything that raises effort raises θ. Hence, the equilibrium promotion standard is strictly increasing in v, while the effect of λ is ambiguous.

3 Competing Professions

We now turn to the heart of the analysis: the study of how differences in incentive structures affect the allocation of talent across professions, as well as the exertion of effort in each profession. All individuals must choose which profession to enter and how hard to work. The two professions may differ in their base wage, the number of promotions opportunities, the economic value of a promotion, or their meritocracy, i.e., the degree to which luck affects who gets promoted. The promotion "market" in each profession clears separately. Thus, both professions have their own endogenous promotion standard, which color agents' career choices and effort decisions.

Agents who choose the same profession compete with one another for a limited number of promotions. Thus, it would seem that agents of similar ability have an incentive to spread out across the professions to mitigate head-on competition. In fact, we show that the opposite happens: unless professions are identical, individuals sort across professions according to ability.

The Two Profession Model

The main change from the model considered in Section 2 is the introduction of an additional profession. Specifically, individuals are free to enter any one of two (mutually exclusive) professions $i \in \{1, 2\}$, each with a base wage w_i and a mass $m_i > 0$ of promotion opportunities paying a promotion benefit $v_i > 0$. In addition to differing in their base wage and the number and value of available promotions, professions may differ in how meritocratic they are. That is, the noise component of output in profession i has precision λ_i.

Without loss of generality, we normalize the base wage in profession 1 to zero. Individuals who have entered profession i and are promoted receive both the base wage, w_i, and the promotion benefit, v_i, while those who are not promoted receive only the base wage. Promotions are scarce, i.e., $m_1 + m_2 < 1$. In each profession, the mass m_i of individuals with the highest output are promoted.

Each profession attracts a certain distribution of abilities. Let $H_i(a)$ denote the *mass* distribution of abilities in profession i. That is, $H_i(a)$ represents the measure of individuals in i with ability a or lower. The sum of the mass distributions in the two professions must "add up" to the distribution of talent in society as a whole. I.e., for all a, $H_1(a) + H_2(a) = G(a)$.

Individuals simultaneously and independently choose their profession and level of effort.[3] A Bayesian Nash equilibrium consists of a tuple $\{(H_1^*(a), H_2^*(a)), (x_1^*(a), x_2^*(a)), (\theta_1^*, \theta_2^*)\}$ of ability mass distributions $H_i^*(a)$, effort profiles $x_i^*(a)$, and promotion standards θ_i^* such that: 1) conditional on H_i^*, $\{x_i^*(a), \theta_i^*\}$ constitutes an equilibrium for profession i; and 2) if H_i^* assigns positive mass density to ability type a in profession i, then this ability type cannot gain by switching professions.

Of particular interest is the interpretation of profession 1 as the private sector and profession 2 as the public sector, where the latter is broadly defined. Individuals choose whether

[3]The analysis remains unchanged if agents get to observe everybody's choice of profession before choosing their effort. The reason is that, because agents are atomistic, unilateral deviations have no effect on the optimal choices or payoffs of other agents. Hence, any Bayesian Nash equilibrium of the simultaneous move game is a perfect Bayesian equilibrium of the sequential move game, and vice-versa.

to pursue a career in the former or the latter and embark upon this path through a variety of entry points large enough to accommodate however many individuals choose each sector. For instance, in the case of the private sector, while there is a limited number of positions in large New York law firms, any individual is free to set up a private practice. In the public sector, while there is a fixed number of formal civil service positions, any individual is free to join or create a non-profit, or other public interest group. In law, promotion may consist of making partner in a firm. In the public sector, promotion might vault a person working in a non-profit to a more formal civil service position inside the government.

Benchmark - Identical Professions

As a basis for subsequent comparison, we first examine a setting where the two professions are identical: both have the same promotion opportunities, $m_1 = m_2 = m$, base wage, $w_1 = w_2 = 0$, value to promotion, $v_1 = v_2 = v$, and are equally meritocratic, $\lambda_1 = \lambda_2 = \lambda$. The expected profit from entering profession $i = 1, 2$ is

$$\pi_i(a) = v\left(1 - F\left(\theta_i - x_i(a)\right)\right) - c\left(x_i(a), a\right)$$

Since the two professions are essentially identical, it is obvious that, in equilibrium, both professions must have the same promotion standard, $\theta_1^* = \theta_2^* \equiv \theta^*$. Likewise, equilibrium efforts must coincide for all a, i.e., $x_1^*(a) = x_2^*(a) \equiv x^*(a)$. Hence, both professions offer the same expected payoffs for all types. That is, $\pi_1^*(a) = \pi_2^*(a) \equiv \pi^*(a)$.

Since the two professions do not differ in any payoff relevant aspect, it is readily apparent that there need not be any sorting by ability. Specifically, there is a continuum of equilibria that only differ from one another in the distribution of abilities across professions. To see this, let A_i be the set of agents choosing profession i, and notice that any pair of ability distributions (H_1^*, H_2^*) satisfying

$$\int_{a \in A_1} \left(1 - F\left(\theta^* - x^*(a)\right)\right) dH_1^*(a) = \int_{a \in A_2} \left(1 - F\left(\theta^* - x^*(a)\right)\right) dH_2^*(a) = m \qquad (4)$$

comprise an equilibrium. At one extreme, we have an equilibrium that involves perfect replication across professions, i.e., $H_1^*(a) = H_2^*(a)$ for all a. Basically, half of individuals of a given ability choose profession 1, while the other half choose profession 2. At the other extreme, we have perfect separation. In one of these perfectly separating equilibria, which we refer to as the "low-high" equilibrium, there exists an ability threshold $\tilde{a}$ such that all agents less talented than $\tilde{a}$ enter profession 1, while those more talented than $\tilde{a}$ enter profession 2.[4] In the other perfectly separating equilibrium, which we refer to as the "high-low" equilibrium, reverse sorting occurs. Any intermediate amount of sorting is also possible. For instance, starting from any equilibrium distribution $(H_1^*(a), H_2^*(a))$ of agents, we can construct another equilibrium distribution $\left(\hat{H}_1^*(a), \hat{H}_2^*(a)\right)$ by simply exchanging between the two professions groups of agents that generate an equal mass of "winners," W. This procedure allows us to arbitrarily increase or decrease the overall level of sorting.

The following proposition formalizes these observations for the benchmark model.

Proposition 3 *In the benchmark model, there is a unique promotion standard θ^* and there are unique effort and profit profiles $x^*(a)$ and $\pi^*(a)$ such that, in every equilibrium, $\theta_1^* = \theta_2^* = \theta^*$, $x_1^*(a) = x_2^*(a) = x^*(a)$, and $\pi_1^*(a) = \pi_2^*(a) = \pi^*(a)$ for all a. Equilibria, of which there are a continuum, differ only in the distribution of agents across professions.*

The benchmark outcome offers a useful starting point for considering how marginal changes in the parameters of the model affect the talent distribution across professions, as well as the effort of individuals in each profession. For instance, if profession 2 represents the public sector, its base wage, the set of promotion opportunities, the value of a promotion, and the degree of meritocracy are all, at least to some extent, under the control of policy makers. As "brain drain" from the public sector is a considerable worry in many countries, our primary focus will be on what policies succeed in attracting the best and the brightest, as well as on the effects of these policies on work ethic.

[4] In the analysis below, we shall restrict attention to the generic case where $x(\tilde{a}) \neq \theta^*$.

3.1 Meritocracy

A common complaint about HR policies in the public sector is that promotion depends more on seniority or political connections than on individual performance. Indeed, even in apparently meritocratic settings such as the University of California, promotions are determined, at least in part, by years of service.[5] In developing countries, the often nepotistic nature of hiring into, and promotion within, the public sector is widely cited as an important barrier to economic development (see, e.g., World Bank, 1997).

In this section, we study how a marginal increase in a profession's meritocracy, λ_i, affects its talent pool. Specifically, consider a marginal shift in the benchmark model such that, in profession 2, λ_2 rises from λ to $\lambda + d\lambda$. Our main result is to show that this small change in meritocracy leads to a hugely favorable shift in the distribution of talent toward the more meritocratic profession: in the unique equilibrium, the talented enter profession 2 while the untalented enter profession 1. Formally,

Proposition 4 *Increasing meritocracy is highly effective as a means to attracting talent.*

When a profession marginally increases its meritocracy relative to the benchmark model, individuals sort across professions according to ability. There exists a unique a^* such that, in equilibrium, those more talented than a^* choose the more meritocratic profession, while those less talented choose the less meritocratic profession.

The proposition follows as a consequence of two lemmas. The first lemma (Lemma 3 in the Appendix) shows that, even though a marginal change in λ_2 has a first-order effect on equilibrium efforts, for purposes of determining agents' choice of profession, we may ignore this change and pretend that agents continue to exert effort $x^* (a)$ in both professions. This follows from the envelope theorem, which tells us that a first-order change in effort only has

[5] Promotions and wage increases for the professoriate at the University of California are determined by a rank and step system. Conditional on acceptable performance, it specifies a salary schedule as a function of the number of years of service.

a second-order effect on payoffs. As a consequence, after the change, the difference in payoffs between the two professions is simply

$$\pi_1^*(a) - \pi_2^*(a) = \{(1 - F_\lambda(\theta_1' - x^*(a))) - (1 - F_{\lambda+d\lambda}(\theta_2' - x^*(a)))\} v \tag{5}$$

where θ_i' denotes the new equilibrium promotion standard in profession i, i.e., $\theta_i' = \theta^* + \frac{d\theta_i^*}{d\lambda_2}$. The sign of the expression in (5) depends only on the chance of promotion, $1 - F$, in each profession. Thus, it only remains to determine who finds his chances improved by increased meritocracy and who finds his chances impaired. The former enter profession 2, while the latter enter profession 1.

To determine who is helped and who is harmed by a rise in λ_2, it is useful to consider an individual, a^*, who, after the rise, is indifferent between the two professions. The second lemma (Lemma 4 in the Appendix) shows that those more able than a^* benefit from more meritocracy and opt for profession 2, while those less able than a^* are hurt by it and opt for profession 1. A sketch of the proof is as follows. Since an individual with ability a^* is indifferent between the two professions, effort $x^*(a^*)$ must land him in the same promotion probability quantile in both. By monotonicity, an individual with ability slightly greater than a^* exerts slightly greater effort. This additional effort increases his chances of promotion by $f_\lambda(\theta_1' - x^*(a^*))$ in profession 1 and by $f_{\lambda+d\lambda}(\theta_2' - x^*(a^*))$ in profession 2. The dispersion ordering of ε in λ implies that, for a given quantile in the cumulative distribution, the density is increasing in the precision parameter. Hence, for an individual with ability slightly greater than a^*, the chances of promotion are higher in profession 2 than profession 1. Naturally, this tips the scales in favor of profession 2. This result extends globally—it holds for all individuals with higher ability. An analogous argument shows that individuals with ability lower than a^* strictly prefer less meritocratic profession 1.

On a more intuitive level, noise tends to reduce the promotion chances of the talented, while raising the chances of the untalented who, of necessity, rely more on luck to clear the threshold. As a consequence, the talented gravitate toward the profession where the role of luck is diminished, whereas the untalented are attracted to the profession where luck plays more of a role.

Proposition 4 shows that even modest differences in meritocracy lead to substantial differences in talent pools. We now examine how these differences in talent affect the "work cultures" (i.e., profiles of equilibrium effort) of the two professions.

The tournaments literature shows that effort depends crucially on ability differences in the population. This suggests that the intensity of a profession's work culture should critically depend on the heterogeneity of its talent pool. Of course, this intuition fails to account for the endogeneity of these talent pools and, in particular, the cutoff ability of the marginal type. Accounting for endogeneity proves crucial in understanding how changes in meritocracy in one profession affect the work cultures of *both* professions.

Take as the point of departure the low-high equilibrium of the benchmark model and marginally increase λ_2. Since profession 1 experienced no change in its incentive system, one would be tempted to conclude that there should be no change in effort or in profession 1's promotion standard. This, however, is incorrect. To see why, suppose that the marginal individual in the low-high equilibrium of the benchmark model, $\tilde{a}$, requires a lucky break in order to be promoted. An increase in meritocracy makes it less likely that he will exceed the original promotion standard θ^* in profession 2 when exerting his original level of effort, $x^*(\tilde{a})$. Hence, under θ^*, this individual now strictly prefers profession 1 over profession 2 and, to clear the market, the promotion standard must rise in the former profession and fall in the latter. By contrast, if $\tilde{a}$ needs to avoid an unlucky break in the benchmark model, then the situation is exactly reversed—increased meritocracy in profession 2 raises the promotion standard there while lowering it in profession 1.

While increased meritocracy in profession 2 can raise or lower the promotion standard in the profession 1, the effect on the marginal type's effort is unambiguous: for those near the top of the ability distribution in profession 1, the presence of a more meritocratic alternative undermines work incentives, leading to a drop in equilibrium effort. Recall that effort is chosen to equate marginal benefit with marginal cost. That is,

$$f_\lambda\left(\theta_1 - x_1(a)\right) v_1 = \frac{\partial c\left(x_1(a), a\right)}{\partial x_1}$$

The implicit function theorem yields that, relative to the benchmark model, the change in effort of the (ex-post) marginal type a^* in profession 1 takes the sign of

$$\frac{dx_1(a^*)}{d\lambda_2} \propto f'_\lambda\left(\theta^* - x^*(a^*)\right) \frac{d\theta_1^*}{d\lambda_2}$$

Roughly, the change in the marginal benefit of effort is proportional to the change in the probability of hitting the promotion standard times the change in the promotion standard itself. When the marginal individual, a^*, requires a lucky break to obtain a promotion then, by single-peakedness of f, the probability of hitting the standard falls while the promotion standard in profession 1 increases.[6] As a consequence, optimal effort of the marginal individual in profession 1 falls. When a^* needs to avoid an unlucky break, the chance of hitting the standard increases while the standard itself falls. Again, the optimal response is to economize on effort. To summarize:

Remark 1 *A marginal increase in the meritocracy of a profession relative to the benchmark model strictly reduces the effort of the marginal individual, a^*, entering the less meritocratic profession.*

Remark 1 highlights an externality that is present when one accounts for endogenous selection: a rise in meritocracy in profession 2 erodes work incentives in profession 1, at least for the most able individual in that profession. Indeed, when the most able individual requires a lucky break to succeed, the result is even more pernicious—*all* agents in profession 1 reduce their effort.

[6] Recall that we restrict attention to the generic situation where $x^*(\tilde{a}) \neq \theta^*$. In that case, continuity implies that a^* needs a lucky break if and only if $\tilde{a}$ needs a lucky break.

The situation in profession 2 is more complex, owing to the presence of both the direct effect of a change in meritocracy on the chance of hitting the promotion standard, as well as an indirect effect due to the change in the promotion standard itself. The following technical condition—which is satisfied by many common distributions including the Normal, the Laplace, and the Pareto—guarantees that the (ambiguous) direct effect in profession 2 does not overwhelm the sum of the indirect effects in both professions. It thereby ensures that the effort of the marginal individual, a^*, is strictly greater in the more meritocratic profession 2 than in the less meritocratic profession 1. Formally,

Condition 1: For all ε, λ :

$$f_\lambda(\varepsilon)\frac{\partial f_\lambda(\varepsilon)}{\partial\lambda} > \frac{\partial F_\lambda(\varepsilon)}{\partial\lambda} f'_\lambda(\varepsilon) \tag{6}$$

Notice that the RHS is (weakly) negative while, provided $f_\lambda(\varepsilon)$ satisfies single-crossing, the LHS is strictly positive if and only if $|\varepsilon|$ is not too large. Hence, for small $|\varepsilon|$, Condition 1 is satisfied. For large $|\varepsilon|$, $\frac{\partial f_\lambda(\varepsilon)}{\partial\lambda} < 0$. In that case, the inequality in (6) is equivalent to $f_\lambda(\varepsilon) < f'_\lambda(\varepsilon)\left(\frac{\partial F_\lambda(\varepsilon)}{\partial\lambda} / \frac{\partial f_\lambda(\varepsilon)}{\partial\lambda}\right)$, where the RHS is now guaranteed to be *strictly* positive. We may conclude that Condition 1 boils down to the requirement that the tails of the noise distribution are not too thick. As even the thick-tailed Pareto distribution satisfies it, the condition appears to be relatively mild.

Since we earlier showed that effort is increasing in ability, it now follows that

Proposition 5 *If Condition 1 holds, then the marginally more meritocratic profession exhibits a stronger work culture. That is, every individual in the more meritocratic profession exerts strictly more effort than the hardest working individual in the less meritocratic profession.*

Proposition 5 paints a rosy picture of the benefits of meritocracy. The more meritocratic profession enjoys both a more capable and a more industrious workforce, despite offering equal promotion benefits, base wage, and promotion opportunities.

3.2 Promotion Benefits

A firm seeking to squeeze more effort from its workforce is often advised to sharpen performance-based incentives. In terms of the model, this prescription amounts to increasing v, the economic benefit of promotion. Intuitively, when pay is contingent on successful performance, workers have stronger incentives to exert effort, so as to improve their chances of surpassing the performance threshold. However, this intuition (and the formal models illustrating it) represents a partial equilibrium view. That is, implicitly, the composition of the workforce is assumed to be fixed. Of course, in our setting, the composition of the workforce is *not* fixed. It adjusts depending on the base wage, promotion opportunities, promotion benefits, and the performance evaluation scheme used.

However, it would seem that endogenizing the talent pool merely reinforces the benefits of sharpening performance incentives. Intuitively, more talented individuals stand a greater chance of securing promotion than their less talented peers. This suggests that offering sharper incentives makes a profession relatively more attractive to the former than to the latter. Thus, increasing promotion benefits would succeed both in attracting top talent and inducing them to work hard. Even this intuition is incomplete, however, as it fails to account for the endogeneity of the performance threshold.

Ceteris paribus, a profession offering greater promotion benefits is more attractive to all workers. As a result, promotions in that profession would exceed the number of available slots, such that the promotion standard must rise. Thus, when entering the profession, agents face a trade-off between higher promotion benefits versus higher promotion standards. How this plays out in terms of selection depends on the cost-benefit ratio of the trade-off for each ability type.

The key point is that the selection effect of raising promotion benefits depends on the statistical properties of ε, the noise in performance evaluation. Suppose that, starting from the benchmark model, profession 2 marginally increases performance benefits, v. The gains from these greater rewards are proportional to the chance of promotion, i.e., $1 - F(\theta^* - x^*(a))$. The costs from the higher promotion standard are proportional to the *change* in the chance of promotion, i.e., $f(\theta^* - x^*(a))$. Hence, the cost-benefit ratio of an increase in v is proportional to the hazard rate of the noise, $f/(1-F)$, and whether raising promotion benefits succeeds in attracting top talent depends on whether the hazard rate is increasing or decreasing.

The intuitive outcome results when the hazard rate is increasing. In that case, greater promotion benefits lead to more favorable selection, as well as greater effort. To see this, recall that effort is an increasing function of ability. Thus, greater effort leads to a smaller argument $\theta - x(a)$. This lowers the hazard rate and, hence, the cost-benefit ratio of entering profession 2 for more able individuals. As a result, top talent opts for profession 2. When the hazard rate is decreasing, the reverse is holds—the rise in standards outweighs the increased benefit from promotion in the eyes of top talent, but not in the eyes of the talentless. A rise in promotion benefits now induces unfavorable selection—only the least talented are attracted to profession 2.

Formally, suppose that the hazard rate of the noise is strictly monotone, and consider a change to the benchmark model whereby profession 2 increases its promotion benefits from v to $v + dv$. This yields:

Proposition 6 *Increasing promotion benefits may or may not be effective as a means to attracting talent.*

When a profession marginally increases promotion benefits relative to the benchmark model, individuals sort across professions according to ability. In the unique equilibrium, talented individuals choose the profession offering greater promotion benefits if and only if the hazard rate of the noise in performance evaluation is increasing.

Proposition 6 identifies conditions such that higher-powered incentives lead to unfavorable selection. Nonetheless, it might seem that, even when selection is unfavorable, more powerful incentives would translate into a stronger work culture. Our next result shows that this need not be true either.

Again, the marginal individual's effort in each profession provides the key to assessing overall work culture. As in Section 3.1, we say that one profession exhibits a stronger work culture than another if all individuals in the first profession work strictly harder than the hardest working individual in the second. It is straightforward to show that the effort of the marginal individual is strictly higher in the profession offering higher promotion benefits if and only if the hazard rate is increasing. Combining this result with Proposition 6 and noting that more able individuals exert more effort yields:

Proposition 7 *Suppose that one profession offers marginally greater promotion benefits than the other. Then the marginal individual, a^*, exerts strictly more effort when grouped with high ability individuals than with low ability individuals.*

As a result, the profession offering marginally higher promotion benefits exhibits a stronger work culture if and only if the hazard rate of the noise in performance evaluation is strictly increasing.

The first part of Proposition 7 shows that the social aspects of the talent pool influence the effort choice of the marginal individual. The marginal individual works harder in the profession where he is the least talented than in the profession where he is the most talented. This implies that, when higher promotion benefits attract talent, the incentive effects go in the expected direction—a rise in promotion benefits translate into more effort. However, when higher promotion benefits repel talent, incentives are undermined—the marginal individual in profession 2 now works *less* hard than his counterpart in profession 1, despite the fact that the benefits from securing promotion are greater.

Propositions 7 and 6 show that an increase in promotion benefits can produce perverse general equilibrium effects. Such an increase may end up attracting a worse pool of workers, all of whom put in strictly less effort than the "laziest" worker in the profession with inferior promotion benefits. Thus, the effectiveness of promotion benefits hinges crucially on the properties of the performance evaluation technology. Raising promotion benefits helps when the noise in performance evaluation exhibits an increasing hazard rate. Raising benefits is counter-productive when the noise exhibits a decreasing hazard rate.

3.3 Promotion Opportunities

A commonly cited drawback of pursuing a career in the public sector is a perceived lack of promotion opportunities (see, e.g., August, Kihn, and Miller, 2010). This suggests that raising the number of promotion opportunities would be an effective way to attract talent. We now study whether this is indeed the case.

In assessing the attractiveness of a profession, an individual considers the value of a promotion, v, times the chance of being promoted. However, this chance is purely a function of an individual's performance relative to the promotion standard. Thus, the availability of promotion opportunities only acts indirectly through its influence on the promotion standard. Our first result shows that a change in promotion opportunities in one profession equally affects promotion standards in both professions. Formally, consider a (not necessarily marginal) shift in the benchmark model, such that the number of promotion opportunities in profession 2, m_2, increase beyond those in profession 1.[7]

Remark 2 *When professions are equally meritocratic and offer identical promotion benefits then, regardless of promotion opportunities, promotion standards are identical across professions.*

To see why this is so, suppose that promotion standards differed across the two professions. In that case, all individuals would be attracted to the profession with the lower standard since, there, the chance of exceeding the standard would be the highest while

[7] Naturally, we continue to require that promotion opportunities are scarce overall, i.e., $m_1 + m_2 < 1$.

the value of promotion is the same. However, this is inconsistent with equilibrium since, now, the low-standards profession will have too few slots to clear the market, while the high-standards profession will have too many. Thus, both professions must have the same promotion standard.

Equality of standards implies that effort profiles must also be the same in the two professions, i.e., $x_1^*(a) = x_2^*(a) \equiv x^*(a)$, and, consequently, so must equilibrium payoffs: $\pi_1^*(a) = \pi_2^*(a) \equiv \pi^*(a)$. It is worth noting that, as a result, the marginal analyses in Sections 3.1, 3.2, and 3.4 (below), carry through unchanged for any $m_1 \neq m_2$.

Equality of standards, effort, and profits still allows for a continuum of equilibrium ability distributions (H_1^*, H_2^*) across professions, now characterized by

$$\int_{a \in A_1} (1 - F(\theta^* - x^*(a)))\, dH_1^*(a) = m_1 < m_2 = \int_{a \in A_2} (1 - F(\theta^* - x^*(a)))\, dH_2^*(a)$$

These equilibria range from "proportional replication" to perfect separation, where proportional replication means that $H_1^*(a) = \frac{m_1}{m_2} H_2^*(a)$ for all a. Thus, an increase in promotion opportunities attracts more, but not necessarily better, workers into profession 2. Indeed, such a policy reform can easily worsen the talent pool. To see why, compare the low-high equilibrium in the benchmark model with the analogous equilibrium after promotion opportunities have been increased in profession 2. After the change in m_2, the most talented once more enter profession 2, but the ability threshold has fallen owing to the improved chances of promotion. The result is a dilution of talent—quite the opposite of what one might have hoped for from such a policy. More generally, since there is a continuum of equilibria both before and after the change to the benchmark model, there is no guarantee that increasing promotion opportunities results in a more favorable talent pool. We summarize this observation in the following proposition.

Proposition 8 *Increasing promotion opportunities is ineffective as a means to attracting talent.*

When a profession increases promotion opportunities relative to the benchmark model, the average quality of its talent pool may rise or fall, depending on which equilibrium is selected.

In the case of public school teachers, our results show that increasing promotion opportunities will induce more, but not necessarily better, individuals to become teachers. Nonetheless, the McKinsey study of August, Kihn, and Miller does hit on something important when emphasizing the 'professionalization' of teaching. As we have seen in section 3.1, if professionalization entails promotion decisions more closely tied to individual effort and success in the classroom—i.e., meritocracy—then such policies can be extremely effective in attracting talented individuals and incenting them to work hard. This, of course, requires jettisoning seniority-based promotion policies. Absent a reform in performance evaluation, increasing promotion opportunities may only serve to increase the cost of education, without improving educational outcomes.

3.4 Base Wage

For those promoted to the highest levels, public sector pay in the US badly lags private sector offerings. For instance, the President of the United States earns vastly less than a CEO of a Fortune 500 company. One way the public sector might counter this disadvantage is by raising the base wage of all civil servants. To find out whether such a strategy is effective, we study how a marginal increase in the base wage of one profession affects the distribution of talent across professions. We show that the effect depends on the scarcity of promotion opportunities, $m_1 + m_2$, in the economy as a whole.

A higher base wage attracts talent when promotion opportunities are plentiful, while it repels talent when they are scarce. The intuition is as follows. While the benefit of a higher base wage is the same for everybody, the cost of the concomitant increase in the promotion standard depends on how far an individual's equilibrium effort puts him away from the standard. When total promotion opportunities are sufficiently plentiful, the most talented operate so far above the promotion standard that, unlike the less talented, they are not much hurt by a small increase in standards. As a result, the talented are attracted to the high-base-wage profession with high standards, while the untalented are attracted to the low-base-wage profession with low standards. By contrast, when promotion opportunities are sufficiently scarce, it is the least talented who operate so far *below* the promotion standard that, in this case, it is they who are not much hurt by an increase in standards. Therefore, now the untalented opt for the high-base-wage profession, while the talented opt for the low-base-wage profession. Finally, in intermediate cases, an increase in standards is most costly for individuals of middling ability. As a result, they enter the low-base-wage profession, while both the most *and* the least talented enter the high-base-wage profession.

Formally, consider a marginal shift in the benchmark model such that the base wage in profession 2 rises from zero to $w_2 = dw$. Then,

Proposition 9 *The effectiveness of raising the base wage as a means to attracting talent depends on the scarcity of promotion opportunities in the economy.*

A marginal increase in the base wage relative to the benchmark model 1) repels talent when total promotion opportunities, $m_1 + m_2$, are sufficiently scarce; 2) attracts talent when promotion opportunities are sufficiently plentiful; 3) attracts both the very best and the very worst while repelling the mediocre in intermediate cases.

Returning once more to the case of school teachers, the model suggests that across-the-board increases in salaries may not be a cost effective way to attract top talent to teaching. Indeed, if promotion opportunities for potential teachers are scarce overall, raising teacher salaries regardless of performance may well have the perverse effect of repelling the very talent the profession is so desperate to attract.

Finally, we show that

Proposition 10 *Marginal individuals exert strictly more effort when grouped with their higher ability neighbors than with their lower ability neighbors.*

Proposition 10 illustrates the salutary effects on work ethic of having to compete with individuals who are slightly more talented than oneself. This is consistent with the patterns uncovered in Sections 3.1 and 3.2.

4 Global Policy Changes: The Laplace Model

While we did allow for global changes in promotion opportunities, up until now, we have only considered how *marginal* changes in the base wage, promotion benefits and meritocracy affect the talent pool and effort. Moreover, we only considered changes to each parameter in isolation. In practice, professions often differ markedly, and in several respects. For example, the public sector and the private sector substantially differ in the scarcity of promotion opportunities, the generosity of promotion benefits, and the meritocracy of promotion decisions. Also, when performing policy analyses, one may be interested in the effect of a package of reforms, rather than a change along a single dimension. While our general model permits the evaluation of the effect of a local change to a single parameter, we require additional structure to make statements about the effects of simultaneous *global* changes to *multiple* parameters.

Fortunately, assuming that professions pay the same base wage, i.e., $w_1 = w_2 = 0$, an especially tractable functional form of the two-profession model is available.[8] Suppose that the noise distribution is Laplacian centered around zero, i.e.

$$F(\varepsilon_i) = \begin{cases} \frac{1}{2}e^{\lambda_i \varepsilon_i} & \text{if} \quad \varepsilon_i \leq 0 \\ 1 - \frac{1}{2}e^{-\lambda_i \varepsilon_i} & \text{if} \quad \varepsilon_i > 0 \end{cases}$$

and let the cost of effort be of the simple polynomial form

$$C(X, a) = \frac{X^\beta}{a} = \frac{e^{\beta x}}{a} = c(x, a)$$

[8] Global changes in the base wage can in fact be analyzed in the context of the Laplace model, and they yield the expected results. I.e., Proposition 9 extends globally. However, the model becomes intractable when we combine global changes in the base wage with global changes in meritocracy and promotion benefits.

To ensure that the second-order conditions are satisfied, we assume that $\beta > \lambda_i$, $i = 1, 2$. Ability is uniformly distributed on $[\underline{a}, \overline{a}]$, where $0 < \underline{a} < \overline{a}$. Finally, in each profession, we fix a budget for promotion benefits, $B_i = m_i v_i > 0$, and we make promotions m_i sufficiently scarce—and, thus, benefits v_i sufficiently large—such that, in both professions, individuals need a lucky break to secure a promotion. As we show in the Appendix, this can always be done.[9] For future reference, we will refer to this collection of assumptions as the Laplace model.

We begin by considering the case where the promotion standard in profession i is exogenous and equal to θ_i. It is straightforward to show that optimal effort is given by

$$x_i(a) = \ln\left(\frac{a v_i \lambda_i}{2\beta} \frac{1}{e^{\lambda_i \theta_i}}\right)^{\frac{1}{\beta - \lambda_i}} \tag{7}$$

Next, we examine how differences in promotion opportunities, promotion benefits, and meritocracy affect the distribution of talent and effort across professions. Specifically, we examine sorting and work culture for fixed budgets B_1 and B_2, when $m_1 \neq m_2$, $v_1 \neq v_2$, and $\lambda_2 > \lambda_1$. That is, profession 2 is more meritocratic than profession 1, but promotion opportunities and benefits may be larger in either profession. Our main result is to show that

Proposition 11 *In the unique equilibrium of the Laplace model, individuals sort across professions according to ability. The talented choose the more meritocratic profession, while the untalented choose the less meritocratic profession.*

Every individual in the more meritocratic profession exerts strictly more effort than the hardest working individual in the less meritocratic profession.

Proposition 11 shows that meritocracy trumps all other considerations in determining talent and effort allocations: even when promotion benefits and opportunities are greater in

[9] A sufficient condition is that $m_i < \frac{1}{2}\frac{\beta-\lambda}{\beta}\frac{1-\rho_i^{\frac{\beta}{\beta-\lambda}}}{1-\rho_i}$ for $i \in \{1, 2\}$, where ρ_i denotes the ratio of lowest to highest ability type in profession i.

the less meritocratic profession, this profession still ends up with less talent and less (per capita) effort than the more meritocratic profession.

Why are promotion benefits powerless in this case? Propositions 6 and 7 established that the profession offering the greater promotion benefits attracts the most talented individuals and enjoys a stronger work culture if and only if the hazard rate of the noise distribution is strictly increasing. However, in the Laplace model with sufficiently scarce promotion opportunities, the hazard rate is *constant*. As a consequence, promotion benefits have no effect on sorting or work culture.[10]

Proposition 11 can be used to rationalize intelligence differences in academia, where promotion opportunities (tenured jobs) are scarce and promotion benefits differ wildly across academic fields. Think of profession 2 as representing a "harder" field, such as mathematics or physics, and profession 1 as representing a "softer" field, such as economics. If performance is measured more noisily in the latter than in the former, then Proposition 11 suggests that higher ability individuals flock to the harder fields, leaving the lesser talents to the softer fields. This happens even though some soft fields, such as economics, offer more and better-paying promotion opportunities (tenured jobs) than some hard fields, such as mathematics.

[10] While the Laplace model exhibits a constant hazard rate over positive realizations of ε—corresponding to lucky breaks—its hazard rate is strictly increasing over negative realizations of ε—corresponding to unlucky breaks. If we set $\lambda_1 = \lambda_2 = \lambda$ and reexamine the Laplace model when promotions are sufficiently plentiful (such that, in both professions, individuals merely need to avoid an unlucky break to secure promotion), then the local results in Propositions 6 and 7 extend globally. Closed form solutions obtain and all yield the expected comparative static implications. (Detailed calculations are available from the authors upon request.) More broadly, if $\lambda_2 > \lambda_1$, $v_2 \geq v_1$, and promotions are sufficiently plentiful, both selection forces push in the same direction, such that the talented choose profession 2 and the untalented choose profession 1. However, if promotion benefits become lop-sided in favor of the less meritocratic profession 1, they start to dominate meritocratic considerations. For example, suppose that $\beta = 2$, $\lambda_1 = .9$, $\lambda_2 = 1$, $m_1 = m_2 = .45$, $v_1 = 1.1$, $v_2 = 1$, $\overline{a} = 2$, $\underline{a} = 1$. Despite profession 1 being less meritocratic, in equilibrium, the most talented ($a \geq 1.49$) opt for profession 1, while the less talented ($a < 1.49$) opt for profession 2.

This prediction of the model is broadly consistent with existing empirical evidence. For instance, Gibson and Light (1967) found that the measured IQs of faculty at the University of Cambridge differed significantly across fields: mathematicians had the highest IQs, averaging 130, while social scientists had the lowest IQs, averaging 122. Using Army General Classification Test results to estimate IQs of students awarded US doctorates in 1958, Harmon (1961) comes to very similar conclusions. The prediction is also broadly consistent with movements across fields. While the economics profession has seen its fair share of mathematicians who have successfully made the transition to economics, such as Nobel Laureate John Nash, we know of no instance where an economics PhD has acquired an academic position in math or physics, much less a Fields Medal or Nobel Prize.

In summary, Proposition 11 suggests that a profession seeking to attract talent and induce hard work is best served by focusing on improving the meritocracy of promotions, rather than relying merely or mainly on pecuniary incentives. It also suggests that fighting nepotism and political promotions in the public sector not only improves the performance of the existing pool of civil servants, but also induces more capable and talented individuals to join the civil service.

5 Extensions

While the model analyzed so far provides some interesting insights, its parsimony also makes it unrealistic in several respects. First, the compensation structure is assumed to be exogenous. While this may be a reasonable assumption in the short run, in the long-run, promotion benefits must correspond to the value of output produced. That is, the budget for promotion benefits is endogenous. For instance, a profession that only attracts mediocrities with a weak work ethic cannot continue to offer promotion benefits that far exceed the low productivity of its workforce. In the context of the Laplace model, we therefore examine the long-run effects of professions offering endogenously determined promotion benefits consistent with a zero profit condition. The analysis is contained in Section 5.1.

The model is also unrealistic in limiting attention to two professions. While this is reasonable at a suitable level of aggregation—such as when studying the public versus the private sector—analyzing the distribution of talent and effort at a more micro level requires that we extend the model to multiple professions. We do so in Section 5.2.

Finally, we have assumed that workers are solely motivated by money. Clearly, in many professions, non-pecuniary considerations are also important. In section 5.3, we study an extension of the model where an individual's utility from choosing a profession depends both on expected monetary payoffs, as well as on idiosyncratic tastes for the tasks required.

In each of these extensions, we find that our earlier conclusions as to the effectiveness of meritocracy as a means to attracting talent remain valid.

5.1 Endogenous Promotion Benefits

Rather than determined exogenously, long-run promotion benefits are determined endogenously by the productivity of a profession's workforce. For instance, an important step in the career of a lawyer is making partner at a firm. While associates competing to make partner have expectations about the lifetime benefit of such a step, ultimately, it depends on the firm's productivity and, even more broadly, on the productivity of the legal profession as a whole. To examine the effect of endogenous promotion benefits on selection and work culture, we study an extension of the Laplace model where the budgets for promotion benefits are determined by the aggregate effort put forth by individuals working in each profession.

Formally, let A_i denote the set of individuals choosing profession i, and denote by $H_i(a)$ its cumulative mass function. Suppose that effort in profession i translates into surplus, S_i, according to the aggregator function

$$S_i = \left(\int_{a \in A_i} X_i(a)\, dH_i(a) \right)^{\gamma}$$

where $0 < \gamma < 1$. This aggregator assumes that aggregate effort is subject to diminishing returns. In effect, it represents a Cobb-Douglas production function with a single input, i.e., effort, subject to decreasing returns to scale. We assume that professions are perfectly competitive in pursuit of skilled labor, such that all surplus is paid out in the form of promotion benefits. Hence,

$$v_i = \frac{S_i}{m_i}$$

We refer to this amended model as the Laplace model with endogenous benefits.

Before proceeding to analyze the two-profession model, we first establish that the model with endogenous benefits is well-behaved in the single profession case. In Proposition 12 we show that, with a single profession, endogenizing promotion benefits is relatively straightforward. In particular, in addition to the trivial equilibrium where nobody exerts any effort, there exists a unique promotion standard and schedule of optimal effort that yields promotion benefits equal to the surplus produced. Formally,

Proposition 12 *With a single profession, the Laplace model with endogenous benefits has a unique interior equilibrium.*

We assume that the interior equilibrium pertains and show that the main conclusion of Proposition 11 continues to hold. Specifically, provided that promotion opportunities are sufficiently scarce, the more talented always opt for the more meritocratic profession, regardless of the benefit levels that prevail in equilibrium. Formally,

Proposition 13 *An equilibrium exists in the Laplace model with endogenous benefits. Moreover, in any equilibrium, the more talented choose the more meritocratic profession while the less talented choose the less meritocratic profession.*

Given the dominance of meritocracy over all other considerations in the Laplace model, Proposition 13 is, perhaps, not all that surprising. Still, it is reassuring that the results of the model do not depend on the exogeneity of promotion benefits.

To illustrate the power of meritocracy, consider the following example. Let $\lambda_2 = 1.4 > 1.3 = \lambda_1$, such that profession 2 is more meritocratic than profession 1. Individuals have uniformly distributed abilities on the interval $[1, 2]$, while $\beta = 2$ and $\gamma = \frac{1}{2}$. Finally, suppose that more meritocratic profession 2 offers 10% fewer promotion opportunities than less meritocratic profession 1. In this situation, profession 2 attracts the more talented individuals, while profession 1 attracts the less talented. Specifically, all individuals whose ability exceeds $a^* = 1.72$ choose profession 2, while the remainder choose profession 1. Thus, there are 2.6 times more individuals competing in profession 1 than in profession 2. On average, individuals in profession 2 exert almost 80% more effort. Despite having a much more talented and much harder-working workforce, the endogenous promotion benefits, v_2, offered in profession 2 are 10% *smaller* than those offered in profession 1.

Why do the best-and-the-brightest opt for a profession with fewer and lower paying promotion opportunities, and why do they exert so much effort in the face of these incentives? Top talent is attracted to profession 2 by its relative exclusivity, which increases the chance of being promoted, and the relative objectivity of performance measurement. The 10% fewer promotion opportunities in profession 2 are more than compensated for by the 60% fewer individuals competing for these slots. Indeed, this makes the "effective" number of promotion opportunities in profession 2 (i.e., the ratio of m_2 to the mass of individuals opting for profession 2) much greater than in profession 1. The combination of fewer competitors and more precise performance measurement implies that, in expectation, the most talented are better off choosing profession 2 as their career path.

The example suggests that, even in straitened budgetary circumstances, the public sector's problem of attracting and motivating top talent is not insoluble. The public sector need not match the private sector either in promotion opportunities nor in promotion benefits to secure a workforce of competent and dedicated civil servants. However, meritocracy is necessary. A system heavily dependent on seniority or political influence to secure promotion will never succeed in these goals, nor will it suffice to merely throw money at the problem and raise promotion opportunities and benefits. What is instead required is a link between performance and promotion that at least matches that of the private sector.

5.2 n Professions

While the economic intuition of the model is conveyed most clearly with only two professions, the main results generalize to an arbitrary number of professions. This is true both for the marginal analysis of Section 3 and for the global analysis of Section 4. We illustrate this by generalizing Proposition 4 (i.e., the result that meritocracy attracts talent) to n professions, numbered 1 to n.

As usual, our point of departure is the benchmark model, where all professions offer the same base wage and the same promotion benefits, and use the same performance measurement technology. (Professions may differ in promotion opportunities without any particular consequence for the results.) Now, let us consider a marginal change in meritocracy. Specifically, define a strictly increasing sequence $\{s_i\}_{i\in\{1,\ldots,n\}}$, where $s_1 = 0$, and marginally perturb the benchmark model by setting $\lambda_i' = \lambda + s_i d\lambda$. Notice that $\lambda = \lambda_1' < \lambda_2' < \ldots < \lambda_n'$, such that profession 1 is the least meritocratic, while profession n is the most meritocratic. It is easily verified that, for any pair of professions (i, j), Lemmas 3 and 4 in the Appendix generalize in a natural way. Hence, in any equilibrium of the perturbed n-profession model, individuals sort across professions according to ability, with the most able going into profession n and the least able going into profession 1. The economic rationale for this sorting is identical to that in the two profession model: more able individuals benefit relatively more from having less noisy performance evaluations than do less talented individuals. Formally,

Proposition 14 *Suppose professions are ordered from least to most meritocratic. In the unique equilibrium, individuals sort across professions according to their ability.*

Specifically, let $a_{0,1}^* = \underline{a}$ *and* $a_{n,n+1}^* = \overline{a}$*. There exists a unique, strictly increasing sequence* *of abilities* $a^*_{0,1}, a^*_{1,2}, ..., a^*_{n-1,n}, a^*_{n,n+1}$ *such that, in equilibrium, individuals with abilities* $a \in [a^*_{i-1,i}, a^*_{i,i+1})$ *enter profession* i*,* $i = 1, ..., n$*.*

Proposition 14 is analogous to the two-profession result in Proposition 4. Extending existence and uniqueness to the n profession case requires some care, however. Here, we sketch the main idea of the proof. To show that there exists a unique constellation of equilibrium thresholds, we treat the first threshold, $a_{1,2}$, as exogenous and recursively compute threshold $a_{i,i+1}$ using the indifference condition between professions $i-1$ and i for an individual with ability $a_{i-1,i}$. We then show that, by continuity and strict monotonicity, there exists a unique value of $a_{1,2}$ that leads to a feasible set of thresholds, which requires that $a_{n-1,n}$ is indifferent between professions $n-1$ and n. This guarantees that there exists a unique equilibrium.

Proposition 14 shows that the selection powers of meritocracy apply outside of the two profession context. Our results on the effects of marginal changes in promotion benefits, v_i, and base wage, w_i, readily extend to n professions as well. Indeed, the arguments for the n profession model are essentially analogous to those for the two profession model. Similarly, the global results for the Laplace model may be generalized in an equally straightforward manner. To conserve space, we omit a formal statement and proof of each of these generalizations, but they are available from the authors upon request.

5.3 Idiosyncratic Preferences

Clearly, there is more to choosing a profession than simply calculating expected monetary payoffs. Non-pecuniary aspects, such as the kind of people one is likely to work with, the nature of the work itself, opportunities for work-life balance and so forth, also play a role. Unlike money, however, preferences over these aspects of a profession are likely to differ from one individual to another. For instance, a profession requiring considerable travel might be considered a burden by some, but a blessing by others. To capture this idea, we introduce the notion that individuals have idiosyncratic non-pecuniary preferences over professions, which may affect their career choice.

We model this by assuming that an individual's payoff from profession i depends on expected monetary compensation plus the realization of an i.i.d. random variable δ_i, which represents the non-pecuniary benefits or costs of profession i to this individual. With this simple amendment, we return to studying marginal changes in the benchmark model.

Beginning with the benchmark model itself, recall that when individuals had purely pecuniary preferences, there was a multiplicity of equilibria, ranging from complete replication to complete separation. The introduction of non-pecuniary preferences, in effect, acts as an equilibrium refinement: only complete replication remains an equilibrium. To see this, first notice that if the promotion standards in the two professions are the same, then idiosyncratic preferences alone determine the choice of profession and, since these preferences are orthogonal to ability, this implies complete replication. Of course, this step merely establishes that such an equilibrium exists. Uniqueness follows from the fact that, in any equilibrium, the promotion standards must be the same in both professions. While this seems intuitive given the symmetry of the model, the precise argument is slightly more involved and requires that effort not change disproportionately to differences in promotion standards. The details are given in the proof of the following proposition.

Proposition 15 *In the benchmark model with idiosyncratic preferences, the unique equilibrium entails complete replication. That is, promotion standards are the same in both professions and each individual selects profession 1 if and only if* $\delta_1 - \delta_2 \geq 0$.

Next, we consider a situation where, all else equal, profession 2 becomes marginally more meritocratic than profession 1. For the same reasons as before, high ability individuals find profession 2 relatively more attractive, while low ability individuals find profession 1 more attractive. Indeed, with the addition of non-pecuniary factors, the result is a probabilistic version of Proposition 4:

Proposition 16 *In the model with idiosyncratic preferences, increasing meritocracy is an effective means to attracting talent.*

When a profession marginally increases meritocracy relative to the benchmark model, there exists a unique ability level a^* *such that, in equilibrium, those more talented than* a^* *are more likely to enter the more meritocratic profession, while those less talented than* a^* *are more likely to enter the less meritocratic profession.*

Our result on the effect of a marginal increase in meritocracy on work culture extends in analogous fashion, as do our results on the effects of a marginal increase in promotion benefits and base wage. Finally, with idiosyncratic preferences, a marginal increase in promotion opportunities disproportionately attracts individuals of intermediate ability, while repelling the very best and the very worst. To conserve space, we omit a formal statement and proof of these results, but they are available from the authors upon request.

6 Conclusion

Dysfunction in the public sector costs the world economy many billions of dollars each year (see, e.g., Mauro, 1995). The long-term effects, in terms of suppressing entrepreneurship, limiting the size and scale of enterprises, and distorting competition are probably far greater. Developing a well-functioning public sector is, however, a complex problem: governments must attract and promote talented individuals, and these individuals must be given proper incentives to do their jobs well. The natural tendency is either to throw money at the problem, or to ignore the problem entirely. In this paper, we argue that neither option is likely to lead to good outcomes. Our main finding is that, even if a government does nothing to increase base wages, promotion benefits, or promotion opportunities, it can still succeed in improving the talent pool of civil servants and raise their effort level by making the promotion process more meritocratic.

While this solution is cheap in theory, implementing it may be difficult. Vested interests often use civil service positions as a dedicated workforce for achieving private gains and as a personal piggy bank for rewarding loyal followers. Obviously, promotion based on merit rather than loyalty or personal relationships conflicts with such a spoils system. One possible solution is to implement the process prospectively rather than retroactively. This ensures that vested interests continue to enjoy the spoils of past appointees, while at the same time initiating a process whereby, over time, the public sector attracts better people and becomes more efficient. The experience of the US in the 19th century highlights the transformative possibilities of such a change in rules.

A public sector institution crying out for reform today is the US army. Its inability to retain top junior officers is becoming an ever more serious issue (see e.g., Kane, 2011, and Wardynski et al., 2010). The problem is especially severe in light of the considerable investment the military makes in the human capital of these individuals. So far, the main response to this crisis has been to spend more money in the form of retention bonuses. Yet, this has done little to stem the tide of defections of the best and the brightest. In light of our findings, this lack of success is hardly surprising. What is required is a fundamental rethink of the process of evaluating officers. At present, the promotion system for junior officers is largely based on seniority. While, in principle, promotion to captain is merit-based, in practice, nearly all individuals receive the same merit score and all those making captain have the same years of experience. In a sense, the performance measures are not sufficiently meritocratic. This undermines the incentives for young officers to take initiative and distinguish themselves among their peers, and reduces the attractiveness of a career in the army for the most talented. In an environment of defence cuts, our results suggest that making performance measures more sensitive to individual achievement offers a cost-effective contribution to alleviating this crisis.

Much work remains to be done. While we have highlighted comparative aspects of various performance schemes in a world of competing professions, we have not identified an optimal scheme for each profession. Moreover, the career paths in our model are a mere caricature—individuals are either promoted or not, followed by the end of the game. In practice, the process of evaluation and promotion is one that occurs many times over the lifetime of a worker. Examining how dynamic considerations affect our conclusions remains an open question. Finally, we have assumed that all promotions within a profession are identical. Clearly, they are not. Indeed, there is scope for larger and smaller promotions, and for faster and slower paths of advancement. None of this is in the present model.

Nonetheless, we suspect that the main insight of the paper—the power of meritocracy to attract top talent and inspire them to work hard—will remain paramount in any of these extensions. The basic intuition that able individuals are attracted to professions where their talent will be rewarded, and that they will work hard to ensure that it is, strikes us as important regardless of the time horizon, as well as the particulars of the many career paths that might be followed.

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