Teaching to the top and seeking out superstars*

Heski Bar-Isaac and Juanjo Ganuza†
NYU and UPF

January 2005

Abstract

We consider the impact of recruitment and training policies for the incentives of agents with career concerns. Training can be targeted, that is it has (or is chosen to have) more of an impact on particular types of agents and recruitment techniques can focus on finding superstars or weeding out poor performers.

We highlight that different ways to improve average ability can have exactly opposite implications for career concerns. While teaching to the top (training which is complementary to skill) or identifying star performers increases agents' reputational concerns, teaching to the bottom has the opposite effect.

*Versions of this paper have appeared under the title "Static Efficiency and Dynamic Incentives" and "Reputation for Excellence and Ineptitude". We thank Jordi Blanes, Patrick Bolton, Pablo Casas, Antoine Faure-Grimaud, Leonardo Felli, Ian Jewitt, Clare Leaver, Alessandro Pavan, Larry Samuelson, Lucy White and audiences at ESSET 2004 and IIOC 2004, for comments and helpful conversations relating to this work and our students who wittingly or not have helped us understand some of these effects.

†Department of Economics, Stern School of Business, NYU, 44 West 4th Street, New York, NY 10012, USA. Tel: 212 998 0533; Fax: 212 995 4218; email heski@nyu.edu and Department of Economics and Business, Universitat Pompeu Fabra, Jaume I, 2E82 , Ramon Trias Fargas, 25-27, 08005-Barcelona (Spain) Tel (+34) 93 542 2719; fax (+34) 93 542 1746; email juanjo.ganuza@upf.edu.

> In the next decade and beyond, the ability to attract, develop, retain and deploy staff will be the single biggest determinant of a professional service firm's success.
>
> Maister (1997) p.189

> I do not approve of anything that tampers with natural ignorance. Ignorance is like a delicate exotic fruit; touch it and the bloom is gone. The whole theory of modern education is radically unsound. Fortunately in England, at any rate, education produces no effect whatsoever.[1]
>
> Lady Bracknell in Oscar Wilde (1895) *The Importance of Being Earnest*

1 Introduction

Popular press and academic literature, have come to stress the importance of industries where human capital plays a critical role. Moreover, many such industries, including professional services such as the law, audit, consulting and architecture, can not (or do not) use explicit outcome contingent contracts and career concerns have a significant effect on incentives, as discussed in Fama (1980), Holmstrom (1982/99). Specifically, Holmstrom argues that when outcomes are observed and when they are influenced by both talent and effort as well as luck, agents exert effort to affect the labour market's assessment of their talent.

In human capital intensive industries, it is clear that the quality of employees is of paramount importance. This observation, has led numerous authors (Michaels et al. (2001), Maister (1997), Smart (1999), Hacker (2001) and no doubt many others) to stress the significance of recruitment and development of staff. One contribution of this paper is to highlight that in addition to affecting the quality of staff, training and recruitment policies also play a role in affecting the behavior of employees through their career concern incentives. Recruitment and training policies affect beliefs about the employees who have been trained and hired and beliefs about their worth, and the distribution of these beliefs in turn influence employees' incentives.

In particular, we highlight that while many different training and recruitment policies might have the same effect on the average level of talent in the organization, they can

[1] One of the authors is at pains to point out that much has changed in English education in the last century.

have very different (and indeed exactly opposite) implications for incentives. Specifically, training policies that are targeted towards the top end of the talent distribution (or which will be more effective in raising the productivity of the most talented) and recruitment policies that are geared towards finding the very best will lead to higher incentives for employees. Conversely other polices which improve average talent by targeting training policies towards the lower end of the talent distribution or ensure that the least talented are seldom recruited will reduce employees' incentives. Thus tampering with natural ignorance, as Lady Bracknell suggests, can indeed have deleterious effects.

In the two period model we present and discuss below, we can separate between two channels through which training can have an effect. First training the top (or recruiting more of the very best) increases the dispersion of type so signals about type generated through work are more informative and secondly, when training the top implies there is a greater pecuniary payoff to revealing yourself to be there.

As with any model of reputation, it is worth noting that beliefs are critical for incentives. In particular, here driving incentives are the beliefs of the employees concerning the beliefs of their employer and the outside labour market, which will determine how observable outcomes will be interpreted and thereby the wages that they might receive in the future. Most theoretical models, and the one below is no exception in this regard, suppose that in equilibrium, beliefs will accurately reflect the underlying state. In practice, however, it is easy to imagine that it is possible to fool some of the people some of the time,[2] and that firms may generate greater effort from employees by stressing that their recruitment policies focus on hiring the very best, whether they do so or not.

While this paper highlights the role of prior beliefs in reputational concerns and factors that influence these prior beliefs (in particular recruitment and training)[3], there is a wide literature which builds on the work of Holmstrom (1982/99) and examines other aspects of career concern models. Dewatripont, Jewitt and Tirole (1999) for example, provide a thorough analysis characterizing the impact of different information structures (mappings from talent and effort into observable outcomes). Others have focused on specific applications, whose primary effect is to alter such information structures, in particular through teamwork

[2] We need not be as skeptical as Abraham Lincoln who famously asserted:

> You can fool all of the people some of the time. You can fool some of the people all of the time. But you can't fool all of the people all of the time.

[3] Though there are of course other factors which might affect such prior beliefs such as task assignments and technological innovations.

(Meyer (1994) and Jeon (1996)) and delegation of power (Ortega (2003), Blanes-i-Vidal (2002)). Though altering the marginal productivity of talent or rescaling the distribution of talent are theoretically equivalent, thinking about the two ideas separately can be useful in considering applications. Much of the literature, for analytical tractability and in order to focus on specific issues has tended to model talent as normally distributed and the rewards to talent as linear. Glazer and Segendorff (2003) and Harstad (2004) derive interesting implications for organizational design by considering convex return functions (and in the latter case by stressing that product market competition may lead to such convex return functions). Bar-Isaac (2004a) highlights the importance of widely-dispersed priors and how partnerships and teamwork might foster them.

The relationship between recruitment policies, through its effect on firm reputation on individual reputation and behaviour has been discussed to some extent in Tirole (1996) and Bar-Isaac (2004b).

In the rest of note, we first present a two-period model of career concerns with three types of agents, of which only one is strategic, and derive a simple expression which characterizes equilibrium effort. We then consider comparative statics of effort with respect to parameters which have natural interpretations of training to the top, or bottom and searching for superstars or weeding out the poorest performers. We find that these different ways for raising average ability can have very different consequences for incentives and go on to discuss these results, both with regard to the applications of training and recruitment policies, and with regard to more methodological concerns.

2 Model

We introduce a two period model with a continuum of types of agents parameterized by $t \in [0, 1]$. Specifically in Period 1 a type t agent will have no strategic decision to make with probability t and in this case will succeed (for example by producing a high quality product) with probability μ and fails with probability $1 - \mu$, otherwise (with probability $1 - t$) the agent must make an effort decision. In this latter case, when she chooses effort e, she succeeds with probability $\alpha + e$. Thus overall a t-type agent exerting effort t when given the opportunity to exert effort would succeed with probability $t\mu + (1 - t)(\alpha + e)$ and fail otherwise. Effort is costly and specifically exerting effort e costs the agent $\frac{e^2}{2\gamma}$, where $\gamma < 1 - \alpha$.

The model is intended to reflect that agents might be confronted with a variety of different tasks, whose nature is unobserved by customers. For example, customers hiring consulting firms find it difficult to determine the extent to which the project that they are assigning is a complex one or a simple one. Similarly, the difficulty of the project depends on the consultant's ability and experience. Depending on the value of μ, the model allows for somewhat different interpretations. Specifically, when $\mu = 1$ one could think of the agent's type reflecting her talent and an agent with a high value of t finds it costless to succeed in a wide range of tasks, in this case ability and effort are substitutes and an agent would like customers to believe that she has a high value of t. In contrast, when $\mu = 0$ then one can think of skill and effort as complements—in this case even if the agent has some understanding of the task, exerting effort will still improve the outcome, however if she has no understanding of the task then she will surely fail. Notice, that in the case that $\mu = 0$, the agent would prefer customers to believe that she is a type with a low value of t and so when $\mu = 0$, one should think of agents with low values of t as more talented. In both these cases we can think of more able agents as having facility in some tasks but not in others. The difference in productivity for a task in which one has facility and in which one does not when exerting no effort (which is the case in period 2) is simply given by $|\mu - \alpha|$.

Let $g(t)$ denote the distribution function for the types of agent and let T denote the average type (according to the *ex-ante* beliefs) $T = \int_0^1 tg(t)dt$ and let V denote the variance of this prior distribution $V = \int_0^1 (t-T)^2 g(t)dt$ so $\int_0^1 t^2 g(t)dt = V + T^2$. It will be useful to note that since $0 < t^2 < t < 1$ in the range $[0, 1]$ it follows that $0 < V + T^2 < T < 1$ and that $V < \frac{1}{4}$. This distribution function of types is common knowledge among the agent and customers.

Customers are risk neutral, value a success at 1 and a failure at 0 and they Bertrand compete for the agent's service in each period.[4] Moreover, outcomes are observable but effort is not observable and contracts are incomplete, so that in effect an agent is paid in advance at a price which is simply the customers' common belief that the agent will produce a success.

There are two periods of trade, and outcomes are observed (and beliefs revised) in between the two periods.[5] Specifically timing is as follows:

[4] The assumption that customers Bertrand compete for the product is not crucial, similar results would hold so long as the price paid was increasing in the customers' expected likelihood that the agent will be successful.

[5] One need not take the two periods of the model literally, rather the second period can be thought of as a reduced form payoff for a given reputation level.

1. Period 1
    (a) customers Bertrand compete for the agent's service
    (b) the agent decides the level of effort if appropriate (that is if it is a task where effort will make a difference)
    (c) success/failure commonly observed
    (d) customers update beliefs according to Bayes rule
2. Period 2
    (a) customers Bertrand compete
    (b) success/failure observed

Notice that in period 2, we could allow the agents the opportunity to exert effort but no agent would do so. Note that whether the agent knows her type or not would have no effect on this model since she has no ability to signal her type (we rule out long-term and outcome contingent contracts) and at the point where an agent has to make an effort decision then the problem is identical for all types. If agents had to make an effort decision before she knew what kind of task she faced then we would obtain qualitatively similar results if the agent did not know her type, though the analysis of this problem when the agent did know her own type would be more complex.

We suppose that agents weigh the two periods equally and that agents maximize the sum of profits for the two periods and we solve for the effort exerted in the Perfect Bayesian equilibrium.[6]

3 Equilibrium analysis

Trivially, when faced with an effort decision, all agents will make the same choice of effort (the benefits are identical for all agents and determined by equilibrium beliefs and the costs are identical for all agents, even though the frequency with which they have to make such decisions alters). Suppose that the equilibrium effort level is given by x.

[6] Allowing for discounting between periods or indeed allowing profits in the second period to be more valuable than in the first (consistent with an interpretation of the second period as a reduced form for the future) does not affect the qualitative results.

Then a type t agent generates success in the first period with probability

$$\mu t + (1-t)(\alpha + x) = (\mu - \alpha - x)t + (\alpha + x), \tag{1}$$

and generates a failure with probability

$$1 - \mu t - (1-t)(\alpha + x) = 1 - \alpha - x - t(\mu - \alpha - x). \tag{2}$$

By Bayes rule, the probability density function given a success and given the belief that agents exert effort x in the first period can be written down as:

$$s(t,x) = \frac{(\mu - \alpha - x)t + \alpha + x}{\int_0^1 \left[(\mu - \alpha - x)t + \alpha + x\right] g(t)dt} g(t) = \frac{(\mu - \alpha - x)t + \alpha + x}{(\mu - \alpha - x)T + (\alpha + x)} g(t), \tag{3}$$

and the probability density function given a failure in the first period is

$$f(t,x) = \frac{1 - (\mu - \alpha - x)t - (\alpha + x)}{\int_0^1 \left[(\mu - \alpha - x)t + \alpha + x\right] g(t)dt} g(t) = \frac{1 - (\mu - \alpha - x)t - (\alpha + x)}{1 - (\mu - \alpha - x)T - (\alpha + x)} g(t). \tag{4}$$

In the second period, an agent of type t will exert no effort and so succeed with probability $\mu t + (1-t)\alpha = t(\mu - \alpha) + \alpha$. In particular it follows, that if customers believed that the types were distributed according to $g(.)$ going into period 2 then they would be willing to pay the agent $\int_0^1 (t(\mu - \alpha) + \alpha) g(t)dt$.

It follows that the price that customers would pay following success and failure respectively are given by:

$$S(x) = \int_0^1 (t(\mu - \alpha) + \alpha) s(t,x)dt = (\mu - \alpha) E\left[t|S,x\right] + \alpha, \tag{5}$$

and

$$F(x) = \int_0^1 (t(\mu - \alpha) + \alpha) f(t,x)dt = (\mu - \alpha) E\left[t|F,x\right] + \alpha, \tag{6}$$

where

$$E\left[t|S,x\right] = \int_0^1 ts(t,x)dt = T + \frac{(\mu - \alpha - x)V}{(\mu - \alpha - x)T + (\alpha + x)} \tag{7}$$

and

$$E[t|F,x] = \int_0^1 tf(t,x)dt = T - \frac{(\mu - \alpha - x)V}{(1-\alpha-x) - (\mu-\alpha-x)T} \tag{8}$$

Finally notice that an agent's problem is to choose e to maximize

$$(\alpha + e)S + (1-\alpha-e)F - \frac{e^2}{\gamma} \tag{9}$$

so the first order condition suggests that $\frac{e}{\gamma} = S(e) - F(e)$ and a rational expectations equilibrium is defined by the effort level x that satisfies:

$$\frac{x}{\gamma} = S(x) - F(x). \tag{10}$$

Lemma 1 *(i) The equilibrium effort e^* is lower than the efficient solution $e^{fb} = \gamma$. (ii) $1 \geq S(e) - F(e) \geq 0$ for all e, as long as $\mu < \alpha$ or $\mu > \alpha + \gamma$.*

Proof. (i) Notice that $S(x) < 1$ for all x and $F(x) > 0$ for all x, so in particular $S(\gamma) - F(\gamma) < 1$, then the equilibrium effort level

$$\frac{e^*}{\gamma} = S(e^*) - F(e^*) < 1 \Longrightarrow e^* < \gamma \tag{11}$$

(ii)

$$S - F = (\mu - \alpha)\left[\frac{(\mu-\alpha-x)V}{(\mu-\alpha-x)T + \alpha + x} + \frac{(\mu-\alpha-x)V}{1-\alpha-x-(\mu-\alpha-x)T}\right] \tag{12}$$

Rearranging terms, we obtain

$$S - F = \frac{(\mu-\alpha-x)(\mu-\alpha)V}{[(\mu-\alpha-x)T+\alpha+x]\,[1-\alpha-x-(\mu-\alpha-x)T]} \tag{13}$$

The denominator is always positive, since $(\mu-\alpha-x)T+\alpha+x = \mu T + (\alpha+x)(1-T) > 0$, and $(1-\alpha-x) > (\mu-\alpha-x)T$.

Next, if $\mu < \alpha$, then $S - F > 0$ since $\mu - \alpha < 0$ and $\mu - \alpha - x < 0$, and if $\mu > \alpha + \gamma$, then $S - F > 0$ because $\mu - \alpha > 0$ and $\mu - \alpha - x > 0$. ■

Proposition 2 *There exists a unique solution for the equation (10) in the range $(0, \gamma)$, when $\mu > \alpha + \gamma$ or when $\mu < \alpha$.*

Proof. Let $h(x) = -\frac{x}{\gamma} + S(x) - F(x)$. The equilibrium effort is then given by the solution of $h(e^*) = 0$ for $e^* \in (0, \gamma)$. Notice, that given Lemma 1, $h(0) > 0$ and $h(\gamma) < 0$. Moreover, $h(x)$ is continuous, and thus there exists at least one solution in the range $(0, \gamma)$.

In order to demonstrate uniqueness, first take the derivative of $(S - F)$:

$$\frac{d(S-F)}{dx} = -(\mu - \alpha)V[\frac{\mu}{[(\mu - \alpha - x)T + (\alpha + x)]^2} + \frac{(1-\mu)}{[(1-\alpha-x) - (\mu - \alpha - x)T]^2}] < 0 \tag{14}$$

Since $T \leq 1$, then if $\mu > \alpha + \gamma$, $\frac{d(S-F)}{dx} < 0$ and so $h(x)$ is monotonically decreasing in the range $(0, \gamma)$ and so the solution must be unique.

If $\mu < \alpha$ then $\frac{d(S-F)}{dx} > 0$ and so potentially, $h(x)$ could be increasing in some subset of $(0, \gamma)$ (note that since $h(0) > 0$ and $h(\gamma) < 0$ at must be decreasing in some of the range). However, we know that $\frac{d^3h(x)}{dx^3} > 0$ since

$$\frac{d^3h(x)}{d^3x} = (\alpha - \mu)V[\frac{\mu 6(1-T)^2}{[(\mu - \alpha - x)T + \alpha + x]^4} + \frac{(1-\mu)6(1-T)^2}{[1 - \alpha - x - (\mu - \alpha - x)T]^2}] > 0 \tag{15}$$

Suppose for a contradiction that $h(e^*) = 0$ has a number of solutions $0 < e_1 < \ldots < e_N < \gamma$. Then first note that since $h(0) > 0$ and $h(\gamma) < 0$ then N must be an odd number. In particular therefore if there are multiple solutions to $h(e^*)$ in the range then there must be at least three. However $h(0) > 0$ and $0 < e_1 < e_2 < e_3$ with $h(e_1) = h(e_2) = h(e_3) = 0$ requires $\frac{dh(e_1)}{dx} < 0$, $\frac{dh(e_2)}{dx} > 0$ and $\frac{dh(e_3)}{dx} < 0$ which contradicts $\frac{d^3h(x)}{d^3x} > 0$. ■

Note in particular that in the special cases when $\mu = 1$ and $\mu = 0$ then there is a unique solution and so in these two cases (and where $\mu > \alpha + \gamma$ and $\mu < \alpha$) comparative statics exercises are well defined and can be explored.

4 Comparative Static Results

The first result is a very intuitive one, if effort is less costly then the agent will exert more effort (when relevant) in equilibrium.

Proposition 3 *The equilibrium effort e^* is increasing in γ*

Proof. Note that for the arguments of the proof of proposition, $h(x)$ is decreasing in the equilibrium effort, $h'(e^*) < 0$.

Using the implicit function theorem $\frac{de^*}{da} = -\frac{\frac{\partial h(a)}{\partial a}}{\frac{\partial h(e)}{\partial e}}$ and since $\frac{\partial h(e)}{\partial e} < 0$, the sign of $\frac{de^*}{da}$ is simply the sign of $\frac{\partial h(x,a)}{\partial a}$ and so it is sufficient to consider that expression for $a \in \{\gamma, V, \alpha, \mu\}$; Recall

$$h(x) = -\frac{x}{\gamma} + S(x) - F(x). \tag{16}$$

and so taking the derivative with respect to γ, we obtain

$$\frac{\partial h(x,\gamma)}{\partial \gamma} = \frac{x}{\gamma^2} > 0 \tag{17}$$

Therefore, we conclude that the optimal effort e^* is increasing in γ. ■

Next we turn to comparative statics with respect to V, the intuition here is clear, the greater the variance in the distribution of types, the more scope that the observation of a success or failure has to shift beliefs and associated reward. This is a familiar intuition (from Holmstrom (1999) for example).

Proposition 4 *The optimal effort e^* is increasing in V.*

Proof. As in the proof of Proposition 3, the sign of $\frac{de^*}{dV}$ is simply the sign of $\frac{\partial h(x,V)}{\partial V}$. So taking the derivative with respect to V:

$$\frac{\partial h}{\partial V} = \frac{\partial(S-F)}{\partial V} = \frac{(\mu-\alpha)(\mu-\alpha-x)}{[(\mu-\alpha-x)T + (\alpha+x)]\,[(1-\alpha-x) - (\mu-\alpha-x)T]} > 0. \tag{18}$$

■

Notice that while increasing V or γ has a clear monotonic effect on effort, it is reasonable to suppose that comparative statics with respect to other parameters might depend on which of the two interpretations alluded to in the description of the model in Section 2 and whether an agent's reputational concern is to try to convince customers that she is a "high t" type or a "low t" type. In the following discussions, therefore we separate between two cases, where these concerns are clear and work in opposite directions and which simplify notation. Specifically, we consider the cases where $\mu = 0$ (and the concern is to show oneself to be a "high t" type) and the case where $\mu = 1$ (and the concern is to show oneself to be a "low t" type).

We consider comparative statics with respect to α. Underlying the following result are two effects, first that it is more important to show oneself to be at the top of the ability of distribution or having facility in a greater range of tasks (high t in the case when $\mu = 1$, low t in the case when $\mu = 0$) the greater the difference in the productivity of an agent in a task in which she has facility to her productivity in one which she does not regardless of her level of effort (that is the greater is $|\mu - \alpha - x|$ for all effort levels x). Secondly as $|\mu - \alpha - x|$ increases then an observation of success or failure becomes more informative. We distinguish explicitly between these two effects in the discussion below In particular therefore when μ is high enough, one would expect that an increase in α should reduce effort, but when μ is low, it would increase equilibrium effort. Note however that in all cases, increasing α raises the average productivity of agents in period 1. The Proposition below demonstrates that these intuitions are borne out.

Proposition 5 *Equilibrium effort is increasing in α but decreasing in μ when $\mu < \alpha$ but decreasing in α and increasing in μ when $\mu > \alpha + \gamma$.*

Proof. As in the proof of Proposition 3, it is sufficient to consider $\frac{\partial h}{\partial \alpha}$, and $\frac{\partial h}{\partial \mu}$.

$$\begin{aligned}\frac{\partial h(x,\alpha)}{\partial \mu} = \frac{\partial (S-F)}{\partial \mu} = \quad & \left[\frac{(\mu-\alpha-x)V}{(\mu-\alpha-x)T+\alpha+x} + \frac{(\mu-\alpha-x)V}{1-\alpha-x-(\mu-\alpha-x)T}\right] \\ & +(\mu-\alpha)\left[\frac{(\alpha+x)V}{((\mu-\alpha-x)T+\alpha+x)^2} + \frac{(1-\alpha-x)V}{(1-\alpha-x-(\mu-\alpha-x)T)^2}\right]\end{aligned} \tag{19}$$

Notice that given that the denominators are always positive, if $\mu > \alpha + x$, (which is true when $\mu > \alpha + \gamma$ by Proposition 2) then $\frac{\partial (S-F)}{\partial \mu} > 0$ since $(\mu - \alpha - x)$ and $(\mu - \alpha)$ are positive, similarly if $\mu < \alpha$, then $\frac{\partial (S-F)}{\partial \mu} < 0$.

Similarly

$$\begin{aligned}\frac{\partial h(x,\alpha)}{\partial \alpha} = \frac{\partial (S-F)}{\partial \alpha} = \quad & -\left[\frac{(\mu-\alpha-x)V}{(\mu-\alpha-x)T+\alpha+x} + \frac{(\mu-\alpha-x)V}{1-\alpha-x-(\mu-\alpha-x)T}\right] \\ & +(\mu-\alpha)\left[\frac{-VT}{((\mu-\alpha-x)T+\alpha+x)^2} + \frac{-V(1-\mu)}{(1-\alpha-x-(\mu-\alpha-x)T)^2}\right]\end{aligned} \tag{20}$$

Again the denominators are always positive and if $\mu > \alpha + \gamma$, then $\frac{\partial (S-F)}{\partial \alpha} < 0$ since $(\mu - \alpha - x)$ and $(\mu - \alpha)$ are positive, similarly if $\mu < \alpha$, then $\frac{\partial (S-F)}{\partial \alpha} > 0$. ■

5 Discussion

In this section we highlight a number of aspects arising from the model and results presented above. First we return to the discussion in the introduction and illustrate how the model demonstrates that if training can be targeted towards having more of an effect on some types than others, then training that is complementary with talent would generate more effort. Next we turn to recruitment policies and highlight that among policies with the same effect on average ability then those which are more concerned with identifying the very best will lead to more effort from those hired than policies more concerned about ruling out the very worst. We then turn to a couple of more methodological issues. First adapting the model slightly in order to highlight that improving the ability of agents (through changing α or μ) affects reputational concerns and the equilibrium, through two different channels, a "value effect" and an "information effect". We conclude the section by illustrating two special cases of the model and through them relating this work to the literature on reputation and in particular the distinction between a reputational concern for excellence and ineptitude.

5.1 Targeted training and teaching to the top

Increasing α and increasing μ can both increase the ability of agents, and can readily be interpreted as the result of training directed towards different types of agents. However, as demonstrated in Proposition 5, these two means of increasing average ability have exactly opposite effects for equilibrium effort. In particular for low values of μ when an agent would like customers to believe that she is a "low t" type then raising the ability of a "low t" type relatively more than raising the ability of a "high t" type (either by decreasing μ or by increasing α), heightens this reputational concern. As discussed below, it does so through two channels, by raising the pecuniary value of showing oneself to be a higher type and by making the outcome more informative about the agent's type.

Similarly in the case where μ is high, then agents with high t are the most productive and in order to heighten the reputational concern for agents seeking to convince consumers that they are the most able, then a greater distinction between the most able and the least able (here by increasing μ or decreasing α).

Thus in all cases raising the productivity of the most productive agents increases the equilibrium effort.

5.2 Recruitment policies and searching for superstars

While, training as described above affects the productivity of a given type and thereby affects the prior beliefs about an agent's productivity, interviewing and recruitment policies directly affect the initial belief about the distribution of types $g(t)$. When employers seek recruitment policies which select better quality agents, there are various ways in which this can be achieved. Consider the case when μ is high, so that types with high values of t are the better agents), a recruitment policy that selects better agents will lead to a shift in the prior distribution from $g(t)$ with associated T and V, to a different prior distribution $g'(t)$ with associated $T' > T$ and V'. Following Proposition 3, among all policies with the same effect on average ability (that generate the same T'), an employer would prefer to choose a policy that raised rather reduced the variance of the distribution. When superstars and disastrous potential recruits are rare, then it follows that employers concerned with employees' efforts would be better using recruitment policies that concentrated more on ensuring that any potential superstars were recruited than ruling out the worst of the applicants.

For example, suppose that with no recruitment policy, types are distributed according to the degenerate distribution $g(0) = \frac{1}{10}$, $g(\frac{1}{2}) = \frac{4}{5}$ and $g(1) = \frac{1}{10}$ so that $T = \frac{1}{2}$ and $V = \frac{1}{20}$. Now consider, two recruitment policies which raise the average ability, one does so by reducing the probability of recruiting disasters. Specifically Policy A leads to the distribution $g_A(0) = \frac{1}{20}$, $g_A(\frac{1}{2}) = \frac{17}{20}$, and $g_A(1) = \frac{1}{10}$ so that $T_A = \frac{21}{40}$ and $V_A = \frac{1}{20}(\frac{21}{40})^2+\frac{17}{20}(\frac{1}{40})^2+\frac{1}{10}(\frac{19}{40})^2 = \frac{59}{1600}$. Policy B leads to the distribution $g_B(0) = \frac{1}{10}$, $g_B(\frac{1}{2}) = \frac{3}{4}$, and $g_B(1) = \frac{3}{20}$, then $T_B = \frac{21}{40}$ and $V_B = \frac{1}{10}(\frac{21}{40})^2 + \frac{3}{4}(\frac{1}{40})^2 + \frac{3}{20}(\frac{19}{40})^2 = \frac{99}{1600}$.Since $V_B > V_A$ it follows by Proposition 3 that, while both policies raise average ability equally, the latter policy would lead to greater equilibrium effort compared to the first and so would be preferred.

5.3 The information and value effects

By adapting the model slightly to suppose that in period 1, a type t agent then succeeds with probability $t\mu' + (1-t)\alpha'$ then we can distinguish between two channels through which changes in ability as discussed in Proposition 5 and Section 5.1 affect incentives. Specifically, in this modified model $S - F = (\mu' - \alpha')\left[\frac{(\mu-\alpha-x)V}{(\mu-\alpha-x)T+\alpha+x} + \frac{(\mu-\alpha-x)V}{1-\alpha-x-(\mu-\alpha-x)T}\right]$ and similar qualitative results obtain the following result.

Proposition 6 *Equilibrium effort is increasing in α and α' but decreasing in μ and μ' when $\mu, \mu' < \alpha$ but decreasing in α and α' and increasing in μ and μ' when $\mu, \mu' > \alpha + \gamma$.*

Proof. Similar to the proof of Proposition 5, it is sufficient to consider $\frac{\partial(S-F)}{\partial\alpha}$, $\frac{\partial(S-F)}{\partial\alpha'}$, $\frac{\partial(S-F)}{\partial\mu}$,and $\frac{\partial(S-F)}{\partial\mu'}$.

First
$$\frac{\partial(S-F)}{\partial\mu'}=\frac{(\mu-\alpha-x)V}{(\mu-\alpha-x)T+\alpha+x}+\frac{(\mu-\alpha-x)V}{1-\alpha-x-(\mu-\alpha-x)T} \tag{21}$$
which is negative when $\mu<\alpha$ but positive when $\mu>\alpha+\gamma$. Similarly,
$$\frac{\partial(S-F)}{\partial\alpha'}=-\frac{(\mu-\alpha-x)V}{(\mu-\alpha-x)T+\alpha+x}-\frac{(\mu-\alpha-x)V}{1-\alpha-x-(\mu-\alpha-x)T} \tag{22}$$
which is positive when $\mu<\alpha$ but negative when $\mu>\alpha+\gamma$.

Next
$$\frac{\partial(S-F)}{\partial\mu}=(\mu'-\alpha')\left[\frac{(\alpha+x)V}{((\mu-\alpha-x)T+\alpha+x)^2}+\frac{(1-\alpha-x)V}{(1-\alpha-x-(\mu-\alpha-x)T)^2}\right]\text{, and} \tag{23}$$
$$\frac{\partial(S-F)}{\partial\alpha}=(\mu'-\alpha')\left[\frac{-VT}{((\mu-\alpha-x)T+\alpha+x)^2}+\frac{-V(1-\mu)}{(1-\alpha-x-(\mu-\alpha-x)T)^2}\right]. \tag{24}$$

Similarly to the proof of Proposition 5, the derivatives have the signs claimed in the relevant parameter ranges. ■

Thus Proposition 6 demonstrates that the overall effect of changing the abilities of types through changes to μ and α described in Proposition 5 can be decomposed into two distinct mechanisms.

First consider the comparative statics with respect to the second period productivities μ', and α'. Fixing some effort level, then the beliefs about the type of an agent following either a success or a failure do not change as μ' or α' changes. However, since the belief that the agent is excellent following a success is higher than it is following a failure, raising (lowering) μ' in the case where $\mu'>\alpha+\gamma$ (where $\mu'<\alpha$) increases S—the agent's wage following a success—by more than it increases F, the wage following failure. Since incentives are stronger the greater the difference between S and F, an increase in μ' therefore raises incentives. A similar argument applies for α'. Notice that changing μ', and α' does not affect the inferences that customers draw from the outcomes (in equilibrium when they correctly anticipate x) but they affect the value to the agent of being thought of as a particular type. We therefore term this channel for influencing an agent's incentives a "value effect".

Turning now to the comparative statics with respect to the first period productivities through μ, and α. If the beliefs about the type of the agent are fixed, then increasing μ, and α has no effect whatsoever on the value of the agent in Period 1. Changing μ and α however can affect the inferences that customers draw from an observation of success of failure, we therefore term such changes as having an "information effect". In particular, intuition can be drawn from the observation that for a fixed level of effort, increasing (reducing) μ' in the case where $\mu' > \alpha + \gamma$ (where $\mu' < \alpha$) increases increases the probability that "better types" generate success and decreases the probability that they generate failure. Therefore, conditional on observing on a success, customers believe that the agent is more likely to be at the top of the ability distribution and so S is higher, while conditional on observing a failure, customers believe that the agent is less likely to be at the top of the distribution and so F is lower. In particular, therefore, $(S - F)$ increases. Similar arguments apply with regard to changes in α.

5.4 Reputation for excellence or ineptitude

This note relates to a wider literature on reputation. Much of the economic literature on reputation has focused on a reputation for excellence (trying to show that you are a type who always does well, or where reputation is about "who you'd like to be").[7] In these models, the "most talented" are non strategic and implicitly, they are assumed to be somewhat unusual or scarce, so for example one might expect training to have little effect on them. More recent literature (Mailath and Samuelson (2001), Tadelis (2002), Bar-Isaac (2004a)) and common intuition suggests that often, reputational concerns might also relate to avoiding a reputation for ineptitude (trying to show that you are not a type who always does badly or where reputation is about "who you're not") where the top of the distribution is the strategic type, and the bottom of the distribution is an inept types whom one might expect to be little affected by training. This distinction between these two approaches to reputation has been forcibly made recently by Mailath and Samuelson (1998) who highlight, in particular, that the latter view of reputation leads to increasing certainty about the agent's type over time and so reputational incentives disappear over

[7] Following Kreps and Wilson (1982) and Milgrom and Roberts (1982) and later Fudenberg and Levine (1989), the formal economic literature on reputation has been used primarily to discuss beliefs about the type of the agent. Previous literature (Klein and Leffler (1981) for example) and a great deal of intuition has also used the term in a somewhat looser fashion to consider sustaining certain actions in infinitely repeated games. As highlighted in Fudenberg and Levine (1989) this corresponds closely to the notion of reputation where reputation is a concern to show that you're a "Stackelberg" type—that is a type whose behavior a strategic agent would like to promise to commit to—similar to what we term later in this note a reputation for excellence.

time unless type uncertainty is continually introduced.[8]

In practice, it is far from obvious whether it is more appropriate to think of agents as particularly concerned that others should think them to be excellent or that they should not think them to be inept. However as we illustrate, modelling reputational concerns in these two ways can lead to opposite conclusions.

This note highlights an important distinction between the two approaches in a simple two-period model. Specifically, following the intuition of the paragraphs above, making the strategic agent more efficient diminishes reputational concerns (reducing effort) when reputation is about excellence but increases reputational concerns when reputation is about ineptitude, as discussed in Section 5.4.

To see this more clearly consider setting $\mu = 1$ and the degenerate distribution $g(0) = 1-p$ and $g(1) = p$. This corresponds to a fairly typical model where type $t = 0$ corresponds to the strategic type whose reputational concern is to try to convince customers that she is the "excellent" or Stackelberg type. Following Proposition 3 in this case improving the strategic agent by raising α would reduce effort.

In contrast suppose that a strategic agent's reputational concern is to avoid a reputation for ineptitude. This corresponds to the model where $\mu = 0$ with $g(0) = 1 - p$ and $g(1) = p$ and in this case improving the strategic agent by raising α would increase equilibrium effort.

It is worth noting that in those papers that have considered something akin to the inept type we consider in this note (in particular Diamond (1989), Mailath and Samuelson (1998), Tadelis (2002) and Bar-Isaac (2004a), there are no reputational incentives from trying to avoid a reputation for ineptitude or gain a reputation for competence *per se*. Essentially this is because in the notation of this paper they have taken $\alpha = 0$. Thus the literature to date, which has focused largely on long-run reputation effects, has been ill-equipped to consider and has passed over the simple observations we make in this note. It is worth noting, in addition, that perpetual replenishment of type uncertainty in some sense

[8] Further in Mailath and Samuelson (1998), the model is constructed in such a way that there is unravelling so that if there are no reputational incentives at some point, there are no such incentives throughout.

The more general point on reputational incentives disappearing over time without some kind of replenishment of type uncertainty applies more widely. Indeed, Cripps, Mailath and Samuelson (2004) show this to be the case unless actions are perfectly observable, even in the case when reputation is about excellence and a competent agent can perfectly mimic an excellent agent (though incentives may disappear only in the very long run).

Bar-Isaac (2004a) suggests an endogenous mechanism to maintain type uncertainty by allowing agents to choose to work in teams.

might also be thought of as ensuring that all reputational concerns are short-term (though in addition the analysis in Mailath and Samuelson (1998), Tadelis (2002) and Bar-Isaac (2004a) show that constant replenishment of type uncertainty can lead to reputational incentives that would not arise in a finite horizon model) and so our short-term analysis might have some bite even in the long-run where there is continuous introduction of type uncertainty, for example through name-trading, overlapping-generations of juniors and seniors, obsolescence of skills or other exogenous and endogenous mechanisms.

6 Summary

At heart this note highlights the simple observation that the distribution of prior beliefs is a crucial determinant of reputational incentives and there are many policies that firms undertake (in particular, training and recruitment policies) which affect the shape of the distribution of these priors. Different policies which affect the mean talent in the same way can have exactly opposite implications for reputational concerns.

References

[1] Heski Bar-Isaac (2004a) "Something to prove: Reputation in teams," working paper, NYU

[2] Heski Bar-Isaac (2004b) " A review of an idiosyncratic selection of literature loosely related to interactions between individual and collective reputations," working paper, NYU

[3] Jordi Blanes-i-Vidal (2002) ""Authority, Delegation and The Winner's Curse," working paper, LSE

[4] Martin W. Cripps, George J. Mailath and Larry Samuelson (2004) "Imperfect Monitoring and Impermanent Reputation," *Econometrica*, 72, 407-432

[5] Mathias Dewatripont; Ian Jewitt; Jean Tirole (1999) "The Economics of Career Concerns, Part I: Comparing Information Structures," *The Review of Economic Studies*, Vol. 66, No. 1, Special Issue: Contracts, 183-198

[6] Douglas W. Diamond (1989) "Reputation Acquisition in Debt Markets," *The Journal of Political Economy*, 97, 828-862

[7] Eugene F. Fama (1980) “Agency Problems and the Theory of the Firm,” *The Journal of Political Economy*, 88 (2), 288-307

[8] Nick Feltovich, Richmond Harbaugh and Ted To (2002) “Too Cool for School? Signaling and Countersignaling,” *The RAND Journal of Economics*, 33, 630-649

[9] Drew Fudenberg and David K. Levine (1989) “Reputation and Equilibrium Selection in Games with a Patient Player,” *Econometrica*, 57, 759-778

[10] Amihai Glazer and Bjorn Segendorff (2001) “Reputation in team production,” Working Paper Series in Economics and Finance, Working Paper No. 425, Stockholm School of Economics

[11] Carol A. Hacker (2001) *How to Compete in the War for Talent : A Guide to Hiring the Best*, DC Press

[12] Bard Harstad (2004) “Organizations and Careers,” working paper, Northwestern University

[13] Bengt Holmstrom (1999) “Managerial Incentive Problems—A Dynamic Perspective,” *The Review of Economic Studies*, 66, 169-182; (originally appeared (1982) in *Essays in Honor of Professor Lars Wahlback*).

[14] Seonghoon Jeon (1996) “Moral Hazard and Reputational Concerns in Teams: Implications for Organizational Choice,” *International Journal of Industrial Organization*, 14, 297-315

[15] Benjamin Klein and Keith B. Leffler (1981) “The Role of Market Forces in Assuring Contractual Performance,” *Journal of Political Economy*, 89, 615-641

[16] David Kreps and Robert Wilson (1982) “Reputation and Imperfect Information,” *Journal of Economic Theory*, 27, 253-279

[17] George J. Mailath and Larry Samuelson (1998) “Your Reputation Is Who You’re Not, Not Who You’d Like To Be,” CARESS working paper 98-11, University of Pennsylvania

[18] George J. Mailath and Larry Samuelson (2001) “Who Wants a Good Reputation?” *The Review of Economic Studies*, 68, 415-441

[19] David H. Maister (1997): *Managing The Professional Service Firm*, Free Press; Reprint edition

[20] Margaret A. Meyer (1994): “The Dynamics of Learning with Team Production: Implications for Task Assignment,” *The Quarterly Journal of Economics*, 109 (4), 1157-1184

[21] Ed Michaels, Helen Handfield-Jones, Beth Axelrod (2001) *The War for Talent*, Harvard Business School Press

[22] Paul Milgrom and John Roberts (1982) "Predation, Reputation and Entry Deterrence," Journal of Economic Theory, 27, 280-312

[23] Jaime Ortega (2003) "Power in the Firm and Managerial Career Concerns," *Journal of Economics and Management Strategy*, Vol. 12 (1), 1-29

[24] Bradford D. Smart (1999): *Topgrading: How Leading Companies Win by Hiring, Coaching and Keeping the Best People*, Prentice Hall Art

[25] Steven Tadelis (2002) "The Market for Reputations as an Incentive Mechanism," *The Journal of Political Economy*, 110, 854-82

[26] Jean Tirole (1996) "A Theory of Collective Reputations (with Applications to the Persistence of Corruption and to Firm Quality)," *The Review of Economic Studies*, 63, 1-22